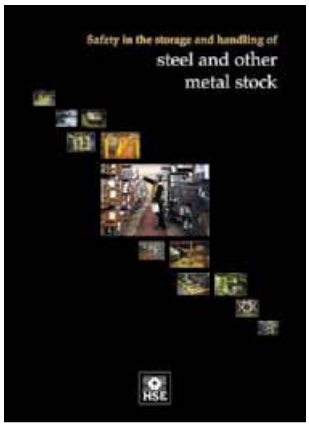
Safety in the storage and handling of steel and other metal stock



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This book provides advice on how to work safely when storing and handling steel and other metal stock. The practical guidance will help you to manage risks and create a safer working environment while illustrations of safe and unsafe practice make the issues easy to understand.

Essential reading for anyone in organisations such as stock producers, stockholders, stock hauliers, stock users or anyone involved in training staff in those organisations, the book examines causes of accidents, legal requirements, common hazards and how to assess and manage the risks from them, provision of training and information for employees, and inspection and maintenance of storage and handling equipment.

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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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Introduction

What is the purpose of this guidance?

1 Many accidents, some resulting in death and serious injury, continue to occur during the storage and handling of steel and other metal stock. They cause enormous social and economic cost over and above the human tragedy involved. It is in everyone's interest that they are reduced in number. Ironically, accident investigation often shows that they could have been avoided. This guidance sets out a blueprint for those health and safety standards that need to be met in order for such accidents to be prevented. The most successful metal stockholders and handlers already implement the good practice outlined and have excellent safety records. Applying the guidance to your work will help you manage the risks better and create a safer working environment for everyone.

2 This publication provides practical guidance and reference to help you:

- identify the main health and safety hazards and properly assess the risks;
- identify the likely causes of accidents and ill-health;
- understand the basic principles of good health and safety management, including how to prepare your safety policy;
- recognise the most common stock storage and handling systems and the advantages and disadvantages of each type;
- understand how to meet the requirements for provision of information, instruction, training and supervision to your employees; and
- meet your obligations in health and safety law.

3 The guidance contains illustrations of safe and unsafe practice to help you understand good risk management more clearly. A glossary of some of the terms used appears on pages 88-89, and details of further reading and training material are listed on page 93.

Who should read it?

4 This guidance is important for:

- employers, managers, supervisors, employees, safety representatives, safety advisers and self-employed people in organisations such as:
  - stock producers;
  - stockholders;
  - stock hauliers;
  - stock users;
  - those involved in training staff in these organisations.

What does it cover?

5 It looks at:

- the causes of accidents and the requirements of the law;
- the hazards involved in metal stock storage/handling and how to assess the risks from them;
- managing the risks, particularly in the areas of:
  - (un)loading of delivery vehicles;
  - storage;
  - lifting operations;
  - manual handling operations;
- information, instruction, training and supervision for employees;
- inspection and maintenance of storage/handling equipment;
- auditing of risk management systems.

Causes of accidents in stock handling

6 The most common accidents usually involve (see also paragraph 17):

- musculoskeletal (for example back) injury from a manual handling operation;
- slips and trips;
- falls from height;
- being struck or crushed by falling or otherwise mobile stock, or by heavy lifting accessories;
- being struck by a moving vehicle.

7 Table 1 gives some examples of reported accidents, their causes and consequences. It is worth noting that subsequent investigation of such accidents showed the majority of them to have been entirely foreseeable and preventable.

Table 1 Some examples of accidents and their root causes

The accident consequences	Believed root cause(s) of accident
1 An employee was loading 8ft long brass bars into an A-frame (vertical) storage rack. The chains for holding stock in place in the rack were removed, to allow the loading of the rack. The bars were leant against the back of the rack. There was insufficient room in the rack for the complete load so the last few bars were stored in the almost vertical position. As the employee turned to pick up another bar, several heavy bars fell out of the rack and onto him, causing him serious injury.	Insufficient storage facility to accommodate delivery load, because of inadequate delivery planning. Inadequate instruction to staff on how to deal with the problem safely. Poor management and supervision of the ordering and delivery/storage operation.
2 Bundles of rolled bar and section were stacked on the floor of a warehouse, the bundle layers being separated by timber bearers. Two employees were walking alongside, in a gangway, when a steel banding wire failed, causing one of the four bundles at the base of the stack to seperate. The entire stack then collapsed onto the two men who were both seriously injured.	Failure of steel banding material (possibly because of earlier lifting by the banding) led to stack collapse. Inadequate storage containment and separation of pedestrians allowed material to collapse onto pedestrians. Poor design of storage facility and pedestrian walkways symptomatic of poor planning and risk management.
3 As instructed, an employee was lifting bundles of tube by placing lifting hooks under the wire. One of the bandings failed, and the load fell and struck him, causing him serious injury.	Failure of banding material resulted from and unsafe lifting operation, ie lifting of load by its banding. Poor assessment of the risks. Inadequate instruction and training to the operator in correct lifting procedure.
4 An employee was climbing a 'Christmas Tree' rack to read a stock tag. The wheeled stepladder provided could not be used because the gangway was obstructed by pallets. The employee lost his footing and fell. He was fatally injured when he struck his head on a pallet.	Inadequate instruction/training and supervision of employee. Poor housekeeping resulting in an unsafe system of work and a fatal fall from height. Poor management of workplace risk, systems of work and training.
5 An employee was standing on a stack of bundled long product while attaching lifting equipment. He lost his footing, fell and was seriously injured.	Fall from a height due to inadequate planning of lifting operation and safe means of access to job. An unsafe system of work created by an unsafe place of work. Employee inadequately instructed and trained. Inadequate supervision and poor management of risk.
6 An employee entered a ladder rack to remove a bundle of light gauge tube, using a single-hoist crane. A horizontal cross member had been left behind when the previous bundle had been removed. The next rack was filled with three tonnes of bundled tube. Each bundle was separated by horizontal members resting on welded brackets. When the cross member was removed, the upright column deflected into the rack where the employee was standing. This caused all of the cross members in the adjoining rack to fall off the welded brackets. The bundles collapsed downwards as the employee fell approximately one metre through the rack. The collapsing upright caught on a neighbouring rack and partially supported the fallen bundles. The employee suffered serious injury.	Partial collapse of ladder rack due to inadequate planning of storage facility for the product type. An inadequately planned and unsafe lifting operation was carried out by a poorly trained and instructed employee. Poor management of lifting operation and employee training. Poor supervision.

What are the legal duties?

8 The principal legislation relevant to metal stock storage and handling includes:

- Health and Safety at Work etc Act 1974;[1]
- Management of Health and Safety at Work Regulations;[2]
- Lifting Operations and Lifting Equipment Regulations;[3]
- Provision and Use of Work Equipment Regulations;[4]
- Personal Protective Equipment at Work Regulations;[5]
- Manual Handling Operations Regulations;[6]
- Workplace (Health, Safety and Welfare) Regulations;[7]
- Health and Safety (Consultation with Employees) Regulations;[8]
- Reporting of Injuries, Diseases and Dangerous Occurrences Regulations;[9]
- Proposed Work at Height Regulations (due out in 2005 and available from The Stationery Office when published).[10]

9 The main requirements for employers, self-employed people, employees, equipment suppliers, manufacturers, designers, installers etc are given below.

Employers

10 Employers should:

- provide and maintain safe systems of work and take all reasonably practicable steps to ensure the health and safety of employees and other people, for example members of the public, contractors, visitors;
- do a proper risk assessment of stock storage and handling and prepare effective policies for meeting their legal duties;
- consult with employees and involve them in the risk assessment process, the planning of storage and handling operations and the implementation of risk control measures;
- inform, instruct and train employees so that they fully understand what they must do to ensure safe stock handling and storage;
- plan and supervise lifting operations to ensure they are carried out safely; ensure that any equipment provided for stock storage or handling is fit for its intended purpose, regularly inspected, properly maintained and properly used;
- provide suitable personal protective equipment to employees, ensure that it is properly stored and maintained, and train employees to use it properly;
- ensure that the maximum tonnages/quantities of product that can be safely stored within storage areas and systems are not exceeded and that suitable contingency plans are made to cope safely at times of high demand;
- co-operate with other employers to ensure safety in joint operations, in particular in stock deliveries;
- monitor and review stock storage and handling systems to ensure that standards are being maintained;
- report certain injuries, diseases and dangerous occurrences (including specified failures and deficiencies of lifting equipment) to the enforcing authority.

Self-employed people

11 Self-employed people should:

- adequately control the risks they create to their own and other people's health and safety.

Employees

12 Employees should:

- take care of their own and other people's health and safety;
- co-operate with their employer and any other person who has health and safety legal duties.

Equipment suppliers, manufacturers, designers, installers etc

13 This group should:

- ensure the articles they supply for use at work are safe;
- provide enough information about their product(s) to enable their customers to use them safely.

14 This guidance explains how to meet these various responsibilities so that occupational accidents and ill health associated with stock storage and handling can be avoided.

Managing health and safety

Where to start

15 Appoint someone with enough knowledge of your stock storage and handling processes and the law to enable them to carry out a proper risk assessment. Employees should be involved in the assessment (and subsequent risk management) process as they have first-hand knowledge of the hazards and risks involved. Ideally, the appointed person and employees should carry out the risk assessments of stock storage and handling operations as a team. And remember:

- assessment is fundamental to an effective safety management system;
- competence and teamwork will ensure that all the important items are dealt with.

Carrying out a risk assessment[11]

16 There are five steps:

- identify the hazards - a hazard is 'something that may cause harm';
- decide who might be harmed, and how;
- evaluate the risks and decide whether the existing precautions are adequate or whether they need to be improved;
- record the assessment findings;
- review and revise the assessment when necessary.

Step 1 - What are the main hazards associated with the storage and handling of stock?

17 Injuries are most often caused by:

- **musculoskeletal (back) injury**, for example when:
  - manually moving stock from storage systems;
  - manually moving heavy lifting accessories;
  - manually unloading vehicles;
- **slips and trips**, for example:
  - on poorly maintained floors in untidy work or storage areas, or when oil or water has been spilt on floors;
  - because loose materials have been left on the vehicle bed, or the vehicle bed floor is poorly maintained or there is oil or water on it;
- **falls from height**, for example:
  - on and from delivery vehicles (see Figure 1);
  - when accessing stock and storage systems (see Figure 2);

Figure 1 Unsafe system of work. Fall from lorry during 'barring-off' of bundled stock

Figure 2 Unsafe system of work. Fall from height while climbing toast rack to attach lifting clamps.

- **being struck or crushed by moving stock**, for example:
  - when it falls from a vehicle during unloading;
  - when it moves unexpectedly on a vehicle during unloading;
  - when it moves or falls during lifting or handling operations;
  - when storage or containment systems fail;
- **being struck or crushed by heavy lifting attachments** that unexpectedly topple over;
- **being struck by moving vehicles**, for example:
  - during vehicle reversing operations in delivery areas;
  - when stock is being handled by fork-lift trucks in storage or processing areas;
- **being cut by sharp edges**, for example on banding or sheet stock.

18 The risks from these hazards may be compounded by other factors, for example:

- unsafe systems of work;
- inadequate measures to prevent falls when working at height;
- unsafe storage and containment of unstable heavy items (for example lifting attachments or stock items);
- use of inappropriate or poorly maintained lifting and handling equipment;
- incompatible storage and handling systems;
- poor instruction and training;
- lack of supervision;
- poor co-ordination of stock handling;
- poor working environment and/or poor housekeeping;
- overstocking of the storage system beyond its design capacity.

19 And remember, additional hazards may be created by:

- maintenance work;
- work by contractors - both for the contractors themselves and others;
- the installation of new plant or the introduction of new materials;
- work outside ordinary working hours or normal day-to-day procedures.

Step 2 - Who might be harmed and how?

20 Those at risk of injury could include:

- operatives;
- fork-lift truck drivers;
- delivery vehicle drivers;
- maintenance staff;
- cleaners;
- visitors;
- young workers;
- trainees;
- those who do a particular job only infrequently, for example stocktakers;
- agency workers;
- members of the public.

21 Understanding how those at risk might be harmed requires a thorough knowledge of the work process and the nature of the hazards. Consider, for example, the main causes of injury (see paragraph 17) and the risks (see paragraphs 18-19).

Step 3 - Evaluate the level of risk and decide whether more needs to be done

22 Evaluating risk requires competence and a comprehensive knowledge of many things, including:

- the hazards involved and the ways in which they can harm people;
- the nature of the possible harm and the probability of it occurring;
- the minimum standards of risk control set by the law and how they are to be achieved.

23 If the risk is unacceptably high, consider what needs to be done to reduce it. This guidance should help you find a solution.

Step 4 – Recording the assessment

24 Although there is no prescribed format, the law requires that the significant findings of the assessment are recorded. The National Association of Steel Stockholders (NASS) has produced guidance.[12, 13]

Step 5 - Reviewing and revising the assessment

25 Do this when there are significant changes in work procedures, for example:

- if the type of stock held/used changes;
- if new storage or handling/processing equipment is introduced.

Key questions for employers

Have you:

- appointed a competent person(s) to carry out risk assessments of stock storage and handling operations (see paragraph 15)?
- made arrangements to involve your employees (see paragraph 15)?
- identified the significant hazards associated with your stock handling and storage operations (see paragraphs 17-18)?
- identified any areas requiring additional controls/precautionary measures in order to prevent harm (see paragraph 19)?
- established who is at risk of harm from the hazards you have identified (see paragraph 20)?
- identifed how they could be harmed (see paragraph 21)?
- assessed the risks associated with all of the hazards (see paragraphs 22-23)?
- recorded your findings (see paragraph 24)?
- made sure that both management and employees know and fully understand the findings?
- prepared a policy and arrangements for reviewing the assessment as and when necessary (see paragraphs 27-32)?

Key questions for employees

Do you know and understand:

- the hazards from metal stock storage and handling and how they could harm you?
- the risks to your health and safety from them?
- the precautions necessary to protect you from those risks?

Has your employer:

- consulted with you, or your safety representative, on the risk assessment of your work?
- discussed the risk assessment findings with you?

26 Having identified where the risks are and the level or risk, the next important step is to decide how they are to be controlled. This will require a **safety policy**.

Preparing a safety policy

27 A safety policy is fundamental to effective safety management. All employers employing five or more people must by law prepare one. It must set out the policy with respect to the health and safety of all those who may be affected by the work activities of the business. Company directors[14] are personally responsible for ensuring that a policy statement is prepared. It must set out the details of the organisation and management arrangements in force for carrying it out. The most effective policies are prepared with input from those with a comprehensive knowledge of the business, ie management and employees.

What should go into a safety policy?

28 It should be in three parts:

- Part 1: Statement of intent;
- Part 2: Organisation: managing its implementation;
- Part 3: Arrangements for meeting the objectives.

29 Proper authorisation and endorsement of the policy by the most senior management is essential; it must be reviewed periodically and revised as often as appropriate. It is suggested that policies should be reviewed annually, ideally when yearly business plans are being made.

Part 1: Statement of intent

30 Based on the risk assessment findings, it should include:

- a clear explanation of the organisation's general aims/objectives with regard to employees' health, safety and welfare (see paragraph 31);
- the standards of compliance to be achieved;
- how and when the policy implementation is to be monitored and reviewed.

31 Sections 2 and 3 of the Health and Safety at Work etc Act 1974[1] provide a useful checklist of the overall standards and objectives to be met. They include the provision and maintenance of:

- a safe place of work;
- safe access to and from the workplace;
- adequate arrangements for the safe use, handling and storage of materials;
- information, instruction and training of employees, supervision of their work, and consultation with them;
- safe equipment and systems of work;
- adequate welfare facilities.

32 The Management of Health and Safety at Work Regulations[2] will provide other objectives, for example the need to:

- assess occupational hazard and risk;
- appoint competent health and safety assistance;
- have procedures for dealing with emergencies;
- monitor health and safety performance;
- investigate workplace incidents to find causes and prevent recurrence;
- report certain incidents to the enforcing authority.

Part 2: Organisation

33 This should clearly identify those with safety responsibilities (for example directors, managers, other employees, advisors), what they are responsible for and how they are to be held accountable; for example who is responsible for:

- carrying out risk assessments;
- drawing up written safe delivery plans for stock;
- dealing with personal protective equipment;
- planning lifting operations;
- planning and purchase of safe storage and handling systems;
- equipment/racking inspection and examination;
- incident investigation/reporting;
- safety performance monitoring;
- training;
- supervising contractors;
- consulting with employees;
- providing competent health and safety assistance.

