Safety at granulators

HSE information sheet

Plastics Processing Sheet No 10 (Revision 1)

Introduction

This information sheet is one of a series produced by HSE's manufacturing sector and gives practical advice for owners and users of granulators. It gives information on the commonly accepted and practicable safeguards for significant hazards on granulators *supplied before* before the publication of BS EN 12012-1:2000. This standard was replaced by BS EN 12012-1:2007[1] and represents 'state of the art' for these machines. This guidance can be used as a check for machines manufactured after 2000 to make sure that they meet the minimum levels of protection required.

The main UK legal requirements covering the safe use of granulators are the Provision and Use of Work Equipment Regulations 1998.[2]

Since 1995, all new machinery has been subject to the European Machinery Directive, which requires machines to be safe by design and construction. When first placed on the market or first put into service, machinery must meet all relevant Essential Health and Safety Requirements (EHSRs) in the Directive. The machine should be designed to the 'state of the art', and be accompanied by user instructions, a Declaration of Conformity, and bear a CE marking. Further guidance on the Directive and the UK Supply of Machinery (Safety) Regulations is available from HSE's website and in *Buying new machinery*.[3]

Guarding standards

In Table 1 (overleaf) are the practical safeguards that you can apply. Current standards are quoted to illustrate acceptable levels of safety. Where the publication date of standards is after the machine manufacturing date you should ensure that standards that were current at the time of manufacturing are met. For pre-1995 machinery, safeguards that meet PD 5304:2005[4] are acceptable alternatives to the more recent BS ENs quoted.

Table 1 Practical safeguards to apply to maintain acceptable levels of safety

Hazard	Safeguard
Access to blades when rotor is under powered motion or running down	***Reaching through feed opening and hopper*** This should be prevented by design, ie size of feed opening in hopper and its position, to prevent the operator reaching the blades when standing at the highest accessible feeding position (eg from a platform etc). The reach distance to hazardous moving parts from the highest accessible feed position should comply with BS EN ISO 13857.[5] ***Granulators fed by conveyors*** If the granulator is fed by a conveyor you should make sure that it is not possible for operators to access the blades by reaching through the feeding point. You can achieve this by one or a combination of the following: ■ the conveyor acting as the guard; ■ fixed guarding positioned to comply with the safety distances in BS EN ISO 13857; ■ interlocking guards with guard locking in accordance with BS EN 1088[6] such that the guard cannot be opened until all hazardous movement has stopped. In addition, if the conveyor is wide enough for a person to climb or fall onto it then you should take measures to make sure the machine is shut down before they reach the feed opening, eg through personal detection systems. ***Reaching into cutting chamber with hopper removed*** When the hopper can be removed or hinged out of position before the rundown period is completed, then an interlocking guard with guard locking should be fitted to prevent access until all hazardous movement has stopped. ***Reaching through any other openings in the feed hopper, eg inspection covers*** *Either:* ■ use fixed guarding positioned to comply with the safety distances in BS EN ISO 13857; *or* ■ use interlocking guard with guard locking. ***Reaching through the discharge area*** *Either:* ■ position a fixed mesh guard (separate to the screen), to comply with the safety distances in BS EN ISO 13857, and use in conjunction with a safe system of work that takes account of rundown times whenever it is removed; *or* ■ have a removable mesh guard (separate to the screen) with guard locking.
Unpowered movement of blades	A safe system of work, including rotor restraint where necessary.
Ejection of process material or machine parts from a feed hopper opening or chamber	*Either:* ■ by the design of the feed hopper eg restraining plates, dog-legs etc; *or* ■ by protective flaps at the feed hopper. A chamber should be strong enough to withstand the impact of breaking or loosening of a blade during rotation. Even with these measures in place there may be a residual risk of materials being ejected. You should therefore consider excluding others from the area and providing appropriate personal protective equipment for operators.

