

Tread**safely**

A guide to health and safety in the tyre retread industry



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Section 1 | Introduction

This guide has been prepared by the Health and Safety Executive (HSE), in consultation with the Rubber Industry Advisory Committee (RUBIAC). It has the support of the Retread Manufacturers Association (RMA), the British Rubber Manufacturers Association (BRMA) and the Trades Union Congress (TUC).

It will help employers in the retread industry achieve and maintain safe and healthy working conditions and provide employee safety representatives with a useful source of information. It concentrates on the main hazards in the tyre retread industry and indicates what to do to ensure the risks are properly controlled.

Getting started

It is difficult to advise on exactly which hazards you must deal with first. Much will depend on the particular circumstances of your work activities and the quality of the health and safety measures you already have in place to control risks. An initial brief read of the guide should give you a good idea of the areas in which your existing health and safety precautions may be lacking or require improvement. To help you decide, think about the following:

- What is the worst result? A broken finger, someone losing an arm or being killed?
- How likely is it to happen? How often do you do the job? How close do people get to the hazard? How likely is it that something can go wrong?
- How many people could be hurt if something did go wrong? Could this include people who don't work for you?

If you identify measures you need to take to improve control of health and safety risks, you should prepare an appropriate health and safety improvement plan for implementing them. HSE recommends that you involve your managers, supervisors and employees (especially safety representatives) in developing the plan and setting priorities for action.

Why you should read this guide

Accidents and ill health caused by work can have an enormous human cost, both in terms of the pain and suffering experienced by the person who is injured or becomes ill, and through the effects that this can have on their family and home life.

Accidents and ill health also cost the employer time and money. Your insurance does not cover all

the costs arising from accidents and ill health and they can have a dramatic effect on your business. Taking action to improve standards of health and safety, as well as complying with the law, is good for your business.

Case study

A worker was using an unguarded drilling machine in a small factory employing 15 people. His sleeve caught on the rotating drill entangling his arm, breaking both bones in his lower arm and causing serious tissue damage. He was off work for three months and he was unable to return to operating the machine for eight months.

The costs to the company were:

■ Wages for injured worker/replacement worker over the period	... £17 000 +
■ Loss of production/overtime payments to cover lost production	... £11 000 +
■ Loss of time of manager/MD	... £4000 +
■ Legal expenses, fines and court costs	... £7000 +
■ Increase in Employers' Liability Insurance Premiums	... £6000 +
■ Total costs to the business	... £45 000 +

Remember:

- ✓ Accidents and ill health can have an enormous human cost.
- ✓ The financial costs of accidents can have a dramatic effect on your business.
- ✓ A poor accident record may lead to increased premiums for Employers' Liability Insurance and you may even be refused insurance cover.
- ✓ Not all of the costs of accidents and ill health are covered by your insurance.
- ✓ By preventing accidents and ill health you will save your business time and money.

Section 2 | Training

Do you carry out any health and safety training? If you do, is it effective?

Training is often seen as a burden with no payback. Yet without proper training in health and safety you could lose the very people your company depends on, either temporarily through injury or long-term ill health and absence, or permanently through a fatal accident or staff leaving to work somewhere else.

Overall improvements in health and safety need to be underpinned by good health and safety training otherwise they are unlikely to be sustained.

In the retread industry, employers rely on employees to follow safe systems of work. Effective health and safety training is essential to provide employees with the knowledge and skills they need to work safely. Failing to provide effective training can lead to injury, ill health, damage to plant and equipment and loss of production, all of which can prove costly to the business.

Case study

A new employee was injured at a tyre-buffing machine when his shirt became entangled on the rasp. The open guard had failed to operate the safety interlock switch. The interlock should have been properly maintained, but the employee was untrained and had insufficient knowledge of the machine and its safety devices to understand that the guard was defective.

Provide your employees with the information, instruction and supervised practice they need to enable them to work safely. They need to understand:

- the hazards and potential risks associated with their work;
- the measures provided to prevent injury and ill health;
- the precautions they must take;
- their responsibilities for their own safety and that of others;
- how to report defects and unsafe conditions; and
- where to go for help.

Training should be structured and include an appropriate balance of formal instruction and practical training, including supervised practice on the job. In both cases the training needs to be given by someone who has the knowledge and skills to deliver it. If the only training you give is by an experienced worker showing the trainee what to do, you are unlikely to succeed. Experience has

shown that all too often the experienced worker passes on to the trainee bad habits, short cuts and sometimes even unsafe practices.

After the training, it is important to make sure trainees have understood what they have been taught and have developed the skills they need to work safely. You can do this by checking their knowledge (eg by asking structured questions) and observing them as they work to check their skills.

You also need to evaluate the content and quality of each training session you provide so you can identify the improvements you need to make for future training programmes. It is essential that you involve the trainees in this process. Ask them about the training course. Did it meet their expectations? Did it cover the right topics? Were the topics covered in enough (or too much) depth? Was the quality and length of each training session right? Were the training facilities suitable? Above all, do the trainees think that the training objectives were met?

Appointed safety representatives are entitled to the training they need to carry out their functions properly. In the case of Trades Union-appointed representatives, the Unions provide the training. If there are safety representatives on your workforce make sure you give them the time off work they need for this training and encourage them to attend the appropriate training course.

It is not only operators and shop floor workers who need training. Managers need to know how to manage health and safety, and supervisors need to know how to supervise safe work activity. So you need to provide them with health and safety training appropriate to their roles. Ensure agency staff are properly trained too.

Remember:

- ✓ Train your employees in safe systems of work.
- ✓ Adopt a structured approach to training.
- ✓ Validate the training you give and evaluate it by asking the trainees for their views on the training they have received.
- ✓ Ensure your training arrangements take account of agency staff.
- ✓ Provide your supervisors with the training they need to supervise safe work activity.
- ✓ Train your managers how to manage health and safety.

Section 3 | New machines

New machinery should have a European Union CE marking when you buy it. But remember, this is just a *claim* by the manufacturer that the machinery meets the legal requirements. As the machinery user *you* must check the machine is safe to use.

How can I check the machine?

Make sure the supplier or installer gives you information on how the machine works and about its safety features. Unless it is a machine of a type you are already very familiar with, ask the supplier to demonstrate how it works and explain the safety features.

Ask the supplier the following questions:

- What health and safety risks might there be when using the machine?
- Are there any dangerous parts and what guards will be provided?
- Will the machine need emergency stop controls and how will it be isolated?
- How do the controls and the control system work?
- Will the machine produce dust or fume? Are these likely to be in significant quantities and can our existing extraction system be adapted to cope or will we have to buy a new system?
- Has the machine been designed to minimise the noise and vibration levels produced?
- Are there any extremely hot or very cold parts of the machine and can they be insulated or protected?
- What has been done to reduce the risk of electric shock, particularly during maintenance work when covers and panels may be open?
- Are there risks from other sources of energy such as hydraulic or pneumatic power?
- Is there clear information about installation, maintenance and breakdown procedures?
- Will the supplier inform me if problems arise with similar machines bought by other users?
- Will the supplier inform me of future modifications or improvements to this model of the machine?

Take a close look at the machine. Compare it with other machines of the same type that you already have. The safety features should certainly be as good as, and preferably better than, those on existing machines.

What else do I need to check?

- Is there a CE marking and a certificate of conformity?
- Has the supplier explained what the machinery is designed to be used for and what it cannot be used for?
- Is there a manual (written in English) that includes clear and comprehensive instructions for safe use, assembly, installation, commissioning, handling, adjustment and maintenance?
- Do any parts look dangerous, eg exposed gears, cutters etc?
- Are there guards and are they strong, robust and securely mounted?
- Are interlocks fitted to prevent the machine operating with guards open or removed?
- Do you understand the controls?
- Can dust or fume escape from the machine?
- Is the machine excessively noisy?
- Does it vibrate a lot?
- Do exposed parts get excessively hot or cold?
- Are there special features, such as a slow crawl speed, needed for setting up the machine?
- Have you been given information about any remaining risks from the machine and the precautions taken to deal with them? These may include electrical, hydraulic, pneumatic, stored energy, thermal, radiation or health hazards.
- Do *you* think the machine is safe?

Remember:

- ✓ Never assume machinery is safe just because it has a CE marking.
- ✓ Ask the supplier about the machine's safety features and controls.
- ✓ Check the machine yourself.

Section 4 | Keeping things safe

To prevent machinery accidents you must ensure that machines are operated safely and properly maintained. You also need to ensure that controls, guards and safety devices are checked and inspected at regular intervals.

Machinery accidents in the retread industry usually occur because safeguards:

- are provided but are inadequate; or
- are provided but get removed or fall into disrepair or disuse; or
- are defeated or overridden.

What do I need to do?

- Provide the correct safeguards in the first place.
- Make regular checks to ensure they are kept in position and are working effectively.
- Ensure safe systems of work are provided and followed.

How can I do this?

- Check your existing machines to make sure the safeguards meet the standards described later in this guide. If they don't, *upgrade them as soon as possible*.
- Implement a system of routine checks at two levels. Draw up two checklists for each machine.

What to include in an operator checklist

In this checklist, set out the simple safety checks that the machine operator should complete each day or each shift. The operator should carry out the checks at the start of the shift or as soon as practicable after the shift begins. A copy of the checklist can be fixed to the machine or next to it for the operators to sign when they have completed the checks. Some employers find it helpful to include a diagram showing the safeguards to be checked.

Train the operators how to carry out the checks and make sure they understand what action to take if their checks reveal a faulty or missing guard, control or safety device. Explain their responsibilities for completing the checks properly and ensure they understand they will be held accountable for doing them each day and for completing them properly.

What to include in a machine setter/maintenance fitter checklist

This checklist should contain the more detailed checks that a competent machine setter or fitter should carry out at least once a month. These will require the person concerned to have sufficient knowledge of the design, construction and correct operation of the machine. Refer to the manufacturer's manual or get advice from an engineer when deciding what these checks should involve. Make sure the setter or fitter is competent to carry out the checks properly. Provide the necessary instruction and training and explain their responsibilities.

Any system of checking can fall into disuse over time so put in place arrangements for an appropriate manager or supervisor to check and monitor the system to ensure it continues to operate properly.

Safe systems of work

Finally, provide machine operators with safe systems of work for operating their machines and use these as the basis for training the operators. Make sure your routine workplace health and safety checks include observation of how machines are being operated in practice to confirm they are being operated safely.

Remember:

- ✓ Make sure your machines have the safeguards described in this guide.
- ✓ Use an operator's daily checklist.
- ✓ Operate a more detailed monthly checking system.
- ✓ Provide safe systems of work and ensure they are followed.

Section 5 | Extruders

Extruders are capable of inflicting serious injuries.
Apply the following safeguards.

Table 1 Safeguards when using extruders

<i>Hazard</i>	<i>Safeguard</i>
Trap between screw (or ram) and the barrel at main feed opening	Prevent access to the screw or ram while it is in motion. Prevent access to the trapping zone by the design of the feed opening, ie ensure the distances to the trapping point are such that a person's finger cannot reach the trapping zone. Alternatively provide fixed or interlocked guards to prohibit access to the danger zone while the screw or ram is operating.
Trap between screw (or ram) and the barrel at other openings	Prevent access to the screw or ram while it is in motion. Prevent access by the design of the opening or by fixed or interlocked guards.
Trap by feed system elements (roll feed)	Prevent access to any trapping parts while they are in motion. A hopper cover that serves as a fixed guard should prevent access to the danger zone but further fixed or interlocked guards may be needed.
Trap by feed system elements (cover feed)	Prevent access to any trapping parts while they are in motion. Prevent access to the danger zone by design or by fixed or interlocked guards. If the cover feed system can be swivelled away to expose dangerous parts, provide a fixed or interlocked guard.



Figure 1 Extruder infeed

Section 6 | Buffing and peeling machines

Very serious accidents have happened at tyre buffing and peeling machines. Table 2 summarises the main hazards and the usual safeguards for dealing with them.

Table 2 Hazards and safeguards for buffing and peeling machines

<i>Hazard</i>	<i>Safeguard</i>
Buffing machines	
Contact with the rasp at:	
<ul style="list-style-type: none"> ■ constrained head machines 	Prevent access to the rasp when it is in motion. Provide an automatic rasp shield/guard mounted on the rasp housing to completely enclose the rotating rasp. Only when the rasp is within 50 mm of the tyre surface does the shield open to allow the rasp to make contact with the tyre. When the rasp is retracted the shield closes again. Alternatively, provide a combined photo proximity and automatic braking system. The photoelectric beam prevents the rasp from rotating until it is within 50 mm of the tyre surface. If the rasp head is retracted away from the tyre the photoelectric device triggers an injection brake to stop the rasp instantaneously. The photoelectric device is self-checking on a cyclic basis to prevent it being bypassed.
<ul style="list-style-type: none"> ■ articulated-head machines 	Prevent access to the rasp when it is in motion. Provide a two-hand control system mounted on the rasp body. This ensures that the operator's hands are kept well away from the rasp when it is rotating. Release of either of the hand controls either causes the rasp to brake and stop immediately or closes a guard over the rasp.
<ul style="list-style-type: none"> ■ automatic machines 	Prevent access to the rasp when it is in motion. Provide a full guard enclosure around the machine with interlocked access doors or photoelectric devices that prevent movement of the rasp before a person can gain access to the danger zone.
When changing rasps	Prevent access to the rasp when it is in motion. Interlock the rasp housing with the rasp motor to halt all movement of the rasp before access is possible. Provide and maintain a safe system of work for changing rasps.
Traps/nips at the belt and pulley drive of the rasp motor	Provide a fixed guard to totally enclose the drive. If frequent access is needed the guard should be interlocked with the motor.
Entanglement and in-running nips at tyre drive rollers	If these can be reached provide a fixed guard to prevent access. Ensure the machine is fitted with a device to prevent the drive roller from rotating unless the tyre is in position and, in the case of machines with inflation facilities, inflated.
Traps at expanding chucks and rim flanges	Ensure the controls are positioned at a safe distance from the trapping zone. Ensure a self-centring three-position control valve is fitted. The valve should have a spring-biased set position and should shut off the air supply to both sides of the pneumatic cylinder when the operating control is released.
Foot trap from descending tyre lift	If there is a trapping hazard provide a fixed chock or similar restraint to prevent any part of the lift getting closer than 100 mm above the floor.
Peeling machines	
Access to the peeling blade	Position the controls at a safe distance from the peeling zone. Provide and maintain a safe system of work to ensure the tyre is not revolving when the operator removes strips or chunks of tread. Provide emergency stop buttons and reverse rotation push buttons in a readily accessible position. Provide operators with suitable face shields and make sure they wear them.



