Manufacturing intelligence: Plastic injection moulding

Helping brokers protect clients
We know that your clients take risk management seriously and that it plays a key role in the service you offer. We have produced this guide to highlight the controls your clients can take to help reduce the risks associated with the production processes of the injection moulding trade.

**Process overview**

Injection moulding is the process by which plastic raw materials are heated into a liquid state and squeezed (injected) into a mould.

The raw plastic, usually in granular pellet or powder form, is placed into a hopper. The hopper then feeds the plastic into a heated injection unit, where it is pushed through a long chamber with a reciprocating screw. Here, it is softened to a fluid state. A nozzle is located at the end of the chamber and the fluid plastic is forced through the nozzle into a cold and closed mould. The halves of the mould are held shut with a system of clamps. When the plastic is cooled and solidified, the halves open and the finished products are ejected from the press.

Mould or die are the common terms used to describe the tool used to produce plastic parts in moulding. Since moulds can be expensive to manufacture, they are often used in mass production where thousands of parts were being produced. Typical moulds are constructed from hardened steel, pre-hardened steel, aluminum, and/or beryllium copper alloy, meaning some can be theft attractive. The moulds can be manufactured either by CNC machining or by using electrical discharge machining processes.

Modern day injection moulding machines are controlled by a in-built computer, with sensor fed information being used to control the actions of the machine and ensure consistent output and quality.

Injection mouldings count for a significant proportion of plastic production, from the manufacturing of micro parts and small items like disposable razors and bottle lids to large components such as car bumpers and wheelie bins. The machinery can be used to manufacture one consistent part in a repeating process, or there could be a multi impression tool designed to incorporate many components on the same tool with a single injection.
Risk features

**Business Interruption**

Key attention should be paid to the nature of the moulds used in the injection moulding process. These can be unique, bespoke and one-off moulds which can be of high value and extremely difficult to replace. They have limited application hence their theft attractiveness is limited, but significant damage (especially fire damage) can render the mould unusable therefore leaving the manufacturer with a long lead time and business interruption to reproduce the original mould.

Relatively small fires can result in a significant business interruption (often greater than property loss) due to contamination from smoke, water extinguishment, heat etc. rendering all stock unsuitable for sale.

**Material Damage**

Machinery has the capacity to be left to run unattended with automated hopper feeds providing the raw material. Smaller operations will have more labour intensive production procedures, whereas larger operations with higher turnover machines require constant monitoring and attention.

Unattended running of machinery is generally not an attractive feature for insurers. This is principally because a small fault in an unattended machine can quickly escalate to a major problem when no one is in attendance to spot and correct the issue quickly.

In repetitive batch processing, high piled storage in fixed metal racked systems can be expected, which can bring a significant fire loading to the premises and is a feature which needs to be considered as part of the Fire Risk Assessment. It is a better feature when businesses have fully separated storage of finished stock from the production areas, ideally in a separate building or otherwise with at least a two hour fire separation.

Appropriate storage arrangements for flammable liquids is also important.

**Employer’s Liability**

Raw materials comprise plastic pellets, granules and powders including additives such as fillers, pigments, fire retardants and stabilisers. Loose granules or spillages can create slip hazards. When the material is heated during the process, plastic fume can be produced which includes respiratory sensitisers, irritants and carcinogens. The extent of fume production is influenced by the material being processed, the temperature being applied, the operating procedures, the reliability of temperature control and machine maintenance. Machine cleaning, maintenance and ventilation play an important role in mitigating any potential plastic fume.

Workplace ergonomics, poor posture and handling can create musculoskeletal disorders leading to significant injury and claims potential. Proper assessment of work stations and activities is required to avoid and control this exposure.

**Public Liability**

It is important to understand the functionality of the range of components parts manufactured and also the client’s position in the ultimate chain of supply. Parts may be manufactured solely to customer specification or your client may provide some form of design service. Products with a safety critical function or those ultimately intended for the North American market can represent additional risks that require a robust risk management approach.

Quality control measures play an important role in mitigating risk. Good quality control measures include ongoing reviews of the design and formulation of products, product testing, identification and recording of product distribution, controls on packaging and labelling and formulating a recall plan. It is important that the client retains full traceability for the materials supplied to them.
The tables below highlight some specific hazards present in injection moulding along with those associated precautions which will help prevent major physical property loss. Generic risks resulting from arson, electrical sources and waste are not mentioned here.