Entanglement with flexible feed material, including from kickback	■ Use a mechanical feeding device; *and/or* ■ use an elongated hopper for long stretches of materials being fed in to support them; *and/or* ■ feed in pre-cut, shredded, baled or bagged material, ideally as a ball. Maximum length of pre-cut material to be 1.5 m.
Falling through feed hopper opening	If feed openings are large enough to allow whole-body entry then the hopper opening should be at least 1.2 m above the working platform and the reach distance to the danger zone should comply with BS EN ISO 13857. Feed openings 1.2–1.4 m in height will need additional precautions to prevent access. Feed hopper openings should be as small as possible for the materials being processed. If conveyors are used to feed the granulator then you should take measures to prevent a person falling through a feed hopper opening, eg by raising the height of the feed conveyor to prevent a person climbing/falling on to it, or using person-detecting systems. Safe systems of work should be in place for tasks such as clearing blockages to make sure a person doesn't go up the conveyor to access the blockage while the machine is operating.
Movement of power-operated devices such as feed hopper, screen plate cradle or other enclosing equipment	Use an interlocking guard with guard locking to prevent such devices being operated until all movement of the rotor and feed rolls has stopped. If movement of a power-operated device creates a danger in itself then use *either:* ■ a two-hand control device; *or* ■ a hold-to-run control device positioned in either case to give a clear view of the relevant danger area.
In-running nips of feed rolls	Fixed guarding, or by distance guarding positioned – taking into account safety distances – to prevent the operator reaching the danger zone.
In-running nips of vee-belt and pulley drives	Fixed guarding, or by distance guarding positioned – taking into account safety distances – to prevent the operator reaching the danger zone.
Unpowered feed hopper/hood falling under gravity	■ The centre of gravity at the fully open position to be well beyond its pivot point; *and/or* ■ held in the open position by a mechanical constraint device to prevent inadvertent closure.

Safe systems of work during maintenance

Accidents often occur because safe systems of work are not being followed, for instance when maintenance staff need to gain access into the cutting chamber.

To ensure safety in these circumstances your safe system of work must include a lock-off procedure.

Lock-off procedures usually involve:

- isolating the machine from the mains supply by locking off power;
- using a padlock with only one key;
- using a multiple hasp padlock where several people are working on the machine, so each can fit their own lock;
- putting a warning notice on the isolator.

You should also consider whether a permit to work is appropriate for any maintenance tasks on granulators.

After following these procedures, and before gaining access to the cutting chamber, those working on the machine should check by both looking and listening that motion has stopped. Parts giving access to the cutting chamber should be secured in the open position.

When the blades need to be handled, suitable gloves should be worn.

When removing blades there is a risk that the remaining blades will rotate under gravity. You should ensure it is not possible for the blades to rotate when carrying out this job.

Safe systems of work should be provided for maintenance tasks.

Operator safety checklist

Regular checks by the operator are a good way of identifying problems as well as making sure machinery is safe for use. It is recommended that operator checks are carried out at regular intervals, as a suggestion daily or after mould changes. Table 2 contains the recommended minimum checks the operator should carry out on a regular basis. You may also want to consult the manufacturer's instructions to see if you should carry out any additional operator checks.

Table 2 Recommended minimum checks for the operator to carry out

The answer to all questions should be 'yes' or action needs to be taken	**Yes**	**No**
Are all fixed and interlocked guards in place, in good condition and secure?		
Are all interlocking devices correctly aligned and securely attached to guards?		
Does opening an interlocked guard immediately stop the parts it protects?		
When an interlocked guard is open do all dangerous parts remain stationary if a start control is pressed?		
Where time-delay interlocks are fitted do they prevent access until rotation of dangerous parts has stopped?		
Are fixed guards held in place with fastenings that require a tool to undo them?		
Where pressure-sensitive mats are fitted does the pressure-sensitive mat indicator work when the mat is stepped on?		
Do any trip devices function correctly?		
Are all control unit enclosures closed, locked and the keys removed?		
Where two-hand controls are provided do both buttons have to be pressed together for the machine to operate?		
Where hold-to-run controls are provided, if you release the button does the machine stop?		
Where fitted, are adjustable guards adjusted correctly?		
Are safety devices, interlocks and guards free from evidence of being tampered with?		
Where fitted, are the protective flaps or restraining plates in the feed hopper intact and unbroken?		
Where fitted, are any deflecting screens on feed devices intact and unbroken?		
If used, are rotor restraint devices readily available?		

