QUALITY IMPROVEMENT IN FLUID RESERVOIR MANUFACTURING PROCESS OF BRAKING SYSTEM OF CARS

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ABSTRACT

Reservoir contains braking fluid in braking system it is made up of thermoplastic material named polypropylene. The manufacturing of reservoir involves processes such as injection moulding and hot plate welding This process explains about the quality improvement in injection moulding, hot plate welding by studying the properties of polypropylene is normally tough and flexible especially when copolymerized with ethylene. This allows polypropylene to be used as an engineering plastics and improving the process parameters in manufacturing to resolve the welding failure, assembly contamination, part line mismatch problems occurred in the product.

Key words: Quality improvement in fluid reservoir for braking system

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I. INTRODUCTION

A typical braking system in which each circuit acts on both front wheels and one-rear wheel. Pressing the brake pedal forces fluid out of the master cylinder along the brake pipes to the slave cylinders at the wheels; the master cylinder has a reservoir which keeps it full. Modern cars have brakes on all four wheels, operated by a hydraulic system. The brakes may be disc type or drum type. The front brakes play a greater part in stopping the car than the rear ones, because braking throws the car weight forward on to the front wheels. Many cars therefore have disc brakes, which are generally more efficient, at the front and drum brakes at the rear. All-disc braking systems are used on some expensive or high-performance cars, and all-drum systems on some older or smaller cars. A hydraulic brake circuit has fluid-filled master and slave cylinders connected by pipes. When you push the brake pedal it depresses a piston in the master cylinder, forcing fluid along the pipe. The fluid travels to slave cylinders at each wheel and fills them, forcing pistons out to apply teethes brakes.

i)Servo-Assisted Braking

This arrangement allows great force to be exerted by the brakes, in the same way that a long-handled lever can easily lift a heavy object a short distance. Most modern cars are fitted with twin hydraulic circuits, with two master cylinders in tandem, in case one should fail. Sometimes one circuit works the front brakes and one the rear brakes; or each circuit works both front brakes and one of the rear brakes; or one circuit works all four brakes and the other the front ones only. Under heavy braking, so much weight may come off the rear wheels that they lock, possibly causing a dangerous skid. For this reason, the rear brakes are deliberately made less powerful than the front. Most cars now also have a load-sensitive pressure-limiting valve. It closes when heavy braking raises hydraulic pressure to a level that might cause the rear brakes to lock, and prevents any further movement of fluid to them. Advanced cars may even have complex anti-lock systems that sense in various ways how the car is decelerating and whether any wheels are locking. Such systems apply and release the brakes in rapid succession to stop them locking.

ii) Power-Assisted Brakes

Many cars also have power assistance to reduce the effort needed to apply the brakes. Usually the source of power is the pressure difference between the partial vacuum in the inlet manifold and the outside air.

iii) Drum Brakes

A drum brake has a hollow drum that turns with the wheel. Its open back is covered by a stationary back plate on which there are two curved shoes carrying friction linings. The shoes are forced outwards by hydraulic pressure moving pistons in the brake's wheel cylinders, so pressing the linings against the inside of the drum to slow or stop it. Each brake shoe has a pivot at one end and a piston at the other. A leading shoe has the piston at the leading edge relative to the direction in which the drum turns.

iv) Drum Brake

A drum brake with a leading and trailing shoe, which has only one hydraulic cylinder; brakes with two leading shoes have a cylinder for each shoe and are fitted to the front wheels on an all-drum system. The rotation of the drum tends to pull the leading shoe firmly against it when it makes contact, improving the braking effect.

Some drums have twin leading shoes, each with its own hydraulic cylinder; others have one leading and one trailing shoe - with the pivot at the front.

This design allows the two shoes to be forced apart from each other by a single cylinder with a piston in each end. It is simpler but less powerful than the two-leading-shoe system, and is usually restricted to rear brakes. In either type, return springs pull the shoes back a short way when the brakes are released. Shoe travel is kept as short as possible by an adjuster. Older systems have manual adjusters that need to be turned from time to time as the friction linings wear. Later brakes have automatic adjustment by means of a ratchet.Drum brakes may fade if they are applied repeatedly within a short time - they heat up and lose their efficiency until they cool down again. Discs, with their more open construction, are much less prone to fading.

v) Disc Brake

The basic type of disc brake with a single pair of pistons. There may be more than one pair, or a single piston operating both pads, like a scissor mechanism, through different types of calipers - a swinging or a sliding caliper. The servo unit that provides the assistance has a pipe connection to the inlet manifold. A direct-acting servo is fitted between the brake pedal and the master cylinder. The brake pedal pushes a rod that in turn pushes the master-cylinder piston. But the brake pedal also works on a set of air valves, and there is a large rubber diaphragm connected to the master-cylinder piston.

