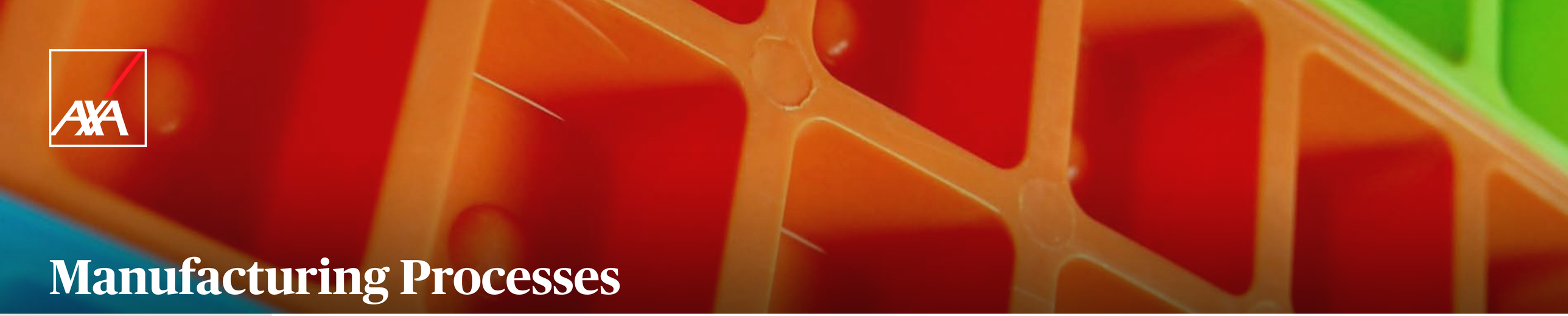
Manufacturing Intelligence:

Vacuum formed plastics



Manufacturing Processes

We know that your clients take risk management seriously and that it plays a key role in the service you offer. We've produced this guide to highlight the controls your clients can take to help reduce the risks associated with the manufacture of vaccuum formed plastics.

Trade overview

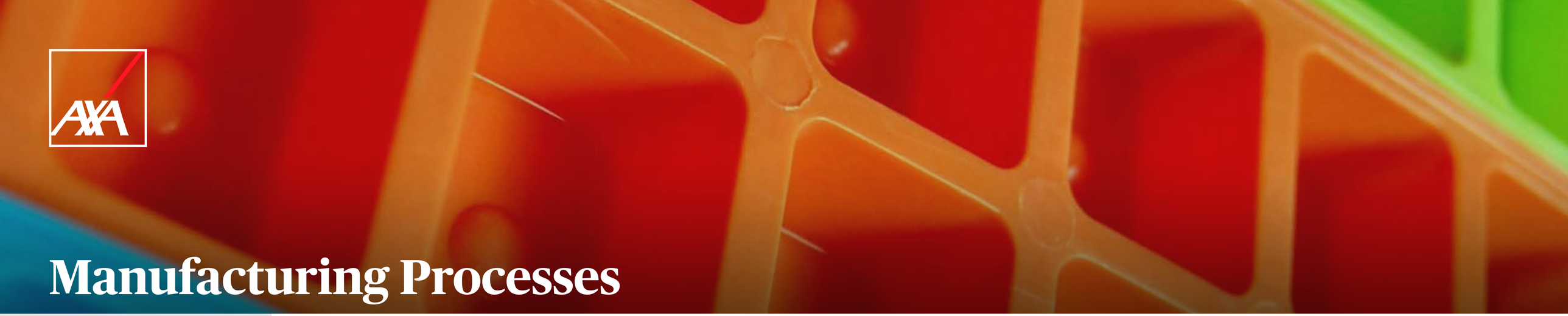
Plastic vacuum forming involves shaping plastic objects from thermoplastic sheets, which are heated and then forced onto a mould by a vacuum.

Process

The process involves loading a sheet of thermoplastic material into a vacuum forming tool containing the mould within the thermo-forming machine. Heat is applied until the sheet softens and then a vacuum is applied which draws the sheet into the mould forming the required shape. The plastic is then cooled by air and the hardened object removed. Following completion of the moulding process, the sheets undergo finishing processes which can include drilling, trimming and cutting to create the end product. Modern vacuum forming process machines use sophisticated pneumatic, hydraulic and heat controls which enables higher production speeds and more detailed vacuum formed applications. There is no use of highly flammable liquids within the process.

