



Plastics recycling

Plastics Processing Sheet No 2

Introduction

This information sheet was produced by the Health and Safety Executive in consultation with the Plastics Processors' Health and Safety Liaison Committee. The committee comprises the Health and Safety Executive, employers and employee representatives in the plastics industry.

Plastics recycling is a growth industry, especially for smaller businesses, and this growth is set to continue. This information sheet is aimed at these smaller businesses. It identifies the commonly encountered hazards and the basic precautions to be taken for:

- machinery safety;
- noise;
- hazardous substances; and
- material handling and safe access.

Recommendations for further reading are listed at the end of the information sheet.

Machinery safety

Four types of machine are in widespread use in the industry: granulators, agglomerators/crumbers, shredders and extruders. Some issues are common to most or all of these machines, whereas other requirements are more machine specific.

This information sheet has been prepared with existing machinery in mind, but new, CE-marked machines may be built to alternative standards.

Common issues

Operating instructions/training

Whatever the age of the machinery, companies should refer to manufacturers' operating manuals and train their staff in safe operating procedures.

Feed/discharge openings

Feed openings and discharge points to and from dangerous parts (eg rotors, cutters, blades and screws/rams) should be designed or safeguarded so that operators cannot reach these parts.

Means of access will always include:

- reaching through the opening with hands/arms; but depending upon the feeding system and the heights of platforms, etc may also include:
- reaching through the opening with feet/legs; and
- accidentally falling into the opening.

Interlocking of guards

A number of serious accidents have occurred because bolted guards have been removed to clear blockages, or for

maintenance purposes, and have not been replaced. For this reason, supplementary time-delayed interlocks should be used to prevent access until the dangerous parts have come to rest. These will *normally* be needed at the feed guards on granulators, agglomerators and extruders and at the discharge guards of granulators and agglomerators. However, such precautions may not be necessary on larger granulators, for example where removal of the hopper is a major operation in itself.

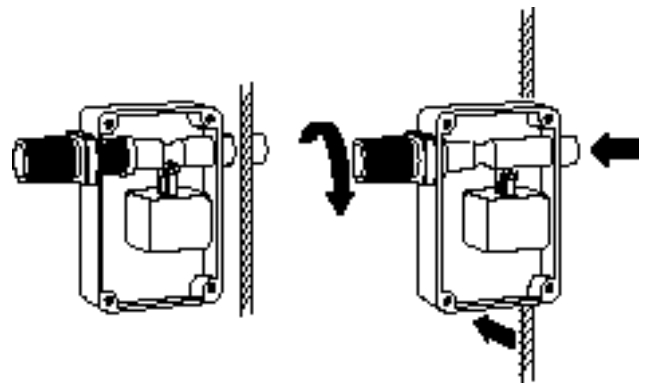


Figure 1 Time delayed bolt-operated interlock

Film feeding

There is a risk of the operator becoming entangled in the film while feeding the machine, and they can be drawn forcibly against the machine, or into it. To prevent this, the film should be fed in mechanically or be pre-cut, shredded, baled or bagged and ideally fed in as a 'ball' so that it no longer presents a risk of entanglement. A maximum length of 1.5 m is recommended if the material is pre-cut.

Flying process material

Where there is a risk of process material flying out from machinery feed openings, screens or flaps should be provided to prevent people being struck. If there is still a risk, impact grade face protection should be provided and worn.

Metal contamination

Metal coming into contact with high speed cutters/blades can cause major damage to the machinery and eject high-speed particles of metal into the workplace. Measures should be taken to prevent metal contaminants entering machinery (eg hand sorting and metal detectors).

Emergency stops

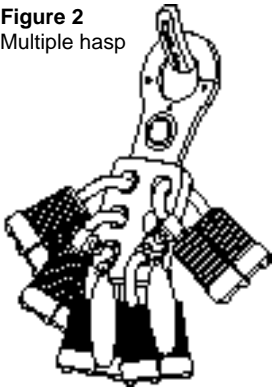
Emergency stops should be fitted within easy reach of operating positions. These should be red, mushroom-headed buttons which stop all dangerous motion and require positive re-setting.

Maintenance

A safe system of work is required for any maintenance

activities which involve the removal of guards. Where the maintenance work involves access into the machine, this system should include a lock-off procedure.

Figure 2
Multiple hasp



Lock-off procedures usually involve the following steps:

- isolating the machine from the main supply by locking off all forms of power (eg electrical, hydraulic, pneumatic);
- using a padlock with only one key;
- using a multiple hasp where several people are working, so each can fit their own lock; and
- putting a warning notice on the isolator.