Figure 2 Articulated-head buffing machine with two-hand control

Section 7 | Guillotines and tread cutters

There are serious cutting and amputation hazards to the fingers from the guillotines and cutters used to cut pre-cured tread to length. Make sure guillotines are provided with strong guards large enough to prevent access to the cutting zone and blade from both the feed and delivery sides.

The dimensions of the feed and delivery openings in the guards should be as stated in Table 3. The guards should either be fixed or interlocked to ensure that a power stroke of the blade is possible only when the guard is fully closed. Set the guard to the lowest possible height above the surface of the worktable. Check the dimensions of the feed and delivery openings to make sure it is impossible to reach the cutting zone with the guard in the closed (ie working) position.

Dimensions of openings in guards and corresponding safety distances

The maximum acceptable size of the narrowest dimension of the feed or delivery opening in the guard depends on the distance measured from the plane of the opening in the guard to the danger zone inside the machine.

In the case of a guillotine where the blade descends vertically and which is fed with a strip of precured tread through a horizontal slot opening in the machine guard (and/or delivered through a

similar slot opening) the vertical dimension of the slot and the horizontal reach distance from the plane of the opening to the danger zone (ie the blade of the guillotine) should be as stated in Table 3. The table is based on the specification for regular openings in guards and corresponding safety distances as set out in BS EN 294: 1992 *Safety of machinery - Safety distances to prevent danger zones being reached by the upper limbs*.

NEVER rely on the presence of the strip of tread rubber in the guard opening to prevent access to the guillotine blade. The measurement is the narrowest dimension of the opening in the guard with *no tread rubber present*.

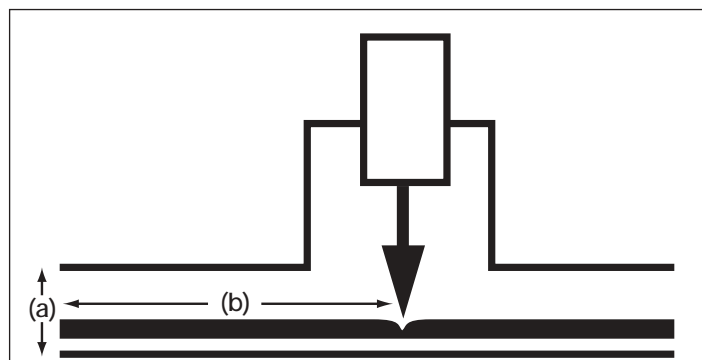


Figure 3 Guard opening (a) versus safety distance (b)

Table 3 Minimum safety distances for a range of sizes of feed/delivery openings in guards

Part of body	Opening (a)	Safety distance for slot opening (b)
Finger tip	Less than or equal to 4 mm	Greater than or equal to 2 mm
	Greater than 4 mm but less than or equal to 6 mm	Greater than or equal to 10 mm
Finger up to knuckle joint or whole hand	Greater than 6 mm but less than or equal to 8 mm	Greater than or equal to 20 mm
	Greater than 8 mm but less than or equal to 10 mm	Greater than or equal to 80 mm
	Greater than 10 mm but less than or equal to 12 mm	Greater than or equal to 100 mm
	Greater than 12 mm but less than or equal to 20 mm	Greater than or equal to 120 mm
	Greater than 20 mm but less than or equal to 30 mm	Greater than or equal to 850 mm
Arm up to the junction with the shoulder	Greater than 30 mm but less than or equal to 40 mm	Greater than or equal to 850 mm
	Greater than 40 mm but less than or equal to 120 mm	Greater than or equal to 850 mm

Section 8 | Tyre presses

Tyre presses in the retread industry do not cause a large number of machinery accidents, however, they can inflict injury, so apply the following safeguards.

Steam-operated tyre presses are subject to the Pressure Systems Safety Regulations. Ensure presses and their steam supply systems are thoroughly examined by a competent person, such as the engineering surveyor of an insurance company or plant inspection body, at suitable intervals in accordance with a written scheme of examination. The RMA or BRMA will be able to give you the names of plant inspection bodies able to draw up written schemes of examination and provide competent persons to carry out examinations.

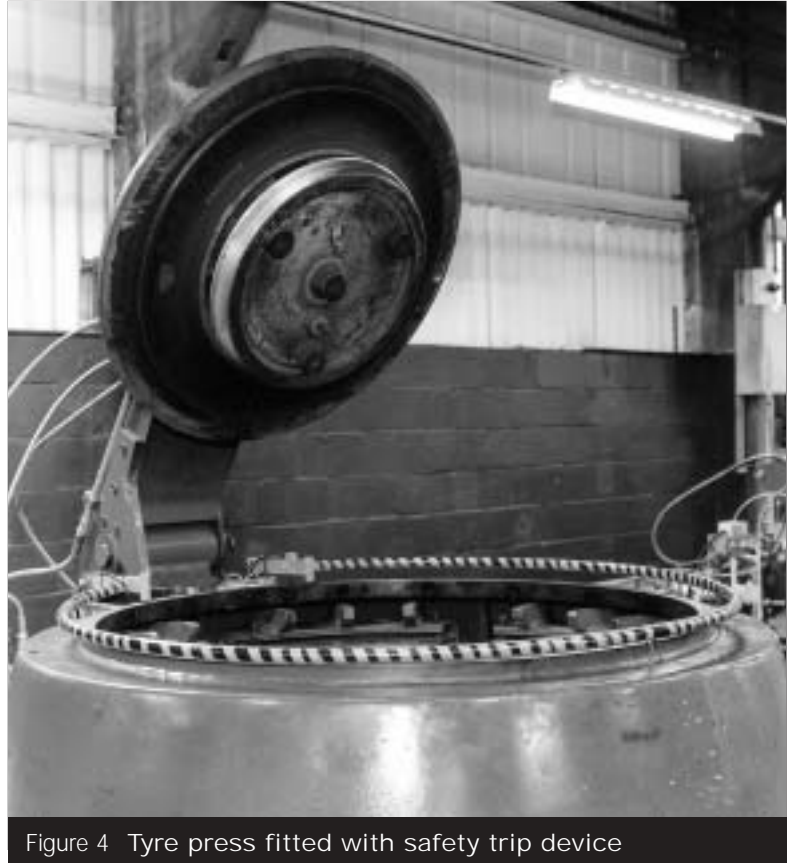


Figure 4 Tyre press fitted with safety trip device

Table 4 Hazards and safeguards at tyre presses

Hazard	Safeguard
Gravity closure causes trapping risk	The press should be designed to prevent the risk of closure under gravity.
Powered closure causes trapping risk	Provide a tripping device to arrest and reverse the closing movement of the press when the device is operated. It should be of suitable design, dimensions and location to ensure it will be actuated if any part of a person's body approaches the trapping zone during the press closing cycle. Alternatively provide a photoelectric safety device that will arrest and reverse the closing movement if any part of a person's body approaches the trapping zone during the closing cycle.
Loaders/unloaders, intersegment traps, lid to segment traps and other shearing and trapping points	Provide a tripping device as above and check to confirm there is no access to these trapping points during the dangerous part of the cycle.
Inflation pressure inside the press	Ensure inflation pressure above the bare minimum needed to fill out the bladder cannot be applied until the press is closed and that the press cannot be opened while inflation pressure remains, eg by means of pressure switches connected to the press closing and opening circuits.
Hot parts of the press	Prevent access to hot parts by fitting suitable insulation. Provide suitable personal protective equipment to protect against heat burns.

Section 9 | Tyre inflation-testing machines

Inflated tyres contain very high levels of stored energy. If this is released suddenly through failure of the tyre it can cause serious injuries. Inflation-testing machines must be designed, maintained and operated to ensure that the risk of a tyre

bursting is minimal. They should also be fitted with strong, rigid safety guards to protect the operator from injury in case an inflated tyre bursts. Apply the safeguards in Table 5.

Table 5 Hazards and safeguards for tyre inflation-testing machines

Hazard	Safeguard
Foot trap from descending tyre lift	If there is a trapping hazard provide a fixed chock or similar restraint to prevent any part of the tyre lift approaching closer than 100 mm to the floor.
Traps at chucks and reciprocating flange plates	<p>Ensure operating controls are positioned at a safe distance from the trapping zone.</p> <p>Ensure a self-centring three-position control valve is fitted. It should have a spring-biased set position and should shut off the air supply to both sides of the pneumatic cylinder when the operating control is released.</p> <p>Vent the machine fully before changing plates.</p>
Tyre burst/sudden release of pressure	<p>Limit the maximum air pressure available at the machine to the minimum necessary for the tests carried out.</p> <p>Ensure the machine is designed to apply the inflation pressure in sequential steps, ie designed to prevent the higher-pressure settings being applied unless the lower-pressure settings have been selected first.</p> <p>Fit a suitable warning device incorporating a flashing light to indicate when the higher-pressure range has been selected.</p> <p>Limit the maximum inflation pressure on a car tyre inflation-testing machine to no more than 4 bar (59 psi).</p> <p>Limit the maximum inflation pressure on a truck tyre inflation-testing machine to no more than 7 bar (102 psi). If higher pressures are absolutely essential the machine will need to be enclosed in a specially designed and constructed blast protection enclosure. Get specialist advice for this.</p> <p>Provide strong, rigid guards designed to protect the operator from injury if a tyre bursts. They should be positively interlocked to ensure air pressure equal to or greater than 3 bar (44 psi) cannot be applied to the tyre until the guard is fully closed. The guard should incorporate a viewing panel to allow the operator a clear view of the tyre through it. Keep the panel clean.</p> <p>On a <i>car</i> tyre machine the interlock should be arranged to ensure that the tyre automatically deflates as soon as the guard is moved out of the operating position.</p> <p>On a <i>truck</i> tyre machine the guard should lock in the operating position and the interlock should prevent air pressure being applied to the tyre until the guard is locked in that position. The guard and machine controls should be such that it is impossible to operate the machine while the operator's body is inside the guarding system.</p> <p>Ensure operators never touch or make contact with a tyre when it is inflated to above 5 bar. Any inspection carried out when this pressure is exceeded should be entirely visual. The operator should not touch the tyre.</p>

continued...



Figure 5 Truck tyre inflation-testing machine fitted with safety guard

Table 5 (continued)

<i>Hazard</i>	<i>Safeguard</i>
	<p>Provide and maintain an effective system of work to ensure that tyre casings requiring 'full penetration repairs' are not inflated above 3 bar.</p> <p>Ensure casings are checked for bulges and distortion at the lower pressure setting before allowing higher pressures to be applied.</p> <p>Train operators to view the tyre through the viewing panel on the guard. Provide them with suitable eye protectors and make sure they wear them.</p> <p>Provide a red mushroom-headed emergency stop button in a readily accessible position on the outside of the guard. Operating the emergency button should cause the tyre to deflate immediately.</p> <p>If the machine is also used for tyre buffing, building or grooving, make sure there is an effective interlock to prevent the tyre from being inflated above 2 bar when these operations are to be performed.</p> <p>Locate the machine in a position where the operator will not be distracted by other activities and where other people will not be endangered, ideally in a separate room. If this is not possible, consider locating it in a clearly marked 'restricted' area from which people other than the machine operator are excluded.</p>

Section 10 | Noise

Some activities in the retread industry like shot blasting, tyre buffing, skiving and inflation testing can produce high noise levels. If employees are exposed to high noise levels for prolonged periods of time there is a serious risk of them suffering irreversible hearing loss. Occupational hearing loss is a serious, disabling condition and successful civil claims against employers for failing to prevent noise-induced deafness are common. They often lead to settlements that prove expensive for the employer.

First action level

Where employees are exposed to a daily personal noise exposure of 85 decibels (dB(A)) or more you need to take action. This is known as the first action level. As a rough guide, 85 dB(A) is about the noise level you would experience in a busy city street full of heavy traffic. At this level you have to raise your voice to make yourself heard by someone standing 2 m away.

Second action level

A daily personal noise exposure of 90 dB(A) is known as the second action level. At 90 dB(A) you would have to raise your voice to make yourself heard by someone standing 1 m away. Where any employees are exposed to the second action level, or above, there are additional measures that you must take.

Here are some typical noise levels to which operators can be exposed in retread processes.

Skiving	94 to above 100 dB(A)
Buffing	85 to 92 dB(A)
Inflation testing	Over 90 dB(A)
Shot blasting	Over 100 to 110 dB(A)

Note: Every time the noise level increases by 3 dB(A) the noise energy approximately doubles. Therefore 93 dB(A) is approximately twice 90 dB(A).

What do I have to do?

If any employees are likely to have a daily personal exposure at, or above, the first action level you must ensure that a competent person carries out a noise assessment to identify employees who are at risk and to provide the information to help you decide what noise-control measures you need to take. You can get the names of organisations that are able to help you carry out this assessment from RMA, BRMA or the British Institute of Occupational Hygiene (BIOH)

(Tel: 01332 298087, website: www.bioh.org).

You must reduce the risk of hearing damage to be as low as reasonably practicable by reducing the level of noise generated in the first place. This may be achieved by using quieter machinery and equipment wherever possible, or by providing acoustic enclosures around noisy equipment and segregating activities that generate high noise levels from other areas to avoid unnecessary noise sharing.

If, after you have done all this, there are still some employees who are exposed to noise levels at, or above, the first action level but below the second action level you must inform them of the noise levels to which they are exposed, explain the risks and make suitable hearing protectors available for them to wear if they wish.

If there are some employees who are exposed to the second action level or above, you must issue suitable hearing protection and require it to be worn correctly. You will need to train employees in the correct use and maintenance of hearing protectors.

At or above the second action level you must designate and clearly mark ear protection zones within the workplace and you must enforce the proper wearing of hearing protectors by anyone entering those zones. This includes supervisors, managers, office staff and visitors who need to enter the zones even if only for a short period of time. Managers and supervisors should set a good example by wearing their hearing protectors in the ear protection zones to persuade other employees to do the same.

Tyre-buffing machine example

As an example, these are the measures you should consider at a noisy tyre-buffing machine where noise levels between 85 and 92 dB(A) can be expected at the buffing operator's position unless suitable control measures are put in place. The measures should be applied in this order of preference with personal hearing protection being relied on only as a last resort.

Step 1 - Reduce noise at source

For example, use peeling to remove the bulk of the tread to minimise the amount of noisy buffing required. Fit noisy air exhausts and extraction systems with suitable silencing devices.

Step 2 - Provide acoustic enclosures

Automatic buffing machines can be placed inside acoustic enclosures. These can significantly reduce the noise levels at the operator's working position.