When the brakes are off, both sides of the diaphragm are exposed to the vacuum from the manifold. Pressing the brake pedal closes the valve linking the rear side of the diaphragm to the manifold, and opens a valve that lets in air from outside. The higher pressure of the outside air forces the diaphragm forward to push on the master-cylinder piston, and thereby assists the braking effort. If the pedal is then held, and pressed no further, the air valve admits no more air from outside, so the pressure on the brakes remains the same. When the pedal is released, the space behind the diaphragm is reopened to the manifold, so the pressure drops and the diaphragm falls back. If the vacuum fails because the engine stops, for example the brakes still work because there is a normal mechanical link between the pedal and the master cylinder. But much more force must be exerted on the brake pedal to apply them.Some cars have an indirect-acting servo fitted in the hydraulic lines between the master cylinder and the brakes. Such a unit can be mounted anywhere in the engine compartment instead of having to be directly in front of the pedal. It too relies on manifold vacuum to provide the boost. Pressing the brake pedal causes hydraulic pressure build up from the master cylinder, a valve opens and that triggers the vacuum servo Fluid pressure distributes itself evenly around the system. The combined surface 'pushing' area of all the slave pistons is much greater than that of the piston in the master cylinder. A hydraulic brake circuit has fluid-filled master and slave cylinders connected by pipes. When you push the brake pedal it depresses a piston in the master cylinder, forcing fluid along the pipe. The fluid travels to slave cylinders at each wheel and fills them, forcing pistons out to apply teethes brakes.Fluid pressure distributes itself evenly around the system. The combined surface 'pushing' area of all the slave pistons is much greater than that of the piston in the master cylinder.Consequently, the master piston has to travel several inches to move the slave pistons the fraction of an inch it takes to apply the brakes.