34 Roles and responsibilities should be clearly defined and senior management should secure the full commitment of everyone to achieving the company's policy on health and safety at work.

Part 3: Arrangements for implementing the policy

35 The arrangements should ensure, for example, that:

- all significant workplace hazards are identified and the risks from them properly assessed;
- safe storage and handling equipment is used;
- safe means of access are provided to stored materials;
- musculoskeletal disorders associated with manual handling operations are avoided;
- lifting operations are properly planned and supervised;
- safe systems of work are followed;
- employees are properly instructed, trained and supervised;
- appropriate personal protective equipment is provided;
- equipment, workplace and systems of work are inspected, monitored and maintained;
- results of inspections and examinations are recorded and acted upon;
- emergency and first-aid procedures are implemented;
- safety of contractors (for example those carrying out maintenance on racking, cranes, fork-lift trucks) and visitors (for example delivery-vehicle drivers) is ensured;
- delivery plans are prepared and implemented;
- employees and competent advisers are consulted;
- reportable incidents are investigated and reported to the enforcing authority;
- the policy is regularly reviewed and revised when necessary.

36 And remember that:

- those most closely involved in the work, at whatever level, will have a valuable contribution to make as to how the job can be done safely;
- the better informed and trained people are, the more valuable their contribution;
- the safety of visitors and members of the public must be ensured.

Involving employees[8, 15]

37 The policy statement must be brought to the attention of all employees. They must be kept adequately informed and committed to its implementation. Employee involvement can be achieved by, for example:

- developing and implementing the policy with the full involvement of employees (for example via safety committee meetings);
- using the policy as part of induction training programmes;
- making it a part of health and safety training sessions.

38 Effective safety management[2, 16] depends on a 'partnership' between employers and their employees. Proper consultation with, and involvement of, informed employees is essential in drawing up realistic, workable risk management objectives and arrangements.

Checking the policy is being implemented

39 Monitoring the workplace is an excellent way of managing risk on an ongoing basis. It can be done by:

- regular workplace inspections;
- analysis and investigation of workplace accidents and ill health;
- routine spot checks;
- periodic auditing of performance.

Key questions for employers

Have you:

- prepared a three-part policy statement (see paragraph 28)?
- clearly defined your policy objectives (including those relevant to meeting the standards in this guidance) and the arrangements for meeting them (see paragraphs 30-32)?
- set out the safety management organisation for implementing your policy, and clearly defined individual employees' roles and responsibilities at all levels (see paragraph 33-34)?
- set out the arrangements and performance standards for meeting your policy objectives based on the findings of adequate risk assessments (see paragraphs 35-36)?
- made arrangements for periodic review and revision of your policy (see paragraphs 25 and 29);
- made proper arrangements for consulting with your employees (see paragraph 37)?
- made arrangements for monitoring and auditing of your safety performance (see paragraph 39)?
- arranged for your policy to be signed and dated by the most senior person in your organisation?
- brought its contents to the attention of all your employees (see paragraph 37)?

Key questions for employees

Ask yourself the following questions:

- have you read your employer's health and safety policy statement?
- has it been explained to you and do you understand it?
- are you consulted by your employer on health and safety matters?

Do you know:

- who has health and safety responsibilities in your organisation and what those responsibilities are?
- what action to take in unsafe situations and who to report them to?
- your employer's arrangements for consulting with you on matters relating to your health and safety?

Storage

Planning stock storage arrangements

40 Remember:

- storage and handling systems are work equipment subject to the requirements of the Workplace (Health, Safety and Welfare) Regulations 1992[7] or the Provision and Use of Work Equipment Regulations (PUWER)[4] and the Lifting Operations and Lifting Equipment Regulations (LOLER).[3] They must be safe to use and suitable for their intended purpose;
- stock should be stored and stacked so that it is not likely to fall or move and cause injury;
- any storage racking used must be designed to be strong and stable enough for the loads placed on it. Likely damage, for example from lift trucks, should be taken into consideration. It must be properly installed, regularly inspected, maintained and safely used.[17]

Making sure storage systems are safe

Design

41 People working between, or close to, stored products may be exposed to significant risk of injury, for example if a stack collapses, or product moves or falls unexpectedly (see Figure 3). Safety is an important element of storage systems design.

Figure 3 Failure of banding resulting in collapse of free-standing stack of bundles. No provision for containing collapsing stack safely. No protected aisles for operators to work from

Storage systems should be designed and operated to:

- provide a safe place of work, which exposes workers to the minimum health and safety risks and keeps them away from areas of danger;
- minimise the amount of time that personnel spend in storage areas;
- minimise the risks to personnel from equipment or load failure;
- be provided with adequate access platforms, steps, ladders and handrails to allow safe access and exit for workers and to avoid the need for people to walk or stand on the stock itself;
- ensure that stock movement is always controlled and eliminate the risk of unintentional movement;
- take account of the effect of external influences on stock stability, for example weather or vibration;
- minimise the number of times stock has to be handled;
- be the most efficient and easy to use;
- reduce, so far as is reasonably practicable, the need for personnel to work within the racks, climb over them or climb over stock;
- incorporate arrangements for the safe storage of lifting accessories (for example C-hooks);
- be backed up by safe systems of work that are easy to manage and control;
- be regularly inspected and properly maintained.

42 Here are some examples of safety features which could be designed into the storage system:

- operate cranes from outside storage racks when stock is being lifted or moved;
- provide safe, clearly defined means of access, both through and within storage areas, for all access requirements (including for jobs such as cleaning, stock-taking and maintenance);
- provide clearly defined routes for fork-lift trucks and other vehicles which are separate from pedestrian routes;
- provide proper barriers and containment for stored stock;
- provide suitable equipment and facilities to restrain stock (for example supports, chains, banding, chocks) and prevent unintentional movement.

43 Advice on the points covered in paragraphs 41 and 42 can be obtained from equipment designers, manufacturers and suppliers, health and safety advisers, managers, employees, or safety representatives.

Falls from height

44 Many serious accidents have occurred when employees have tried to access stock at heights by unsafe means (for example by climbing up racking supports), or have worked at height with inadequate protection and fallen onto hard surfaces or sharp edges. The proposed Work at Height Regulations[10] will require steps to be taken to reduce the risks of such falls. Always:

- identify and minimise the need for access to height when planning storage systems;
- provide suitable, safe means of access, for example safety steps or safety platforms. The risk assessment will determine the safest means - for example ladders are the least safe; mobile elevating work platforms (MEWPs) and order picking equipment are much safer;
- provide suitable means, for example platforms, guard rails etc, to prevent falls when working at heights.

Access routes/aisles/gangways

45 Gangways and aisles are a form of traffic route and should:

- be clearly defined (for example suitable floor markings can be used to indicate gangways/aisles, work areas, storage areas etc) (see Photograph 1);
- provide separate routes for vehicles and pedestrians where possible, with clearly marked and designated pedestrian crossing zones (see Photograph 2);
- be separated from storage areas, wherever possible, by means of suitable physical barriers.

Photograph 1 Storage of narrow coils in standing coil rack. Good stock containment with safe access for slingers and a protected/clearly defined pedestrian route

Photograph 2 Good layout of toast rack storage with clearly defined pedestrian routes and separation from fork-lift trucks

46 Barriers should be capable of restraining any collapsed or moving stock so that it cannot fall into gangways and aisles (see Photograph 3). Cross-bay gangways and aisles may be required to provide adequate access around stored stock. Operators should, so far as is reasonably practicable, conduct or control lifting and handling operations from clearly defined safe places.

Photograph 3 Broad coil storage using floor-mounted inverted metal channels. Containment posts fitted to channel ends and clearly defined working areas and pedestrian routes

Visibility

47 Good visibility should be maintained to allow people to work safely. It is important that:

- overhead travelling-crane operators are able to see the load and any obstructions or people working along the route;
- drivers of vehicles are able to see pedestrians;
- the height of stored stock is limited to allow good visibility; for example the height of stored stock close to a gangway opening directly on to a vehicle route may need to be limited to allow drivers to see pedestrians;
- all work areas are adequately lit and the use of other aids to improve visibility (for example parabolic mirrors, high-visibility clothing) may need to be considered;
- vehicles with good driver-visibility (with or without the load) are selected; it may be necessary to improve vision on some existing vehicles, for example by fitting extra mirrors or CCTV reversing aids.

Slips and trips[18]

48 Stock surfaces may be slippery, unstable and uneven; this can increase the risk of slips. To reduce the risk of slipping, ensure that:

- employees do not climb onto, or walk over stock;
- floor surfaces of walkways and work areas are kept free of leakages/spillages, for example oil or water;
- roadways and loading/unloading areas are kept free from ice and snow in winter.

49 Good housekeeping is important to reduce the risk of trips (see Photograph 4). Remember to:

- keep designated work areas free of material which might be a tripping hazard, for example poorly stored equipment, material or waste (see Photographs 48-50, page 71);
- keep walkways free from tripping hazards, for example protruding metal, work materials, empty pallets and loose banding and packaging materials;
- keep floor and road surfaces level and properly maintained, and free of potholes, protruding objects, and inadequately covered drains/manholes etc.

Photograph 4 Free-standing stacks of broad, long product on firm, level ground using wooden bearers. Note poor control of tripping hazards in access area

Falling materials and head protection

50 Falling stock can be a serious hazard:

- head protection, ie hard hats, may be required for crane operators, slingers and other people at risk of being struck on the head by moving or falling material;
- barriers and containment may be required to eliminate the risk of people being injured by falling materials.

What other factors can increase the risks from storage systems?

51 The main factors are:

- floor conditions - permissible loadings of internal floors should not be exceeded; load bearing of external surfaces may be affected by sewers, culverts, loose ground etc;
- vibration - product stability can be affected by vibration from movement of other large masses, for example traffic, large presses or cranes;
- environmental conditions - products stored in the open can be affected by high winds, rain or ice;
- collision - the main dangers are from passing fork-lift trucks, overhead travelling cranes or heavy goods vehicles;
- strength of material restraints - this will include racks and shelving, bearers, chocks, dunnage and strappings etc.

52 Reduce the risks by:

- limiting the safe height of stacked stock;
- restraining the movement of stored stock;
- providing suitable access equipment.

Choosing a safe storage system

53 Choose the storage system (or combination of storage systems) which best fits business needs and offers an appropriate level of safety. Consider the following:

- the physical characteristics of the stock (and any ancillary items) to be stored or handled, for example size, mass, shape, surface finish, centre of gravity, or stability;
- the associated lifting and handling system(s) to be used which are appropriate for the particular stock range and storage system;
- maximum tonnages and volumes to be stored and their accessibility, with consideration for any foreseeable changes in the future;
- product turnover rate;
- location and space available;
- extent of banding (bundling) of supplied material and typical delivery quantities;
- stacking pattern, any likely stack failure modes, and foreseeable effects of banding failure on stack stability;
- use of battens, and the effect of batten failure on stack stability;
- environmental conditions (for example flooring; drainage; whether the storage system is in or out of doors; wind loading; and the likely weather conditions);
- impact loadings which the system needs to be able to withstand (for example from contact with vehicles, suspended loads and subsequent material collapses etc);

- extent to which storage systems can contain the stock within the storage area in the event of stack collapse or failure, so that material does not fall into walkways or work areas;
- who will be using the storage system; how it will be used; and what are the foreseeable risks to safety.

What information on the storage systems is needed, and why?

54 Key information about the requirements for safe use of all storage equipment should be obtained, including:

- suppliers' information on the requirements for safe installation, operation and maintenance of the equipment, including safe loading capacities;
- certificates of conformity for 'CE'-marked equipment;
- results of structural surveys carried out in advance of equipment installation;
- in-house inspection reports to review causes of damage/misuse and remedial action.

55 This information will be essential for:

- risk assessment;
- planning for safe provision and use of the equipment;
- devising training programmes; and
- planning of inspection and maintenance schedules.

Storage systems

Which storage systems are best suited to different types of stock?

56 Stored stock can be either:

- free-standing, ie stock is placed or stacked on the ground without any fixed supports or racks, or stored on the floor on bearers;
- supported, ie stock is restrained or supported by racks or other permanent or semi-permanent storage equipment (including frames or stillages).

57 Choice of storage system will depend on many factors, including;

- type and stability of stock;
- handling system to be used;
- anticipated stock quantities;
- frequency of movements;
- picking requirements of the user.

Type and stability of stock

58 The main types of stock are:

- long, narrow, for example tube, bar, narrow section;
- long, broad, for example columns, beams;
- coil, broad and narrow;
- sheet/plate.

59 Descriptions of different stock types are given in British Standard BS EN 10079: 1993 *Definition of steel products*.[19] Storage systems are usually designed for a limited range of product types. For example, a system designed to store bundles of tube safely will normally be unsuitable for storing coiled product. Remember that there are likely to be additional requirements for safe storage of lifting accessories (see paragraph 171).

60 The physical characteristics of product types determine their inherent stability. While some product shapes can be safely stored in free-standing stacks (see Photograph 5), others cannot. Figures 4 and 5 illustrate how some unstable products can move and therefore create danger. If there is any doubt about a product's inherent stability, then stacks should be restrained and adequately supported within a suitable racking system. Racking systems are designed to be used with a limited range of product type. Each has its own strengths and weaknesses as summarised in Table 2 (page 27).

Photograph 5 Free-standing stacks of narrow coils (bore-vertical) on wooden bearers on solid floor. Individual coils separated by bearers for safe/easier attachment of coil lifters

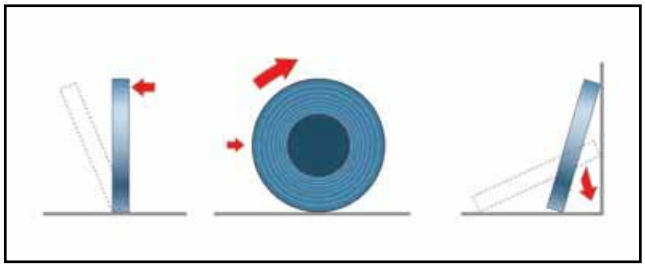


Figure 4 Narrow coils can move unexpectedly and cause crushing injuries

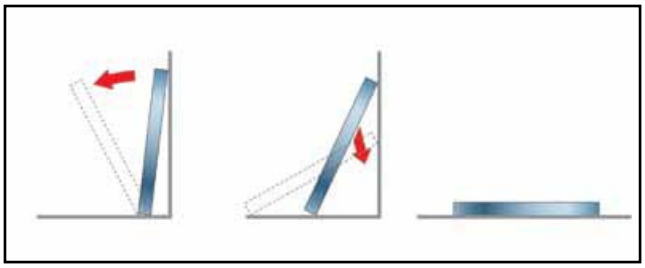


Figure 5 Inadequately supported plate or long product can slip or topple

Long, narrow stock (for example bar, tube and narrow sections)

61 Long, narrow stock is most stable when laid on its side and safest when stored horizontally in storage racks. Horizontal storage and handling systems should be used in preference to vertical systems. Free-standing storage should be avoided wherever possible.

62 Small-gauge material is likely to sag if it is inadequately supported. Bunding or packaging of stock can reduce sagging and make stock-handling easier and safer; bundles can be stacked and handled safely within a properly designed storage system.

63 The most common types of supported storage systems for long, narrow products are given on pages 23-25 and their relative strengths and weaknesses described in Table 2.

Cantilever racking (see Photograph 6 and Figures 6-8 in Table 2)

64 Cantilever racking consists of vertical struts and horizontal arms which hold the stored material. It is the least labour intensive of the various racking types; gives the greatest storage density; is the easiest to manage; and is considered to be the safest available (see 'Training material' page 93).

Photograph 6 Storage of long, round product on double-sided cantilever rack. Heaviest stock correctly stored at bottom of rack

65 Racks can be single or double-sided. A smaller version with arms that slope down towards the centre column is known as 'Christmas tree' racking. The most common cause of failure is misuse, for example as a result of:

- incorrect load distribution on the rack, such as heavy loading at the top, when lower arms are unloaded or partially loaded. Loads should be evenly distributed across the rack;
- storage of excessively long material on the rack arms. This may cause the unsupported ends of the material to sag so that the mid-section bends upwards and becomes inadequately supported;
- returning of loose material to the rack (for example after the banding has been split) in such a way that it is not adequately contained on the arms. Loose sections should ideally be rebanded before being put back into storage; alternatively loose material should be stored separately in a suitable stillage;
- loads incorrectly placed on the racking arms, for example too near the ends of the support arms so that the centre of gravity is at, or near, the outer edge of the arms;
- shock and live loads, for example impact damage from lift trucks and careless placement or retrieval of stock.

