National Journal of Advanced Research
Online ISSN: 2455-216X; Impact Factor: RJIF 5.12
www.allnationaljournal.com
Volume 2; Issue 5; September 2016; Page No. 01-05

Casting of piston housing used in hydraulic oil filter

[1] Uppala Visweswara Rao, [2] Chundi Sireesha

[1]M.Tech Student, Dept. of Mechanical Engineering, Chirala Engineering College, Chirala, Prakasam, Andhra Pradesh, India
[2] Assistant Professor Dept. of Mechanical Engineering, Chirala Engineering College, Chirala, Prakasam, Andhra Pradesh, India

Abstract
An oil filter is a filter to remove contaminants from engine oil, transmission oil, lubricating oil, or hydraulic oil. Oil filters are used in many different types of hydraulic machinery. A chief use of the oil filter is in internal-combustion engines in on- and off-road motor vehicles, light aircraft, and various naval vessels. Other vehicle hydraulic systems, such as those in automatic transmissions and power steering, are often equipped with an oil filter. Gas turbine engines, such as those on jet aircraft, require the use of oil filters. And oil production, transport, and recycling facilities employ filters.

Parts of the hydraulic oil filter in our project are piston housing, shaft housing, top plate, crankshaft, and piston.

The aim of the paper is to model and design casting tool for piston housing which is used in a hydraulic oil filter having pressure 50kg/cm^2. In casting tool, we are designing core cavity, mould base plates. Calculations are to be done for cavity fill time, cavity fill rate, gate area, runner area, shot weight, Die Cooling Calculations. CNC programming for core and cavity is to be done and for remaining manufacturing processes are to be done.

Modeling and Casting Tool Design and CNC program generation is done in 3D parametric software Pro/Engineer.

Keywords: hydraulic oil filter, Modeling, Casting Tool Design, CNC

Introduction
Hydraulic machines are machinery and tools that use liquid fluid power to do simple work. Heavy equipment is a common example.

In this type of machine, hydraulic fluid is transmitted throughout the machine to various hydraulic motors and hydraulic cylinders and which becomes pressurised according to the resistance present. The fluid is controlled directly or automatically by control valves and distributed through hoses and tubes.

The popularity of hydraulic machinery is due to the very large amount of power that can be transferred through small tubes and flexible hoses, and the high power density and wide array of actuators that can make use of this power.

Hydraulic machinery is operated by the use of hydraulics, where a liquid is the powering medium.

An oil filter is a filter designed to remove contaminants from engine oil, transmission oil, lubricating oil, or hydraulic oil. Oil filters are used in many different types of hydraulic machinery. A chief use of the oil filter is in internal-combustion engines in on- and off-road motor vehicles, light aircraft, and various naval vessels. Other vehicle hydraulic systems, such as those in automatic transmissions and power steering, are often equipped with an oil filter. Gas turbine engines, such as those on jet aircraft, require the use of oil filters. Aside from these uses, oil production, transport, and recycling facilities also employ filters in the manufacturing process.

Casting
Casting is one of the oldest procedures done on metals. Many products are formed using this method. Here is an attempt to share the knowledge of casting.

Casting is one of four types: sand casting, permanent mold casting, plaster casting and Die casting. All these types of castings have their own advantages and disadvantages. Depending on the properties of the product requited, one of the casting is selected.

Sand Casting: Sand casting is the oldest casting of the above. This method of casting is in use since 1950.The texture of the product depends on the sand used for casting. The end product is given smooth finishing at the end. Usually iron, steel, bronze, brass, aluminium, magnesium alloys which often include lead, tin, and zinc are used.

Permanent mold casting: Permanent mold casting uses two pieces of mold. This molds are joined together and molten metal is pored into this mold. The hot metal is allowed to cool and the mold pieces are separated. Some products have metal extrusion which are removed by flash grind or by hand. Tin, lead and Zinc are commonly moulded using this method.

Plaster casting: Plaster casting is one of the easiest methods. However it is used for metals with low melting point like Copper, Zinc and Aluminum. This is the easiest process because mold can be made easily in case it brakes in the procedures.

Die casting: Die casting is done by introducing molten metal into the mold at high or low pressure. Earlier only low-pressure die-casting was used but now a days high pressure die casting is used more extensively. Molds are well designed to give complex products with stunning accuracy and smooth finishing. They are made of high quality steel as steel has higher melting point. These molds can be reused thousands of times. Casts can be single cavity that produces only a single component, multiple cavity that produces multiple identical parts at a time, unit die that produces different parts and combination die that produces different parts in one go.

