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## Manufacturing Process of Automotive Interior Trim Parts

- **What is the meaning of trim parts?**

Trim parts are parts that made by metals or polymers on cars and this parts mainly made for visual aesthetic. That parts usually made by polymers (ABS, PLA, faux leather etc.). Its intention is to make interior car designs more comfortable and aesthetic. There are two types of trim parts [1]:

1. Interior trim parts
2. Exterior trim parts



Figure 1 - Interior design of 1960 Aston Martin DB4 Series II



Figure 2 - Front Cup Holder Trim Panel of the R35 Nissan GT-R

- **Why we need interior trim parts on cars?**

Many car users believe that cars should be comfortable and well-designed. It stems from people's aesthetic need. Most of trim parts are not used for a technical function but it shows car interior design more comfortable and luxurious therefore companies work on trim parts.

- **Manufacturing process of interior trim parts on car**

High performance polymers are playing an important role in the automotive industry. There are major polymers used in automotive interior trim parts such as [2,10,11,12]:

- **Poly-Vinyl-Chloride (PVC)**

PVC is a good flexible material and a flame retardant. It can be more flexible depending on amount and type of plasticizers used so it has a wide usage area in automotive industry.

- **Acrylonitrile Butadiene Styrene (ABS)**

ABS, a rubbery substance, provides resilience even at low temperatures so it can absorb vibrations in vehicle. Vibration makes dashboard less readable as a conclusion most of manufacturer prefer ABS in dashboard manufacturing process in order to prevent vibration.

- **POM (polyoxymethylene)**

In low temperatures, POM has excellent stiffness, rigidity, and yield strength. It mainly used for trim parts manufacturing

There are major types of polymer trim parts manufacturing such as:

### - 3D Printing

This process is a type of hot manufacturing method. In this process, a hot nozzle injects molten polymer to printing surface. This process generally has low production accuracy.

### - CNC Machining

There are a lot of types of CNC Machining but all of CNC machining methods includes computer control. This process has high production accuracy and capability.



Figure 3 - A Sample for 3D Printer



Figure 4 - A CNC Machining Operation

### - Rotational Molding

This process includes two perpendicular axis rotation and heat system. The mold always continues to rotate during the heating phase and the cooling phase. In this way, molten polymer is evenly distributed [3].

### - Vacuum Forming

This process used for sheet polymer forming in industry. In this process, sheet polymer heated and vacuumed to the mold. It is very cheap manufacturing method for automotive industry.

### - Injection Molding

This process is a manufacturing method for producing parts by injecting molten material into a mold. This process requires chip removal from parts surface [4].

On the other hand, some metal sheets (aluminum, etc.) were preferred in the trim part manufacturing process of the companies. There are some major metal trim parts production process such as:

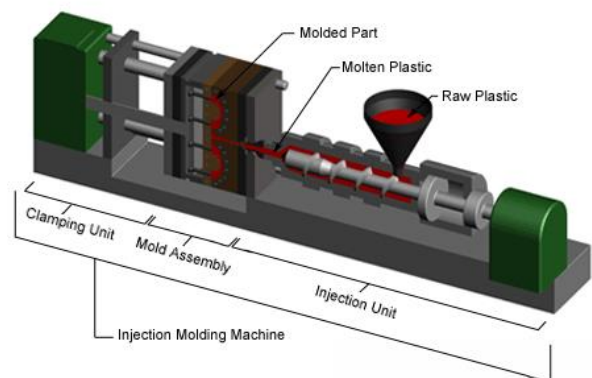


Figure 5 - Sample Diagram of Injection Molding

### - Bending

Bending is a manufacturing process to produce U-shape, V-shape etc. along a straight axis in soft materials (mainly sheet metal) [6].

### - Hemming

This process used for finishing operations. It is the process of bending the sheet of the outer panel over the inner panel. It makes metal trim parts more aesthetic [7].

### - Hydroforming

Hydro forming process is an effective way to shape ductile metals such as aluminum, low alloy steel etc. Hydroforming is a specialized type of forming that uses a high-pressure hydraulic fluid to press room temperature working material into a mold [8].

### - Laser Cutting

This process uses laser to cut metal sheets with computer control. It can't give a curve to sheet, but it is faster than other sheet cutting process [9].

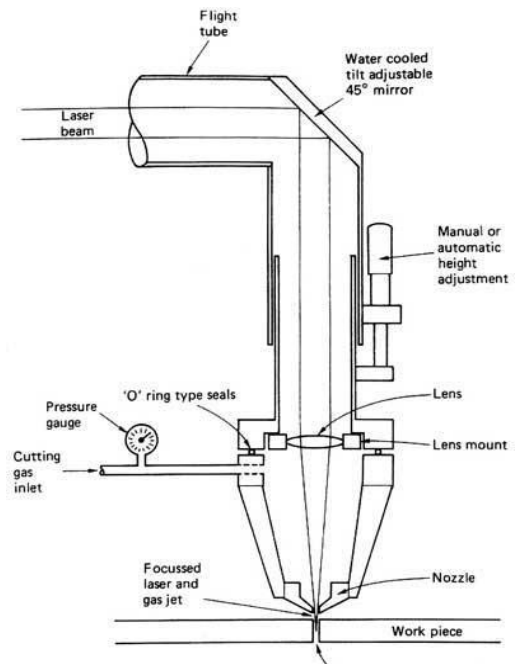


Figure 6 - Sample Diagram of Laser Cutting

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**Figure 1** - [https://houtkamp.nl/portfolio\\_page/1960-aston-martin-db4-series-ii-original-left-hand-drive-copy/](https://houtkamp.nl/portfolio_page/1960-aston-martin-db4-series-ii-original-left-hand-drive-copy/)

**Figure 2** - <http://www.gt-rr.com/cup-holder-carbon-fiber>

**Figure 3** - <https://www.designworldonline.com/makerbot-refocuses-professional-educational-3d-printing-users/>

**Figure 4** - <https://community.plm.automation.siemens.com/t5/Solid-Edge-Blog/5-Benefits-of-CNC-Machining-for-Manufacturers/ba-p/516015>

**Figure 5** - [writeopinions.com](https://writeopinions.com)

**Figure 6** - [https://en.wikipedia.org/wiki/Laser\\_cutting](https://en.wikipedia.org/wiki/Laser_cutting)