66 Instruction and supervision should aim to eliminate such misuse.

67 The associated handling system usually comprises counterbalanced fork-lift trucks, side loaders or customised overhead cranes (see Photograph 7).

Photograph 7 Overhead travelling crane adapted for work with cantilever rack

Photograph 8 Toast rack for long product. Rounded cappings on uprights to prevent load snagging during lowering

Toast racking (see Photograph 8)

68 Toast racking consists of substantial uprights (supported by a frame) with bundles of material being stacked between them. The uprights should restrain movement of the stock and prevent it from toppling into gangways and working areas. Groups of uprights should be linked at floor level and may also need to be braced at high level to ensure stability. Maximum stack heights can be indicated by markings or by limiting the height of the uprights. The top of an upright should always be higher than the stack. End uprights may need to be strengthened, for example if they are alongside a gangway or pedestrian route, to contain any possible collapse of the racking system.

A-frame racks (see Figure 11 in Table 2)

69 These consist of an A-shaped upright frame fitted with arms similar to a cantilever rack. Products are stored either horizontally across the arms or upright between the arms, when they are known as leaning racks.

70 For horizontal storage, they can be designed to be loaded and unloaded by overhead cranes. When used as leaning racks they should be equipped with base restraints (such as a lip or raised edge) and movable restraints (such as chains or bars) to prevent products from sliding or falling out of the rack.

Ladder racking (see Photographs 9 and 10 and Figure 12 in Table 2)

Photograph 9 Removal of lifting slings from bundles of tubes in ladder rack. Protected aisle allows safe access for operator

Photograph 10 Long product stored in ladder rack. Safe/easy access for operator from protected aisle. Rounded cappings to prevent load snagging

71 Ladder racks are similar to toast racks but have detachable horizontal members supported by the vertical metal uprights. The horizontal members allow different types of product to be shored one above the other and such racks allow large densities of diverse products to be stored in a given floor space. However, because materials are stacked in ‘pockets’ one above the other, reaching and extracting materials can be more difficult. Cranes should not be used to drag material out horizontally as this can pull the rack over and damage the lifting equipment. Other types of racking may be easier, quicker and safer to use. Past experience has shown ladder racking to be more susceptible to sudden, catastrophic failure in the event of misuse. Any battens used to separate bundles should be made of metal or hardwood.

Other racking systems

Pigeon-hole racks

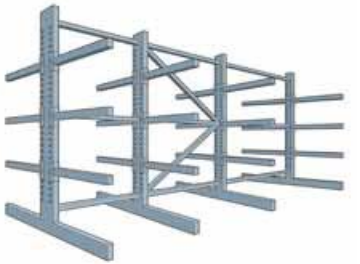
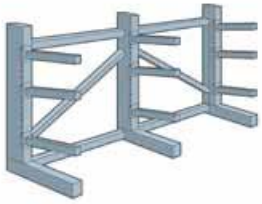
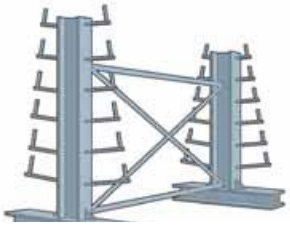
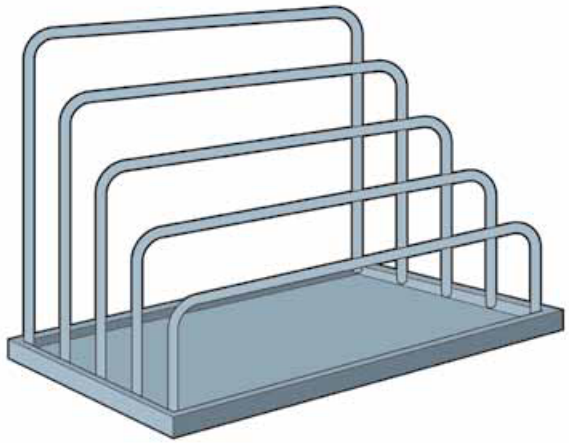
72 These are shelves which are designed to store long, narrow products. They are only suitable for relatively light-weight and small products which can be lifted by hand. A suitable mesh or solid panel should be fitted at the rear to prevent items from being pushed out through the back of the rack into working areas or other racks or equipment.

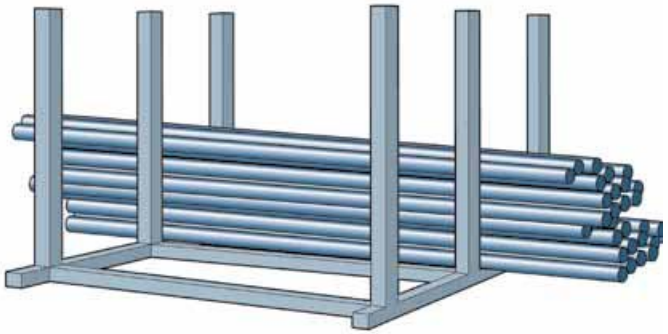
Splitting racks (see Photograph 11)

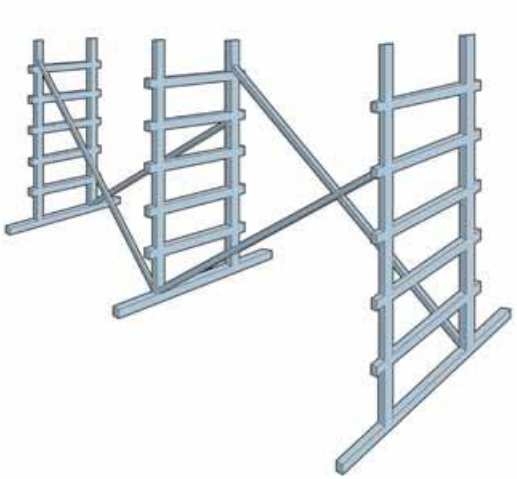
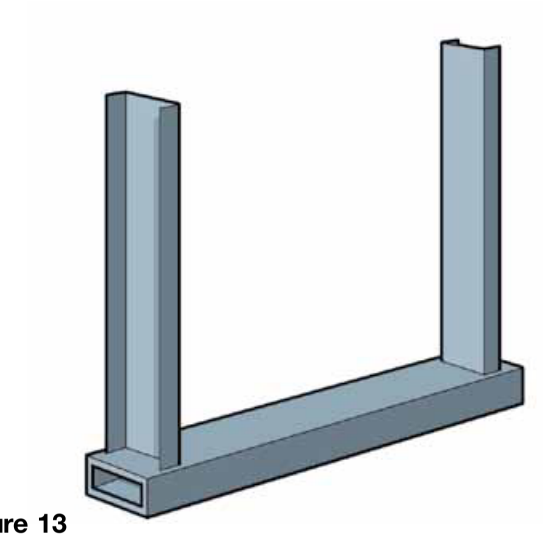
73 During 'order picking' it may be necessary for bundles to be split into smaller quantities. Proprietary 'splitting racks' should be used for this purpose. The racking should be designed to contain the bundles being split and prevent people from being hit by moving stock when the banding material is cut.

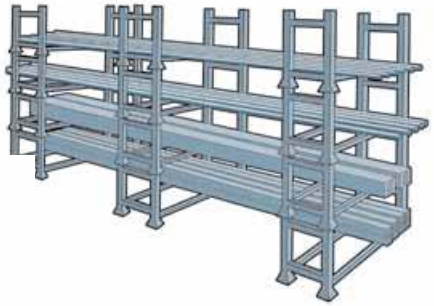
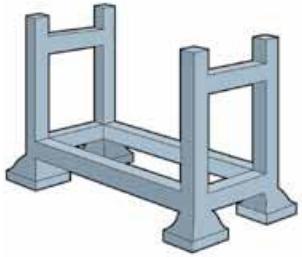
Photograph 11 Safe splitting of long, narrow product in an upright splitting rack. Bundles separated by wooden bearers to allow attachment of lifting slings

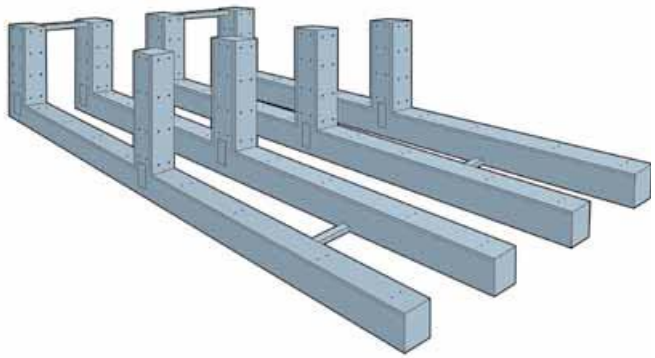
Table 2 Characteristics of the most common types of racking

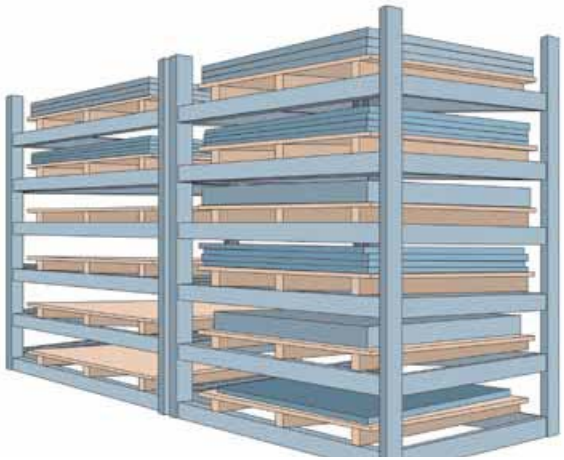
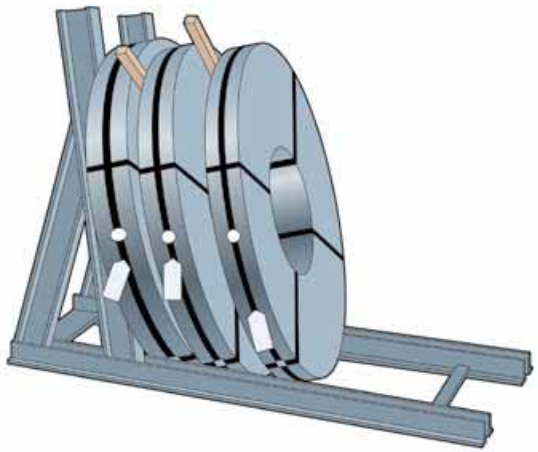
Type	Range of product types	Volume stored	Ease of access	Main hazards to be controlled
Cantilever rack  **Figure 6**  **Figure 7**  **Figure 8**	Several bays, each able to hold a different product.	Low.	Greater range of products. All porducts are easily accessible.	Racking failure from overloading. Bent arms. Items rolling off arms. Falls from height (people climbing up racking). Vehicle impact.
Toast rack (sheet, plate)  **Figure 9**	Fewer bays. Only one product per bay.	High.	All products are accessible.	Racking failure from overloading. Minor collapses. Damage from impact. Falls from height.

Type	Range of product types	Volume stored	Ease of access	Main hazards to be controlled
Toast rack (long product)  **Figure 10**	Similar stock shapes stored in same slots.	Low.	Two-directional access required to avoid lifting over top. (An equal access width is required on both sides).	Manual handling. Sharp edges. Larger products require larger side access for safe removal. Product must be stored in correct slot.
A-frame  **Figure 11** (Stock can also be stored horizontally across the arms).	Usually one product per arm. Heavier sections on lower arms.	Low.	From two sides. Products are easiily accessed. SWL restrictions.	Deflection and collapse of structure from collision with fork-lift truck, lifting tackle, stock. Manual handling. Falls from height (people climbing up racking sides to gain access).

Type	Range of product types	Volume stored	Ease of access	Main hazards to be controlled
Ladder rack  **Figure 12**	Each bay divided into several pockets, each able to store a different product.	Medium.	Poor accessibility (necessary to first remove products in upper pockets to reach products in lower ones).	Falls from height. Delection and collapse of vertical and horizontal members. Manual handling. Support bracket failures. Unexpected failure of lifting equipment due to entanglement with racking. Collapse of racking 'ladders' in plane parallel to stock if racking is misused (eg incorrect product length).
U-frame  **Figure 13**	Single product type (between uprights).	Very low. Often used only as temporary storage.	Space required on all sides for access.	Entrapment/ crushing. Can topple easily when product drawn out over itself. Can be unstable when stacked. Load-bearing capacity must be assessed and displayed.

Type	Range of product types	Volume stored	Ease of access	Main hazards to be controlled
Cradles  Figure 15  Figure 14	Usually one product per tier.	Medium.	Can be all-round access but usually in rows allowing acess from front and rear only. Access for operator may be problematic.	Instability of product. Possible instability when stacked. Entrapment. Contact with stock. Slips, trips and falls.
Stillages (long product)  Figure 16	Usually one product per tier.	Medium/high.	Poor - confined to ends if single product required. Need to remove one tier to access stock from tier below. Safe access to lower levels of stack may be problematic.	Entrapment. Falls from height. Contact with sharp edges. Slips and trips. Manual handling.

Type	Range of product types	Volume stored	Ease of access	Main hazards to be controlled
Standing coil, bore-vertical  **Figure 17**	Slit coil. Usually for temporary storage, work in progress or stock awaiting despatch.	Medium/high.	Stored in rows with adequate space for operator/fork-lift truck use. Overhead travelling crane and appropriate bore grabs can be used for handling individual coils.	Stack imbalance. Entrapment. Broken banding. Sharp egdes. Slips, trips and falls.
Standing coil rack, bore-horizontal **- wedged** **- floor rack**  **Figure 18**	Slit coil. Temporary storage for work in progress or stock awaiting despatch.	Medium. Usually upon flat floor, retained in angled support.	Stored in rows to allow operator access. Within rows, lifting equipment access required. Narrow slit coil usually banded back as a solid wide coil ready for single lift.	Coil imbalance. Entrapment. Broken banding. Coil laps. Slips, trips and falls.

Type	Range of product types	Volume stored	Ease of access	Main hazards to be controlled
Pallet racking  **Figure 19**	Sheet and plate. Coil and profiles. Most materials palletised.	Medium. Adequate access gangways required.	Unrestricted access by fork-lift truck direct to storage position. SWL restrictions.	Overload of racking. Inadequate shelf support for pallet design. Contact damage with fork-lift truck and danger of rack collapse. Falls from height (eg stocktakers). Imbalance and rack toppling if base not adequately secured.
Leaning coil  **Figure 20**	Sllit coil. Temporary storage for stock awaiting further processing or despatch.	Medium. Single high. Adequate access required for personnel and lifting equipment. Low if only fork-lift truck used.	Stored in rows to allow operator access. Access required for lifitng equipemt between rows.	Coil slippage. Entrapment between coils. Coil topple. Broken banding. Coil laps. Slips, trips and falls.

U-frames (see Photograph 12 and Figure 13 in Table 2)

74 These are U-shaped supports and are used in pairs. Experience indicates that they are inherently unstable and stacks may collapse catastrophically when subjected to abuse or accidental impact, for example when stock is being added or removed. There have been a number of fatal accidents associated with such collapses, and in view of the high risk of serious/fatal injuries associated with U-frame failures, a risk assessment is likely to indicate that other forms of storage, for example cantilever racking, could provide reasonably practicable safer alternatives.

Photograph 12 Poorly stacked U-frame. Rack/uprights are distorted and there is a risk of collapse

75 Before free-standing or stacked U-frames are used, a risk assessment must be carried out. This should take full account of any access needs to storage areas, for example for attachment of lifting equipment, and the associated risk from stack collapse.

76 Where free-standing or stacked U-frames are used:

- storage areas must be clearly segregated and constructed to ensure safe stock containment in the event of stack collapse;
- gangways, barriers and places of work must be designed and constructed to ensure safety to personnel in the event of stack collapse;
- frames should be regularly inspected and any showing distortion or cracked welds should be removed from service immediately and be repaired or replaced.

Cradles (see Figures 14 and 15 in Table 2)

77 U-frames can be made safer by modification to form ‘cradles’. Two U-frames are connected together by fixed cross-members to form a portable cradle with four feet. These have greatly increased stability and are more suitable for limited stacking. When planning lifting operations, consider cradles as part of the load. They are not subject to the requirements for thorough examination or inspection under LOLER but must be of adequate strength and properly maintained.

