Subject: Injection Moulding Overview	Product: A1000 or G7 Drives	Doc#: AO.AFD.69
Title: Injection Molding		

Injection Molding

Application Overview

Injection molding is a manufacturing technique for making parts from plastic material. Heated, fluid plastic is injected at high pressure into a mould, which is the inverse of the desired shape. The steel or aluminum mold is machined with the contours of the final product. Injection molding is used for create a variety of parts, like plastic milk cartons, containers, bottle caps, automotive dashboards, pocket combs, and most other plastic products available today. Injection molding is the most common method of part manufacture. AC drives will commonly be used to power the hydraulic oil pressure pump for operating the mold works of an injection-molding machine. Servo drives can be used to operate the injection screw, as precision control is often required for the injection step. Significant energy savings are often realized by replacing hydraulics with electric drive systems on injection molding machines.

Application Challenges:

- High cost for initial tooling
- Energy savings
- Durability for continuous operation
- Cyclical load conditions
- Protection of expensive molds and screws
- Quick restart in the event of power loss

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Yaskawa Products:

Product	Feature	Benefit
A1000 OR G7 Drives	Torque Limit	The torque limit function limits the amount of motor torque in all four quadrants of vector control operation. Damage to machinery can be prevented by properly setting the Torque Limit Function.
	Overtorque Detection	The drive can warn the user of a damaging load related fault situation before it occurs by using Overtorque and/or Undertorque Detection. This is useful for detecting any process irregularities or preventing excessive damage to expensive screws or gears.
	Open Loop Vector Motor Control Mode	Using Open Loop Vector the drive can maintain the speed of the injection molder with an accuracy of +/-0.2 %. Use of Frequency Reference Hold and Frequency Reference Loss Functions help maintain speed.
	Energy Saving Mode	Power can be conserved using the Energy Saving Control when the drive is waiting for a command or during preparations for the next process task.
	Undertorque Detection	The Undertorque and Overtorque Detection features immediately sense problems with the hydraulic pump by monitoring for excessive or insufficient pressure.
	Torque Monitor	The Torque Monitor allows the user to have exact control of melted material viscosity.
	Momentary Powerloss Ride-thru	The Momentary Powerloss Ride-through and Fault Restart functions allow the drive to continue operation without the need for attended restart. (An injection molder can be difficult to restart if it is shut off in the middle of a process).

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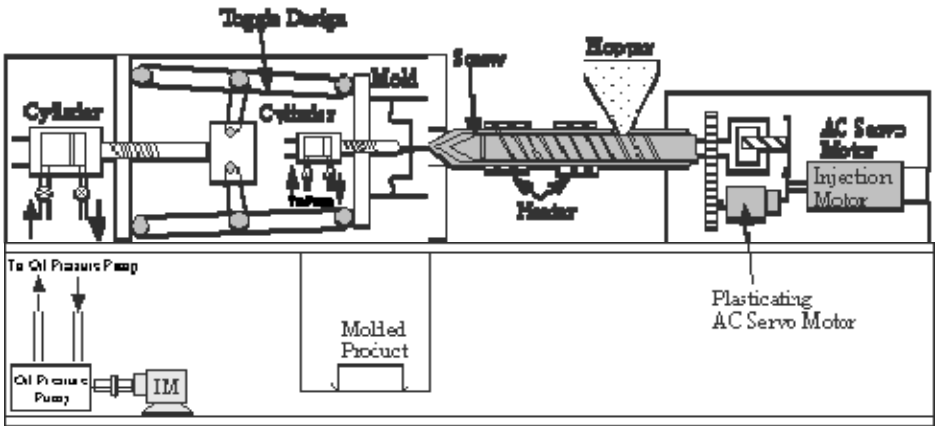
Application Details:



The injection molding is a cyclical process. Cycle times may range from 10 to 100 seconds and are controlled by the cooling time of the melted plastic. The melted plastic comes from hard plastic pellets that are fed into the hopper of the injection-molding machine. The pellets or plastic powder is melted inside the machine and then forced into the mold thru a nozzle (like a syringe) by a long screw within a heated cylinder.

A reciprocating screw type injection-molding machine has screw that rotates forward and fills the mould with melted plastic, holds the melted plastic under high pressure. The screw forces more melted plastic into the mold as required. The mold eventually becomes full and the plastic cools in the mould. This separates the cold plastic in the mold from the liquid plastic in the screw. The screw is stopped while the heater around the cylinder and the screw inside the cylinder melts more pellets. The mold then opens, typically in half, and the cooled solid plastic part is ejected as mold is closed again and prepared for the next shot of melted plastic.

Pelletized or powdered materials that are commonly used in injection molding machines:

- Ethylene
- Polystyrene
- Acrylonitrile-Butadiene-Styrene (ABS)
- Nylon
- Polycarbonate
- Polypropylene