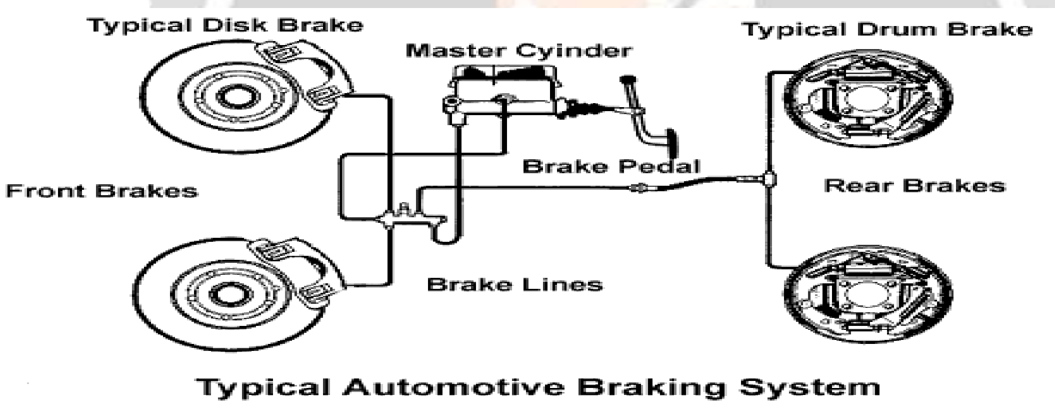


Fig- 1 automotive breaking system

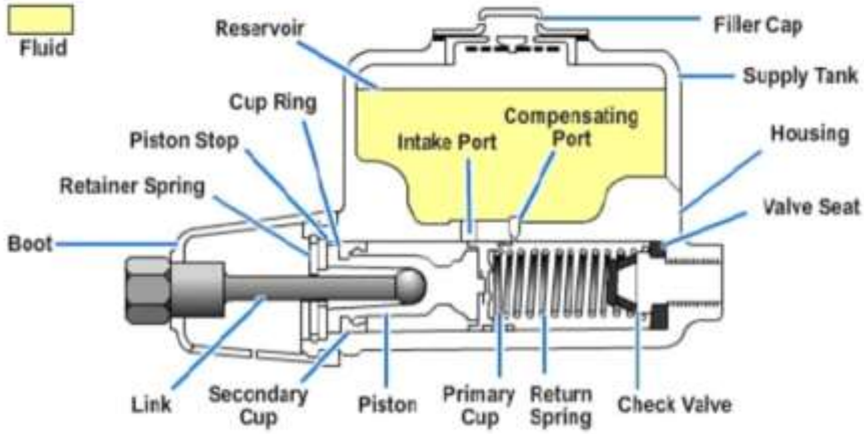


Fig 2 Master Cylinder

II INJECTION MOULDING

- Injection moulding is a manufacturing process for producing parts by injecting material into a mould. Injection moulding can be performed with a host of materials, including metals, glasses, elastomers, confections, and most commonly thermoplastic and thermosetting polymers.
- Material for the part is fed into a heated barrel, mixed, and forced into a mould cavity, where it cools and hardens to the configuration of the cavity. After a product is designed, usually by an industrial designer or an engineer, moulds are made by a mould maker (or toolmaker) from metal, usually either steel or aluminum, and precision-machined to form the features of the desired part. Injection moulding is widely used for manufacturing a variety of parts, from the smallest components to entire body panels of cars.
- Advances in 3D printing technology, using photopolymers which do not melt during the injection moulding of some lower temperature thermoplastics, can be used for some simple injection moulds
- Parts to be injection moulded must be very carefully designed to facilitate the moulding process; the material used for the part, the desired shape and features of the part, the material of the mould, and the properties of the moulding machine must all be taken into account. The versatility of injection moulding is facilitated by this breadth of design considerations and possibilities.

- Injection moulding is used to create many things such as wire spools, packaging, bottle caps, automotive dashboards, Game boys, pocket combs, some musical instruments (and parts of them), one-piece chairs and small tables, storage containers, mechanical parts (including gears), and most other plastic products available today. Injection moulding is the most common modern method of manufacturing parts; it is ideal for producing high volumes of the same object.

i) Block Diagram

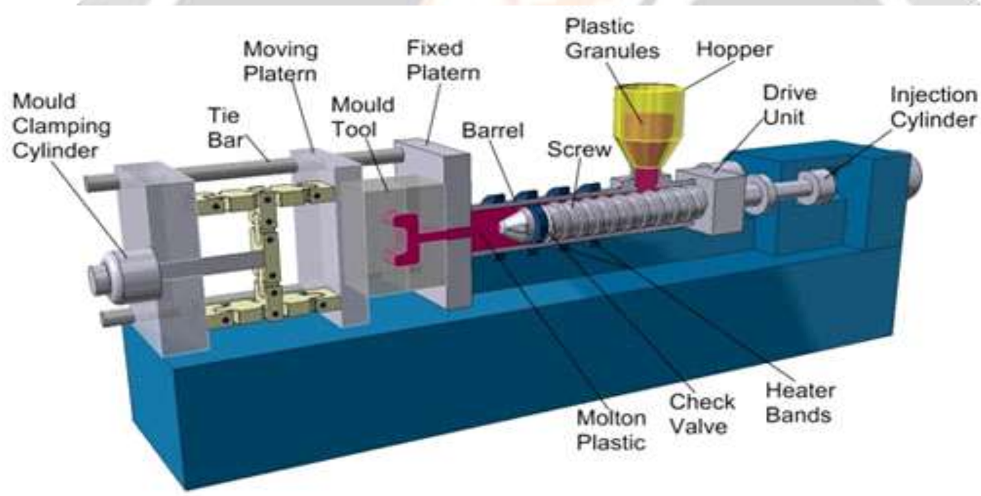


Fig -3

Injection Moulding

ii) Design of Fluid Reservoir

Fig-4 Design of Fluid Reservoir

III CHEMICAL AND PHYSICAL PROPERTIES

Most commercial polypropylene is iso-tactic and has an intermediate level of crystalline between that of low-density polyethylene (LDPE) and high-density polyethylene (HDPE). Polypropylene is normally tough and flexible, especially when copolymerized with ethylene. This allows polypropylene to be used as an engineering plastic, competing with materials such as acrylic nit riles butadiene styrene (ABS). Polypropylene is reasonably economical, and can be made translucent when uncolored but is not as readily made transparent as polystyrene, acrylic, or certain other plastics. It is often opaque or colored using pigments. Polypropylene has good resistance to fatigue. The melting point of polypropylene occurs at a range, so a melting point is determined by finding the highest temperature of a differential scanning calorimetric chart. Perfectly iso-tactic PP has a melting point of 171 °C (340 °F). Commercial iso-tactic PP has a melting point that ranges from 160 to 166 °C (320 to 331 °F), depending on ataxic material and crystallinity. Syndiotactic PP with a crystalline of 30% has a melting point of 130 °C (266 °F).[2] The melt flow rate (MFR) or melt flow index (MFI) is a measure of molecular weight of polypropylene