Stillages (see Figure 16 in Table 2)

78 Stillages are portable and designed to rigidly support stored stock. They consist of parallel horizontal supports fitted with cross-members and vertical supports, and lock together when stacked. Stillages should be clearly marked with their rated capacity and, because designs vary, the manufacturer's guidance on use and stacking restrictions should always be followed. Stillages are part of the load and are not subject to LOLER's requirements for examination and inspection, but must be of adequate strength and properly maintained.

Long, broad stock (for example columns and beams)

Free-standing

79 These products are best suited to free-standing storage on the floor on bearers (see Photograph 4, page 19). In some cases bundling may improve inherent stability and improve ease of handling and storage. Lifting is best suited to overhead travelling cranes and handling can be made easier and safer by the use of customised lifting accessories such as 'splitting bars' (see Photograph 13) and 'fish' plates (see Photograph 14). See also 'Rules for safe stacking' (page 49).

Photograph 13 Use of a splitter bar to allow safe positioning of bearers and attachment of lifting accessories

Photograph 14 Use of a 'fish' plate for safely raising long, broad product

Coils

80 Coils are generally either **narrow** (where the diameter-to-width ratio is over 6.5:1) or **broad**. The physical properties and requirements for safe storage and handling are very different for the two types.

Narrow coils (see Figure 4, page 21)

81 Narrow coils behave rather like round coins - they are stable when laid flat **(bore-vertical** or **eye-to-sky)** but unstable when standing on their narrow edge **(bore-horizontal** or **eye-to-horizontal)**. On edge they can easily roll, be knocked over and, if leant too heavily against a support, slide away from it under their own weight (see Figures 21 and 22).

Figure 21 Operator crushed by toppling narrow coil. Coils should be moved using appropriate lifting equipment

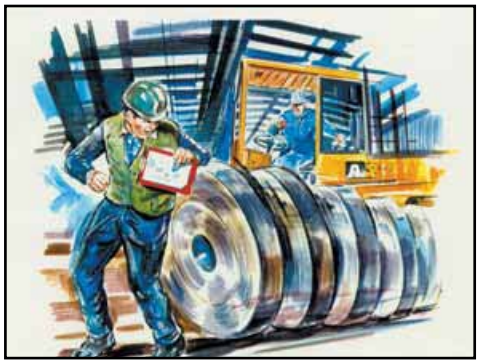


Figure 22 Operator crushed by collapsing narrow coils. Coils should always be properly supported and protected from moving vehicles

82 Coils with small widths and large diameters are unstable if left free-standing with bore horizontal. Narrow coils should therefore be either banded together to form a more stable composite coil or stored in a leaning coil rack. Where the ratio is greater than 10:1, coils should be stored bore-vertical or in a fully enclosed cassette.

83 Narrow coils should not be stored bore-horizontal unless they are adequately supported by fixed supports. If such supports are not available, coils should be stored in the bore-vertical configuration.

Free-standing storage - bore-vertical

84 Floor storage: Coils should be safely laid flat and formed into a stack. Pallets can be used to support such stacks. Battens should be placed between the coils to permit access for safe handling. When stacking coils in this way, instability can arise where wider diameter coils are placed on top of narrower ones ('hour-glass' effect) (see Photograph 15).

Photograph 15 Stack of bore-vertical narrow coils with wider diameter coils stacked on top of narrower ones ('hour-glass effect')

85 Pallets:[20] These are normally reusable and made of wood (although pallets made of plastic and metal are available). They can be either two- or four-way entry and reversible and can be stored on the ground or on a pallet rack, subject to the load capacity of the rack (see Figure 19 in Table 2).

86 Materials can be loosely stacked on pallets for storage or banded to pallets for safe handling.

87 Pallets should be:

- robust;
- capable of safely bearing the load placed on them;
- of an appropriate size so that loads do not overhang the sides;
- maintained in a suitable condition for safe use, for example timbers of wooden pallets must not be split or damaged.

88 If pallets are used:

- appropriate lifting and handling equipment should be used to manoeuvre them;
- floors, where they are used, must be level and capable of taking the weight;
- only tidy, evenly banded pallets should be stacked (to ensure stability) and safe height limits should be clearly defined;
- if stacked, the stacks should be neat, vertical, level, stable and blocked (to prevent damage to pallets below); and
- they must be properly maintained. Reusable pallets should be regularly inspected and maintained.

89 Box pallets: These vary in design but are essentially self-contained storage units comprising a base and support frame. They can be placed alongside coil-processing machinery to enable coils awaiting use to be stored safely.

Supported storage - bore-horizontal

90 Cages (see Photograph 16): These may be substantial portable units. They are fixed to the floor and have openings on the side or top and are used for safe transportation of narrow coil.

Photograph 16 Narrow coils strapped into a cage ready for despatch. Facilitates lifting, and cage can be safely strapped to vehicle bed

Photograph 17 Cantilevered arms provide safe temporary storage for narrow coils and a C-hook

Photograph 18 Narrow coils stored on cantilevered arms. Stops at ends of arms to prevent coils from slipping off

Photograph 19 Narrow coils safely stored in a leaning coil rack

Photograph 20 Separation of blocks of narrow coils in leaning rack to facilitate safe use of lifting attachments

91 Horizontal supports (see Photographs 17 and 18): These include horizontal bars or support arms, or capstan arms, and can be used to separate, sort and band coils as well as supporting them safely. Remember:

- the open end of the support bar should be fitted with a lip to help contain the coil(s) and prevent it/them from falling off;
- the maximum permitted weight or safe working load (SWL) should be clearly marked on the bar;
- there should be gaps in the top surface of the supports to allow safe use of lifting equipment.

92 Leaning coil racks (see Photographs 19 and 20): These incorporate a substantial support against which rows of narrow coils can be leant. Suitable side supports should be fitted to prevent coils from rolling; these should be sufficiently strong and rigid to retain slipping coils, for example by being sunk into the floor, particularly if fork-lift trucks are to be used for coil handling. The angle of storage can be set by the design of the back rest - the angle must not be too steep or the coil may slip and fall; the back rest should be tall enough to safely support the largest diameter of coil that is to be stored.

93 Proper storage is essential in such racks if instability and collapse are to be avoided. Coils are held in place by friction between the base of the coil and the floor surface, so it is important that coils are not stored on slippery or low-friction surfaces. As far as possible, the supports should also be kept dry and free from oil. T-pegs, formed from two pieces of wood, should be used to separate coils which are to be handled by cranes (see Photograph 21). Tidiness is important - if coils are not stacked straight, at the correct angle, and properly separated by pegs, they can become unstable and collapse. Large-diameter, narrow-width coils can collapse if leant up against a support; they can be supported by banding several coils together or by placing against larger-diameter, larger-width coils. The risk of collapse of the centre of the coils can be avoided by placing these coils onto a standing coil rack.

Photgraph 21 T-pegs to separate blocks of narrow coil (see also Photograph 20)

94 Standing coil racks (see Photograph 22): These comprise two floor-mounted, parallel, raised base support rails with attached vertical frames and are designed to store coils vertically. Frames must be strong enough to retain coils within the rack and end posts should be fitted, which are tall enough and strong enough to prevent coils from falling out. Suitable additional coil supports, made from either wood or recycled plastic, can be used to reduce coil damage and minimise the risk of coils sliding along the rack.

Photograph 22 Good design of standing coil rack

Broad coils

95 Because of their shape they behave rather like a drum, ie when standing eye-horizontal they can roll, and, once rolling, are difficult to stop and are dangerous because of their large mass. Larger broad coils are too big to be stored in the eye-to-sky configuration; they should always be safely chocked, and appropriately supported and barriered when stored bore-horizontal. They should be stored on a stable, level surface and in a properly designated storage area with safe access for people and handling equipment (see Photograph 23).

Photograph 23 Hardwood chocks and upright barriers for containing stored broad coils

Free-standing storage - chocked

96 Broad coils can be stored single-level or stacked (see paragraph 99). Suitable chocking of the base layer is essential to prevent movement. Single-level rows of coils always exert lower forces on the chocks than stacks, so stacking should be avoided wherever possible. Unstacked coils are easier and safer to handle and are also less prone to damage. The stacking of free-standing coils more than two high can greatly increase the risk of stack collapse; this should be taken into consideration in risk assessments.

97 Coils should always be chocked using properly designed and located chocks (see Figure 23). Chocks can be made of hardwood, steel or a composite - softwood is unsuitable. They need frequent checking as they are subject to high levels of wear which can necessitate frequent replacement. They should be:

- of an appropriate size and wedge angle;
- right-angled in cross-section (square or rectangular cross-sections are not recommended). The two sides that enclose the smallest angle (wedge angle) should form the wedge between the coil and the floor. (The smaller the wedge angle, the lower the coefficient of friction necessary to hold it in place. However, if the angle is too small there is a risk of the coil climbing up the chock, causing the coil to move unexpectedly and/or the stack to collapse).

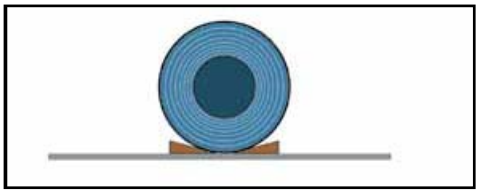


Figure 23 Chocked coil

98 Also:

- employees should be trained in their safe use;
- a minimum of two chocks should be placed on each side of the coil, equally about its centre line;
- the floor condition should be checked regularly to ensure that it is clean and free from contamination, for example by oil (if coils are oiled then oil can leak from them and reduce the friction between the floor and any chocks, leading to stack failure and collapse; wooden chocks should not be used to support oiled coils);
- substantial and suitably designed containment barriers, or end stops, should be positioned at both ends of a row or stack to prevent coils from rolling out of the storage area (see Photograph 24);
- safe access routes and gangways should be provided, for example with a suitable gangway on one/both sides of each row of coils, to allow safe access for the use of lifting equipment, with the exclusion of unauthorised personnel;
- lifting equipment should be designed to allow employees to work from a safe position so that, for example, they are not required to enter a row of coils or reach through a coil; accessories such as C-hooks and coil grabs should be used and equipment operated from the gangways (see paragraph 140);
- supervisors should ensure that chocks and other equipment are fit for purpose, properly maintained and correctly used;
- damaged chocks should not be used - an adequate supply of replacement chocks should be readily available.

Photograph 24 Solid uprights for containing stock, eg chocked broad coils, within storage areas

Stacking

99 When stacking broad coils, the weight of material in the higher levels causes considerable downward gravimetric forces on the lower base-level coils (see Figure 24). Such forces can cause stack failure and collapse, for example if:

- coils in the base layer 'climb' over the chock or support system (see Figure 25);
- a chocked base-level coil 'slides', pushing a chock along the floor (see Figure 26);
- there is a failure in the support system or one or more of the chocks;
- poor alignment of coils within a stack causes it to turn or distort;
- varying coil diameters are used in the base layer so that coils in the upper layers are stacked on differing heights of lower coils (thereby causing the former to fall off the latter);
- coils are not tightly wound (this can cause them to sag and distort the stack).

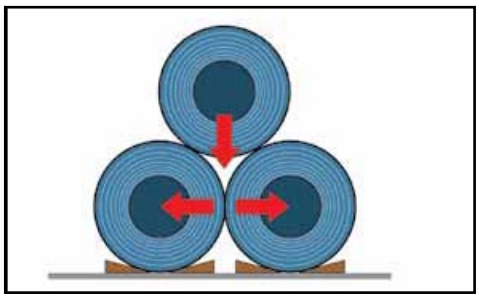


Figure 24 Forces in coil stacking

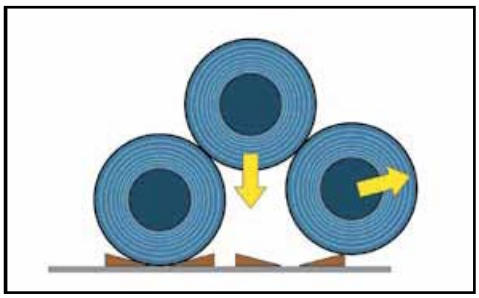


Figure 25 Failure caused by coil climbing over the clock

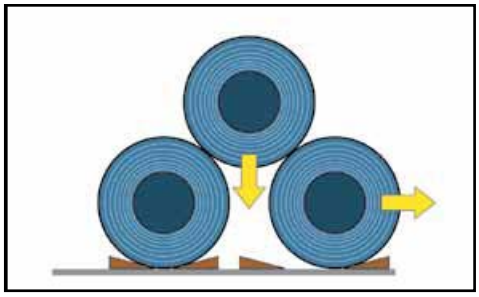


Figure 26 Failure caused by chock sliding

Safe broad coil stacking (bore-horizontal)

Rules for safe broad coil stacking

When broad coil is being stacked:

- a risk assessment should be carried out to determine the risks and consequences of stack failure and the appropriate stack support and containment system;
- stack heights should be as low as possible; for stacking more than two high a correctly designed proprietary coil support system is likely to be necessary;
- the base level of coils must be adequately supported; it is also good practice to strap together the two adjacent coils at each end of the base row to prevent unexpected movement as a result of downward pressure from coils in the upper row, thereby improving stack stability;
- coils should be correctly aligned and stacked so that the centre point of each coil is directly above an imaginary line joining the centre points of the row of coils and running down the middle of the rack or row (see Figure 27);
- the stack should be built with the bottom coils touching;
- stacks should be prevented from sliding, by for example placing fixed restraints at the ends;
- every coil in the base row should be chocked on both sides using suitable chocks (see paragraph 98);
- coil diameters in the base row should not vary by more than 10% to ensure that coils placed above them are secure (see Figures 28 and 29);
- if coils are removed from the stack (see Figures 30 and 31), replacement coils must have the same diameter or be not more than 10% smaller (see Figures 32 and 33); if this is not possible then either a gap must be left or the entire stack rebuilt;
- coils which are partially unwound, which have broken bands or loose packaging, or which rest on dunnage, should not be block stacked.

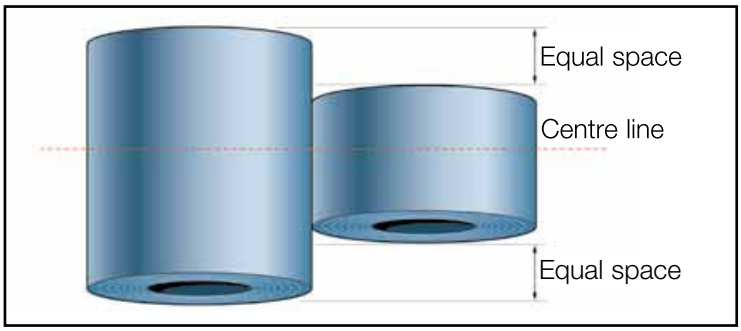


Figure 27 Correctly aligned coils

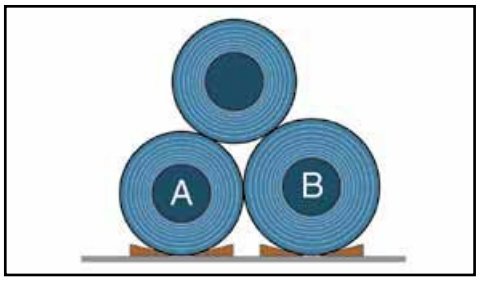


Figure 28 Diameters of coils A and B must not differ by more than 10% to permit two-high block standing

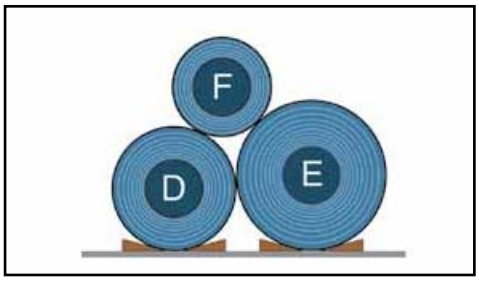


Figure 29 Diameters of coils D and E differ by more than 10% and two-high block-stacking is therefore unsafe, regardless of the diameter of coil F