Step 3 - Prevent noise sharing

Segregate noisy buffing machines from other relatively quiet work activities and processes. Fit suitable acoustic barriers or partitions to reduce the amount of noise reaching adjacent work areas. Partitions can be effective in reducing noise levels at adjacent workstations but will not reduce the noise level at the buffing machine operator's position.

Step 4 - Designate ear protection zones and provide hearing protectors

If, after applying the above measures, the noise levels, although reduced, are still at or above the second action level, you will need to mark the affected area with conspicuous noise warning signs and issue people who enter or work in the area with suitable hearing protectors. Give them a choice of different types of hearing protector, explain why and when they must wear them, train them how to wear the protectors properly and how to maintain them. Carry out regular checks to make sure that hearing protectors are being worn and maintained properly.



Figure 6 Automatic buffing machine fitted with acoustic enclosure

Other noisy processes

You should apply the same approach at other noisy processes. For example, you can use quieter electric skiving tools to replace noisy pneumatic ones. Pneumatic tools can be made quieter by fitting silencers to the exhaust ports. Similarly you can fit silencers to tyre inflation-testing machines and you can isolate these machines from other work activities by segregating them or providing acoustic screens to minimise noise sharing.

The pressure controls on tyre inflation-testing machines should be designed to minimise the risk of a tyre bursting. However, unless the risk has been eliminated altogether, operators and others in the vicinity of an inflation-testing machine while it is operating should still wear suitable hearing protectors to protect against the extremely high noise levels that will result if there is a burst.

Health surveillance

If noise levels are such that you have to designate ear protection zones and rely on hearing protectors to protect your employees, you will need to decide if you also need to carry out regular hearing checks (audiometry) on the employees concerned. Ask the competent person who carries out your noise assessment for advice. If any employees are exposed to a daily personal exposure of 95 dB(A) or more, routine audiometry is essential. For daily personal exposure levels from 91 to 94 dB(A) it is recommended good practice. Audiometry should be carried out by a suitably trained person. RMA or BRMA will give you names of organisations able to provide an audiometry service.

Remember:

- ✓ Assess the noise levels to which people are exposed.
- ✓ Reduce the noise being generated by using quieter machines and equipment.
- ✓ Provide acoustic enclosures where possible.
- ✓ Avoid noise sharing.
- ✓ If people are still exposed to levels at or above the second action level, mark ear protection zones and ensure hearing protectors are worn.
- ✓ Ensure managers and supervisors always set a good example by wearing their hearing protectors when they go into ear protection zones.

Section 11 | Hand-arm vibration

Exposure to high levels of vibration from power tools can lead to hand-arm vibration syndrome (HAVS), sometimes known as vibration white finger (VWF). One of the operations likely to lead to high vibration exposure is skiving using hand-held power tools. Most truck tyre casings require some form of skiving. It is possible to control the vibration exposure to acceptable levels by taking the following precautions.

Vibration action levels

The HSE action level for vibration is a daily personal exposure, averaged over 8 hours, of $2.8 \text{ ms}^{-2} \text{ A}(8)$. If this level is likely to be exceeded regularly you should put in place effective control measures to reduce exposure. Also provide health surveillance in these circumstances.

If employees are hand skiving all day there is a strong likelihood that the action level will be exceeded. For example, with a typical combination, involving the use of a tungsten carbide cutting wheel and grinding wheel, each mounted in an air- or flexi-shaft-driven power tool, it is possible to reach the action level after only half a day's skiving. This applies to truck tyres in reasonably good condition. For tyres in particularly poor condition, requiring many cuts, it may take only a couple of hours to reach the action level.

In all these cases, a vibration risk assessment will be required to quantify the exposure of your employees to vibration. This involves calculating the exposure by determining the tool vibration level and the length of time the tool is used. Tool manufacturers and suppliers should be able to provide you with 'in use' vibration levels for the tools they supply.

Control measures

There are a number of simple and effective ways to control the vibration exposure from skiving. Select low-vibration tools - ask the equipment supplier for information about the vibration exposure levels the tools can be expected to produce when they are used for skiving and compare these with the action levels.

Limit the length of time any employee is exposed to hand-arm vibration. Unless very low-vibration tools are being used, it may not be safe to allow a person to carry out skiving for a full day or shift. Use job rotation to limit exposure, preferably by combining the skiving operation with other work that has little vibration exposure.

The condition of the tyre casings being processed also has an effect on exposure. The poorer the condition of the casing the greater the vibration exposure is likely to be. It is good practice to limit the number of tyre casings in poor condition being

processed each day or shift. Never process large batches of casings that are in poor condition together.

There is little evidence that so-called anti-vibration gloves provide protection against HAVS, although some gloves may provide support for the hands or wrist to alleviate other conditions. Gloves in general can help to keep hands warm when using vibrating tools and so aid blood circulation. This is particularly important for older air tools with uninsulated metal bodies.

Make sure you always purchase low-vibration tools and maintain them properly according to the manufacturer's guidance.

Health surveillance

Health surveillance will be needed if there is a significant risk of employees contracting HAVS even after the control measures described above have been taken, ie those exposed to vibration levels at or above 2.8 ms^{-2} . A qualified medical practitioner should supervise the health surveillance programme. They may be able to train your own nurse or first-aider to help too.

When control measures are introduced it is important to maintain the surveillance to check the measures are effective. If some employees are diagnosed as having the early stages of HAVS, their exposure to vibration should be severely limited, for example by introducing low-vibration tools and reducing their exposure times.

The RMA and BRMA will give you the names of professional organisations that can give further assistance. The Medical Inspector at your local HSE office will also be able to offer advice.

Remember:

- ✓ Daily use of hand-held powered tools can lead to hand-arm vibration syndrome (HAVS) unless you take precautions to limit exposure.
- ✓ Always choose low-vibration equipment when buying new hand-held powered tools.
- ✓ Ask the supplier about the vibration levels that can be expected when the tool is used for skiving and compare these with the action level.
- ✓ Maintain hand-held powered tools in accordance with the manufacturer's instructions.
- ✓ Limit the length of time each day, or each shift, that any employee is allowed to carry out skiving (eg by job rotation).
- ✓ Ensure employees are not required to skive tyre casings that are in poor condition for prolonged periods.

Section 12 | Dust from buffing, skiving and other operations

Several processes in the retread industry produce inhalable and respirable nuisance dust. You must prevent or, where this is not reasonably practicable, adequately control the exposure of employees to dust from tyre retread processes, such as tyre buffing and skiving operations.

You must keep the total airborne concentrations of dust in a person's breathing zone below 10 milligrams of dust per cubic metre of air. The respirable portion (ie the fraction of the dust which can penetrate the gas exchange region of the lung) must be kept below 4 milligrams per cubic metre.

LEV equipment

Provide effective local exhaust ventilation (LEV) equipment to capture the dust at the point where it is generated. For example, on a buffing machine, the extraction hood should be integral with the rasp housing. Shrouding the rasps with brushes or strips of rubber to maximise the extent to which the hood encloses the rasp will improve extraction efficiency and help contain larger particles of dust. Provide purpose-designed flexible LEV systems to capture and take away dust from skiving operations.

Any extraction system should be designed to ensure that:

- the extraction hood encloses the source of dust as much as possible;
- the hood is positioned to capture the dust in the direction it is travelling;
- the air velocity at the face of the hood is sufficient to capture the dust; and
- contaminated air is not drawn past the operator's breathing zone.

The dust-laden air from the extractor hood will need to be ducted away to an efficient dust-collection unit. For maximum efficiency, ducts should be rigid and as straight as possible with a minimum number of bends. Avoid sharp bends.

Extraction systems to control dust from skiving operations and buffing machines may have to incorporate flexible ducts which have a high resistance to air flow and can deteriorate rapidly through general wear and tear. The extra resistance to air flow must be taken into account in the initial design specification and when deciding the nature and frequency of maintenance checks.

Ensure your LEV system is designed by a competent ventilation engineer who has experience of designing and installing LEV equipment. When the system is first installed

measure the operating parameters such as air velocity at the face of the hood and the static pressures at key test points on the system with the equipment working properly and keep a record. When the system is inspected and tested periodically during its operational life, these measurements can then be compared with the original operating parameters to decide if there has been any deterioration in performance.

Maintenance scheme

Put in place a planned maintenance scheme for the extraction system. This should include:

- Daily checks to confirm the equipment is switched on and working.
- Weekly visual inspections of the extractor hoods, flexible ducts and connections, the main ductwork and any dust filter. Check the static pressure or face velocity at the extraction hood. Check the manometer at the dust filter to ensure the pressure drop is acceptable and in accordance with the manufacturer's recommendations.
- Emptying the dust collector frequently in accordance with the manufacturer's recommendations.
- Thorough examination and test of the whole system by a competent ventilation engineer at appropriate intervals not exceeding 14 months. The competent engineer must provide you with a report of each examination and test.



Figure 7 Buffing machine rasp housing fitted with LEV

Good housekeeping

You also need to prevent dust from accumulating on the floor and other surfaces. If dust is allowed to accumulate it will be disturbed and spread by draughts or people walking about and could become airborne again. So clean floors and surfaces frequently using a dustless method such as by using a type H industrial vacuum cleaner fitted with a HEPA filter.

Respiratory protective equipment (RPE)

In a few situations, like emptying dust collectors or cleaning out ducts, it may not be possible to achieve control over respirable dust by LEV equipment. In these circumstances, provide the employees at risk with suitable RPE and require them to wear it. You need to select the right type of respiratory protection. Disposable dust mask respirators (FFP2 or FFP3 made to EN 149 standard) are suitable if they are needed only occasionally and for short durations. They should be tested for fit to the worker's face (ask your supplier)

but they do not need maintenance because they should be thrown away after each use. If a respirator is needed more frequently or for longer periods of use then a ventilated visor is a good choice. Most people find them comfortable to wear. They do not need to be tested for face fit but do need to be maintained properly (ask the supplier).

You must also put in place effective arrangements for storing the RPE when it is not in use, cleaning and maintaining it, including replacing filters at the appropriate intervals where necessary. Train employees how to wear their respirators properly and how to look after them, and explain what the equipment will (and will not) protect them against.

Remember:

- ✓ Control the dust.
- ✓ Provide LEV equipment.
- ✓ Maintain the LEV equipment and have it checked and examined at regular intervals.
- ✓ Keep the area clean using a dustless method.
- ✓ Use respirators where dust cannot be controlled by LEV.

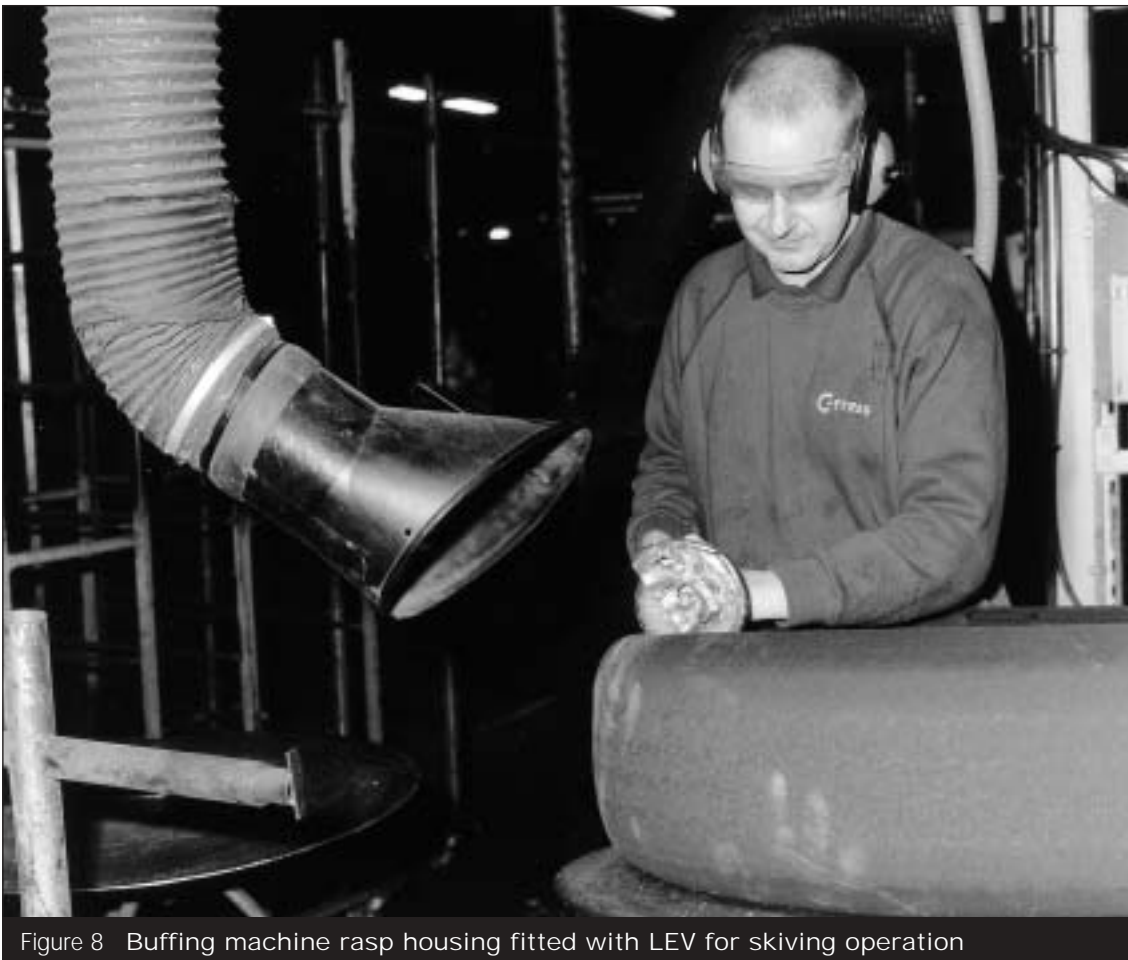


Figure 8 Buffing machine rasp housing fitted with LEV for skiving operation

Section 13 | Rubber fume

Rubber fume is classified as a carcinogen (ie it may cause cancer) and stringent control measures are needed. The law specifies a maximum exposure limit (MEL) (averaged over an 8-hour period) of 0.6 milligrams per cubic metre of air in the operator's breathing zone. This concentration of fume could be exceeded at hot cure tyre presses unless you have effective control measures. Fumes escape when the presses are opened and continue to come off as tyres cool.

In general, remoulds made by the cold cure, or precure, process produce lower fume levels during curing. But operators can be exposed to high concentrations of fume for a short duration when the autoclave door is first opened.

How can I control the fume?