Machine-specific hazards

Granulators

Many serious accidents have occurred during blade changing and the clearing of blockages, often due to unpowered movement of the blades. Chocks or in-built mechanical restraints should be used to stop the rotor moving during such procedures. Lifting aids should be used for heavy blades.

Agglomerators/crumbers

The feed opening cannot always be restricted to recognised safe dimensions because of the operational difficulties this would create. The following combination of measures is therefore needed:

- the feed opening should be central to the lid and be restricted to 250 mm diameter on machines with a lid diameter up to 1000 mm and 300 mm for larger diameter lids. For square openings, the 250/300 mm dimensions should be the maximum diagonal measurement;
- the feed opening should be positioned at least 1 m above the blades; and
- the working platform should be at least 1.1 m below the level of the feed opening.

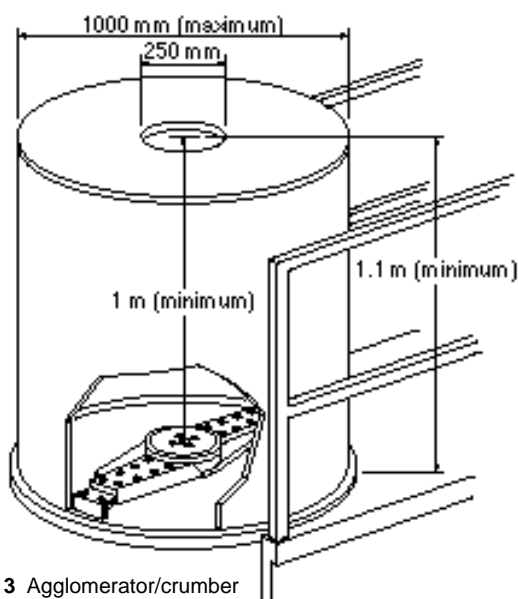


Figure 3 Agglomerator/crumbler

Shredders

For manually fed machines, a balance has to be struck between machine safety and good ergonomic feeding practice. As a minimum, the working platform should be at least 1.2 m below the level of the feed opening to prevent operators overbalancing onto the dangerous parts. However, if the operator can still reach the dangerous parts from this position, additional precautions will be needed.

A number of accidents have occurred when operators have used their arms or legs to apply downward pressure on the feed material. Such dangerous practices should not be permitted. There should be no need for any such action on the part of the operator if appropriate shredder and cutting tools are used to draw the material into the shredding chamber. As an alternative, the feed material could be held against the cutters by a mechanical device.

Extruders

Many parts of extruders will be hot. To prevent burns, these parts should be insulated or protected. Personal protection and warning signs may also be needed.

There is also a risk of molten plastic being ejected. Impact grade face protection and hand protection (suitable for heat, cuts, puncture and chemicals) should be provided and worn.

Noise

The Noise at Work Regulations 1989 are intended to reduce work-related hearing damage and establish action levels. These action levels are 85 dB(A) and 90 dB(A) ($L_{EP,d}$)*.

Granulators are extremely noisy, with some emitting well over 100 dB(A). Agglomerators usually exceed 90 dB(A) and extruders 85 dB(A).

As a rule of thumb, if you cannot hear a normal conversation in your workplace clearly when you are 2 m away from the speaker, the noise level is likely to be around 85 dB(A) or higher. If you cannot hear someone clearly when you are about 1 m away, the level is likely to be around 90 dB(A) or higher.

If you find that the noise levels are at 85 dB(A) or above, you must:

- have the risk assessed by a competent person;
- tell your workers about the risks and precautions; and
- make hearing protection freely available to those who want it.

If you find that the noise levels are at 90 dB(A) or above, you must also:

- do all that is reasonably practicable to reduce exposure without relying on hearing protection, eg use engineering controls; and
- use signs to identify these areas and require your staff to wear hearing protection when working inside them.

*Daily personal noise exposure: the worker's noise exposure averaged over an 8-hour working period.

If exposure can't be reduced, or until it is reduced below 90 dB(A), those affected must wear appropriate hearing protection. You should provide audiometry if exposure exceeds an $L_{EP,d}$ of 95 dB(A) - ignoring any effect of hearing protection.

Hazardous substances

Hazardous substances may be encountered in a number of different ways during recycling. The main hazards and the relevant precautions are described here.

Contaminated plastic waste

Waste material can be contaminated with a variety of hazardous substances, eg chemical residues, used syringes, pesticides, etc. Disease-carrying animals may be wrapped up in the material, eg rats in plastic film from farms. You can protect employees from both the chemical and biological hazards by providing suitable personal protective equipment such as gloves, eye protection and impervious aprons.