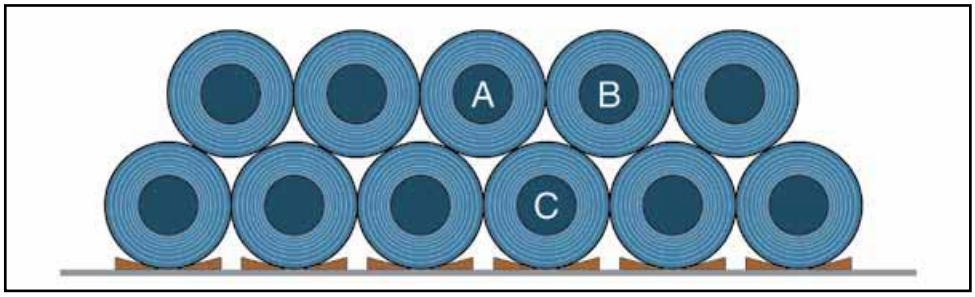


Figure 30 A complete block-stack before any coils have been removed

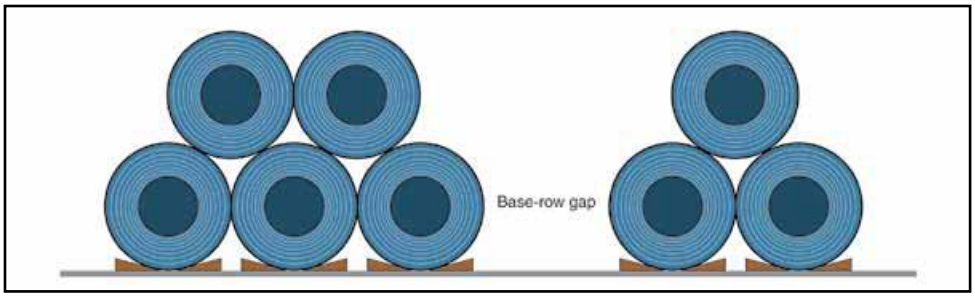


Figure 31 Coils A, B and C have been removed (see Figure 30)

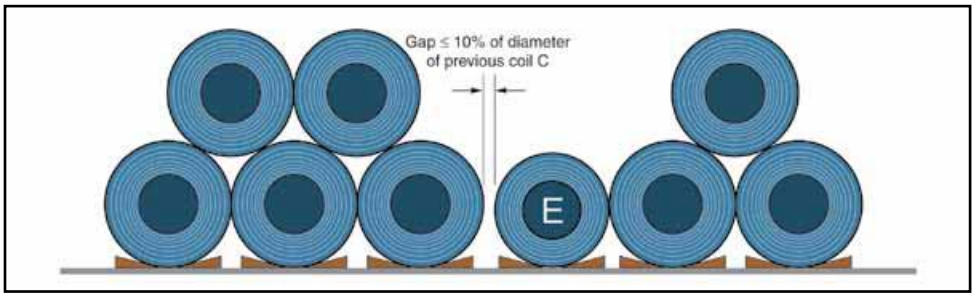


Figure 32 Coil E has been added to Figure 31, properly positioned and chocked. As it leaves a gap which is no greater than 10% of the previous coil's diameter, block-stacking may continue

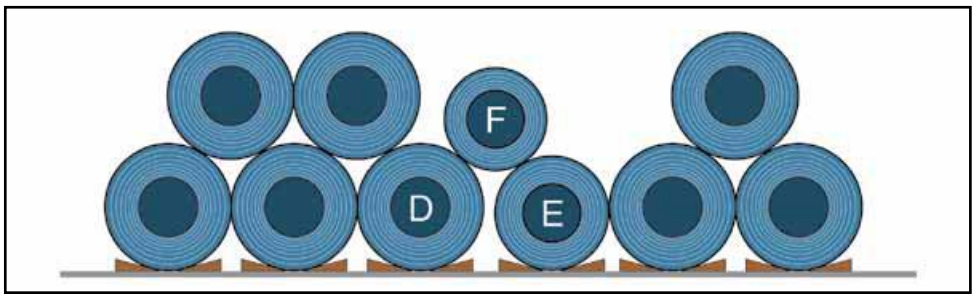


Figure 33 Coil F has been added to Figure 32, creating a block-stack without the need to rebuild the entire stack. However, the diameter of F must not exceed the diameter of D or E

100 Plastic coil supports (see Photograph 25): Coil supports made of recycled plastic can be used to chock (and support) coils. They are often fitted into inverted channels which help to maintain even spacing of coils. Although this system may have a high capital cost when compared to other systems, the supports usually have a long working life and require little maintenance. They are usually easier to use than other systems and may require less supervision. It is essential that frames are constructed so that they:

- hold the supports correctly at a dimension which matches the range of stored coil widths and prevent coils from rolling;
- prevent failed supports from opening and releasing coils;
- have closed ends to prevent supports from being pushed out of the frames;
- allow for the use of blocks between coil supports to prevent them from sliding;
- provide safe means of access (in the form of suitable routes and gangways), so that employees do not have to enter the racks (a gangway should normally be provided on each side of a row of coils);
- allow the use of suitable lifting equipment (including, for example, C-hooks or coil grabs) which allows employees to work from a safe position, so that they are not required, for instance, to enter or reach through a row of coils.

Photograph 25 Broad coil storage in plastic coil supports on floor-mounted inverted metal channels

Supported/racked storage

101 Broad coils are safer when stored supported or racked. Coil support and containment is likely to be necessary when coils are stacked.

102 Coil wells (see Photograph 26): These are depressions in the floor (similar in shape to the coil well in a coil-carrying lorry).

Photograph 26 Concrete coil wells for broad and narrow coils

103 Cradles (chairs) (see Photograph 27): These are supports for individual coils and are usually made from wood. They can be placed in rows to support the base level of a multi-level stack of coils. Sometimes they are banded to the base of a coil. Handling equipment should be suitable and should be attached to the coil itself for the purposes of lifting/handling. Fork-lift trucks can be used to lift cradles which are carrying coils, provided that the cradles themselves are designed to be handled in this way.

Photograph 27
Two-high stacked coils. Bottom row supported on wooden cradles and all coils of same size to improve stability

104 Standing coil racks (see Photograph 28): These can be used to store smaller broad coils or a mixture of broad and narrow coils. The frame must be suitably constructed to prevent coils from rolling into work areas or falling out of the end of the rack. In addition:

- end posts should be fitted. These should be tall enough to prevent coils from falling out of the rack, strong enough to take the force of a maximum loading of coils (intermediate posts may be required to limit the maximum load on an end post) and designed to work with the handling system (for example, there should be an opening to permit the use of a C-hook);
- coils should rest upon suitable supports, for example made of hardwood or plastic, to reduce damage to the coil and the likelihood of coils sliding along the rack;
- safe means of access should be provided in the form of suitable routes and gangways so that employees do not have to enter the racks (commonly a gangway will be provided on **each** side of every pair of racks);
- suitable lifting equipment/accessories should be provided, for example C-hooks, which can be used from a safe distance, to avoid the risk of coils falling onto, and injuring, employees (chains and slings are not recommended because employees have to reach between the coils to attach them);
- regular inspections of equipment should be carried out to identify any damage which should be made good at the earliest opportunity; damaged equipment should not be used (it is advisable to record inspection findings and details of any repairs).

Photograph 28
Mixtures of broad and narrow coils in standing coil racks. good separation of coils, and similar sizes stored together. Tops of horizontal supports capped with hardwood to prevent inadvertent movement

Sheet and plate

105 Plates and sheets are most stable when laid flat. When stacked on edge they should always be adequately supported/restrained in suitable racking which prevents them from falling over and enables safe retrieval of individual sheets.

Free-standing horizontal storage (see Photograph 29)

Photograph 29 Tidy and well-spaced, free-standing floor storage of plate. separation of small quantities of sheet by wooden bearers

106 Battens are used for horizontal plate support and separation, and the gaps between sheets allow access for the use of lifting equipment. Correct positioning of battens is essential. They should be placed above one another in the stack and care should be taken to avoid interleaving between stacks which can cause one stack to collapse when lifting stock from an adjoining stack.

107 Sheet and plate can be stored on suitable pallets (see Photograph 30 and paragraph 85). Care should be taken to avoid material overhanging the pallet edge. Stock should, where possible, be strapped to the pallet to aid safe handling.

Photograph 30 Sheets wrapped and banded onto pallets with no exposed sharp edges

Supported horizontal storage

Pallet racking (see Photograph 31)

108 This can be used for safe storage of stacked pallets of stock. Stability of these racks can be improved by fixing them to floors and walls. However, all racking which can be approached by powered mechanical handling equipment should, as a minimum, be fixed down around its perimeter. All beam-to-upright connections should be secured by locking pins.

Photograph 31 Storage of palletised sheet. Robust racking, stock well supported and contained and no sharp edges sticking out

Supported vertical storage

Toast racks (see paragraph 68 and Figure 9 in Table 2)

109 These can be used for storage of vertical sheets or plates in compartments which prevent sideways movement and allow the removal of individual sheets. Plates should be placed with their base against one upright and leaning against a second upright. All plates should lean in the same direction, be supported by at least two uprights and should not touch plates in the adjacent rack. Larger plates may require purpose-built racking which includes steps and walkways to allow slingers safe access and a safe place of work.

Rules for racking and stacking

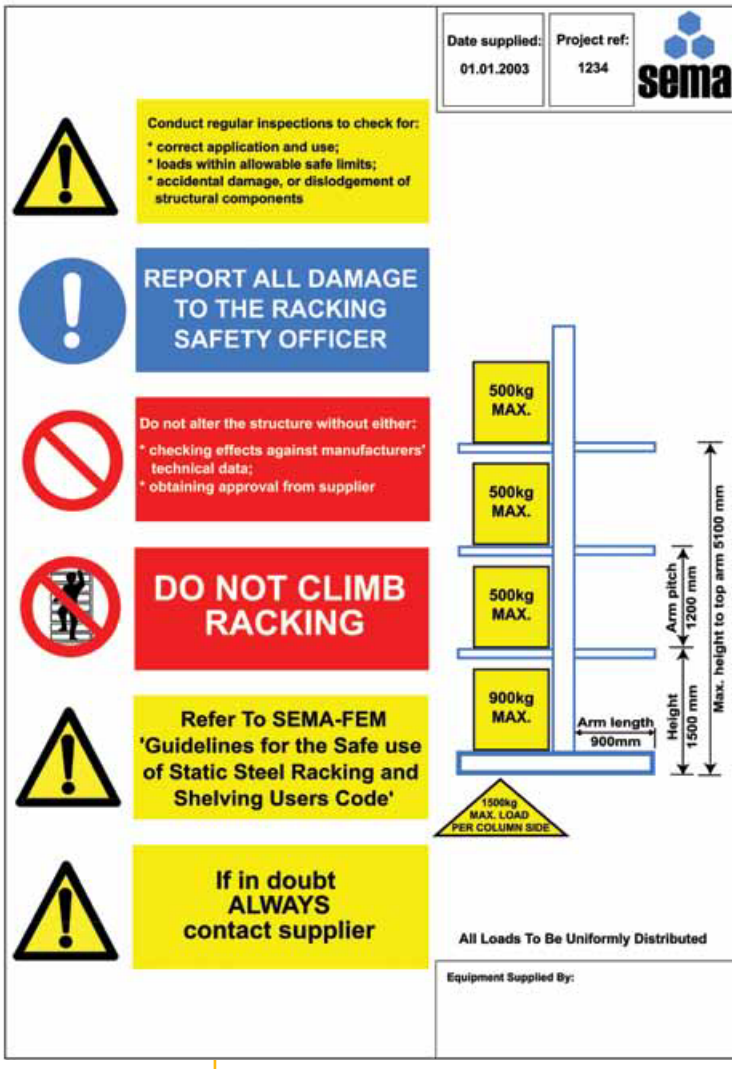
110 Pages 43-46 set out the general rules for safe racking and stacking of material stock:

Rules for safe racking

Racking systems should:

- be fit for purpose, ie designed/sized to accommodate and safely support the maximum anticipated loading and be safe for their intended use;
- be properly and safely installed by trained and competent personnel, for example:
  - a suitable structural survey should be carried out to ensure that the proposed racking system (and anticipated stored material) can be safely accommodated; where the design of the racking requires it to be secured to the building, only those building parts which have been proved by structural calculations should be used and the design of the racking must therefore be compatible with the building/structure layout;
  - double-sided runs should be connected and spaced using suitable run spacers;
  - end uprights may need to be strengthened, if alongside a gangway or pedestrian route, to contain any possible collapse of the racking system;
  - when adjustable pallet racking is installed, beam connector locks should always be securely fixed at the ends of each beam to prevent accidental displacement of the beam, for example by fork-lift trucks;

- highly visible colours for key components of the racking, for example horizontal beams or column guards, will help fork-lift truck drivers position the forks correctly and may help avoid damage;
- be erected on sound, level flooring capable of withstanding the point loading at each base plate;
- incorporate safe means of access for all foreseeable access requirements, for example attachment of lifting accessories, stock-taking etc;
- be securely fixed to the floor and suitably protected from impact damage (the fitting of suitable column guards may help to protect uprights from impact damage from moving trucks);
- be clearly marked with a notice stating its safe working load (SWL) or rated capacity together with any necessary specified load configurations (see example of notice in Photograph 32);
- be properly interfaced with associated handling equipment (for example, aisles should be wide enough to ensure that mechanical handling equipment can be easily and safely manoeuvred and without risk of damage to racking; overhead clearances should be sufficient to permit the safe operation of cranes and lifting equipment);



- be properly used, ie:
  - in accordance with the manufacturer's guidance;
  - within its maximum SWL/ rated capacity;
  - loads should be uniformly distributed across the rack and stored so that heaviest materials are stored lower on the rack than lighter materials;
- not be altered, nor components removed, without confirmation from the manufacturer that it is safe to do so;
- only be used by fully trained/ instructed employees;
- be regularly inspected - it is recommended that records of inspection and follow-up action should be retained (see Appendix 1);
- be maintained in an efficient state and in good repair - damaged components should be repaired/replaced promptly.

Photograph 32 Example of a Safe Working Load (SWL) notice for a cantilever rack

Rules for safe stacking

Safe stacking of free-standing materials requires:

- avoidance of stacking where there is any doubt about a product's inherent stability;
- use of an appropriate stacking system, for example the types of checks or battens used; the stacking pattern and the maximum stack height should be appropriate for the material being stacked, taking account of any likely stack failure modes;
- adherence to safe systems of work, ie those that:
  - minimise the time people spend working within a given stack or passing between adjacent stacks;
  - avoid materials being moved while people are within, or near, the stack;
- safe organisation of storage areas, ie:
  - adequate arrangements should be made to protect people and limit the spread of material in the event of a stack collapse (for example by the use of protected walkways and suitable intermediate/end supports);
  - adequate arrangements should be made to protect stacks from impact damage by vehicles (for example by the use of suitable end supports);
  - safe access should be provided on all sides of a stack to allow for the safe slinging of loads;
- floors to be level and capable of taking the weight;
- safe stack support:
  - each stack should stand on a solid and level surface (for example concrete or railway sleepers), ideally mixed with only one product, and be neat, level and vertical. If products are mixed within a stack, they should be compatible for storage and smaller materials should be placed upon the larger;
  - if battens are used they should be made from square section of a suitable resilient material (so that stacks are always level), placed directly above those in the lower levels of the stack and positioned so that there is no undue bow or sag in the product.

Key questions for employers:

- What is your company's storage system for metal stock and is it appropriate for the types and quantities of stock held (see Table 2 and paragraphs 56-60)?
- Was the stock storage system design based on an appropriate storage/handling plan and is it fit for its intended use (see paragraphs 41-43, 53 and 56)?
- Has all the necessary information about the requirements for safe use of the storage system been obtained from the equipment suppliers (see paragraph 54)?
- Has the storage system been installed in a suitable environment, in accordance with the manufacturer's/supplier's instructions, and in such a way that, in the event of a collapse or failure, product can be contained in the storage area and without employees being put at risk of injury (see 'Rules for safe racking' on page 47)?
- Have employees been fully informed/trained in the safe use of the storage system and the requirements for safe racking and stacking of materials (see paragraphs 198-207, and 'Rules for racking and stacking' on pages 47-49)?
- Are areas of storage racking which are particularly vulnerable to accidental damage, for example from fork-lift trucks and other handling equipment, suitably protected (see 'Rules for safe racking' on page 47)?

- Have arrangements been made for the regular inspection and effective maintenance of the storage system and storage areas, and for completing inspections (see paragraphs 174-178)?
- What is the SWL of the storage racking and is it clearly marked on the racking itself (see 'Rules for safe racking' on page 47)?
- Is the stock handling system(s) appropriate for the storage system used (see paragraphs 40-43)?
- Have the access requirements of employees to the storage system been assessed and are safe means of access and safe places of work provided (see 'Rules for safe stacking' on page 49)?

Key questions for employees:

- What storage systems are used?
- How are they to be used safely and kept safe?
- What would make the equipment unsafe?
- Can you tell if it is damaged or unsafe?
- What are the limitations for use of the storage equipment?
- What are the arrangements for inspection and maintenance of the storage equipment?
- What should be done if the equipment becomes damaged or unsafe?
- When is access needed to storage racks etc, and what for?
- What are the arrangements for safe access?