Extrusion

Extrusion produces some rubber fume but usually at low levels. If you are in doubt about whether fume levels are below the MEL, have them

measured to help you decide if you need to install LEV equipment. This is specialist work and should be carried out by a competent occupational hygienist. It involves putting personal monitors on a number of process operators for a particular length of time, analysing the samples in a laboratory and then interpreting the results. You can get the names of consultants who are able to do this for you from RMA, BRMA or BIOH.

Hot cure (bead to bead) remoulding

- Vulcanising using tyre-curing presses can produce high fume levels. Unless you have already done so, measure the levels of fume to which employees are exposed. Unless the results show that fume levels are very low, LEV will be needed to capture the fume at the presses and conduct it away to a safe place outside. Get advice from the occupational hygienists who carry out the fume measurements for you and ask specialist ventilation engineers if necessary. If fume levels are low and are being controlled by high-level building extractor fans alone, make sure the flow of air into and out of the building is never obstructed.
- Make sure you never exceed the recommended curing temperatures.
- Cool the tyres as quickly as possible, for example, by removing them immediately to a separate ventilated area by means of an enclosed or exhausted conveyor. If you are a small company with only one or two presses, provide a ventilated booth to hold the tyres as they cool. The booth's extraction ventilation should draw the fume away from the operator and duct it to a safe place outside the building. Consult the environmental health department of your local authority about the type of filtration, if any, that may be required to clean the extracted air before it is discharged to atmosphere.
- Make sure tyres have cooled down fully before they are inspected. Inspecting them hot will expose the operator to a high concentration of fume.
- Segregate the press areas from the rest of the factory. Limit access to those people who need to be there.
- Have an effective planned maintenance system covering fume ventilation and extraction equipment. Look at the maintenance manual and follow the instructions.

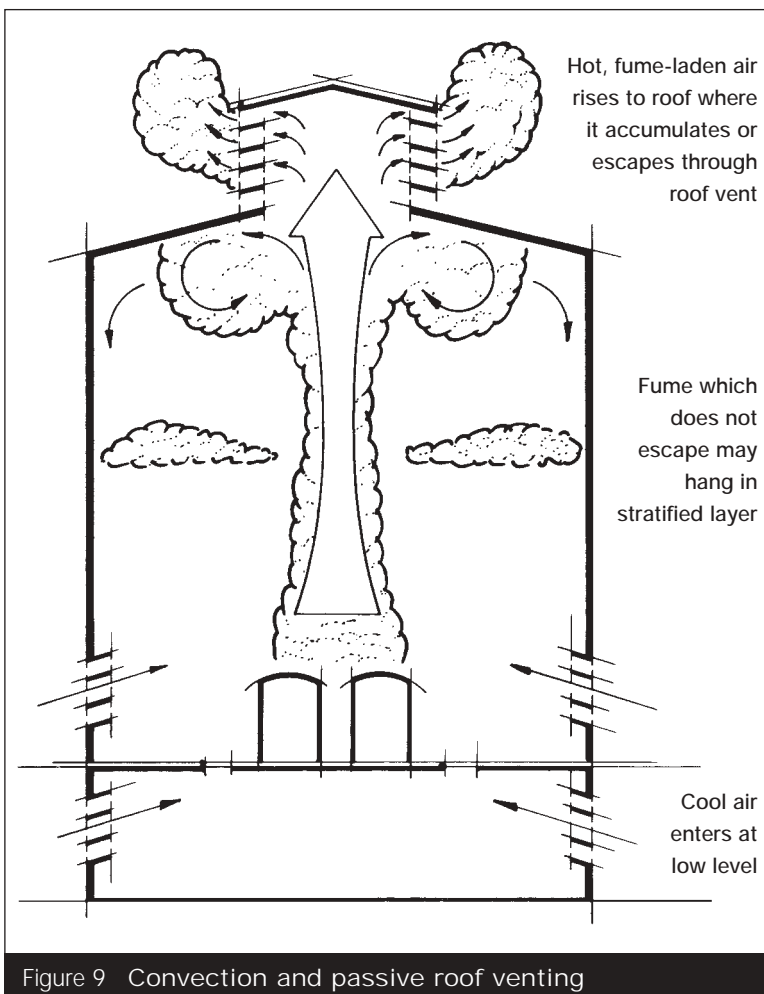


Figure 9 Convection and passive roof venting



Figure 10 Tyre presses fitted with exhaust ventilation for controlling rubber fume

- Make sure you know the design performance of ventilation and extraction equipment. If it is not available ask a ventilation engineer to measure the performance.
- Check each day at the beginning of work that ventilation fans and extraction systems are switched on and working.
- At least once a week check that ventilation fans and extraction systems are clearing the fume properly and that hoods and ducts are in good condition with no holes or loose or damaged joints. Keep records of these checks.
- Make sure the complete ventilation and extraction system is thoroughly examined and tested by a competent engineer at least once every 14 months. Make sure the engineer gives you a report of the results of the examination and test. Take action to remedy any reported defects.
- Have fume levels measured at suitable intervals, at least annually, and record the results. Investigate and take action if the results show fume levels that are higher than expected. You may need to measure fume levels more often than once a year if, for example, you are concerned that the control measures are performing inconsistently (especially if this could take fume levels above the MEL), your work changes seasonally or if you make a change to your process or to the fume-control measures.

Cold-cure remoulding

If you operate the cold-cure process using autoclaves you will probably not need to measure fume levels unless employees are carrying out several cures during a shift.

- Make sure the autoclave is vented to a safe place outside the building.
- Where possible allow the autoclave to cool down fully before opening the door to remove tyres at the end of the cure cycle.
- Where possible allow tyres to cool before removing the envelopes.
- Provide a good standard of general ventilation. Follow the advice given above in relation to high-level extraction fans.
- Install effective LEV over the door of the autoclave and arrange for it to come on before the door is opened.

- Never exceed maximum curing temperatures.
- Have an effective planned maintenance system for fume ventilation and extraction equipment. Look at the maintenance manuals and follow the instructions.
- Ensure the same daily, weekly and 14 monthly checks, examinations and tests mentioned in relation to hot cure remoulding are carried out and records kept.

What health surveillance should I carry out?

The main health risk is one of contracting cancer. There will be no short-term evidence of ill health that can be identified by health screening so it is particularly important that you provide a high standard of training for your employees (see also Section 2 of this guide). The training should ensure employees have a good understanding of the risks to health associated with exposure to rubber fume, how the control measures you have provided operate, how they are maintained, examined and tested and what action must be taken if any of the control measures break down or appear to be faulty.

Make and keep suitable health records for all employees who are exposed to rubber fume (see Appendix 1 for an example). Arrange for records to be reviewed periodically by a competent occupational health professional and keep them for at least 40 years from the date of last entry. Contact your nearest HSE office for advice on what to do with health records if your company ceases trading.

Remember:

- ✓ Rubber fume may cause cancer.
- ✓ Prevent fume wherever you can and keep concentrations of fume in your employees' breathing zones well below the MEL.
- ✓ Provide LEV equipment where necessary and maintain it properly.
- ✓ Have LEV equipment checked and examined regularly by a competent person.
- ✓ Never exceed maximum cure temperatures.
- ✓ Segregate processes producing fume from the rest of the factory.

Section 14 | Adhesives and solvents

Adhesives, rubber solutions, tackifiers and sidewall paints used in the retread industry contain organic solvents. These are harmful in the following ways:

- They evaporate readily and can be breathed in leading to headaches, nausea and other health effects. In high concentrations they can lead to unconsciousness and even death.
- They can be absorbed through the skin, entering the body and causing the same effects as when they are inhaled.
- They dissolve fats and greases easily, so, if they make contact with the skin, their defatting action will remove the skin's natural protection. This can lead to dermatitis and other skin disorders that are often difficult to treat.

How can I protect my workforce?

Step 1 - Elimination

Where possible eliminate the use of solvents altogether, for example by extruding cushion gum direct onto the prepared tyre casing.

Step 2 - Substitution

If you cannot eliminate the use of solvents altogether, consider using a solvent that is not hazardous to health. For example, convert to water-based adhesives instead of solvent-based ones. Ask your suppliers and try out the latest water-based formulations.

If you cannot use water-based products, use solvents that are the least harmful to health. Ask your suppliers for advice and always check the information in the product Material Safety Data Sheet that the supplier must provide by law. But don't ignore the fire hazards and risks to the environment when choosing a product.

Step 3 - Enclose the process

Wherever possible, totally enclose the process to prevent the escape of either liquid or vapour. For example,

if you use substantial quantities of solvent, consider storing them in fixed tanks and distributing them to the point of use by a pump and pipeline system. Systems for degreasing metal components should be totally enclosed wherever possible.

Step 4 - Local exhaust ventilation (LEV) systems

Provide well-designed LEV systems, eg spray booths, to capture solvent vapours at the point at which they are released and prevent them reaching a person's breathing zone or entering the workroom atmosphere. The tyre being sprayed should fit well inside the booth. The exhausted air should be drawn to the back of the booth away from the operator and be ducted to a safe place outside. Consult the Local Authority about filtration of exhausted air. Make sure you maintain a minimum air velocity of at least 1 to 2 m per second across the open face of the booth. Use low-pressure or 'airless' spray systems.

Step 5 - General ventilation

Make sure you have high standards of general ventilation wherever solvent vapours are likely to be present. Maintain a minimum of eight air changes per hour. Never rely solely on general ventilation in circumstances in which LEV equipment would be appropriate. You should always prevent vapours getting into the general atmosphere of the workplace in the first place wherever possible.



Figure 11 Exhausted spray booth for controlling solvent mist and vapours

Step 6 - Personal protective equipment (PPE)

Never rely on PPE as the only, or even the first, line of defence against exposure to solvents. However, you may need to provide it *in addition* to the control measures listed above where those control measures alone do not achieve 100% protection.

You will need to provide overalls or aprons and gloves to prevent contamination of skin and clothing. Ensure the gloves you choose will provide adequate protection against penetration by the *particular* solvents you handle. Nitrile rubber gloves give the best protection against most solvents but ask the supplier to advise you on the best choice for your circumstances. Remember that protective gloves will not last forever - they must be replaced if they get damaged or holed or become contaminated on the inside. They are never totally impervious to solvents so even if they look fine, they will need to be replaced at appropriate intervals before the solvent can permeate through to the inside of the glove.

Protective clothing should be cleaned and replaced regularly. It is important that employees find PPE reasonably comfortable or they will be tempted not to wear it properly. So make sure you involve employees fully when selecting the type of equipment to provide.

There should be very few circumstances in which you need to rely on personal respiratory protection, but where it is needed, select it carefully to ensure it will provide adequate protection against the *particular* solvent vapours involved at the concentrations you are likely to encounter. Get advice from the suppliers of the respiratory protective equipment (RPE).

Skin care

Provide adequate washing facilities, pre-work cream and moisturising cream for employees. Instruct and train them to apply the pre-work cream before working with solvents, tackifiers, sidewall paints etc. Also instruct them to wash after handling these substances, to apply moisturising cream after washing, and to keep their skin clean.

Maintenance and inspection

Provide an effective planned maintenance and inspection system for all the above control measures. See Section 12 for guidance on how to maintain and inspect LEV equipment. Check PPE at least once a month and perhaps more frequently if it is subject to heavy use. Look at the supplier's literature or ask the supplier to advise you of what

should be checked and how often. Draw up suitable checklists and appoint a responsible person such as a supervisor or chargehand to carry out the checks and keep records.

Training and instruction

It is particularly important that employees understand the harmful effects of the products they handle and how these can get into the body. They also need to understand the control measures you have provided, how to use LEV equipment, what PPE to wear and how to fit and wear it properly. They need to understand the arrangements for keeping their PPE clean and maintaining it and they need to know that they must report to their manager or supervisor any symptoms that could be caused by exposure to solvents so that the causes can be investigated. See Section 2 for advice on training.

Health surveillance

Consider training a responsible person such as a manager, supervisor or first-aider to carry out regular basic skin checks (eg of hands and forearms) for those employees who are at significant risk of contracting dermatitis through handling adhesives, solvents, rubber solutions, tackifiers or sidewall paints. The training should be provided by an occupational health professional. Ensure the results of the skin checks are recorded. See Appendix 1 for an example health record.

Put in place arrangements for ensuring that if the responsible person identifies, or suspects, any skin problems the employee concerned is referred to a medical practitioner.

Biological monitoring for absorption of solvents into the body is also available for many solvents - get advice from an occupational health professional if you think this may be required.

Remember:

- ✓ Use a safer product where possible.
- ✓ Enclose processes to the maximum extent.
- ✓ Provide effective LEV equipment.
- ✓ Make sure the LEV equipment is properly maintained and checked and examined regularly by a competent person.
- ✓ Select the right overalls, or aprons, and gloves and make sure they are used and changed regularly.
- ✓ Provide washing and skin care facilities and encourage employees to use them.

Section 15 | Rubber crumb and dust

If rubber crumb from buffing operations is allowed to accumulate it presents a fire risk. Finely divided rubber dust from buffing, skiving and similar operations is also combustible. If fine enough dust is mixed with air in the form of a dust cloud and exposed to a source of ignition it can explode.

Case study

A fire started in rubber crumb and dust inside the duct of the local exhaust ventilation system at a tyre sidewall buffing machine. The fire spread very rapidly and soon destroyed the whole factory.

Fires involving rubber crumb and dust are not uncommon, particularly in the ducts of extraction systems. For a fire or explosion to happen, there needs to be fuel (in this case rubber dust or crumb), oxygen and a source of ignition as shown in Figure 12. Exclude any one of the three and you will prevent the fire or explosion from happening. In practice it is difficult to exclude oxygen because it forms 21% of the air around us. But you can control the fuel and you can prevent sources of ignition. To minimise the risk you should take the following precautions.

Control the fuel

Provide a well-designed extraction system for capturing rubber crumb and dust at source and removing it efficiently to a suitable dust-collection unit, located in a safe position *outside* the building. The unit should be designed to include suitable explosion-relief panels or vents to vent an internal explosion to a safe place, relieving the internal pressure build-up before the dust collector can rupture and cause major damage. Do not allow the buffing machine to operate unless the extraction is running.

The extraction system as a whole and its component parts should be subject to a high standard of cleaning, planned maintenance and inspection. (See Section 12 for more information on local exhaust ventilation (LEV) systems.)

Prevent rubber crumb and dust from accumulating on floors, fixtures and fittings in the work area. Use a dustless method such as a suitable industrial vacuum cleaner to ensure that surfaces and ledges on and around machines are cleaned at frequent intervals. Pay particular attention to removing layers of dust from surfaces that are normally hot such as steam pipes. Allowing rubber dust to accumulate on floors, fixtures, fittings and ledges is inviting trouble.

