

## Plastic Injection Molding

Plastic injection molding machines form parts by melting the resin, injecting the liquid resin into a closed mold, under pressure, cooling the resin inside the closed mold and finally opening the mold and ejecting the part. The resin, in pellet form, feeds from the hopper into the heated barrel where shear forces, friction and the heat from the heater bands melts the plastic. The melt is then pushed into a split die mold through a nozzle by using a hydraulic plunger or a rotating and reciprocating screw. The mold faces are clamped together under many tons of pressure. The high clamping force can be provided either mechanically or hydraulically or by a combination of both. Once the cavity is filled, the part is allowed to cool. When the part has cooled enough the mold is opened. The moving platen moves backwards and the part is removed, either by ejector pins that ejects the part, or by the operator.

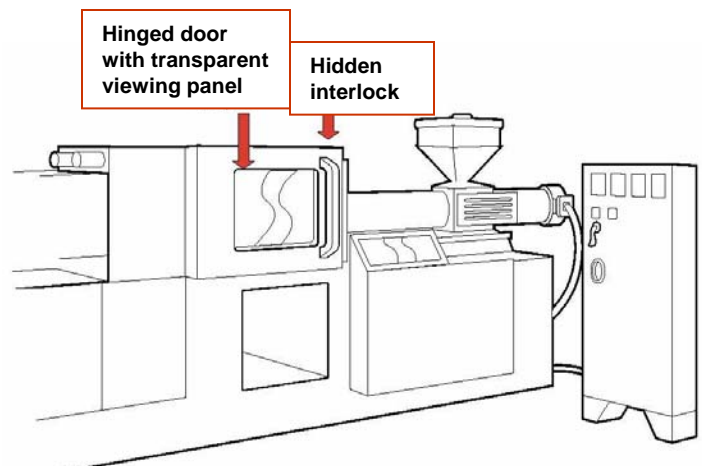
**Operator Involvement:** The operator ensures the machine is operating properly. If the process is not automated, the operator may actuate the machine manually and have to remove parts by hand.

**Hazards:** Primary hazard associated with molding machines is the crushing hazard from the point of operation, or the surface burns to hands, arms, and face from hot plastic (burned parts may require surgical removal). However, operators also come in contact with nip points and electrical. Some common causes of injuries include: crushed in the point of operation due to lack of safeguards and interlocks; interlocks do not function when operator attempts to remove work piece from the mold; inadvertently reaching around guards into hazardous areas; removing guards that are not interlocked, thereby bypassing safeguards;

### Guarding:

Install a safety gate to keep the operator away from moving parts and the mold while the machine is operating. This gate must be in a fully closed position before the clamp can be operated, either manually or automatically. An interlock shall cause the clamp to stop or open when the gate is open a maximum distance of 1 inch.

Install three interlocks: electrical, hydraulic or pneumatic, and mechanical.



### Three Interlocks Required!

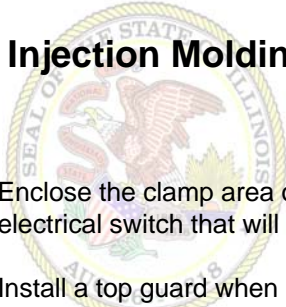
1. The electrical switch that can be actuated only when the safety door is closed to provide operation of the electrical system for clamp closing.
2. The hydraulic or pneumatic interlock, is mechanically operated by opening the safety door, to prevent the clamp from closing when the safety gate is open.
3. A mechanical safety device, actuated by the safety gate, so when the safety gate is opened and the clamp is in its adjusted open position, will physically prevent closing of the clamp.

**References:** OSHA 29 CFR 1910.212; ANSI B151.1; See also OSHA's eTool on plastic molding

### Case Study

33-year old supervisor died when his head was crushed between a hydraulic cylinder and a panel of a plastics injection molding machine. The supervisor was setting-up the machine for a run and was in the process of tightening a bolt. While tightening the bolt the decedent positioned his head so that it was between the hydraulic cylinder and a panel of the machine. During this time the machine cycled and his head was caught.

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1. Enclose the clamp area opposite the operator of the machine with a rear guard interlocked with an electrical switch that will prevent operation of the machine if the guard is open.
2. Install a top guard when it would be possible for an operator standing on the floor to reach over the top of the safety gate and into a hazardous area. If the top guard is movable or portable, provide an interlock that will prevent machine operation if the top guard is moved or removed.
3. Guard all feed openings for plastic materials against accidental insertion of hands by the operator.
4. Provide a cover or barrier to prevent inadvertent contact with high voltage or the heater bands.
5. Install a shield to protect the front, rear, and top of the purging area behind the fixed clamp platen.

## Safer Work Practices

- ❖ Establish and follow a program of periodic and regular inspections of horizontal injection molding machines to ensure that safeguards are in safe operating condition and proper adjustment.
- ❖ Train and instruct employees in the safe method of operation and the safety devices provided before starting work.
- ❖ Provide clearance between machines so that movement of one operator will not interfere with the work of another.
- ❖ Provide ample room for cleaning of machines and handling of material, workpieces, and scrap.
- ❖ Keep all workplaces in a good condition, clean, and as far as practical, dry.
- ❖ Apply warning signs appropriate to each of the various hazards.
- ❖ Wear eye protection Provide steps to a platform for access to the hopper.
- ❖ Provide personal protective equipment to prevent burns when coming in contact with hot surfaces.
- ❖ Provide extension tools so operators do not need to reach into hazard zones.

The number of accidents and the circumstances in which they occur show that most can be avoided by a knowledge of the risks and by adopting safety measures. The simple safety steps given below will help to prevent most accidents at grinding machines. You may find them useful as a safety check list.