Handling

111 Stock is handled during:

- vehicle loading, delivery and unloading;
- processing/manufacture.

112 Delivery[21] is the supply of stock from a stockholder up to the point at which the customer accepts responsibility for it. Unloading may, or may not, be part of the delivery. Handling involves both lifting and transporting operations. Handling systems may comprise combinations of mechanical handling equipment designed to interface with a particular stock storage system.

Ensuring safe (un)loading and delivery of stock

113 Many accidents occur during the (un)loading of delivery vehicles, often resulting in serious and sometimes fatal injuries to people in the vicinity. Poor planning and organisation are usually the main underlying causes.

114 All parties involved (ie supplier, haulier and customer) should liaise closely to:

- plan for safe loading;
- plan for safe delivery;
- plan for safe unloading;
- avoid 'barring-off' (see paragraphs 126-129);
- ensure no one is placed in a position of danger;
- provide information to those who need it;
- allocate responsibilities;
- provide safe means of access to, and exit from, vehicles.

Safe loading – Planning[21, 22]

115 Consider:

- stock items to be loaded, for example:
  - type;
  - weight;
  - loose or bundled;
  - whether oil coated;
  - any packaging arrangements;
  - dunnage requirements;
- safe loading procedures, for example:
  - duties of the driver (load securing, load checking etc);
  - who will be responsible for loading the vehicle;
  - how it will be loaded (plan the lifting operations);
  - arrangements for safe access to the vehicle by the driver;
  - arrangements for ensuring the driver cannot fall from the vehicle and be injured;
  - manual handling requirements;
  - supervision arrangements;
- arrangements for securing the load in transit.

116 The use of a simple sketch can help to show:

- how the load is to be set out on the vehicle;
- dunnage requirements;
- load-securing arrangements for safe transportation.

Safe delivery - Planning

117 The terms of the supply agreement between the supplier/haulier and customer, and the roles of the personnel involved, will determine the point at which the customer accepts responsibility for the goods, ie the point at which delivery ends. Planning for safe delivery should cover the delivery process up to this point; it may or may not, therefore, need to include details of the arrangements for safe unloading - but see paragraph 123 in 'Safe unloading - Planning'. Where there is no pre-agreed point of transfer, it may be assumed that the delivery has been completed when the delivery vehicle has arrived at the delivery address, been parked and is available for unloading.

118 The delivery plan should be based on assessment of the associated risks and should take account of:

- type of stock;
- weight of stock components/bundles;
- vehicle capacities and limitations;
- delivery requirements;
- any site access or transport restrictions;
- intended sequence of unloading;
- anticipated system of unloading and type/capacity of equipment required;
- roles and responsibilities of the people involved, especially the driver.

119 Although planning will require prior agreement between supplier, haulier and customer (as to the equipment, procedures and systems that will be used to ensure the load is delivered/unloaded safely), the supplier has overall responsibility for drawing up the delivery plan and should appoint a competent, responsible person, for example a transport manager, transport supervisor, or driver, to do this.

120 In most cases the delivery plan will need to be written down. It will require clear definition of the responsibilities of the various parties involved and delegation of supervisory responsibilities. All parties (ie suppliers, hauliers and customers) should co-operate to ensure that the plan is followed.

121 Straightforward, single-drop, single-product loads may well require only a very simple delivery plan. Other larger, more complex, mixed-product, multi-drop loads may require the preparation of a more detailed plan. The format of the plan is left to individual operators but it should include the information necessary to ensure safety.

122 Changes to the delivery plan should be avoided wherever possible. In the event of unavoidable changes to the arrangements at any stage in the process, a re-assessment should be carried out and the plan amended and updated, preferably by the person who originally prepared it. In particular, the driver of the vehicle or other person on site should not be responsible for making decisions as to (un)loading or load securing methods, unless they are competent and authorised to do so.

Safe unloading - Planning

123 Whether or not it is part of the delivery process, unloading needs to be planned and a safe system of work followed; for example, is appropriate lifting equipment available on site? When a customer places an order for stock, they and the supplier should agree and plan the arrangements for safe unloading. In most cases it is likely to be the customer who is responsible for planning and supervising the safe lifting operations in accordance with LOLER. The driver may be required to assist in preparations for the lifting operation, for example by attaching lifting accessories to the load, but should always move to a place of safety before any lifting operation takes place.

124 Consider:

- where unloading will take place and the hazards (including likely environment and effects of weather);
- what, if any, vehicular access restrictions apply;
- who will be responsible for unloading the vehicle, including duties of the driver;
- how people not involved in unloading (which may include the driver) are to be kept out of danger areas;
- any requirements for the manual handling of stock during the unloading/delivery process;
- access requirements to the vehicle to prepare for unloading;
- how safe access and a safe place of work are to be provided for anyone involved in preparing for unloading;
- unloading arrangements and availability of personnel;
- lifting operations;
- safe system(s) of work;
- supervision arrangements;
- whether there are any other special factors, for example oiled stock may create additional slip hazards.

125 The extent to which the responsibilities for planning the above points apply to each party will depend on the terms of the supply agreement.

Barring-off

126 Levers, for example metal bars, are sometimes used to physically lever stock off a delivery vehicle when small quantities are delivered, or when suitable equipment for off-loading larger items is unavailable. (Drivers also sometimes use their feet, legs or other parts of the body to physically roll or lever stock off vehicles; the safety risks will be similar and the expectations of the law will be the same.)

127 Barring-off has led to a number of serious and fatal accidents. Operators cannot fully control the procedure and are at risk of serious injury when unexpected stock movement occurs on the vehicle or when stock hits the ground and bounces.

128 This can result in:

- the operator falling from the vehicle;
- the operator, or other people, being struck or crushed by moving stock;
- the operator suffering musculoskeletal injury.

129 Risk assessment will indicate that barring-off is too risky and that a safer alternative means of unloading should be used.

Information

130 Certain information is essential for staff doing the (un)loading and for the driver. For example, the driver may need to know:

- delivery address;
- load and load components;
- instructions to be followed upon arrival at the delivery point;
- site transport restrictions, for example speed limits, reversing constraints, danger areas;
- details of safe unloading procedures, to include for example:
  - where the vehicle will be unloaded;
  - who will be responsible for supervising the unloading of the vehicle;
  - who will be responsible for unloading the vehicle;
  - drivers' duties in respect of the unloading process (see paragraph 132);
  - setting up of exclusion zone round vehicle **before** unloading;
  - hazards for the driver and other people;
  - unloading sequence;
  - safe system of work and equipment to be used;
  - arrangements for safe access to the vehicle/load for attachment of lifting equipment;
  - any manual-handling requirements.

131 The written delivery plan can help to provide much of the above information.

Responsibilities

132 Many incidents occur during stock delivery; drivers are very often injured because they do not stay well clear of lifting operations and moving fork-lift trucks during (un)loading. Roles and responsibilities, in particular those of the driver, should be clearly defined. For example, is the driver responsible for:

- unsheeting the load?
- checking the load prior to unloading?
- taking agreed action in the event of a load being unsafe to unload?
- supervising the unloading?
- slinging stock for lifting?
- carrying out the unloading?
- setting up the exclusion zone around the vehicle?

Safe access up to and down from the vehicle

133 Falls from vehicles/loads can result in serious injuries and fatalities; even low falls have the potential to cause fatal injury.[23, 24] Falls may arise from:

- slips or trips;
- sudden movement of materials;
- unsafe means of access for climbing onto, and getting down from, the vehicle or load.

134 Only those people who need to access the vehicle for (un)loading or (un)sheeting purposes should be allowed onto it, and then only if it is absolutely necessary and in accordance with a safe system of work.

Keeping (un)loading areas safe

135 Remember:

- the need for people to climb onto vehicles or their loads should be avoided as far as possible. Where it is unavoidable, effective measures should be taken to provide safe means of access and prevent falls. These can include use of loading gantries or mobile safety steps (see Photograph 33). Elsewhere, safety nets have been successfully used in (un)loading areas to reduce the risk of injury in the event of a fall from a vehicle; chains can be fitted around trailer beds to prevent falls;

Photograph 33 Safe access to vehicle bed using mobile safety steps. Pedestrian exclusion zone alongside vehicle clearly marked

- the role of the driver should be clearly defined and they should be instructed and trained to ensure that they do not enter danger areas during (un)loading or lifting operations;
- when fork-lift trucks are moving or being used for (un)loading, everyone other than the operator should be kept in safe positions well away from the trucks;
- a clearly defined ‘exclusion zone’ should be established around vehicles being (un)loaded, with access only for those people doing the (un)loading. It is suggested that the size should be based on a distance equal to the height of the load above ground, plus an additional allowance dependent on the nature of the load, for example its potential to bounce or roll. If pedestrians or unauthorised people need to enter the zone, (unloading operations should be temporarily stopped;

- (un)loading on the roadside should be avoided wherever possible. Where it cannot be avoided, the additional risk from moving vehicles should be assessed as well as any risk to members of the public from fork-lift trucks, moving materials etc. Safety can be improved by:
  - fitting load-restraint tension-adjusters to be operated from the nearside of the vehicle, which avoids the need for the driver to stand in the road to adjust them;
  - checking the condition of road surfaces to make sure they are level and free from potholes;
  - protecting members of the public and their rights of way, without diverting them into traffic routes;
  - ensuring adequacy of lighting, warnings, temporary barriers etc, especially during hours of darkness;
- check use of mirrors, audible alarms, banksmen etc in reversing areas;
- roadways and loading/unloading areas may need to be cleared/salted in winter to remove ice/snow.

Rules for safe delivery and unloading

Note that:

- suppliers and customers should agree in advance the arrangements needed for safe delivery of stock, and the supplier should prepare a written 'delivery plan';
- the agreed plan should be followed and supervised;
- an exclusion zone should be created round the vehicle before unloading begins;
- wherever possible, the vehicle should be loaded in such a way that there will be no need for anyone to climb onto it to unload it;
- when preparing for unloading, the load should be inspected from the ground by someone competent to do so, to ensure it is safe to unload;
- everyone should remain in a position of safety which is well clear of lifting operations taking place, or moving vehicles;
- where it is necessary to access the vehicle or load (for example for attaching lifting equipment), a safe means of getting on and off should be provided and effective measures taken to prevent falls;
- the bed of the vehicle should be sound and free from loose material such as dunnage (to avoid tripping hazards);
- no one should ever jump on or off the vehicle bed;
- alternative means of unloading to barring-off should be sought in all cases.

Key questions

Have the following been checked:

- stock (un)loading/delivery is properly planned (see paragraphs 115-125)?
- staff (un)load stock in accordance with those plans?
- designated (un)loading areas are safe?
- suitable lifting/handling equipment is available for safe (un)loading, and used?
- lifting equipment is properly maintained and checked before use?
- the requirements for access to the vehicle during (un)loading have been assessed and safe means provided?
- vehicle (un)loading is properly supervised?
- (un)loading takes place in designated areas and in a safe environment?
- no barring-off of loads takes place (see paragraphs 126-129)?
- no one can be injured by moving material or handling equipment during vehicle (un)loading?
- drivers are safe during delivery and (un)loading?
- exclusion zones are set up around delivery vehicles (see paragraph 135)?
- door openings to storage area are wide enough to get stock through?
- road surfaces are in good condition?
- materials are subject to the minimal amount of handling between delivery and storage?
- all these arrangements are monitored to ensure that they are followed?

Checking stock processing/handling systems are safe

136 Ensure that:

- they are safe by design and properly used;
- banding is handled safely;
- safe lifting operations are planned.

System design

137 Handling systems should be designed to:

- allow those using them to work in safety at all times; for example employees should be able to attach lifting equipment from a safe position and stand in a safe position away from the load during lifting;
- avoid the need for loads to be raised above head height wherever possible;
- avoid the lifting of loads over personnel;
- avoid the need for employees to enter danger areas (to attach slings etc) or reach between unstable or poorly supported materials;
- minimise the number of times the product is handled;
- minimise the need for manual handling of the product;
- use the correct lifting equipment and accessories for the product type.

Banding (see Photograph 34)

138 Banding is intended to keep the load intact; it is not an aid to lifting stock. Handling loads by their banding is likely to damage the banding, with a greatly increased risk of its failure and collapse of the load (see Figure 34). The sharp edges of banding are a hazard with a significant risk of injury from cuts. Remember:

- loads should never be lifted by their banding;
- tension in the banding may cause it to spring back suddenly when cut, posing an additional risk of injury in the event of unexpected breakage or during splitting of bundles;
- hands, arms and face may be at particular risk and, where necessary, appropriate PPE should be provided;
- waste banding materials should be removed as soon as possible after breakage or cutting and placed in a suitable container, for example a waste skip or bin.

Photograph 34 Damaged banding wire suggests that it was being used to lift the bundle

Figure 34 Collapse of bundle being lifted by banding. Loads should not be lifted by their banding nor over people working below

SAFE STORAGE AND HANDLING PRINCIPLES

Storage systems
These should be properly designed, fit for purpose and have their safe operating limits clearly defined. They should be designed to provide safe access for all foreseeable requirements and to interface with the intended handling systems. They should take account of stock stability; for example long, narrow products are more stable when laid on their sides and therefore horizontal storage and handling systems are preferable to vertical ones.

Stock levels
Storage systems should not be operated beyond their design capacity. The maximum tonnage/ quantity of stock that can be safely stored should be known, and different parts of the organisation (sales, purchasing, warehousing etc) should co-operate to ensure that overstocking does not occur. There should be systems in place for monitoring stock levels (by regular inspection/audit) and arrangements should be made to store excess volumes safely in emergency or overflow stores.

Containment
Storage systems should be properly designed to contain product within the storage area and prevent stock from falling into gangways or parts of the workplace. All materials should be suitably contained/restrained to prevent unexpected movement.

Lifting and handling
Only lifting equipment that meets the requirements of the Lifting Operations and Lifting Equipment Regulations 1998 (LOLER) should be used. Bundles should not be lifted by the banding material. All lifting operations should be planned and supervised. Equipment must be regularly examined and properly maintained.

Load marking
Clear markings and notices should be used to indicate weights of products.

Safe access
Adequate means of safe access, suitable and properly maintained floors/ walkways and safe gangways should be provided to allow employees to work in safety. When used by pedestrians, gangways should be at least 800 mm wide and door openings should be wide enough for fork-lift trucks/loads. Vehicles and pedestrians should be kept apart.

Safe place of work
Lifting and handling equipment should be designed, so far as is reasonably practicable, to allow employees to work (for example to sling and handle loads) from a safe position (such as a gangway). People should not be required to climb up onto, or walk on, stacked stock or storage racking.

High-risk areas (for example loading and unloading, stock receiving, stock storage, order preparation, process, despatch) should be clearly defined and unauthorised people kept out.

Splitting of bundles
During order picking it may be necessary for bundles to be broken down into smaller amounts. Bundles should not be split at height, nor when stored in a normal storage rack. Splitting should only be done in a safe place at ground level, or in a restraint/cradle/rack designed for the purpose.

Delivery plans
Stock deliveries should be properly planned and details passed on to all relevant staff. All parties (eg suppliers, hauliers and customers) should co-operate to ensure that the plans are prepared and implemented by trained, competent staff. Employers should ensure the health, safety and welfare of drivers delivering to their premises.

Manual handling
All manual handling of stock should be subject to a risk assessment and avoided wherever possible.

Housekeeping
Good housekeeping is essential in the prevention of slips, trips and falls. Floors should be kept free of banding wire, wood and general waste. Waste banding wire can be razor sharp and should not be left in racks or gangways.

Lifting operations

139 Handling involves routine and one-off lifting operations subject to the Lifting Operations and Lifting Equipment Regulations (LOLER).[3] Lifting operations must be:

- planned by a competent person;
- supervised;
- carried out in a safe manner.

How to ensure lifting operations are safe

140 Lifting operations should be planned after analysis of the hazards and assessment of the risks. In particular:

- lifting appliances and lifting accessories must be suitable for the task;
- adequate information should be obtained from the equipment manufacturer to enable the user to know how to use and maintain it safely;
- safe working loads must not be exceeded;
- safe systems of work must be followed, for example to avoid the need for employees to enter danger areas (to attach slings etc) or to reach between unstable or poorly supported materials;
- a safe place of work must be provided - for example, anyone attaching lifting accessories to stock ('slinging') must be able to do so in safety and must be in a safe position when the load is lifted;
- banding wire or straps should not be used for lifting stock;
- suitable dunnage/bearers should be used to separate load components and give sufficient clearance for safe attachment of lifting accessories;
- any person using lifting equipment must be trained, instructed, informed and supervised to ensure it is properly used and lifting operations are carried out safely;
- cranes should only be used for vertical lifting (not to pull or drag stock out of storage racking, as the excessive loads can damage the crane and/or racking);
- raising loads above head height should be avoided wherever possible;
- wherever practicable, loads should not be carried or suspended over personnel; if the work cannot be carried out any other way, then appropriate protective measures must be ensured;

- lifting equipment (both fixed and mobile) should be designed, installed and used in such a way that the operator and anyone else are in **designated positions of safety** where they are not at risk either of being struck by the lifting equipment, by the load being lifted, or by falling material in the event of equipment or load failure (see Photograph 35).