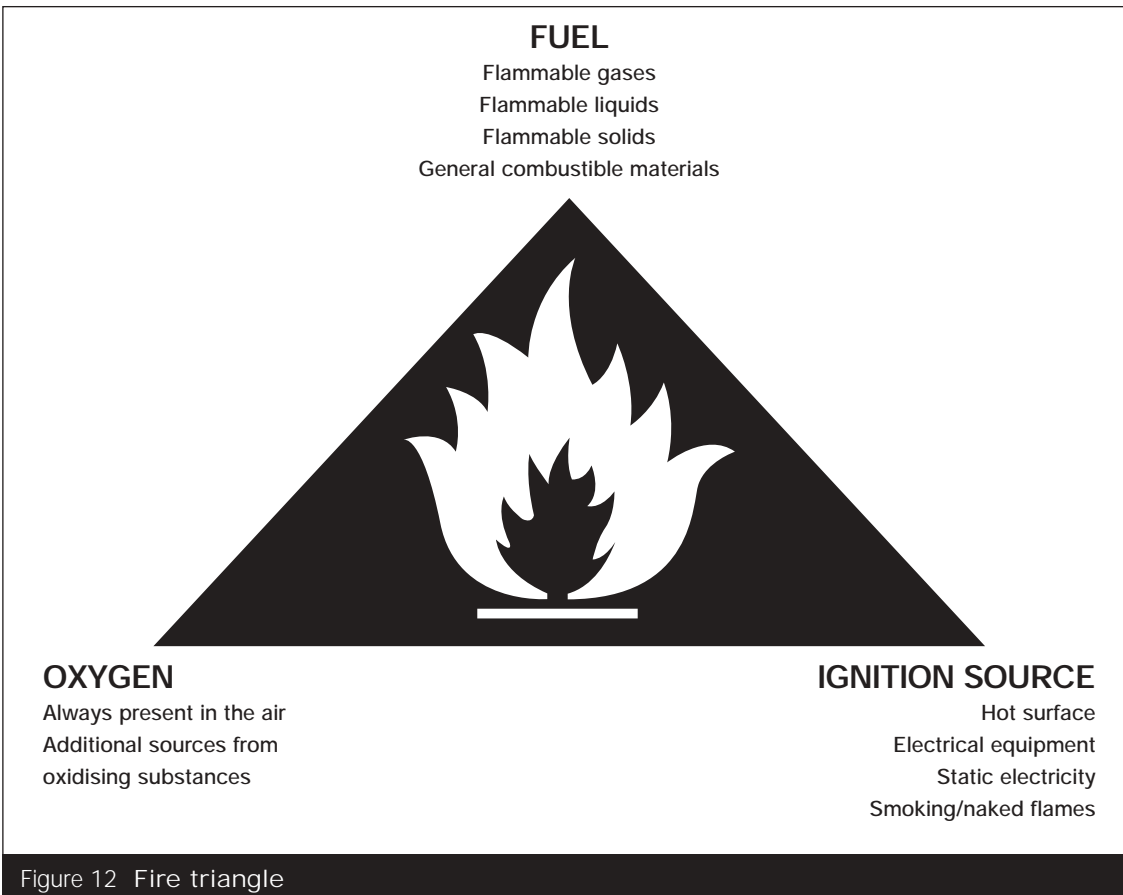


Figure 12 Fire triangle

Prevent sources of ignition

The action of the powered rasp on the tyre will generate heat. If you allow excessive frictional heat to build up, you will produce a source of ignition. Finely divided rubber dust can be easily ignited by sparks from a rasp. Rubber crumb is less easily ignited by a spark but will fuel a fire once it has started.

To minimise the risk of sparks and fires ensure the machine is operated properly and is well maintained. Maintain the performance of the rasps by ensuring they are changed frequently before they become too worn. Do not allow the rasp to make contact with steel plies in the tyre casing as sparks will result. If there are stones or nails in the tyre tread when the rasp is operating, sparks and hot flints can be projected into the duct. Make sure stones and nails are identified and removed during initial inspection of the tyre casing.

Prohibit the use of naked flames and cigarette smoking in the work area.

Make sure electrical components on and near the machine, including light fittings, are of a type suitable for an application in which they can potentially be exposed to combustible dust. Ensure all metalwork is well earthed to prevent the accumulation of static electrical charges.

Faulty electrical equipment can overheat or spark presenting a source of ignition, so make sure it is maintained properly and inspected regularly by a competent electrician. If dust is allowed to accumulate on the surfaces of electrical fittings, heat will build up and fire could result, so make sure they are kept clean.

Detect and minimise the spread of fire

Install suitable automatic fire detectors to detect a fire at any buffing machine. The detectors should be arranged to automatically trigger an alarm, such as the building fire alarm, to give the earliest possible warning of a fire. These detectors can also be arranged to:

- shut down the LEV system;
- operate slam shut dampers in the ductwork of the LEV system to limit the spread of fire along the ducts and manifolds;
- inject fire-extinguishing carbon dioxide gas into the affected LEV ducts; and
- apply fire-fighting foam at and around the buffing machine.

Which of these additional precautions you may need to take will depend on the level of risk in the

circumstances of the particular operations carried out at your factory. Get expert advice, for example from the fire surveyor of your insurance company.

Train operators to check their machines and their extraction systems frequently. Tell them to report the slightest sign of smoke or a hot surface and to take the appropriate action. This will involve alerting others in the area, turning off the LEV equipment and stopping any processes that generate dust or fume. Make sure this can be done quickly. Machines, their electrical fittings and dust-extraction systems should be checked frequently for hot spots or signs of heat damage.

Establish effective emergency arrangements

Make sure the building is provided with a reliable fire-alarm system that is audible in all areas and that everyone understands the action to take on discovering a fire and on hearing the alarm. Test the fire alarm regularly and rehearse the emergency evacuation and assembly procedure at regular intervals. Ensure employees on all shifts participate in a rehearsal of the emergency evacuation procedure at least once a year.

Make sure emergency escape routes are clearly marked and signposted and inspect them frequently to ensure exit routes and emergency exit doors are kept clear. Consult your local Fire Prevention Officer for detailed advice.

Train your employees

Provide employees with the information, instruction and training they need to understand the above precautions and emergency arrangements as well as the actions they need to take to safeguard themselves and others.

Remember:

- ✓ Control rubber crumb and dust and prevent it accumulating in the workplace.
- ✓ Make sure LEV equipment for extracting rubber crumb and dust is well designed and working efficiently.
- ✓ Prevent sources of ignition.
- ✓ Have a system for early detection and limiting the spread of fire.
- ✓ Ensure you have effective arrangements for raising the alarm and evacuating people to safety if there is a fire.
- ✓ Train your employees on the precautions and emergency arrangements.

Section 16 | Stored tyres

Once a fire has taken hold in a stack of tyres or casings it will spread quickly generating large volumes of thick, black smoke that is harmful if inhaled and can rapidly obscure visibility making emergency evacuation and escape difficult.

Fires in tyre stacks are very difficult to fight once they have taken hold. A fire could also pose a serious risk to the general public in the surrounding area. It is essential that you take precautions to minimise the risk of fire in stored tyres and casings including casings rejected at the initial inspection stage:

- Make sure tyres and casings are stored in an orderly fashion.
- Ensure they are stored either inside a secure building or a securely fenced compound to minimise the risk of fires being started maliciously.
- Ensure the premises are kept securely locked out of working hours and review site security arrangements where necessary.
- Keep stored tyres well segregated from highly flammable liquid stores and compounds and from processes that involve a fire risk.
- Ensure there is adequate separation between adjacent stacks of tyres to give sufficient fire breaks.
- Ensure high standards of housekeeping and prevent litter and combustible materials from accumulating in the tyre and casing storage areas.
- Never allow a fire to be lit or a waste incinerator to be used in a yard where tyres or casings are stored.
- Make sure tyre storage areas are visited and checked every day.
- Ask the Fire Prevention Officer of your local fire brigade to advise you about general fire precautions including fire extinguishers, fire alarms and means of escape in case of fire.
- As a general rule prohibit any hot work, such as welding or hot-cutting, that could start a fire in stored tyres. If hot work has to be undertaken, use a permit-to-work system to ensure safety. Hot work should not proceed until a trained, responsible person has issued a written permit. Before signing the permit the responsible person should check that all tyres, casings, flammable liquids and other combustible materials are removed from the area and appropriate precautions have been taken to prevent a fire. The responsible person should ensure that the people who are to carry out the hot work understand the precautions to be taken. They should sign the permit to

confirm that they understand the precautions and accept the conditions specified in the permit. Make sure you have contingency arrangements in place in case things go wrong and ensure the people carrying out the hot work understand the action they must take.

- Train employees in the above precautions and the action to be taken in an emergency.

Remember:

- ✓ Fires in tyre stacks spread quickly and are difficult to fight.
- ✓ Fires in tyre stacks generate large amounts of smoke and could put the public at risk.
- ✓ Store tyres in an orderly fashion and pay close attention to housekeeping and fire-prevention measures.
- ✓ Ask your Fire Prevention Officer to advise you about the general fire precautions you need, then provide and maintain them.
- ✓ Visit and check tyre storage areas frequently.
- ✓ Train your employees about the precautions and emergency procedures.

Section 17 | Adhesives and solvents

Solvent-based adhesives, rubber solutions and sidewall paints are flammable liquids and pose a fire and explosion hazard. If neat solvents are used, this also presents a fire risk. Fires or explosions are likely to happen when flammable liquids and vapours are released or spilled and find a source of ignition. A small quantity of liquid can produce a large volume of flammable vapour.

Flammable liquids that have a flashpoint at or below ambient temperature will give off a vapour that will form a flammable mixture with air that can be ignited. Liquids that have a flashpoint above ambient temperature are less likely to give off flammable concentrations of vapour unless they are heated, mixed with low-flashpoint solvents or atomised to form a mist or spray.

What precautions should I take?

- Wherever possible use water-based products to eliminate the fire hazard altogether. If this is not possible consider substituting a solvent with one with a higher flashpoint. But don't forget to take account of the risks to health and to the environment too.
- Keep the quantities of flammable liquids in use at any one time to an absolute minimum. Return containers not in use to the store.
- Separate areas in which flammable liquids are dispensed and applied from other activities.
- Dispense and apply flammable liquids in a room separated from the rest of the building by fire-resisting walls or partitions.
- Where adhesives are applied by spray gun use a low-pressure or 'airless' spray system. Carry out spraying in a purpose-designed fire-resisting spray booth with exhaust ventilation to capture the vapours and draw them via a fire-resisting duct to a safe place outside the building. Consult the Environmental Health Department of your local authority about filtration of the discharged air.
- Make sure there is a high standard of ventilation wherever flammable liquids are dispensed and applied. Wetted surfaces of tyre casings will be giving off vapour so high standards of ventilation are needed to prevent vapour levels reaching flammable concentrations. Keep total wetted surface areas to a minimum.
- Store flammable liquids in a dedicated storage compound in a safe position in the open air outside the building. If this is not possible store them in a dedicated fire-resisting storeroom with a high standard of ventilation at high and low level in its external walls. Up to 50 litres may be stored in a purpose-built fire-resisting closed storage cabinet or bin.
- Clearly mark stores and cabinets with signs to show they hold flammable liquids and make sure there are arrangements to contain the

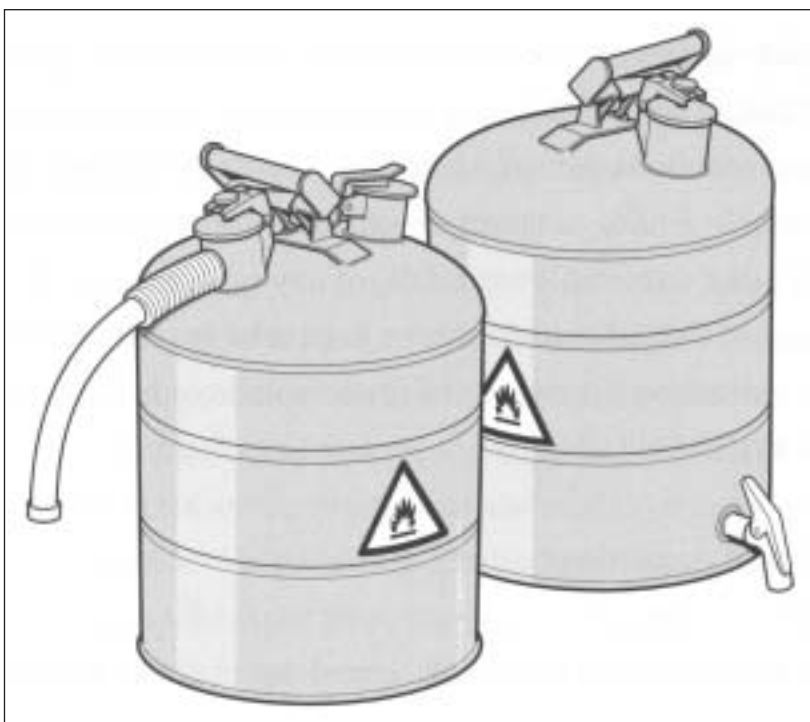


Figure 13 Safety containers

accidental spillage of a single container of the largest size in the store.

- Carry and dispense flammable liquids safely to avoid spillage and release of vapours. Vapours from flammable liquids are heavier than air and tend to flow across the floor.
- Ensure locations in which flammable liquids are dispensed are well ventilated and do not allow dispensing inside the flammable liquids storeroom or area. Dispense flammable liquids over a suitable spill containment/drip tray. Use special purpose-designed safety containers for carrying and dispensing flammable liquids and keep their lids closed to minimise the escape of vapours.

- Keep work locations clean. Do not allow solid residues to build up on surfaces. Remove residues by cleaning frequently with a non-sparking tool or use special-purpose peelable coatings to protect surfaces that can become contaminated (eg overspray in spray booths). Remove contaminated and other combustible materials such as rags, packaging, paper etc and place them in a closed steel bin pending removal from the building.
- Identify and classify any areas where hazardous explosive atmospheres may occur, for example the areas inside and immediately in front of a spray booth where flammable liquids are sprayed and the area inside a storeroom where flammable liquids are stored. Get



specialist advice if you are unsure and mark the areas, where necessary, with the specified 'EX' sign at the points of entry.

- Exclude sources of ignition. Prohibit smoking and naked flames where flammable liquids are used and stored. Keep vehicles such as fork-lift trucks out of the area altogether. Ensure electrical equipment, including light fittings, wall sockets, switches, junction boxes, portable electrical equipment and leads are excluded. This applies to low- and reduced-voltage equipment too. If you cannot avoid having electrical equipment in an area where solvents and adhesives are stored, dispensed or used, it must be of a type specially designed and constructed for use in potentially flammable atmospheres (new



equipment will be marked with the hexagon symbol containing the letters 'Ex'). Get advice from a competent electrical engineer and

ensure the equipment is maintained and inspected by a competent electrician at regular intervals. Take precautions to prevent the build-up of static electrical charges.