Usually zinc, copper, aluminium, magnesium, lead, pewter and tin based alloys are used for die casting.
Using die casting we can make products with pore-free products that do not allow gas to pass though them and making them strong. Two types of machines are used for die-casting. Cold-chamber and hot-chamber die-casting.
Hot-chamber die casting is used for high-fluidity metals. First the molten metal is collected using goose neck and then the metal is shot into the mold. The advantage of this method is the cycles/min are increased. But the disadvantage is that high melting point metals and aluminum pick-sup iron particles.
Cold chamber die casting is used where hot-chamber can not be used. In this process the molten metal is transferred to the injector and then the injector injects the metal into the mold. Metals with high melting points can be die casted using this process but the disadvantage is it is slow than hot-chamber process.

3D Model

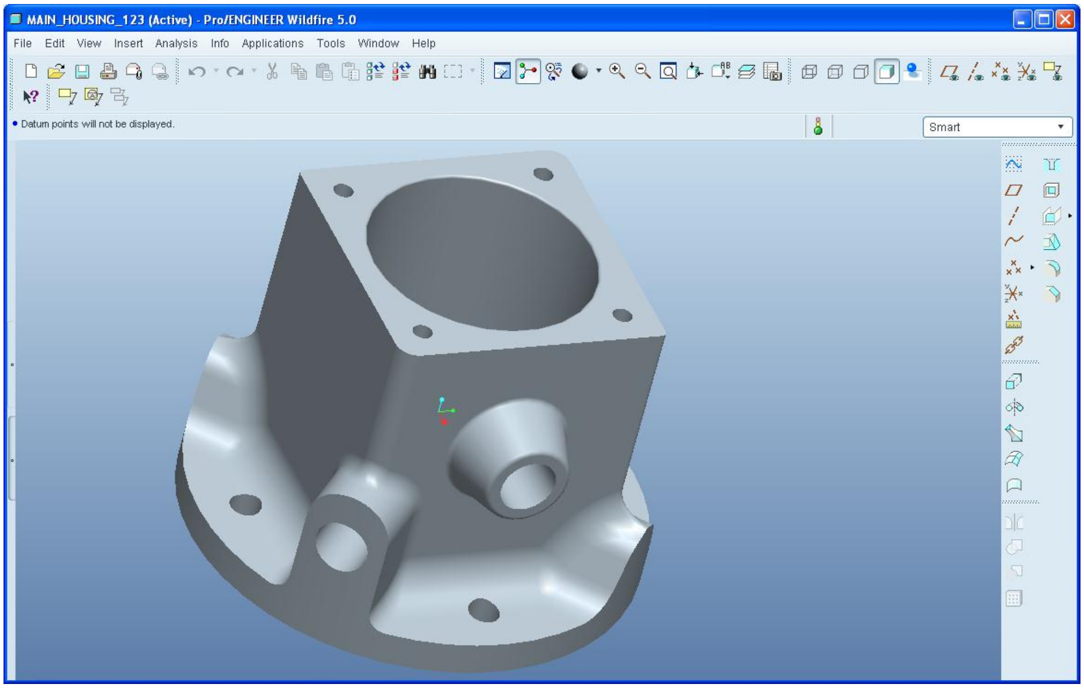

Fig 1

Manufacturing

The manufacturing of various products is done at different scales ranging from humble domestic production of say candlesticks to the manufacturing of huge machines including ships, aeroplanes and so forth. The word manufacturing technology is mainly used for the latter range of the spectrum of manufacturing, and refers to the commercial industrial production of goods for sale and consumption with the help of gadgets and advanced machine tools. Industrial production lines involve changing the shape, form and/or composition of the initial products known as raw materials into products fit for final use known as finished products.

Manufacturing Technology

The subject of manufacturing technology is very vast and includes various types of machines tools required to manufacture finished products which range from simple hand-held tools, lathe machines, grinders, milling machines to highly versatile and complicated computerised numerical control or CNC machines and so forth. Of course it also involves several different techniques of manufacturing which can be a subject matter of different details discussion and some of these include casting, forging, alloying, welding, soldering, brazing etc. each of these techniques have their own advantages and limitations and are a specialized field of knowledge in their own right.