Photograph 35 Safe operating procedures for lifting narrow coil from standing coil rack using C-hook. Coils banded together to improve stability

141 The risk assessment should show that there is a need for the provision of PPE (for example head protection, safety footwear, or gloves) for operators and other people in the vicinity of lifting operations.

Which lifting equipment and accessories are appropriate?

142 Because of the variety of shapes and sizes of metal stock a wide range of lifting equipment and accessories is available. All lifting equipment and accessories must be:

- suitable, ie 'fit for purpose' and clearly marked with their SWL;
- examined by a competent person, at prescribed regular intervals (see Table 3, page 75) and/or in accordance with a scheme of examination;
- maintained so that they are safe for use.

Lifting equipment

Cranes[25, 26]

143 Several types are used in stock-lifting operations.

Overhead travelling cranes (see Photographs 36-38)

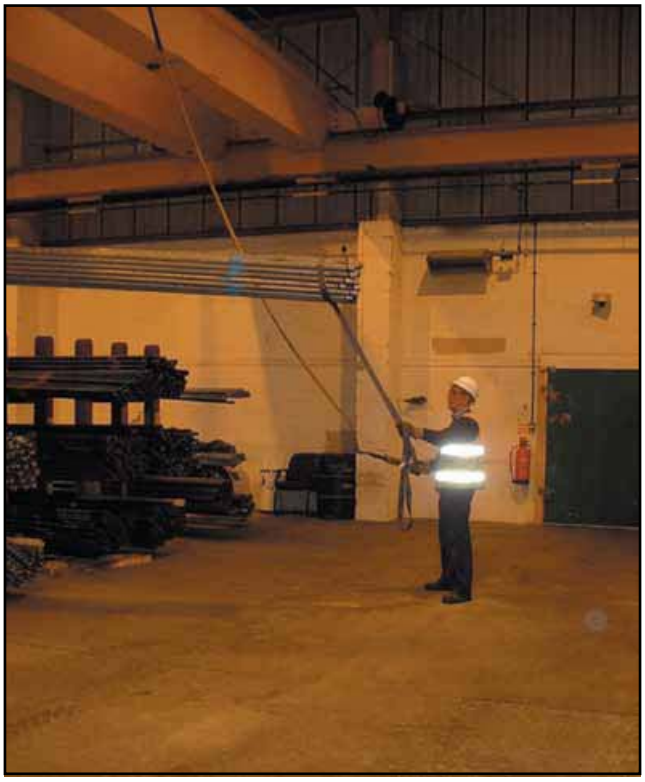
144 When used to lift long, narrow product, twin-hoist cranes can greatly reduce the need for slingers to enter storage racks or climb and walk on stored product, particularly if there is access to both ends of the stock (see Photographs 36-38). They may be fitted with infra-red or radio-controlled operating devices to enable operators to stand further from the load than when using a conventional pendant. With single-hoist cranes the large size and shape of most stock may necessitate the use of accessories (such as spreader beams) for safe lifting.

Photograph 36 See also Photographs 37 and 38. Use of twin crab crane for lifting long product. Each crab operated independently and remotely. Load inclined by outermost crab

Photograph 37 See also Photographs 36 and 38. Inner crab's lifting chain moved towards the opposite end

Photograph 38 See also Photographs 36 and 37. Crabs linked together to effect horizontal lift out of racking. Crane operator at a safe distance in protected gangway throughout

145 The use of ‘tag lines’ can assist the safe manoeuvring of loads during lifting (see Photograph 39).



Photograph 39 Bundle of long product being lifted by overhead crane. Operator in a safe position using a ‘tag line’ to manoeuvre it into position

Vehicle-mounted cranes
146 These are used for (un)loading stock from and onto delivery vehicles. However, because of differences in operation, it should not be assumed that people trained to use other cranes will necessarily be competent to use vehicle-mounted ones.

Swing jib cranes
147 Normally pendant operated, they are used for diverse operations including loading stock onto vehicles or machinery.

Mobile cranes (for example lifting gantries)
148 These are often used for coil handling (for example to up-end small narrow coils to enable handling by fork-lift truck) and in external storage yards.

Fork-lift trucks[27]

149 Fork-lift trucks are widely used for lifting and moving stock. They come in a variety of sizes and types (either rider- or pedestrian-operated), the counterbalanced truck being the most commonly used. Smaller electric trucks are best suited to indoor use, larger diesel-powered trucks for outdoor use. Fork-lift trucks have been involved in many serious accidents. Common causes include:

- inadequate training of operators;
- inadequate segregation of moving trucks from pedestrians;
- failure to use an appropriate type of truck, for example use of rider-operated trucks where pedestrian-operated ones would have been safer;
- use of fork-lift trucks when other lifting/handling equipment (for example cranage) could be safer, such as for very long stock;
- lack of maintenance;
- exceeding the safe working limitations of the truck;
- doorway openings too small to allow unimpeded travel of the truck and its load;
- unsafe use, for example suspending long product by sling or chain from just one of the forks of a counterbalanced truck to allow it to be manoeuvred by a pedestrian walking alongside the truck;
- failure to use appropriate type of lifting accessory;
- failure to use lap restraints where they have been required;
- unsafe working environment (for example holes in roadways or uneven ground surfaces, poor visibility, inadequate traffic routes, inadequate working space, obstacles to vehicles moving freely).

150 The side-loader truck (see Photograph 40) is widely used for handling long product. It can be used for (un)loading cantilever racks and some toast racks, stands or long product stillages. The driver is protected by the cab during lifting and handling.

Photograph 40 Use of a side-loader lift truck for handling long, broad product

151 A range of specialised accessories is available for use with fork-lift trucks enabling them to be adapted for safe handling of a wide range of stock. An assessment should always be made to ensure that appropriate accessories are fitted. Operators should understand the limitations of their trucks (and any accessories) and should not exceed them. Examples of accessories include:

- multi-fork extenders - to improve safe handling of long product (eliminates 'droop' over the fork sides) (see Photograph 41);
- poles - in place of forks for coil handling;
- load clamps.

Photograph 41 Side-loader lift truck fitted with four-fork attachment for carrying long, narrow product. Prevents product sagging over sides of forks

152 Banding of long product makes it safer to handle. Palletisation and strapping also improve load safety.

Lifting accessories

153 There is a range of accessories available for use with different types of stock, including:

- long product/miscellaneous;
  - chains/slings;
  - fish plates (for H-sections) (see paragraph 79);
  - magnets (see paragraphs 155-160);
  - 'splitters' for angled sections (see paragraph 79);
  - various fork-lift truck attachments (see paragraph 151);
- coil:
  - C - hooks (see paragraphs 161-162);
  - vertical lifting 'tongs';
  - telescopic coil lifters (see paragraph 163);
  - coil turn-over units (see Photograph 42);
  - horizontal coil lifters (see paragraph 164);
  - crane-mounted up-ending grabs;
- plate/sheet:
  - clamps (see paragraph 166);
  - magnets (see paragraphs 155-160);
  - sheet lifters (see paragraph 167);
  - vacuum lifters (see paragraph 168).

Photograph 42 Unit for turning coil from bore-vertical to bore-horizontal (and vice versa)

Long product handling and miscellaneous accessories

Chains/slings

154 These contribute to safe lifting because the operator can stand at a safe distance once the slings have been attached to the load. Where someone has to access stock to attach slings, the risk of falls from height must be assessed and suitable precautions taken to prevent it. The use of chains and slings to up-end smaller coils is not recommended because employees have to reach between coils to attach them; coils can then fall and cause injury. Alternative equipment, such as C-hooks, is safer. Some slings are designed for restricted use ('once only' slings); these should be used and discarded in accordance with manufacturers' instructions. All chains and slings should be properly stored when not in use.

Magnets/magnetic cranes (see Photograph 43)

Photograph 43 Magnet lifting equipment for broad, long product. Personnel-free area where magnets are being operated

155 Electromagnets in the form of a single magnet or a group of magnets suspended from chains or wires or attached to lifting equipment in another way can be used for lifting and transporting steels and most ferrous materials. There are two types of electromagnetic crane:

- those in which the magnets are an integral part of the crane;
- those where the magnet can be taken on and off the crane.

156 Where they can be taken on and off the crane, the magnets are deemed to be **lifting accessories** within the meaning of the Supply of Machinery (Safety) Regulations 1992 (as amended)[28] and are subject to LOLER.[3] Where the electromagnet is an integral part of the crane it should be assessed as part of the lifting equipment itself. Subject to completion of a risk assessment and certain rules (see below) being followed, they can be used to lift individual plates, sheets or bundles of stock.

157 Magnetic lifting devices should not be treated as general-purpose pieces of lifting gear, as they have been designed to suit particular types of load and environment. Before magnets are used for lifting, the risk assessment should consider the following:

- magnetic properties of the stock;
- load weight, thickness, shape and area in contact with the magnet;
- surface texture (ie presence of scale, oil etc) and finish (ie rough or smooth) of both stock and magnet;
- stiffness or flexibility of the load;
- capacity of any banding material (on bundles) to withstand imposed stresses, for example from hoisting and swinging of the load:
- temperature of the magnet and load;
- designation of danger areas from which personnel are to be excluded.

158 For controlling bundled product, appropriate risk control measures should be in place to protect people, plant and equipment from the risk of falling material. As only the top sections within the bundle are likely to be sufficiently magnetised to enable safe lifting, poorly magnetised sections will fall away if the banding material fails during a lift. The load should never be lifted by any banding wire straps. Any banding/strapping and jointing clips must be 'fit for purpose' and of adequate strength, and their SWL known.

159 When handling long product with a single magnet, it is possible for the weight of the product to cause it to bend and peel away from the magnet. The reduced contact area between the magnet and the load may reduce the magnetic attraction to such an extent that the load falls off.

160 Where magnetic lifting devices are used, safe working practices and safe operating procedures should be prepared and kept readily available for each type of material. The following should be considered in addition to the general guidance for safe lifting (see paragraph 140).

Additional rules for the safe use of magnets

You should:

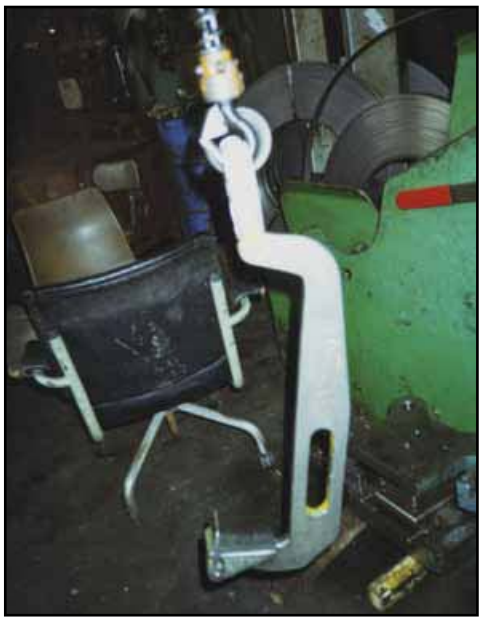
- provide suitable warning devices and indicators, for example to show if the magnet is energised or operating at a reduced power level;
- except for permanent magnets, provide an auxiliary electrical supply which comes into operation automatically on failure of the mains and provides power for at least 20 minutes. Fit power-failure warning devices to both the mains supply and stand-by equipment and ensure that the system is not capable of being energised if the stand-by equipment is below the required power level;
- when they are attached to a crane, include the weight of the magnet and its accessories for assessing the load carrying capacity;
- never exceed the SWL. Where more than one magnet is used, the applied load on each magnet should not exceed that magnet's SWL;
- ensure that there is good contact between the surfaces of the magnet and the load. Magnetic efficiency could be affected by surface contamination;
- assess the risks involved before allowing the load to jump up onto the magnet at the start of lifting. One way to avoid loads jumping onto magnets is to gently lower the de-energised magnet onto the load and, after the power has been switched on, allow it to settle for a few seconds to allow the magnetic field to reach its full strength;
- where possible, magnets should only be used for lifting single items. Where it is necessary to lift more than one item, fully assess the risk of those items which are not in direct contact with the magnet becoming detached/peeling off;
- display warning notices at entrances to places where magnetic lifting is taking place;
- prevent unauthorised access into 'lifting zones', especially at automatically controlled processes. Provide operators with safe places of work and ensure that they cannot be struck by displaced loads, for example reinforced crane cabs;
- never transport a loaded magnet where there is a risk of injury to anyone should the load or part of it fall off. All movements of materials should be properly organised and managed to prevent injuries and damage to plant and key services. Travel routes should be clearly defined and maintained;
- transport loaded magnets at the lowest height possible, where practicable no higher than 1.5 m above ground level. Where this is not practicable, other precautions should be considered;
- de-energise the magnet when not loaded and never leave a load hanging in the air. Magnets should also be de-energised before being unplugged to prevent a high back EMF being generated when they are switched off;
- assess dangers of access to backs of vehicles, for example to trim the load, where magnet lifts are used for loading lorries;
- prepare arrangements for dealing with emergencies, for example action to be taken in the event of power/equipment failure, displaced loads etc;
- note that people with particular types of body implants, both active and passive, for example heart pacemakers, insulin pumps, plates etc, may be affected by the magnetic field around the magnet. Possible interference on plant and controls should be properly assessed.

Coil-handling accessories

C-hooks (see Photograph 35 and paragraph 140)

161 These:

- are versatile and can be shaped to handle large or small and single or multiple coils;
- allow coils to be handled without the need for anyone to place their hand(s) between adjacent coils;
- are often used to handle coils on horizontal supports; there should be gaps in the top surface of the support to allow safe positioning of the hook;
- can be adapted, by the fitting of a hinged flap to the lip of the hook, to lift a single coil lying on the floor safely into a standing position (and vice versa) (see Photograph 44).



Photograph 44 Hinged safety lip on end of adapted C-hook to prevent narrow coil from falling off

Photograph 45 Telescopic coil lifter for lifting broad coil

162 Double C-hooks can be used to lift larger coils, and pivots can be provided to enable coils to be rotated during the lift.

Telescopic coil lifters (man-saver or double acting grabs) (see Photograph 45)

163 These are sophisticated coil-handling machines which allow control of the lifting operation from a safe distance.

Horizontal coil lifters (see Photograph 46)
164 These come in a variety of forms and are used to lift and place coils which are lying horizontally or eye-to-sky. They can be designed to grip the inside of the bore of the coil, or the outside, or the inside and outside simultaneously.

Photograph 46 Horizontal coil lifter raising narrow, bore-vertical coil

Crane-mounted up-ending grabs
165 These can be used to lift, place or up-end coils safely.

Plate/sheet handling accessories

Clamps
166 Some designs only allow lifting of plates which are lying down horizontally, others only plates which are standing vertically; few clamps can lift plates in both planes. Lifting in the wrong plane can result in serious injury (see Figure 35). Because clamps rely on gripping pressures to hold the plate, anything which may reduce that grip (for example rough surface finishes, loose surface scale or oily surfaces) should be avoided. Furthermore, it is not advisable to lift a plate using only a single plate/sheet clamp. The manufacturer's guidance on operating criteria should always be followed; this will include, where relevant, permissible plate thicknesses, including both minimum and maximum thicknesses, rated capacity and SWL. Where vertical plate clamps operating by friction are used, a minimum SWL should be established.

Figure 35 Struck by falling material after failure of plate clamp. Loads should not be moved over people working below. Plate clamps should be maintained and properly positioned

Plate lifters (see Photograph 47)

167 These are comprised of simple hooks that reach under and support each side, or all four corners, of the plate. The rated capacity should not be exceeded and the height of stack lifted should not exceed the height of the lifter's upright, or vertical, section. The maximum height of stack that can be safely handled should be indicated on the plate lifter.