Monthly machine inspections

Monthly machine inspections are recommended. The checklist in Table 3 provides a suggested minimum list of checks to do, but you should also consult the manufacturer's instruction manual to see if you should carry out any additional maintenance inspections.

Table 3 Suggested minimum checklist

The answer to all questions should be 'yes' or action needs to be taken	**Yes**	**No**
Are all fixed guards held in place with fastenings that need a tool to undo them?		
Are all interlocking devices correctly aligned and securely attached to guards?		
Does opening an interlocked guard immediately stop the parts it protects?		
When an interlocked guard is open do all dangerous parts remain stationary if a start control is pressed?		
Where time-delay interlocks are fitted do they prevent access until rotation of dangerous parts has stopped?		
When an emergency stop button is pressed does it stop all movement of the machine?		
Once an emergency stop button has been pressed does all machine movement remain stopped until the button has been reset?		
Do any trip wires stop the machinery almost instantaneously?		
Are control unit enclosures closed, locked and the keys removed and retained by a designated person?		
From a visual inspection, is all electrical wiring in good condition and free from damage?		
Are safety devices, interlocks and guards free from evidence of being tampered with?		
Where two-hand controls are provided do both buttons have to be pressed together for the machine to operate?		
Where hold-to-run controls are provided if you release the button does the machine stop?		
Does the movement of the interlocked guards actuate the sensors of the associated hydraulic, pneumatic or electrical mechanisms? (Visual check)		
Are all pressurised flexible hoses in good condition and their fastenings secured in place?		
Are any rotor restraints used readily available and working effectively?		
Do hoppers hinge back beyond their pivot point? Or, where held open by a mechanical constraint device, is this device in good condition and functioning correctly?		
Where fitted, are the protective flaps or restraining plates in the feed hopper intact and unbroken?		
Where fitted, are any deflecting screens on feed devices intact and unbroken?		
Are any crossbars fitted to the material feed entry secure and in position?		

References and further reading

References

1 BS EN 12012-1 *Plastics and rubber machines. Size reduction machines. Safety requirements for blade granulators* British Standards Institution

2 *Safe use of work equipment. Provision and Use of Work Equipment Regulations 1998. Approved Code of Practice and guidance* L22 (Fourth edition) HSE Books 2014 www.hse.gov.uk/pubns/books/l22.htm

3 *Buying new machinery: A short guide to the law and your responsibilities when buying new machinery for use at work* Leaflet INDG271(rev1) HSE Books 2011 www.hse.gov.uk/pubns/indg271.htm

4 PD 5304 *Guidance on safe use of machinery* British Standards Institution

5 BS EN 1088 *Safety of machinery. Interlocking devices associated with guards* British Standards Institution

6 BS EN ISO 13857 *Safety of machinery. Safety distances to prevent hazard zones being reached by upper and lower limbs* British Standards Institution

Further reading

Code of Practice: Safety in the use and construction of granulators for work in plastics 279/1 British Plastics Federation 1981 www.bpf.co.uk

For health and safety in plastics manufacturing premises see HSE's plastics webpages www.hse.gov.uk/plastics/

For PUWER and CE marking see HSE's work equipment/machinery webpages www.hse.gov.uk/work-equipment-machinery/

Further information

For information about health and safety, or to report inconsistencies or inaccuracies in this guidance, visit www.hse.gov.uk/. You can view HSE guidance online and order priced publications from the website. HSE priced publications are also available from bookshops.

This guidance is issued by the Health and Safety Executive. Following the guidance is not compulsory, unless specifically stated, and you are free to take other action. But if you do follow the guidance you will normally be doing enough to comply with the law. Health and safety inspectors seek to secure compliance with the law and may refer to this guidance.

British Standards can be obtained in PDF or hard copy formats from BSI: http://shop.bsigroup.com or by contacting BSI Customer Services for hard copies only Tel: 020 8996 9001 email: cservices@bsigroup.com.

This document is available at www.hse.gov.uk/pubns/ppis10.htm.

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