Material Science

Another related discipline which does not necessarily fall strictly within the definition and scope of manufacturing technology, but can be said to complement the same is material science. Manufacturing is done by use of metals and materials of different kinds such as semiconductors and alloys hence the importance and knowledge of the same in the field of manufacturing technology cannot be underestimated at any cost. Material science basically deals with the property of materials and their behaviour under different circumstances and environments which is extremely useful and necessary if those materials are to be worked around to manufacture any sort of finished products using them.
Any person wanting to specialize in the area of manufacturing technology needs to master various principles and techniques many of which have been mentioned in the preceding sections. Usually the training starts from learning the very basics of machine workshop including tools and simple procedures such as filing, drilling, boring, honing etc. and goes on to the use of more complicated tools and techniques involving the use of heavy and versatile machine tools.
With the advancement of science and technology, even manufacturing has been reaching new frontiers and specialized needs such as light and strong materials for spacecrafts have led to the development of newer materials which are stronger than steel yet many times lighter than the same. Combined

with other branches of engineering such as computing, electronics, automation etc. this branch of mechanical engineering is certainly set to break all barriers in the coming future.

Process manufacturing is the production of goods that are typically produced in bulk quantities, as opposed to discrete and countable units. Process manufacturing industries include chemicals, food and beverage, gasoline, paint and pharmaceutical.

The production of process goods usually requires inputs for thermal or chemical conversion, such as heat, time and pressure. The product typically cannot be disassembled to its constituent parts. For example, once it is produced, a soft drink cannot be broken down into its ingredients.

The term contrasts with discrete manufacturing, which involves products that can be counted and labeled on an individual basis. Examples of discrete manufacturing industries include automotives, equipment, appliances, apparel, toys and electronics such as televisions and computers.

Milling

Milling is the complex shaping of metal or other materials by removing material to form the final shape. It is generally done on a milling machine, a power-driven machine that in its basic form consists of a milling cutter that rotates about the spindle axis (like a drill), and a worktable that can move in multiple directions (usually two dimensions [x and y axis] relative to the workpiece. The spindle usually moves in the z axis. It is possible to raise the table (where the workpiece rests). Milling machines may be operated manually or under computer numerical control (CNC), and can perform a vast number of complex operations, such as slot cutting, planing, drilling and threading, rabbeting, routing, etc. Two common types of mills are the horizontal mill and vertical mill.

The pieces produced are usually complex 3D objects that are converted into x, y, and z coordinates that are then fed into the CNC machine and allow it to complete the tasks required. The milling machine can produce most parts in 3D, but some require the objects to be rotated around the x, y, or z coordinate axis (depending on the need). Tolerances are usually in the thousandths of an inch (Unit known as Thou), depending on the specific machine.

In order to keep both the bit and material cool, a high temperature coolant is used. In most cases the coolant is sprayed from a hose directly onto the bit and material. This coolant can either be machine or user controlled, depending on the machine.

Materials that can be milled range from aluminium to stainless steel and most everything in between. Each material requires a different speed on the milling tool and varies in the amount of material that can be removed in one pass of the tool. Harder materials are usually milled at slower speeds with small amounts of material removed. Softer materials vary, but usually are milled with a high bit speed.

The use of a milling machine adds costs that are factored into the manufacturing process. Each time the machine is used coolant is also used, which must be periodically added in order to prevent breaking bits. A milling bit must also be changed as needed in order to prevent damage to the material. Time is the biggest factor for costs. Complex parts can require hours to complete, while very simple parts take only minutes. This in turn varies the production time as well, as each part will require different amounts of time.

Safety is key with these machines. The bits are traveling at high speeds and removing pieces of usually scalding hot metal. The advantage of having a CNC milling machine is that it protects the machine operator.