- Provide the right fire extinguishers. Ordinary water-type extinguishers are unsuitable where flammable liquids are stored and used - powder extinguishers are normally required and they should be serviced at suitable intervals. Ask the Fire Prevention Officer of your local fire brigade or the company who supply and service your fire extinguishers for advice about the number, type and size of extinguishers to provide.
- Provide suitable emergency procedures to be followed if there is an accidental spillage of flammable liquids or a fire. These should include what to do if there is a spillage or fire

and what to do when the fire alarm sounds. Remember that spillage of even a relatively small quantity of flammable liquid can produce a large volume of flammable vapour.

- Train employees to have a thorough understanding of the properties of the flammable liquids they use. Tell them about the precautions they must take when handling flammable liquids and what to do if there is an accidental spillage or inadvertent contamination of their clothing. Any spillage including contamination of personal clothing should be treated as an emergency. See also Section 2 for advice about training.

Remember:

- ✓ Use a non-flammable or less flammable product if you can.
- ✓ Keep quantities of flammable liquids to the absolute minimum.
- ✓ Ensure good general ventilation and provide LEV equipment where necessary (eg for spraying).
- ✓ Store flammable liquids safely in an external compound or fire-resisting store.
- ✓ Use methods for carrying and dispensing flammable liquids that minimise the risk of spillage or escape of vapours.
- ✓ Keep the work area clean and free of combustible materials.
- ✓ Have emergency procedures to be followed in case of an accidental spillage or fire.
- ✓ Train employees in the precautions to take and the emergency procedures.

Section 18 | Autoclaves – steam pressure and heat

The main hazards with autoclaves used for curing remoulded tyres by the cold cure (or precure) process are associated with the high levels of stored energy and heat they contain during the curing cycle:

- If the door is not properly secured while the autoclave is under pressure it can be displaced violently allowing an explosive release of pressure that can have a devastating effect. There will be a risk of serious personal injuries and death as well as a risk of extensive damage to plant and buildings.
- If there is residual pressure, even if it is very small, in the autoclave when the door is opened at the end of the curing cycle, the door will fly open violently and put operators at risk of serious injury.
- If there is hot steam or condensate in the autoclave when the door is opened (eg due to inadequate drainage of condensate) there is a risk of scalding to the operator. The design of the type of autoclave commonly used in the retread industry makes this less of a problem.

Design, construction, fittings and markings

- Are all parts of the autoclave properly designed and constructed to recognised standards?
- Is the autoclave clearly marked with its maximum allowable working pressure?
- Is it fitted with a suitable safety valve (pressure relief valve) to prevent it from being overpressurised?
- Is there a suitable reducing valve in the supply line to prevent the maximum allowable pressure being exceeded?
- Is there a suitable isolating valve or stop valve on the inlet line? This should be *in addition* to any door interlock valve.
- Is there a suitable pressure gauge or indicator installed where the operator can easily observe it?
- Are there suitable drains particularly on pipework at positions where sediment or water is likely to accumulate?
- Is there an accurate temperature indicator displaying the internal temperature of the autoclave in a position where it can be easily read by the operator?
- Depending on process conditions and mode of operation, additional fittings such as a vacuum-release device may be desirable. Get advice

from a competent engineer.

- If you have more than one autoclave do they have independent blow-down lines? Alternatively, if this is not possible, are interlock devices provided to ensure that only one blow-down valve can be in the open position at any one time to prevent inadvertent pressurisation or the risk of scalding at an adjacent autoclave?
- If exhausted steam from one autoclave is reused in another autoclave is there a valve in the transfer line that is interlocked with the door-locking mechanism of the autoclave receiving the steam?
- If the autoclave is large enough for a person to enter do you have an effective system to prevent the door being closed with a person inside?
- Do you have a safe system of work, including a permit-to-work system if necessary, to ensure the autoclave has been made safe and effectively isolated from all possible sources of power, steam or other harmful agents before a person is allowed to enter it to carry out inspections, repairs or maintenance?
- Are the blades of internal fans effectively guarded?
- Does the control system include a reliable timer to regulate the cycle time?

Examination and maintenance

- Was the autoclave pressure tested and examined by a competent person before it was first installed?
- Are routine maintenance checks carried out by a competent engineer on the autoclave, its fittings and safety devices and on the steam supply system at suitable intervals?
- Are comprehensive records kept of examinations, tests, faults, repairs and modifications?
- Are the autoclave, its fittings, safety devices and the steam supply system subject to statutory examination by a competent person, such as the appropriate engineer surveyor of a plant inspection body, at the specified intervals in accordance with a statutory written scheme of examination?
- Do you keep copies of the statutory written schemes of examination and records of statutory examinations carried out in accordance with those written schemes?

Safety at autoclaves with quick-opening doors

- Is there an interlock device that prevents the autoclave from being pressurised unless the door is fully closed, the securing mechanism engaged and the chamber fully sealed?
- If pressure is from an external source is there an interlock between the door-securing mechanism and the pressurising fluid inlet valve?
- Is there a mechanism to ensure the source of pressure is isolated and the autoclave vented until the internal pressure is at atmospheric pressure before the door-securing mechanism can be disengaged?
- Is there a means of warning the operator of any residual pressure or high-temperature process fluid in the vessel before the door-securing mechanism is disengaged (eg a test cock interlocked with the door-sealing mechanism)? The test cock should be at least 12 mm internal diameter and should be located where it will not endanger anyone.
- Is the test cock rodded or checked frequently by a safe method to ensure it is kept clear?
- Is the autoclave door fitted with a safety device to ensure even after the door securing mechanism has been released, the door remains captively held until the door seal has been broken to prevent the door opening violently if there is still residual pressure inside?
- Are written instructions for operating the door-securing mechanism displayed close to the autoclave where they can be read?
- Are the people who operate the autoclave, including those who open and close the door, properly trained?

Remember:

- ✓ Ensure correct design, construction, fittings and markings.
- ✓ Ensure all the required safety devices are fitted.
- ✓ Make sure the autoclave and its fittings are properly maintained and examined regularly by a competent person.

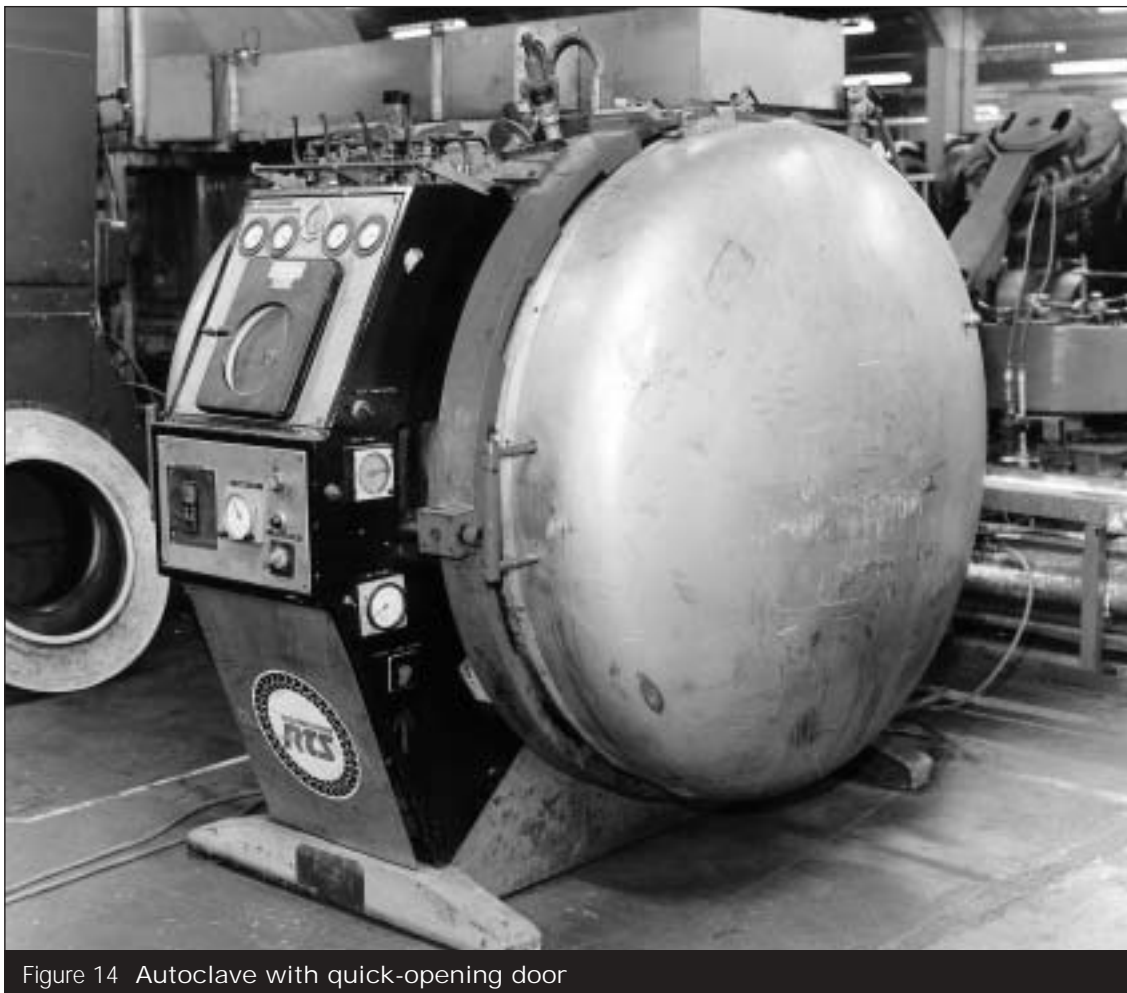


Figure 14 Autoclave with quick-opening door

Section 19 | Hand-knife injuries

Accidents involving hand knives can lead to serious injuries. They usually happen when the knife slips during cutting or trimming. In most cases the blade comes into contact with the worker's other hand or forearm causing lacerations but injuries to other parts of the body are not unknown.

What can I do to prevent hand-knife injuries?

Step 1 - Try to eliminate hand knives wherever possible

- Can the press tool or process be redesigned or modified to eliminate or reduce the use of hand knives for subsequent trimming or cutting?
- Can mould maintenance be improved to reduce the amount of flash needing to be trimmed?
- Can the cutting or trimming process be automated?
- Can you make use of a safer tool (eg a deburring tool instead of a knife)?

Step 2 - Specify the right knife

Consider the wide range of knives now available, conduct trials with different types of safety knife and involve employees in the trials and subsequent choice of knives. Choose the right knife to suit the task and make sure it suits the individual employee too. Don't assume all employees are right-handed. Some will be left-handed and knives designed for left-handed users will suit them better. If possible choose knives with:

- retractable blades;
- round-ended blades to minimise the potential for stabbing injuries;
- handles which allow a firm and comfortable grip; and
- left-handed ergonomic design for left-handed users.

Step 3 - Ensure spare knives and blades are kept available

Make sure you manage stock control properly and put in place arrangements for issuing replacement knives or blades. Injuries are much more likely if employees are allowed to continue using knives with damaged or worn blades or handles. Issue knives on a personal issue basis wherever possible and instruct users how to care for their knives and how to obtain replacement knives and blades.

Step 4 - Provide safe arrangements for storing and carrying knives

Knives left lying on workbenches or loose in tool drawers are a potential source of accidental injury. Knives transported or carried in an inappropriate manner can also cause serious injuries.

- Provide suitable storage racks or slot blocks as appropriate and ensure employees place their knives in them when they are not being used.
- Provide employees with suitable knife belts with sheaths to ensure safety when employees are walking about.
- Prohibit knives from being carried in pockets or in hands from one place of work to another.
- Provide suitable safety containers (eg sharps containers) for disposal of used blades.

Step 5 - Specify and provide the right personal protective equipment (PPE)

Choose PPE that will provide adequate protection for the particular cutting or trimming tasks performed and the foreseeable site and type of injury involved. Make sure the PPE fits individual users and they find it comfortable. Conduct trials with different types of PPE and invite employees to help choose it. Make sure the PPE is CE marked and conforms to the appropriate standard:

- Gloves to BS EN 388: 1994 *Gloves against mechanical risk*.
- Hand/arm protection to BS EN 1082 - 1: 1997 *Gloves and arm guards protecting against cuts and stabs by hand knives*.
- Apron/leggings to BS EN 412: 1993 *Aprons for use with hand knives*.

Provide protective footwear that gives adequate protection against penetration by a dropped knife as well as adequate resistance to slipping. Prohibit soft-topped shoes, sandals or other open shoes.

Step 6 - Ensure a safe working environment

Maintain proper housekeeping:

- Floor surfaces should be level, even and provide adequate slip resistance.
- Provide and enforce the use of bins/containers for waste materials
- Ensure floors are kept free from debris and waste.
- Clean up spillages as soon as they happen.

Make sure employees using knives have enough working space to move freely. Place working surfaces at a height convenient and comfortable for the individual employee and design workstations to avoid awkward working postures, over-reaching etc. Ensure there are good levels of lighting and shadows are avoided.

Step 7 - Train employees to use their knives safely

It is not enough to just demonstrate the task to a new employee - employees need to be properly trained to use the right knife for the job. Training should cover:

- general use, care and maintenance of knives;
- explanation of how injuries can happen and how to prevent them;
- the correct and safe way of working for each individual task/job which involves using a hand knife;
- how often blades should be changed and the criteria for rejecting a blade;
- how to store and carry knives safely; and
- where to obtain first-aid assistance if there is an injury.

Step 8 - Ensure there is adequate first-aid cover

Hand-knife injuries can be serious. Deep lacerations and stabbing injuries leading to arterial bleeding are not unknown. Make sure you have an adequate number of trained first-aiders who are capable of dealing with the kinds of injury that can happen and ensure suitable first-aid equipment is readily available. If you operate a shift system make sure you have proper first-aid cover on all shifts.

Step 9 - Supervise and monitor compliance with your rules for use of hand knives

Make the supervisor responsible and accountable for ensuring the rules are followed at all times. Periodic checks should be carried out by management to ensure that working practices are safe and effective.

Remember:

- ✓ Eliminate or reduce the use of hand knives wherever possible.
- ✓ Specify the right knife for the job and make sure it suits the individual user.
- ✓ Keep spare knives and blades readily available.
- ✓ Provide safe arrangements for storing and carrying knives.
- ✓ Specify the right PPE.
- ✓ Make sure the working environment is safe.
- ✓ Train employees in the safe use of hand knives.
- ✓ Provide proper first-aid arrangements.
- ✓ Supervise and monitor compliance with the rules.