Materials involved in the vacuum forming process include:

- Acrylonitrile butadiene styrene (ABS) plastic used within flame retardant, antibacterial and textured products
- Acrylic capped ABS (for excellent UV performance and high gloss plastics)
- Polyethylene and polypropylene (chemical and resistance plastics)
- Polycarbonate (for high impact plastics)
- Polystyrene (commonly used for packaging)



Manufacturing Processes

Business Interruption

Tooling that creates the final shape of the formed item is often unique and can take weeks or months to reproduce so loss or damage to the tooling can have a significant impact on the business. Tooling is often aluminium and is therefore considered attractive for thieves. A plan is essential to ensure that the tooling and initial design drawings are preserved, duplicated or can be replaced quickly.

The main equipment used in this process are thermo-forming machines (where the sheets are fed, heated and vacuum formed into the mould), guillotines and rollers (for cutting of sheet plastic) plus granulating and grinding machines to recycle the waste.

There's a secondhand market for the key items of machinery so reinstatement of a single machine can be remedied in the short term and allow the continuation of production.

Customers within the food and drink market demand the highest standards and don't tolerate delays. It can be a feature for plastics manufacturers to be reliant on a single customer for a high proportion of their turnover, which can leave them vulnerable in the event of an incident.

Common Material Damage and Business Interruption Hazards

Material Damage

Overheating of plastic and the use of hydraulic fluid lines are two key areas which can lead to machinery fires. There's potential for fluid line failures which could spray flammable hydraulic fluid onto hot machines and cause the rapid development of a fire.

As would be expected in the plastics industry with flammable and combustible materials, storage and housekeeping are top priorities. Good fire detection and protection, including sprinklers where possible, are positive features. Regranulation of plastic waste offcuts to be recycled will often be part of the process, which can introduce the need for more storage.

Whilst end products are unlikely to attract thieves, aluminium tooling is regularly stolen. This, together with inherent arson risks, mean that security of the premises and site should always be considered including good quality alarm protection.

Whilst not common in the industry, unattended operations of machinery can occur on more automated lines which can represent an increased fire risk.

Public and Products Liability

The main exposure arises from the potential production of defective materials and packaging which can lead to costly claims from the food sector where food spoilage or contamination of the packaged product is possible. Good quality control and batch sampling is essential. Traceability and product recall procedures are considered the norm, particularly for products where there's exposure to the food packaging sector.

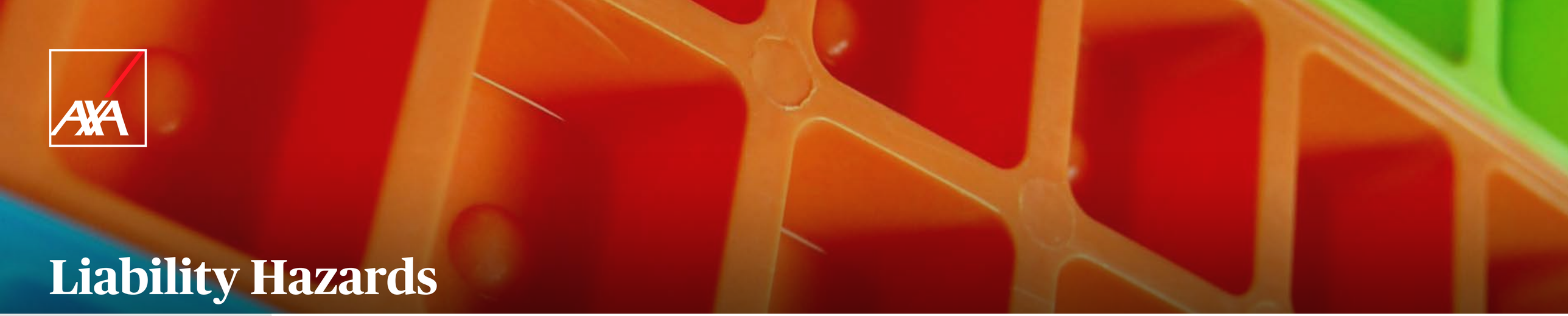
Public Liability exposure is potentially limited to waste streams and disposal of waste offcuts and other elements of waste from the manufacturing process. Legionella may also be an issue where water cooling is being used in the manufacturing process. Compliance with the legal requirements around the control of Legionella would be expected if water cooling is being used.

Employers Liability

The main hazards associated with liability are machinery entrapment, waste trimming and cutting operations, hot surfaces, hydraulic systems, ergonomics and tooling changes. Other hazards can include fumes, noise, vibration and housekeeping issues (for example slips, trips, and falls from plastic off cuts).