### Material Damage and Business Interruption Hazards

#### Features always present

<table>
<thead>
<tr>
<th>Hazard</th>
<th>Control</th>
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<tbody>
<tr>
<td></td>
<td>- Professional and regular maintenance of machinery and equipment.</td>
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<td>- Use of shields to prevent hot fluid coming into contact with hot surfaces.</td>
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<td>- Frequently checking hose and machinery condition.</td>
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<td></td>
<td>- Effective storage management, incorporating separate storage for the various classes of goods e.g. raw materials stored away from finished goods.</td>
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<td>- Effective management to ensure that accumulations of raw materials, finished goods and packaging are not a feature.</td>
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**Hydraulic fluid leakage from hoses and machinery.**

**Overheating during the production process.**

**High quantities of raw materials, including high piled storage.**

**Increased fire ignition and propagation potential when highly flammable liquids are stored to the amount of:**

1. Up to 50 litres in workroom or storeroom
2. Above 50 litres within the premises
3. Above 50 litres in open air.

1. Highly flammable liquids in a work or store room should be stored in a suitable closed vessel in suitably placed cupboard or bin which is a fire resisting structure.
2. Highly flammable liquids in the premises should be stored in a suitable compartment that benefits from 2 hours fire resistance with external ventilation to the open air.
3. Highly flammable liquids in the open air should be stored in a suitable building constructed with a sump or bund wall and benefiting from a minimum of 30 minutes fire resistance.

#### Features sometimes present

<table>
<thead>
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<tr>
<td></td>
<td>- Professional and regular maintenance of machinery and equipment.</td>
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<td></td>
<td>- Frequent clearing of the areas where ground materials are prone to accumulate.</td>
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<td></td>
<td>- Full DSEAR Risk Assessment in conjunction with the Fire Risk Assessment should be carried out.</td>
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<td>- Avoid use of flame guns to clean moulds.</td>
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<td>- Consider any large contracts in action with a single customer and look for other customers.</td>
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<td></td>
<td>- A fully maintained Business Continuity Plan (BCP).</td>
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<td>- Keep store plans and designs off site.</td>
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<td></td>
<td>- Build replacement into a fully maintained BCP</td>
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**Ignition danger when re-granulation processes are undertaken.**

**Explosive atmospheres.**

**Ignition hazard from cleaning methods and cleaning infrequency.**

**Business Interruption danger when there is a reliance on a single customer.**

**Dependence on specialised moulds/dies.**
The table below highlights some specific hazards present in injection moulding, along with the associated controls to help prevent significant injury or third party property damage. Generic risks arising from manual handling, warehousing or any work away from the premises are not mentioned here.

<table>
<thead>
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<th>Features always present</th>
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<tr>
<td>Slips from raw material spillages.</td>
<td>- Good housekeeping and cleaning procedures.</td>
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<tr>
<td>Injuries occurring through faulty guarding.</td>
<td>- Control of guarding should be ensured with frequent checks and adequate staff training.</td>
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| Burns to the skin following contact with hot surfaces or splashing of plasticised material/hydraulic fluid. | - Adequate insulation.  
- Control of guarding with frequent checks and adequate staff training. |
| Cuts from knives or sharp edges. | - Employing a safe system of work.  
- The provision of appropriate PPE. |
| Manual handling and Ergonomic related injuries. | - Implement management controls around lifting and lifting equipment subject to preventative maintenance.  
- Lifting and handling, posture and work place assessment as well as training for staff. |
| COSHH and dust inhalation. | - Effective and maintained extraction.  
- Provision of appropriate PPE. |
| Noise induced hearing loss. | - Formal noise risk assessment by competent and trained person(s).  
- Reduce noise levels as far as possible through the use of soundproofing and engineering controls, supplemented by the provision of PPE. |
| Failure of products due to defect. | - Routine and robust quality control procedures with particular emphasis on safety critical or high potential liability components manufactured.  
- Quality control inspections could include visual inspection batch testing, thickness measurements and defect detection systems which can include surface and embedded techniques.  
- Records of products testing together with calibration of testing equipment needs to be maintained. Full traceability should also be maintained in respect of products or parts supplied. |
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AXA qualified engineers can review business continuity plans and offer additional supporting tools where appropriate.

We have more than 50 experienced specialist surveyor experts carrying out site inspections throughout the UK.

We have one of the most qualified loss prevention teams of any UK insurer with over 850 years of combined experience in the manufacturing sector.

Get in touch:

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