Legionella from water cooling systems

Legionella occurs naturally in water but recirculating water systems (eg cooling systems on extrusion lines) provide a suitable environment for the bacteria to multiply rapidly. The risk of respiratory infection from legionella can be controlled by a proper management system, a water treatment programme and regular maintenance and testing. You will need to notify the local authority if you have a cooling tower or evaporative condenser as part of the cooling system.

Plastic fume and dust

Extruders can give rise to hazardous fume if the material is overheated. Ensuring that operating temperatures are correct and die surfaces are clean should prevent hazardous fume being created, and good general ventilation will also help. If you process mixed recycle it may not, however, be practical to prevent fume by temperature and process controls. In such cases, local exhaust ventilation will probably be required.

There are specific dangers when PVC and acetals are mixed either together or with other materials. They should be processed separately, as they are very temperature sensitive.

Dust and fume may be generated during the normal operation of granulators and agglomerators. This should be controlled by local exhaust ventilation if necessary.

Exposure to processing chemicals

Stabilisers added to the recycled product may be hazardous, eg UVA stabiliser, antioxidants, etc. Refer to the safety datasheets and check your working methods to ensure that the chemicals are being handled safely.

Material handling and safe access

Insecure loads

Check loads to see if they are stable/secure on the vehicle before unloading and give employees instructions for dealing with any vehicle that might arrive on site with an unsafe load. One example would be bulging on a curtain-sided vehicle.

Storage

Contaminants

Remove any obvious contamination in the delivered waste before storage, eg gas cylinders, chemical containers with residues, metal cans, etc.

Stacking waste plastics

Stacks should be stable and erected on firm, level, ground. You will need to limit stack heights to ensure stability. Free-standing pallets should be stacked no more than two high (about 3 m), with only one pallet at the boundary of a large stack. Pallets containing loose material should be shrink-wrapped or the material transferred to more appropriate storage bins.

You should take steps to deal with any potential causes of stack failure, eg expansion of closed polyethylene bottles when exposed to sunlight, which can lead to bales breaking up. The risk is less if the bottles are punctured or caps removed before baling.

Fire

Fire spreads rapidly in plastics, generates a great deal of heat and is difficult to extinguish. It gives off black acrid smoke and poisonous gases such as carbon monoxide. It is therefore important that you prevent sources of ignition by prohibiting smoking and hot work in vulnerable areas; removing easily ignitable material (eg paper) and taking precautions against arson.

The following storage guidelines are recommended for external storage:

<i>Length of pile</i>	<i>Separation distance to boundary or building</i>
Less than 5 m	4 m
Less than 8 m	6 m
Greater than 8 m	8 m

It is recommended that stack areas are kept to a maximum of 200 m², assuming a maximum stack height of 3 m. Maintain spacing between stacks of 3 m. Recyclers with large-scale storage are advised to discuss fire-fighting issues with the local fire authority.

Breaking out bales

Bales can break up suddenly when the straps are removed. The straps themselves may fly apart when cut and pose a hazard to the face and eyes. These dangers can be reduced by opening bales with long bolt cutters (eg 460 mm) used at arm's length, and by wearing a face shield and appropriate gloves.

Working at height

Safe access and suitable protection against falling is needed for all work done at height, whether for routine or maintenance work. Where fork-lift trucks are used as the means of access, a suitable and safe working platform attached to the forks must

be used.

Further reading

Essentials of health and safety at work (3rd edition)
HSE Books 1994 ISBN 0 7176 0716 X

Work equipment. Provision and use of Work Equipment Regulations 1992: Guidance on Regulations L22 HSE Books 1992 ISBN 0 7176 0414 4

Code of Practice: Safety in the use and construction of granulators for working plastics 279/1 (priced) Available from: British Plastics Federation, 6 Bath Place, Rivington Street, London EC2A 3JE Tel: 0171 457 5000.

Introducing the Noise at Work Regulations: A brief guide to the requirements for controlling noise at work INDG75 HSE Books 1996 Single copies free, multiple copies in priced packs ISBN 0 7176 0961 8

Noise in the plastics processing industry: A practical guide to reducing noise arising from existing plant and machinery 1985 (priced) RAPRA Technology Ltd, Shawbury, Shrewsbury, Shropshire SY4 4NR. Tel: 01939 250383 Fax: 01939 251118.

The application of COSHH to plastics processing: A health at work guide ISBN 0 11 885556 5 HSE Books 1990

It takes your breath away: Health advice to the plastics industry INDG195 HSE Books 1995 (free leaflet)

The control of legionellosis including legionnaire's disease HSG70 HSE Books 1993 ISBN 0 7176 0451 9

Don't put your back into it: How to avoid manual handling in the plastics industry INDG194 HSE Books 1995 (free leaflet)

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This leaflet contains notes on good practice which are not compulsory but which you may find helpful in considering what you need to do.

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Further information