

Within engine piston
with the primary
forming processes



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Within this assignment I have been tasked to research into two components of a single consumer product and the primary forming processes used to manufacture the two parts. For this I have chosen my product to be a car with the two parts being the engine cylinder head and the engine piston with the primary forming processes being sand casting and forging respectively. I will do further research into the specific characteristics, advantages and disadvantages of each forming process and why they are the chosen method for the given part over alternatives. 1.

0 Engine cylinder head 1. 1 Overview An engine cylinder head is commonly located at the top of the engine block where it closes off the top of the cylinder forming the combustion chamber where the fuel is burned. The main function of the cylinder head is to help the head gasket to seal the cylinders so that they can build enough compression for engine operation to work efficiently. Also, the cylinder head contains lots of channels and passageways which are used to stop the engine from overheating as they enable engine coolant to pass through, allow air and fuel to the cylinder and let exhaust fumes escape.

(stein, n. d.) 1. 2 Material Cylinder heads in automobiles are subjected to thermal strains, aggressive wear conditions, and high fatigue stresses which is why it is key that the engineer selects the correct material for the job. The main requirements of the material that are needed to be suitable for use in an engine cylinder head are:

- Strength/weight ratio- The applied alloy has to offer sufficient strength and hardness at room temperature for machining and assembly as well as maintaining properties at elevated temperatures of up to 250°C whilst also being as light as possible

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· Thermal conductivity- The alloy will have to have high thermal conductivity to allow the heat from combustion to escape into the coolant quickly. Surface quality- Smooth finishing surfaces are required because of the constant gas flow for combustion as if there were any rough patches or notches over time you will get cracks in the part. Fatigue strength- Having a high fatigue strength if key as engine cylinder heads are exposed to high-cycle fatigue (HCF) from combustion cycles and to low-cycle fatigue (LCF) from thermal expansion and contraction during start-up and stop of the engine (Aluminium Automotive Manual, 2011) Grey cast-iron alloys were the popular choice in material in cylinder heads for many years due to its cheapness compared to other metals like aluminium, castability, machinability, high corrosion resistance, rigidity, and hardness, as well as its low thermal expansion.

However cast-iron has the disadvantages of high weight and low thermal conductivity when compared to alternatives. This then lead to the extensive use of aluminium alloys which left cast iron only being used in applications where the internal stresses are much higher. This is because aluminium alloys are much lighter and more conductive than cast-iron. This makes aluminium alloys more suitable for use in cylinder heads because it will help to keep the weight of the engine down increasing performance of the vehicle and it will allow the heat from combustion to escape into the coolant quicker which is the main purpose of the part. (Galal, 2016)