Section 20 | Eye injuries

A number of processes in the retread industry, like buffing and skiving, involve a risk of injury to the employee's eyes from dust or particles thrown out at high speed. You need to protect your employees from these risks.

What can I do to prevent eye injuries?

Step 1 - Decide if, and where, eye protectors are needed

Consider if there are ways, other than by providing employees with eye protectors to wear, of protecting people from the risk of eye injuries, eg by providing suitable engineering controls?

Where you cannot control the risks by other methods you need to identify the processes and activities that require the use of eye protectors. Draw up a list and make sure that everyone knows which processes require the use of eye protectors. Display warning signs near the machines or activities concerned to show that eye protectors must be worn.

Step 2 - Select and issue the right eye protectors

Choose the type, or types, of eye protectors you provide for your employees carefully. Make sure:

- the eye protectors will give adequate protection against the risk or risks involved under the particular conditions of work;
- they will fit the wearer properly (remember that every employee is different);
- they will be reasonably comfortable for the wearer.

Take advice from the supplier and involve your employees when selecting the particular model, or models, of eye protector you are going to provide. Give them as much freedom of choice as possible, while at the same time making sure the protectors selected will provide adequate protection for the particular risks involved. Issue eye protectors to the employees individually.

Step 3 - Train your employees

Train your employees to use and look after their eye protectors. They need to know:

- which processes and activities require the use of eye protectors;
- the type of eye protectors they must wear;
- how to fit and wear the eye protectors correctly;

- where to keep them when they are not being used, eg a clothes locker;
- how to clean and look after their eye protectors; and
- what to do when their eye protectors become worn or damaged.

Step 4 - Supervise and monitor the use of eye protectors

Establish arrangements for supervising and monitoring the proper use of eye protectors. For example, you could make a supervisor or manager responsible for carrying out regular checks to ensure that:

- employees are wearing their eye protectors when exposed to risk of eye injury;
- they are wearing the right type of eye protector for the risk to which they are exposed; and
- the eye protectors fit them properly and are in good condition.

It is essential that managers and supervisors set a good example by wearing eye protectors whenever they visit the areas where you have identified that eye protection must be worn. Provide visitors with suitable eye protectors and explain they should wear them when they visit the designated eye protection areas.

Remember:

- ✓ Don't rely on eye protectors when you should be providing engineering controls to deal with the risk.
- ✓ Select eye protectors carefully ensuring they are suitable for controlling the risks and fit the wearer properly.
- ✓ Train employees in the correct use and care of eye protectors.
- ✓ Have arrangements for replacing worn or damaged eye protectors.
- ✓ Supervise and monitor the use of eye protectors.
- ✓ Ensure managers, supervisors and visitors wear eye protectors in designated eye protection areas.

Section 21 | Manual handling

More than 43% of all reported injuries in the retread industry are caused by manual handling - the transporting or supporting of loads by hand or bodily force. Most of the reported accidents cause back injury, though hands, arms and feet are also vulnerable. On average each manual handling injury results in 11 working days being lost and for some injuries the time taken off work is very much longer. Many manual handling injuries build up over time rather than being caused by a single incident. They can even lead to long-term incapacity or disability. The costs to your business can be substantial.

Case study

An operator experienced sudden onset of neck pain while handling a tyre. He had been doing the same job for 15 years. He was lifting the tyre onto rollers for inspection and repair. On this occasion rather than using his leg to support the tyre casing he attempted a straight lift.

The operator completed his shift but the pain became severe so he went off work. He had suffered a slipped disc in his neck and needed an operation. Twelve months later he was assessed as 40% disabled. He retired on ill-health grounds and his claim for £70 000 compensation against the company was successful.

What can I do to prevent manual handling injuries?

Step 1 - Avoid hazardous manual handling as far as possible

Step 2 - Assess the risk of injury from any manual handling that cannot be avoided

Step 3 - Reduce the risk of injury from manual handling as far as reasonably practicable

Involve your workforce fully when you complete these steps. Employees are likely to have the best understanding of what the problems are and they are usually able to make a major contribution when it comes to solving them.

Avoid manual handling

Look at all operations that involve lifting, carrying, transferring, pushing or pulling a load and ask if you really need to move the loads in that way. By reorganising the way you do things it may be possible to eliminate a number of hazardous manual handling operations altogether.

Be systematic. Look at each operation involving manual handling from the point where tyre casings are collected by your driver, to unloading tyre casings



Pedestrian-operated pallet truck fitted with carpet pole



Tyre hoist mounted in delivery lorry



Fork truck fitted with tyre clamp



Truck tyre hoist



Conveyor for feeding tyres into lorry

Figure 15 Examples of manual handling

from vehicles into the factory right through the retread processes to loading lorries with retreaded tyres for delivery to your customers. Use the same approach for the receipt, storage and handling of raw materials and don't forget operations involving setting or maintenance of machines including lifting matrices into and out of tyre presses. Think about ways in which you could eliminate or reduce the amount of manual handling. The following are just examples - you may be able to think of others.

- Can you use a monorail system to move tyres from one stage of the retread process to the next?
- Can you use mechanical lifting aids and turning and tilting tables for loading and unloading tyre casings to and from individual machines?
- Can you use purpose-designed electric lifts for stacking and destacking tyre casings in drying areas and storage bays?

- Can you use mechanical aids for loading and unloading matrices at tyre presses?
- Can you use a telescopic flat belt conveyor to load retreaded tyres direct into the back of the delivery lorry in your outloading bay?
- Are there loads that could best be transferred by fork-lift truck or a truck fitted with a carpet pole?

Assess the risk and reduce the risk of injury

Once you have eliminated manual handling operations as far as possible you will need to consider the manual handling activities that you cannot avoid and then assess the risks and reduce the chances of injury.

- Observe each manual handling operation as it takes place.
- Consider how the operations could be made easier and less risky.

Table 6

<i>Problems to look for when making an assessment</i>	<i>Ways of reducing the risk of injury</i>
<p><i>Do the tasks involve:</i></p> <ul style="list-style-type: none"> ■ holding loads away from the body or trunk? ■ twisting, stooping or reaching upwards? ■ large vertical movement? ■ long carrying distances? ■ strenuous pushing or pulling? ■ unpredictable movement of loads? ■ repetitive handling? ■ insufficient rest or recovery time? ■ a work rate imposed by a process? 	<p><i>Can you:</i></p> <ul style="list-style-type: none"> ■ improve workplace layout to improve efficiency? ■ reduce the amount of twisting and stooping? ■ avoid lifting from floor level or above shoulder height? ■ reduce carrying distances? ■ avoid repetitive handling? ■ vary the work, allowing one set of muscles to rest while another is used?
<p><i>Are the loads:</i></p> <ul style="list-style-type: none"> ■ heavy, bulky or unwieldy? ■ difficult to grasp? ■ unstable or unpredictable? ■ intrinsically harmful, eg sharp or hot? 	<p><i>Can you make the load:</i></p> <ul style="list-style-type: none"> ■ lighter or less bulky? ■ easier to grasp? ■ more stable? ■ less damaging to hold?
<p><i>Are there:</i></p> <ul style="list-style-type: none"> ■ constraints on posture? ■ poor floors? ■ variations in level? ■ hot/cold/humid conditions? ■ strong air movements? ■ poor lighting conditions? ■ restrictions on movement or posture from clothes or personal protective equipment? 	<p><i>Can you:</i></p> <ul style="list-style-type: none"> ■ remove obstructions to free movement? ■ provide better flooring? ■ avoid steps and steep ramps? ■ prevent extremes of hot and cold? ■ improve lighting? ■ consider less restrictive clothing or personal protective equipment?
<p><i>Does the job:</i></p> <ul style="list-style-type: none"> ■ require unusual capability? ■ endanger those with a health problem? ■ endanger pregnant women? ■ call for special information or training? 	<p><i>Can you:</i></p> <ul style="list-style-type: none"> ■ take better care of those who have a physical weakness or are pregnant? ■ give your employees more information, eg about the range of tasks they are likely to face? ■ provide training?

- Ask yourself how they can be made less physically demanding.
- Make sure you involve your employees when you carry out this exercise.
- Keep records of your findings and use them to decide what changes you need to make.
- Draw up an action plan and decide your priorities. Tackle those operations that cause the biggest risk first.
- Implement your action plan.

Make sure employees are properly trained in safe lifting methods and techniques and they are familiar with the risk-reduction measures you have put in place. But remember that training on its own will not overcome a lack of mechanical handling aids, unsuitable loads or bad working conditions.

For more information about successful manual handling case studies in the rubber industry see *Reducing manual handling injuries in the rubber industry. A practical guide* (ISBN 0 7176 2466 8 Price £15.00).

Training

Training is important but remember that, on its own, it cannot overcome a lack of mechanical aids, unsuitable loads or bad working conditions. It should cover:

- how to recognise harmful manual handling;
- appropriate systems of work;
- use of mechanical aids; and
- good handling technique.

Good handling technique

- Stop and think. Plan the lift. Where is the load to be placed? Use appropriate handling aids if possible. Do you need help with the load? Remove obstructions such as discarded wrapping materials. For a long lift, such as floor to shoulder height, consider resting the load mid-way on a table or bench to change grip.
- Position the feet. Place feet apart, giving a balanced and stable base for lifting (tight skirts and unsuitable footwear make this difficult). Put your leading leg as far forward as is comfortable and, if possible, pointing in the direction you intend to go.
- Adopt a good posture. When lifting from a low level, bend the knees, but do not kneel or overflex the knees. Keep the back straight, maintaining its natural curve (tucking in the chin helps). Lean forward a little over the load if

necessary to get a good grip. Keep the shoulders level and facing in the same direction as the hips.

- Get a firm grip. Try to keep the arms within the boundary formed by the legs. The best position and type of grip depends on the circumstances and individual preference, but it must be secure. A hook grip is less tiring than keeping the fingers straight. If you need to vary the grip as the lift proceeds, do it as smoothly as possible.
- Keep close to the load. Keep the load close to the trunk for as long as possible. Keep the heaviest side of the load next to the trunk. If a close approach to the load is not possible, slide it towards you before trying to lift.
- Don't jerk. Lift smoothly, raising the chin as the lift begins, keeping control of the load.
- Move the feet. Don't twist the trunk when turning to the side.
- Put down, *then* adjust. If precise positioning of the load is necessary, put it down first, then slide it into the desired position.

Remember:

- ✓ Eliminate hazardous manual handling operations wherever possible.
- ✓ Assess the risks of the remaining manual handling activities.
- ✓ Reduce the risks of manual handling as much as possible.
- ✓ Train employees in safe handling techniques.

Section 22 | Vehicles in the workplace

Every year in the UK (across all industries) more than 70 people are killed in accidents involving vehicles at the workplace. More than 1000 people suffer major injuries such as amputations and broken bones in vehicle accidents each year. All of these accidents are preventable. The most common accidents involve people being struck or run over by moving vehicles, people falling from vehicles, people being struck by objects falling from vehicles or vehicles overturning.

What can I do to reduce the risks from vehicles in the workplace?

Step 1 - Identify the hazards

Look at the activities involving vehicles, such as vehicles arriving or departing from the site, moving around the site and loading and unloading. Decide what are the dangers and what is causing them.

- Is there a danger of someone being struck by a vehicle?
- Is there a danger of someone falling from a vehicle?
- Is there a danger of something, such as part of the load, falling off a vehicle?

Step 2 - Decide who might be harmed

- Pedestrians (including employees and visitors)?
- Drivers (including visiting drivers)?

Step 3 - Assess the risks

- Decide if existing precautions need to be improved and what additional precautions are needed.

Use the following checklist to help you. Once you have decided on the additional precautions you need to take, and the existing ones you need to improve, draw up an action plan and then implement it. Put in place arrangements for checking at regular intervals how well the precautions are working in practice.

For example, a manager or supervisor could carry out observations to check that speed limits are observed properly, one-way traffic routes are being followed, arrangements for segregating pedestrians from vehicle traffic are effective, fork-lift trucks are being operated safely, vehicles are being serviced and maintained properly etc.

Finally, if you decide to make changes, for example introducing new vehicles or changing the

vehicle traffic system, make sure you identify the hazards and assess the risks first. Again, you can use the following checklist to help.

Checklist

The workplace

- Are vehicles and pedestrians kept safely apart?
- Are there suitable pedestrian crossing points on vehicle routes?
- Are pedestrians required to wear high-visibility clothing where necessary?
- Are there suitable and sufficient parking areas?
- Do vehicle routes avoid sharp or blind bends?
- Can you introduce a one-way system for vehicles?
- Do you have clear rules covering safe reversing of lorries?
- Are vehicle routes wide enough?
- Do they have a sound surface?
- Are they well maintained?
- Are road features such as 'Give way' or stop lines at junctions marked?
- Are direction signs, speed limit, and 'No entry' or 'Give way' signs needed?
- Do you need speed humps, barriers or fixed mirrors?

The vehicles

- Are vehicles suitable for the workplace?
- Do they have proper service and parking brakes?
- Do they have horns, lights, reflectors, reversing lights and alarms as necessary?
- Do they have good seats and seat belts?
- Are drivers adequately protected against the weather or adverse environments?
- Are lift trucks fitted with rollover protection and protection against falling objects?
- Are there good planned maintenance and inspection systems in place for all vehicles?

The drivers

- Do drivers carry out daily basic safety checks before using the vehicle?
- Are there proper arrangements for selecting and training drivers to ensure they are capable and competent to operate their vehicles safely?
- Do you check their previous experience before appointing them as drivers?
- Do you test them to ensure they are competent?

- Do you train them how to use the vehicles for the particular jobs they need to do and about the particular hazards they will encounter?
- Have you provided adequate supervision?
- Are there arrangements for regularly checking how well all the above precautions are working?

Remember:

- ✓ Vehicles can kill.
- ✓ Decide who can be harmed and how.
- ✓ Use the checklist to decide how to control the risks.

Section 23 | Falls from height

Every year in the UK (across all industries) about 80 people are killed and more than 5500 seriously injured in falls from height. Falls from height are the second most common cause of major injuries to employees and the most common for self-employed people.

What are the causes?

About a quarter of all fatal and major injuries each year are due to falls from ladders. Other causes include falls from scaffolding, working platforms, vehicles, roof edges, stairs, falls through fragile roofs and from catwalks/gangways.

What can I do to reduce the risks?

Step 1 - Identify all work at height

Start by identifying all work at a height of 2 m or more. But don't forget that falls from a lower height can still cause serious injury. Think not only about work that is carried out every week, but also about infrequent tasks, such as maintaining and cleaning buildings.