IV Thermocouple

A thermocouple is an electrical device consisting of two dissimilar conductors forming electrical junctions at differing temperatures. A thermocouple produces a temperature-dependent voltage as a result of the thermoelectric effect, and this voltage can be interpreted to measure temperature. Thermocouples are a widely used type of temperature sensor.Commercial thermocouples are inexpensive, interchangeable, are supplied with standard connectors, and can measure a wide range of temperatures. In contrast to most other methods of temperature measurement, thermocouples are self powered and require no external form of excitation. The main limitation with thermocouples is accuracy; system errors of less than one degree Celsius (°C) can be difficult to achieve. Thermocouples are widely used in science and industry; applications include temperature measurement for kilns, gas turbine exhaust, diesel engines, and other industrial processes. Thermocouples are also used in homes, offices and businesses as the temperature sensors in thermostats, and also as flame sensors in safety devices for gas-powered major appliances.

i) Before Quality Improvement

Fig.5 Thermocouple Fixed Before Quality Improvement

- Thermo couple fixed at the end of Heater Plate. Not between the two heaters.
- It is not possible to find out heater (H2) failure.

ii) After Quality Improvement

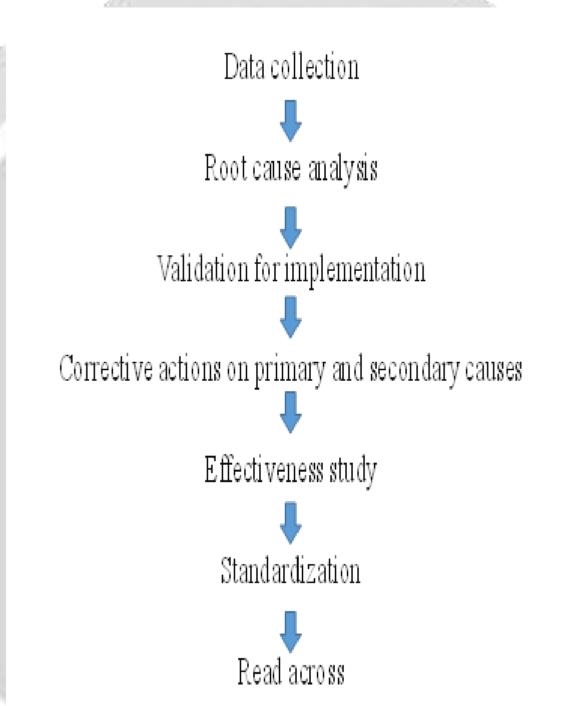
Fig.6 Thermocouple Fixed After Quality Improvement

- Thermo couple fixed in between the Two Heaters.
- It is possible to find out two heater failures at same time.

IV METHODOLOGY

Complaint Analysis is done by Pareto Concept. BTMC has 16 complaints. 9 out of 42 child parts contributes 16 complaints. 12/16 complaints are plastic commodities. Hence plastic commodities are vulnerable in the system .Process improvement in plastic commodity should be done. Out of 12 plastic commodities, One part FR assembly (Fluid Reservoir) alone has 5 complaints. The parts FR assembly -5 complaints and adaptor, FLWI, Cap and Non return value has 3, 2, 1 and 1 respectively.

Reservoir Assembly Child part is considered for Quality improvement at first.



DOT Type	Dry boiling point	Wet boiling point	Viscosity limit	Primary constituent
DOT 2	190 °C (374 °F)	140 °C (284 °F)	1300 mm^2/s	Castor oil/alcohol
DOT 3	205 °C (401 °F)	140 °C (284 °F)	1500 mm^2/s	Glycol Ether

DOT 4	230 °C (446 °F)	155 °C (311 °F)	1800 mm^2/s	Glycol Ether/Borate Ester
DOT 5	260 °C (500 °F)	180 °C (356 °F)	900 mm^2/s	Silicone
DOT 5.1	260 °C (500 °F)	180 °C (356 °F)	900 mm^2/s	Glycol Ether/Borate Ester

Table 1: Chemical Properties of Fluid

CONCLUSION

The 4m-analyses on the brake oil filling machine results us to follow the below. The ensuring of torque by applying the above technique, the preventive maintenance of the brake oil filling machine and proper oil storage techniques. By doing the above changes in the company, the company can ensure 100% efficiency in the production field over all such constrains to produce quality cars there by ensuring safety. Thus my idea would definitely help the company to its motto of "drive defects to zero".

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