Recorded guarding checks at the start of each shift are required.

Maintenance and isolation procedures need to be adequate as there may be several services to isolate before working on equipment (for example hydraulics, electrics and gas). All maintenance employees need to be trained in servicing and maintenance procedures with a permit to work a system for isolation of services. Training needs to be detailed and documented to match the scope of an employee's working activities.



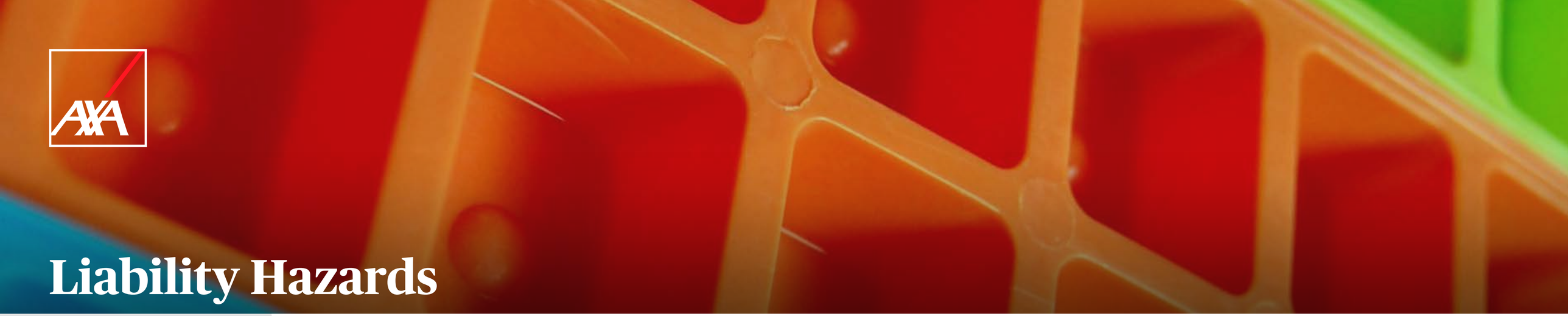
Liability Hazards

The tables below highlight some specific hazards present in the printing industry, along with the associated controls which will help prevent major loss of physical property. Generic risks resulting from arson, electrical sources and waste aren't mentioned here.

Features always present

Hazard	Control
High quantities of raw materials, including high piled storage.	■ Effective storage management, incorporating separate storage for the various classes of goods e.g. raw materials stored away from finished goods. ■ Effective management to ensure that accumulations of raw materials, finished goods and packaging aren't a feature.
Overheating during the production.	■ Competent and regular maintenance of machinery and equipment in accordance with OEM guidance as part of a Planned Preventative Maintenance (PPM) regime, ensuring that thermostatic cut-outs and fire detection equipment are in good working order. Effective training of staff to ensure they understand how the machinery operates.

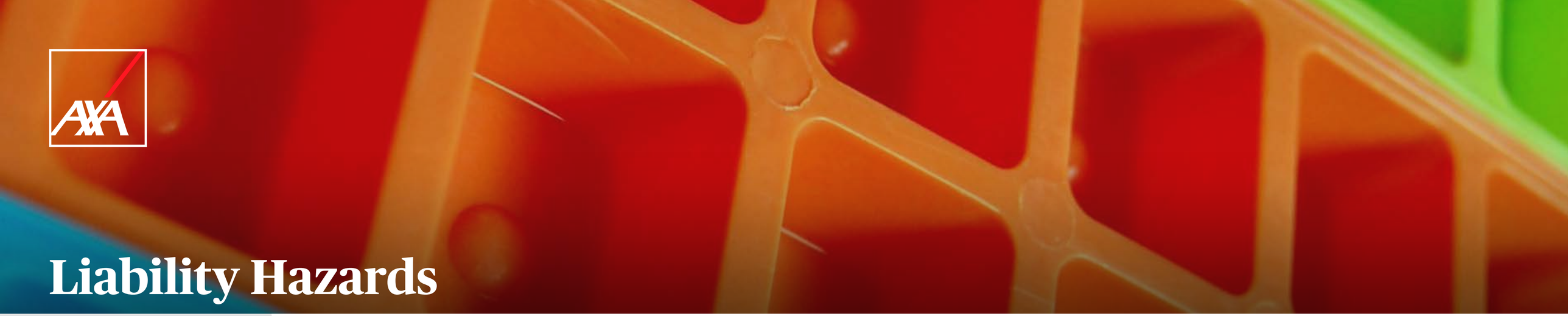
Hazard	Control
Hydraulic fluid leakage from hoses and machinery.	■ Professional and regular maintenance of machinery and equipment. ■ Use of shields to prevent hot fluid coming into contact with hot surfaces. ■ Frequently checking hydraulic hoses and connections plus machinery condition as part of a self-inspection regime.