- Is there a roof, gutter, roof fan, duct, cyclone or dust collector at high level that you need to get to for cleaning or maintenance?
- Are building roofs made of fragile materials through which a person carrying out maintenance could fall?
- Are there electric light fittings, smoke detectors or junction boxes at high level that you need to reach for maintenance purposes?
- Are there mezzanine floors or storage racks that require high-level access?
- Is there a risk of drivers falling from height from their vehicles when delivering or collecting tyres or other loads?
- Are there high-level windows that have to be cleaned?

This is not an exhaustive list. You will be able to identify other situations in which work at height may be required. Don't forget major building work and work involving installation or removal of plant and equipment.

Step 2 - Eliminate the need for high-level working where possible

Think about how you can avoid high-level working.

- Can windows, fixtures and walls be cleaned from floor level using appropriate equipment?
- Can items of equipment to which regular

access is needed for maintenance be relocated to allow access from floor level?

- Ensure new buildings, building extensions and plant structures are designed to eliminate the need for working at height or eliminate the risk. For example:
 - install windows that can be cleaned from inside;
 - install stairways rather than fixed ladders;
 - install fixed edge protection at roof edges;
 - never use fragile material for new roofs or when replacing existing roof panels; and
 - always use a competent specialist contractor to design and carry out the above work.

Step 3 - Assess the risks and choose the right equipment to control them

Where work at height is unavoidable, provide safeguards that are effective to prevent a fall from height. For example:

- Make sure open edges of mezzanine floors are securely fenced with a guardrail, mid-point rail and toe board.
- Ensure any gates in the fencing provided for loading or removing goods from the mezzanine floor are never left open (there are proprietary gate systems available that ensure the opening is always protected).
- Provide suitable protection as necessary for the edges of loading bays.

If frequent or routine high-level access is needed, for example for regular maintenance tasks, you may need to provide a permanent purpose-built access platform at a suitable height. It should be securely fenced on all open sides and access and egress should be via a fixed stairway that should have handrails and be fenced on the open side(s).

Where you are unable to avoid the use of moveable access equipment, ask yourself if you are using the best equipment for the job. Often people are expected to work from portable leaning ladders or stepladders when they should be using a mobile elevating access platform or other safer means of access. Ask yourself the following questions:

- Are we equipped to do this work ourselves? You should always entrust all but the simplest jobs involving work at height to a specialist contractor.
- Why have we chosen to use a ladder?
- Is it because it is the quickest and easiest option?
- Is it the best option?
- Is there a safer way of doing the job?

Step 4 - Provide information and make sure people using and supervising the use of access equipment are properly trained

- Do they know how to select and set up the equipment properly?
- Do they know how to use it safely?
- Do they understand the risks?
- Are they familiar with the rules and standards that apply?
- Do they know where to go for help if they are uncertain?
- Are potential access points to fragile roofs provided with warning signs?

Step 5 - Make sure access equipment is used safely and maintained properly

- Do your rules make it clear which type of access equipment should be used for which job?
- Do supervisors and employees understand and follow the rules?
- Do you have effective arrangements for inspecting and maintaining the access equipment including ladders?
- Is inspection and maintenance carried out by people who are competent to do it?

We still have jobs for which we can only use a ladder

Make sure you use the right type of ladder and that you use it safely:

- Is it suitable for the job? You should never use a domestic or DIY ladder in a factory or industrial environment. Check with the supplier.
- Is it of the right type, size and load rating for the job? Ask the supplier.
- Is it placed at the right angle (1 out to 4 up)?
- Is the ladder properly tied to prevent slipping? If the job is not a one-off think about providing permanent locating hooks or tying points where you need to place the top of the ladder.
- Footing a ladder is much less safe than tying the ladder or using a ladder stability device. Footing should only be used to steady a ladder while it is being tied or if the job is so quick that it can be finished in less time than it would take to tie the ladder.
- Is the ladder resting on a sound, firm, level surface that is not slippery?
- Is the ladder positioned so that work can be done from it without having to lean out sideways or backwards to reach?
- If the ladder is used for people to get onto a

working platform does its top end project a sufficient height above the landing point to afford a good handhold when getting on and off the ladder?

- Can you ensure the person using the ladder maintains three points of contact on the ladder (eg both feet and at least one hand) at all times (ie can the work be done one-handed)? If you cannot you should not be using a ladder.
- Is the ladder kept free from slippery substances?
- Is the ladder segregated from, or protected from, traffic routes?
- Is the ladder stored properly when not in use to prevent deterioration and damage?

Remember:

- ✓ Falls from height kill and maim.
- ✓ Identify all work at height.
- ✓ Eliminate high-level working if you can.
- ✓ Select the best access equipment for the job.
- ✓ If you have to use a ladder make sure it is suitable for the job, in sound condition and properly secured.
- ✓ Ensure access equipment is properly maintained and inspected.

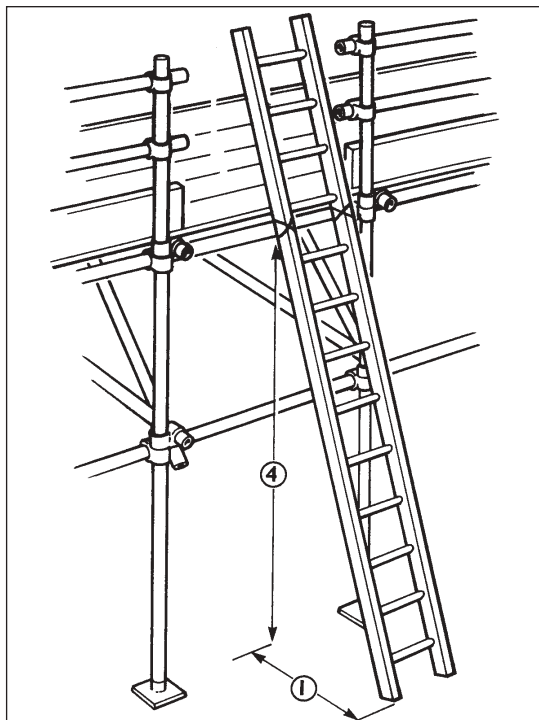


Figure 16 Ladders should be correctly angled one out for every four up

Section 24 | Slips and trips

Slips, trips and falls on the same level are the most common cause of major injuries at work. Many employers still fail to give slips and trips the priority they deserve. Some employers even treat the issue as being outside their control, inevitable or the employee's fault. This is wrong. Employers are under a legal duty to ensure that the risk of slips and trips are properly controlled.

What can I do to reduce the risks?

Identify the slip and trip hazards, decide who may be harmed and how, consider the risks of slips and trips in your premises and put in place the necessary risk control measures. Some examples are in Table 7.

Table 7 Slip and trip hazards

Hazard	Safeguard
Contamination of the floor (eg from spillages, oil, water, grease, mud, rubber crumb and dust)	Prevent contamination in the first place (eg maintain machines properly so they do not leak oil or water and maintain LEV equipment so that it controls rubber crumb effectively). Prevent contamination from reaching floor surfaces. Limit the effects of contamination by treating spillages as soon as they occur. Use safe cleaning methods. Minimise the wetting of floors and contain/limit the spread of contamination across the floor.
Trailing cables, hoses and compressed air lines	Position equipment to avoid cables crossing pedestrian routes. Route cables out of the way and use cable covers to securely fix cables to surfaces.
Poor housekeeping Work in progress, tools and equipment left on the floor	Improve housekeeping. Provide shelves, cupboards and storage racks for tools and equipment and make sure they are used.
Litter, rubbish, plastic bags, packaging, process waste	Keep work areas clean. Provide suitable bins and make sure they are used. Clear up and remove rubbish frequently.
Mats	Ensure mats are securely fixed and do not have curling edges.
Slippery surfaces	Assess the cause and treat accordingly.
Uneven surfaces including gullies and holes	Eliminate holes, slopes and uneven surfaces.
Change from dry to wet surface, eg when floors are being cleaned	Provide suitable footwear and provide warning signs and cones.
Inadequate lighting	Provide adequate levels of lighting and place light fittings to ensure even lighting of floor areas.
Changes of level	Improve lighting and fit visible tread nosings on steps and stairs. Ensure steps and stairs are properly constructed and fitted with handrails.
Slopes	Improve visibility, use floor markings and provide handrails where required.

continued...

Table 7 (continued)

<i>Hazard</i>	<i>Safeguard</i>
Awkward tasks. Does the task involve carrying loads, lifting or lowering, pushing or pulling? Does it involve turning or moving quickly or taking long strides? Does it involve having no hands free to hold onto supports or break a fall? Are there distractions? Does the task itself cause obstructions?	Assess the tasks to ensure they do not compromise the ability to walk safely. Check to ensure obstructions are eliminated or minimised.
Shoes offer insufficient slip resistance, eg the wrong type of shoe, the wrong sole material, the wrong sole pattern, worn soles, poor fit, contaminated shoes, shoes not maintained/renewed	Select footwear suitable for the individual, the floor conditions and the environment. Make arrangements for cleaning and maintaining footwear and replacing it when worn out.

Remember:

- ✓ You must minimise the risk of slips and trips in the workplace.
- ✓ Use the checklist to identify areas and activities that can cause slips and trips.
- ✓ Put in place suitable precautions.



Figure 17 Good housekeeping

Section 25 | Reporting injuries, diseases and dangerous occurrences

Employers and people in control of workplaces must report injuries, dangerous occurrences and certain work-related diseases to the relevant enforcing authority, normally the Health and Safety Executive (HSE). This is a legal requirement under the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995 (RIDDOR).

What must I report?

If you are an **employer** you must report the following work-related incidents:

- deaths;
- major injuries;
- accidents which prevent an employee from doing their normal work for more than three days; and
- certain work-related diseases.

If you are **in control of a workplace** you must report:

- any dangerous occurrence; and
- an accident to a person not at work (eg a member of the public) which results in them suffering injury and being taken to hospital.

If you are **self-employed** you must report an accident to yourself causing major injury, disablement from your normal work for over three days and certain work-related diseases.

What if I am unsure?

If you are unsure if an accident, disease or dangerous occurrence needs to be reported you can phone the Incident Contact Centre (ICC) for advice (see opposite).

How do I report an accident, disease or dangerous occurrence?

You must notify any fatal or major injury accident and any dangerous occurrence *without delay and by the quickest means* (eg telephone).

You can report all incidents to the Incident Contact Centre (ICC) who will forward the report to the appropriate enforcing authority. There is no need to worry about making another report to the Health and Safety Executive or to your local authority.

You can report incidents in a variety of ways but telephoning is the quickest and most straightforward, with no need to fill in a report form. You will be sent a copy of the final report for your own

records – this also meets your statutory obligation to keep records of all reportable incidents and allows you to correct any errors or omissions.

You can also make a report by completing an interactive form on the RIDDOR website (again you will be sent a copy for your records). Reports are also accepted via e-mail (as an attachment), by fax or through the post.

How do I contact the Incident Contact Centre?

- ➔ Telephone (local rate): 0845 300 9923
- ➔ Internet: www.riddor.gov.uk
- ➔ e-mail: riddor@natbrit.com
- ➔ Fax (local rate): 0845 300 9924
- ➔ Post: Incident Contact Centre
Caerphilly Business Park
Caerphilly CF83 3GG

The ICC is open between 0830 and 1700 Monday to Friday.

Remember:

- ✓ You must report certain types of injury, disease and dangerous occurrence to the enforcing authority.
- ✓ You must notify fatalities, major injuries and dangerous occurrences without delay and by the quickest method.
- ✓ You can report to the Incident Contact Centre who will forward your report to the appropriate enforcing authority office.

Appendix 1 | Example of a health record form

<p>1 Employee's surname _____</p> <p>2 Forenames _____</p> <p>3 Permanent address _____</p> <p>_____</p> <p>_____</p> <p>4 Post Code _____</p> <p>5 National Insurance No _____</p> <p>6 Date of birth _____</p> <p>7 Sex _____</p> <p>8 Date of commencement of employment _____</p>	<p>9 Historical record of jobs involving exposure to substances (rubber fume, organic solvents etc) requiring health surveillance in this employment</p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left; border-bottom: 1px solid black;">Date</th> <th style="text-align: left; border-bottom: 1px solid black;">Job</th> <th style="text-align: left; border-bottom: 1px solid black;">Health hazard</th> </tr> </thead> <tbody> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> </tbody> </table>	Date	Job	Health hazard																								
Date	Job	Health hazard																										

10 Health surveillance conclusions			
Date	Type of health surveillance	Comments	Signature

Note: Insert in section 10 conclusions of all health surveillance procedures, indicating the date they were carried out and who performed them. The conclusions should be expressed in terms of the employee's fitness for work and should include, where appropriate, a record of the decisions of a suitably qualified occupational health practitioner or responsible person. However, they should not include confidential clinical data. Where the health surveillance consists of only keeping an individual health record - this would be the case, for example, if the only substance hazardous to health that the person is exposed to is rubber fume - the particulars to be recorded are just those shown in 1 to 9 above.

Appendix 2 | Example of a completed health surveillance conclusions section of a health record

10 Health surveillance conclusions			
Date	Type of health surveillance	Comments	Signature
17/6/01	Visual inspection of skin on hands and forearms	Clear of symptoms	J Bloggs (Retread shop supervisor)
17/7/01	As above	Skin on backs of both hands very red. Referred to GP for diagnosis	J Bloggs (Retread shop supervisor)

Where to get further advice

You can get further general advice from the following organisations:

The Retread Manufacturers Association (RMA)

2nd Floor, Federation House, Station Road, Stoke-on-Trent ST4 2TJ
Tel: 01782 417777
Website: www.retreaders.org.uk
e-mail: retreads@ukonline.co.uk

The British Rubber Manufacturers Association (BRMA)

6 Bath Place, Rivington Street, London EC2A 3JE
Tel: 0207 457 5040
Website: www.brma.co.uk
e-mail: mail@brma.co.uk

Further information

HSE priced and free publications are available by mail order from HSE Books, PO Box 1999, Sudbury, Suffolk CO10 2WA Tel: 01787 881165 Fax: 01787 313995
Website: www.hsebooks.co.uk (HSE priced publications are also available from bookshops and free leaflets can be downloaded from HSE's website: www.hse.gov.uk.)

For information about health and safety ring HSE's Infoline Tel: 08701 545500
Fax: 02920 859260 e-mail: hseinformationservices@natbrit.com or write to HSE Information Services, Caerphilly Business Park, Caerphilly CF83 3GG.

This guidance is issued by the Health and Safety Executive. Following the guidance is not compulsory 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 as illustrating good practice.

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