Roughing

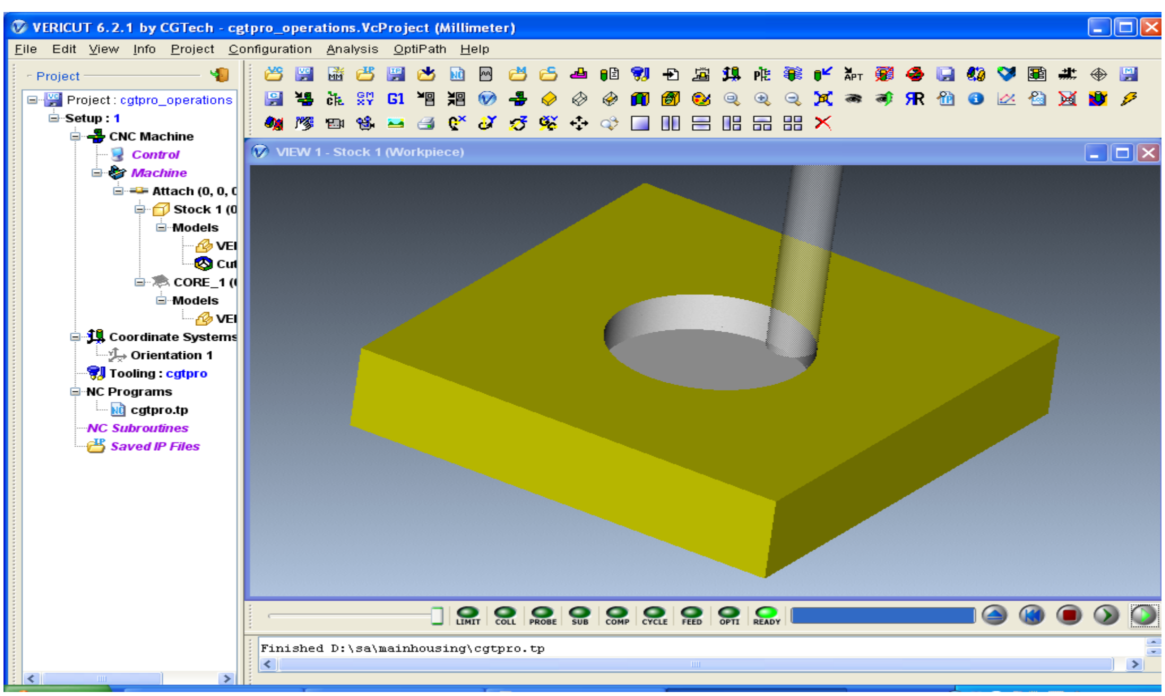

Fig 2:

Cavity

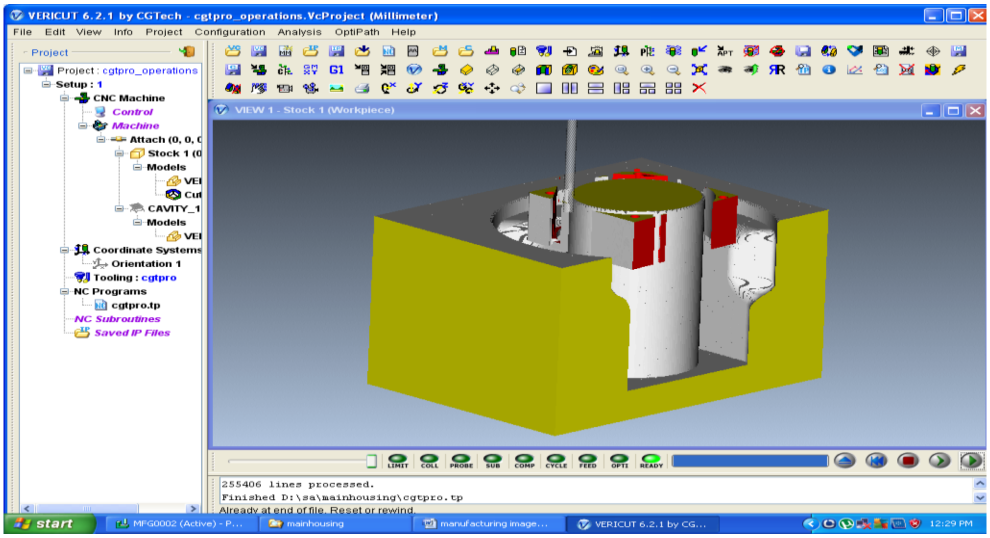

Fig 3:

Side Cavity

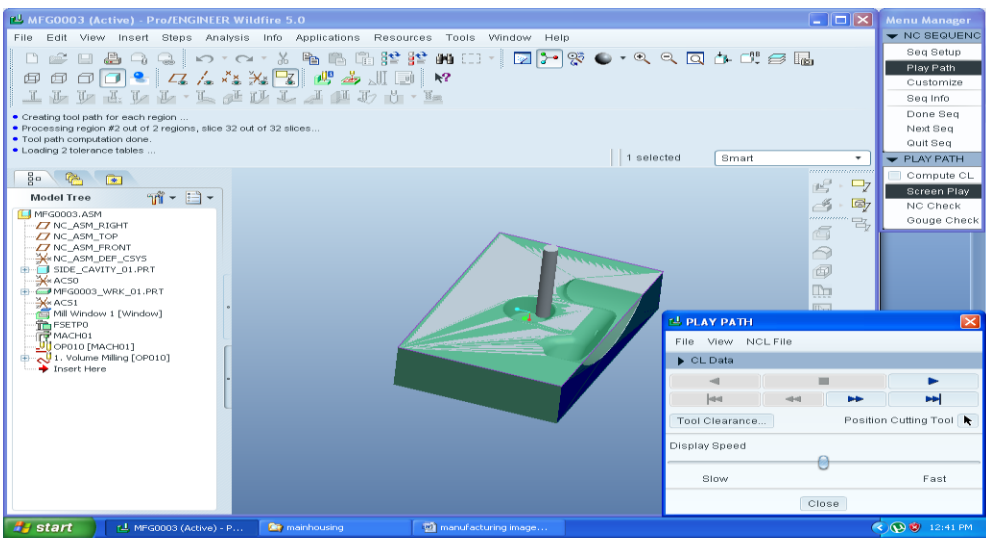

Fig 4:

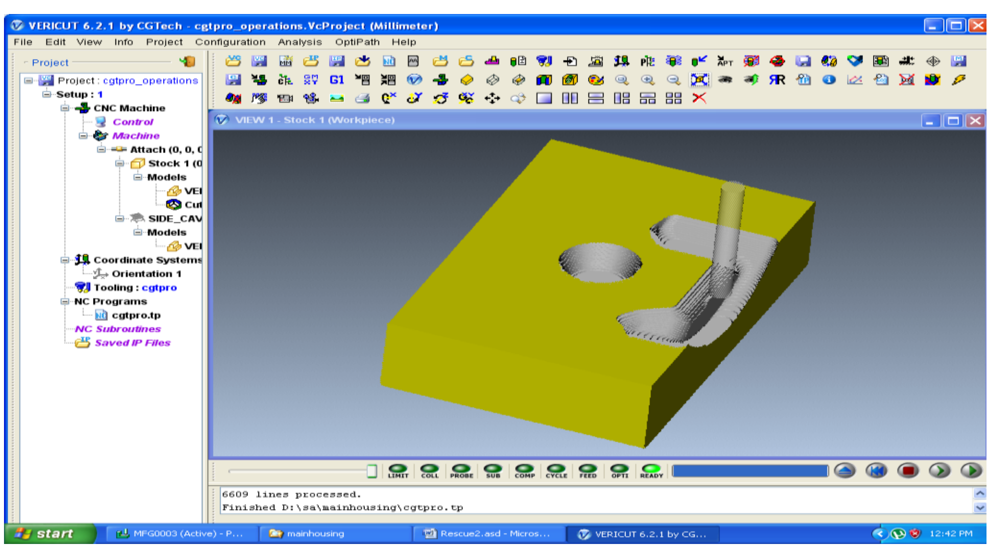

Fig 5:

Conclusion

In this paper It is modeled a piston housing used in a hydraulic oil filter in 3D modeling software Pro/Engineer.

We have designed total cavity die for the piston housing. We have done die design calculations for piston housing. From the calculations, we have to select 2500T machine.

We have extracted core, cavity, prepared total die for the piston housing. We have done CNC programming for core, cavity and side cavity. We have prepared the total casting tool die of piston housing which is ready for manufacturing.

References

1. Die Design book by W. PYE
2. Mechanical Engineering Design by Budynas−Nisbet
3. Manufacturing Process For Engineering Materials, 5th Edition by j.mater
4. Handbook of mechanical engineering - modern manufacturing by Ed. Frank Kreith
5. Automotive Production Systems and Standardisation by WERNER
6. Kasim Daws M, Zouhair AL-Dawood I, Sadiq AL-Kabi H. Selection of Metal Casting Processes: A Fuzzy Approach Jordan Journal of Mechanical and Industrial Engineering 2008; 2(1):45-52.
7. Darina Matisková, Štefan Gašpar, Ladislav Mura. Thermal Factors of Die Casting and Their Impact on the Service Life of Moulds and the Quality of Castings Acta Polytechnica Hungarica, 2013, 10(3).
8. Venkata Ramesh Mamilla, Lakshmi Narayana Rao G. Study on computer numerical control (CNC) machines International Journal of Advanced Scientific Research, 2016; 1(1):21-25.
9. Ndaliman MB, Pius PA. Behavior of Aluminum Alloy Castings under Different Pouring Temperatures and Speeds, LEJPT 2007; 11:71-80
10. Paray F, Kulunk B, Gruzleski JE. Impact properties of Al-Si foundry alloys, Int. Journal of Cast Metals Res. 2000; 13:17-37.