Liability Hazards

Features sometimes present

Hazard	Control
Increased fire ignition risk due to housekeeping of waste products, waste granulating and grinding plus re-use of pre-used materials.	■ Regular removal of waste materials from process areas. ■ All combustible waste to be removed or stored in a metal waste container (preferably with a lockable lid) sited at least 10 metres from any building or as far as away as possible.
Overnight/unattended operations.	■ To be avoided where possible but planned preventative maintenance on machinery and potential sprinkler or localised fire suppression to machines may reduce the risk.



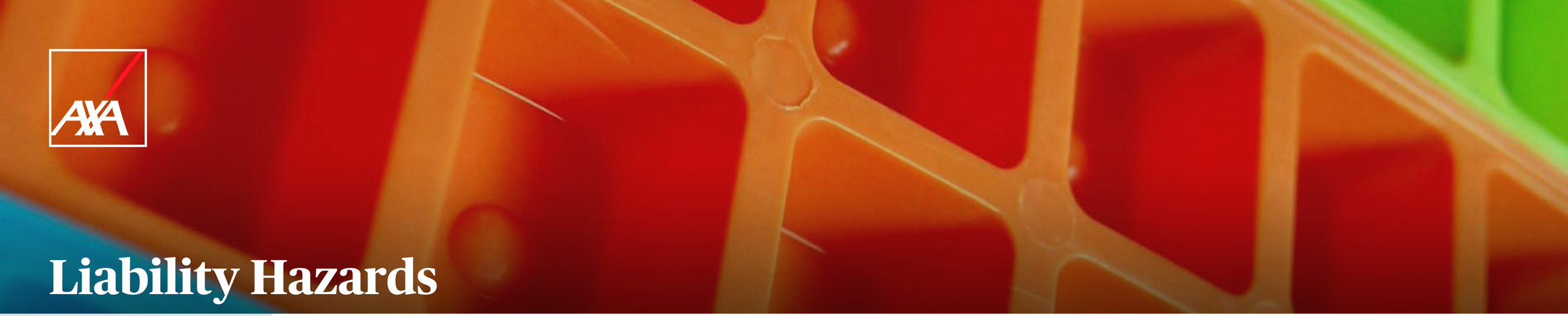
Liability Hazards

The table below highlights some specific hazards present in plastics environments, 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 aren't mentioned here.

Employer's Liability and Public Liability

Hazard	Control
Potential for entrapment/entanglement within machinery. **Training and supervision of maintenance staff and controls relating to isolation of services essential.**	■ Where elimination or replacement process for a less hazardous alternative isn't possible, then appropriate guarding must be in place. ■ The guarding must be fully operational, fitted by a competent person, checked that it's in full working order prior to use of the machinery and a daily record maintained. ■ In addition to daily checks, frequent inspections of the workplace, guards and staff should be completed.
Injury caused by repetitive processes and manual handling.	■ Use of mechanical lifting equipment, safe systems of work, formalised training.

Hazard	Control
Cuts caused by cutting/trimming operations. **Slips, trips and falls.** **Burns caused by contact with hot surfaces.** **Noise induced hearing.** **Legionella exposure.**	■ Ensure appropriate equipment is in place. ■ Where blades are necessary, safety blades should be used. ■ Staff training and appropriate PPE to be issued and maintained. ■ Housekeeping is essential to prevent slips trips and falls. ■ Hearing protection must be worn. Audiometric testing for employees is also recommended. ■ Legionella controls need to be in place, such as keeping pipework as short as possible, antibacterial cleaning including biocide treatments if appropriate and keeping water held at a temperature of 20-45 degrees Celsius.



Liability Hazards

Products Liability

Hazard	Control
Final use within the food industry (where the risk of contamination and product spoilage is higher). **Sharp edges.** **Potential for contamination.**	■ Quality control processes including random sampling. ■ ISO 9001. ■ Consider potential increased exposure including USA/Canada. ■ Ensure machine is checked/cleaning procedures.

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