Photograph 47 Plate lifter

Vacuum lifters[29]

168 These can be used to lift individual plates but cannot be used to lift porous materials. Where they are used:

- the manufacturer's specific instructions for safe use must be followed;
- vacuum pad layouts and working limits should be matched to the intended loads;
- automatic warning devices, which warn of a mains power failure, should be fitted.

169 Vacuum pads are separate lifting accessories within the meaning of the Supply of Machinery (Safety) Regulations 1992 (as amended)[28] and should provide a factor of safety of at least four times the SWL under conditions specified by the manufacturer to ensure that the pads can withstand the stresses in use.

Specialised attachments

170 A range of specialised lifting attachments are available for use with overhead travelling cranes used in specific applications. Photograph 7 (page 24) shows an overhead crane adapted for use with a cantilever rack.

Storage of lifting accessories

171 Many lifting/handling accessories are themselves very heavy; in the past, serious accidents have occurred when free-standing attachments, such as large C-hooks, have fallen over and crushed personnel. All lifting and handling accessories should be safely stored when not in use, to prevent accidents and avoid the risk of damage (see Photographs 48-50).

Photograph 48 Storage frame for C-hook. NB: Lifting chain lying on the floor constitutes a tripping hazard

Photograph 49 Storage frame for heavy C-hook clearly marked with Safe Working Load (SWL)

Photograph 50 Storage rack for lifting attachments

Key questions for employers

Have you:

- identified your lifting operations and appointed someone competent to plan them (see paragraphs 139-141)?
- provided appropriate safe lifting equipment and handling systems (see paragraphs 136, 137, 140)?
- obtained the necessary information regarding safe use of your handling/lifting equipment and instructed and trained your employees?
- instructed your employees to check lifting equipment before they use it?
- instructed employees not to lift or handle bundled material by the banding (see paragraph 138)?
- ensured that loads are not lifted above head height nor over personnel, wherever possible?
- marked all lifting equipment with its SWL and arranged for its regular thorough examination and inspection?
- ensured that all internal stock-handling operations are adequately supervised?
- made handling arrangements to minimise the need for manual handling of stock?
- identified danger areas and made arrangements to keep people out of them and to allow employees to work in a position of safety at all times?
- made arrangements for the safe storage and handling of lifting accessories (see paragraph 171)?
- trained all fork-lift truck operators?
- assessed the range of stock-handling operations to be carried out by fork-lift trucks and provided appropriate accessories (see paragraph 151)?

Key questions for employees

Do you:

- understand the hazards and risks in your stock-handling work?
- know the capabilities and limitations of the lifting/handling equipment you use?
- check all lifting equipment for safety before you use it?
- avoid lifting stock by its banding?
- make sure that everyone, including yourself, are in positions of safety when you lift or move stock?
- use the proper lifting accessories for the stock you handle?
- store lifting accessories safely after you have used them?
- avoid lifting stock above head height or overhead whenever it is unsafe to do so?

Inspection and maintenance of equipment and systems

Why are inspection and maintenance important?

172 Storage racking and handling systems must be maintained in an efficient state and in good repair. As equipment can quickly be subject to significant wear and tear even with the most careful use, a comprehensive programme of periodic inspection and targeted, preventive maintenance is essential. Inspection programmes should always be carried out by trained, competent personnel and should cover:

- inspection before first use;
- routine (ongoing) inspection.

173 Defective equipment should immediately be taken out of service and either repaired before re-use, or replaced.

What should be inspected?

Work equipment

174 All work equipment should be inspected. Inspection programmes, based on the recommendations of equipment manufacturers/suppliers and appointed 'competent persons' should cover:

- all lifting equipment and accessories;
- storage racking (for example for broken, missing or damaged components);
- access equipment;
- floors, guard rails, barriers, safety and SWL notices;
- storage equipment for lifting attachments.

Work systems

175 Systems of work should be periodically checked to ensure that they are in fact safe and to verify that the information, instruction, training and supervision provided for staff is adequate and effective. Examples of systems that should be checked include:

- use of delivery plans;
- systems of work for (un)loading delivery vehicles;
- stacking systems for stock and loads;
- usage of storage systems, for example compatibility with materials being stored;
- SWLs not being exceeded;
- systems for storing lifting accessories safely;
- use of storage and handling systems across the range of requirements.

When should these be inspected?

Before first use

176 Before being taken into use for the first time, or after dismantling and reassembly, equipment should be thoroughly examined to ensure that it is safe for use. Inspection should ensure that it has been correctly installed and is fit for its intended use. Similarly, newly introduced systems of work should be checked early on in their use.

Routinely when in use

177 The management of work equipment and systems should ensure that potentially dangerous situations are readily identified and dealt with quickly and effectively. Regular inspection is needed to ensure that work equipment and systems continue to be safe to use. This should include periodic checks, in accordance with the manufacturer's instructions, as well as statutory thorough examinations. For example:

- operators should check equipment for safety each day before they use it. For instance, they should carry out visual checks of lifting accessories (such as chains, slings and ropes) every time these are taken from the stores for use, and operators of fork-lift trucks should carry out a series of checks on their vehicles every shift;[27]
- weekly or monthly visual inspections should be carried out by a line manager or another appropriate person;
- statutory thorough examinations or inspections should be carried out by competent persons.

Table 3 (see page 75) summarises mandatory and recommended inspection frequencies for different types of equipment.

Table 3 Mandatory and recommended inspection frequencies for key equipment/ systems

Item	Examination/inspection frequency
Lifting equipment, eg cranes	Daily before use by operator and other checks in accordance with manufacturer's recommendations Thorough examination/inspection at least annually or in accordance with schedule prepared by competent person
Lifting accessories, eg: chains; slings; ropes; fork-lift chains; vacuum lifting attachments; magnetic lifting attachments	Daily before use by operator and other checks in accordance with manufacturer's recommendations Thorough examination/inspection at least six-monthly or in accordance with schedule prepared by competent person
Racking systems (including SWL notices etc)	Daily before use by operator and weekly/monthly visual inspections Thorough inspection at least annually
Access equipment. eg mobile saftey steps	Daily before use by operator and monthly visual inspections
Floors; guide rails; barriers	Daily before use by operator and regular visual inspections
Correct use of storage systems	Daily before use by operator and monthly visual inspections
Safe storage arrangements for lifting attachments	Daily before use by operator and monthly visual inspections

How should the inspection findings be recorded?

178 Records may be written or stored in electronic format (provided they are protected from interference and recoverable when needed). They are essential management tools for:

- cost-effective targeting of maintenance;
- training;
- supervision;
- work planning;
- risk control.

179 An example of a racking inspection report is given in Appendix 1.

Manual handling

Why is manual handling of stock hazardous?

180 Because of the size, weight and shape of most metal stock, manual handling will often involve a significant risk of musculoskeletal disorder (MSD). Statistics collected by the industry suggest that over a half of all accidents within steel stockholding happen as a result of a handling operation. Transport, storage and handling systems must therefore be planned, designed and installed to eliminate the need for high-risk manual handling operations wherever possible.

181 MSD from metal stock handling is most likely to be caused by:

- high levels of force (for example when pulling materials out of racks);
- difficult manual handling tasks;
- too much bending, stretching or physical effort;
- poor working posture.

182 In addition, there may be a significant risk of crushing (primarily fingers, hands and feet), or other injury, caused by unexpected movement of material during manual handling.

What needs to be done?

183 Firstly, the Manual Handling Operations Regulations[30] require employers to avoid hazardous manual handling operations wherever possible, for example by mechanisation or providing a safer system of work. Where such operations cannot be avoided, employers should work with their employees to:

- assess the risk;
- make sure that employees know the risk and how to control it;
- determine ways of reducing the risk of injury so far as is reasonably practicable;
- review assessments as and when appropriate.

What operations should be assessed?

184 The assessment should cover the full range of manual handling operations, where there is risk of injury. This will include the majority of situations in which stock is handled. The risk will be increased by:

- the handling of particularly heavy stock;
- holding loads away from the body;
- long carrying distances;
- strenuous pushing or pulling;
- twisting, stooping, or reaching upwards;
- sudden movement of the load;
- the handling of unstable loads or those likely to shift;
- loads that are difficult/awkward to grasp;
- the handling of sharp edges;
- working in awkward environments (for example where there are space constraints, uneven or slippery floors, variations in floor levels, work out of doors or where lighting is poor).

185 The main areas of risk in stock handling are the (un)loading of stock from/onto vehicles and storage systems. Some loads, such as small, compact amounts of lightweight stock (for example aluminium) may be suitable for manual handling. If so, these should be identified in delivery plans. Material should only be handled manually if this can be done safely, bearing in mind the need for safe access, the working environment and the capability of the operator. If manual handling is necessary, the delivery plan should specify the precautions to be taken to reduce the risk of injury and include sufficient instructions to enable it to be done safely. If the risk assessment shows that delivered stock cannot be unloaded safely by manual means and there are no alternative ways of unloading safely, then it should be returned to the supplier.

186 A decision to handle stock manually should not be taken by workers themselves. It should always be specified following a suitable and sufficient risk assessment which identifies the precautions needed to reduce the risk of injury to the lowest level reasonably practicable.

How can the level of risk be reduced?

Avoid dangerous manual handling

187 Proper planning of stock delivery, handling and storage will help to ensure that employees have:

- suitable aids for the safe lifting/moving/storage of stock[31] (for example lifting equipment, trucks and trolleys);
- safe systems of work;
- a safe working environment;
- proper instruction, training and supervision.

Avoid barring-off

188 The risk assessment should indicate that barring-off is unacceptable and that reasonably practicable, safer, alternative means of stock unloading are available.

Employees need to be trained to avoid the risk

189 Anyone required to carry out manual handling operations requires suitable training to enable them to recognise the hazards and know how the risks can be minimised. It should cover at least the following:

- how to recognise hazardous manual handling operations and avoid them;
- how to deal with unfamiliar manual handling operations;
- how to use handling and lifting aids safely;
- information about possible musculoskeletal injuries - what they are and how they affect the individual;
- information about early reporting of symptoms of musculoskeletal injuries;
- effects of personal protective equipment on manual handling operations;
- knowing and understanding their own capabilities and limitations - the effects of age, size, fitness, health, pregnancy;
- safer manual handling techniques;
- the effects of the working environment (for example heat, cold, flooring contamination) and the importance of good housekeeping.

Key questions for employers

Have you:

- identified all manual handling operations involved in your stock storage and handling?
- made a suitable and sufficient assessment of known manual handling operations to identify which carry the greatest risk of musculoskeletal injury?
- determined which can be avoided and taken steps to eliminate them?
- identified those measures necessary to ensure that unavoidable manual handling operations can be carried out safely and made arrangements to ensure these measures are implemented?
- given adequate instructions and provided adequate supervision to ensure that no barring-off of loads takes place?
- made employees fully aware of the risks to their safety from manual handling operations and the steps to be taken to avoid them wherever possible?
- identified manual handling training needs and provided the necessary training?
- made appropriate written records of the assessment findings?

Key questions for employees

Are you ever required to manually handle stock? If so:

- do you understand the hazards/risks involved and has your employer explored with you the practicality of avoiding manual handling?
- where there are no alternatives to manual handling, is the operation safe and without risks to your health?
- is the manual handling within your physical capability and have you been given appropriate training?
- if you are a driver, do you know the dangers of barring-off and the need to avoid it?
- if you have experienced musculoskeletal disorders (for example back problems) in the past, have you discussed these with your employer?

Sharp edges

Where in the workplace are there likely to be hazardous sharp edges?

190 In metal stock handling, many accidents, some serious, have involved contact with sharp edges on:

- sheet or strip metal;
- scrap metal;
- swarf;
- banding;
- parts of handling equipment.[32]

What should be done?

191 Firstly make an assessment to identify the areas of significant risk and the necessary risk reduction measures. These measures may include:

- removal/elimination of sharp edges, for example by:
  - use of blunt-edged (smooth) banding;
  - use of non-metallic strapping instead of metal banding;
  - appropriate design of cutting tools;
  - dressing or rolling the edges of metal strip;
  - requiring suppliers to remove or reduce sharp edges on the material they supply;
- preventing access to sharp edges, for example by:
  - use of suitable physical barriers to prevent contact with sharp edges;
  - allowing only authorised access to stock storage areas;
    ensuring materials do not overhang edges of pallets;
  - fitting padding or wrapping over sharp edges that require handling;
  - providing suitable containers for safe disposal of scrap banding etc;
- organising work to reduce exposure to sharp edges, for example by:
  - automation of handling (for example conveyors, feeds, mechanised handling equipment etc);
  - use of tools to handle and move swarf etc;
  - use of jigs or holders to hold sharp-edged materials;
- reducing tripping hazards, for example through good housekeeping, and therefore the risk of people falling onto sharp edges;
- issuing appropriate personal protective equipment (PPE) (see paragraph 195);
- telling employees where sharp edges exist and what the associated risks are;
- instructing and training staff on what they must do to avoid injury from sharp edges;
- supervising what employees do.

192 Gloves used to protect against sharp edges can be made from very tough materials and, if they become entangled in moving machinery such as conveyor belts, could result in serious injury. The risk assessment should identify any additional risks from wearing PPE.

Key questions for employers

Have you:

- identified those processes/areas of work in which hazardous sharp edges are likely to be present (see paragraph 190)?
- assessed the risks of injury from sharp edges?
- taken appropriate steps to remove sharp edges from the work processes (see paragraph 191)?
- made arrangements for the safe handling/disposal of banding material?
- taken steps, where sharp edges cannot be eliminated, to protect employees by the provision of suitable PPE (see paragraphs 193-197)?

Personal Protective Equipment (PPE)

How to decide when to supply PPE to protect employees

193 Risk control measures which eliminate workplace hazards, or exposure to them, should always be used wherever possible. Use of PPE[5] must always be regarded as a last resort for reducing the effects of unavoidable exposure.

194 Risk assessments should identify:

- those situations in which employees are unavoidably exposed to hazards;
- the appropriate PPE.

What hazards in stock-handling can PPE protect against?

195 Typical hazards (and appropriate PPE) in stock storage and handling environments include:

- falling/moving heavy stock (safety footwear and head protection);
- heat, cold, bad weather (overalls, warm or waterproof clothing);
- moving vehicles, including fork-lift trucks (high-visibility jackets/tabards);
- slips, trips (footwear with slip-/oil-resistant soles);
- sharp edges (gloves, gauntlets, armbands, hand pads, thumb guards, wrapping tape, gaiters, leggings, head protection, face visors);
- noise (ear plugs/defenders).

How to make sure that the PPE provided is effective

196 For PPE to be effective:

- it must be used;
- it must be appropriate for the intended use;
- its use should not cause other risks (for example entanglement at machinery);
- employees must be properly trained in its use;
- it must be properly maintained;
- suitable accommodation must be provided for it to be stored safely.

197 Employers should consider:

- its expected life-span and how often it will have to be replaced;
- whether it will offer adequate protection;
- whether employees have adequate dexterity when wearing it;
- what range of sizes will be required.

Key questions for employers

Have you:

- identified any hazards/risks associated with stock storage and handling operations that can only be reduced by the use of PPE?
- identified the types of PPE appropriate?
- made arrangements to issue the necessary PPE to employees requiring it?
- provided proper storage facilities for PPE?
- adequately informed, instructed and trained employees so that they fully understand:
  - the requirements for proper PPE use;
  - the level of protection it affords;
  - the limitations on its use;
  - the requirements for its proper maintenance;
  - the requirements for reporting its loss or damage?
- set up suitable records showing the issue of PPE, its repair and maintenance and user training?
- made appropriate arrangements to monitor ongoing compliance with the company's policy for the provision and use of PPE?

Key questions for employees

Do you know:

- what PPE you should use and when?
- what hazards it can protect you against and the limits of that protection?
- how, and how often, you should check your PPE?
- what faults can make your PPE ineffective, and the arrangements for getting it repaired?
- what action to take if your PPE gets lost or damaged?
- what facilities have been provided for the safe storage of your PPE?

Information, instruction, training and supervision

Why employees need information, instruction, training and supervision

198 To stay safe, employees need proper information, instruction, training and supervision. Employees must be:

- informed and trained, so that they understand the nature of any risks to their health or safety from the work they do and the measures needed to adequately control those risks;
- instructed and trained in the safe systems of work they must follow;
- supervised to make sure they follow the instructions and training they are given;
- involved in the health and safety management system and decision-making process.[8, 15]

199 Many accidents occur in stock handling when employees (particularly young and inexperienced people) use machines and equipment, or handle heavy and awkward materials, in hazardous circumstances and with inadequate training. Storage and handling systems should not be used by anyone who is not properly instructed and trained.

What basic information and instruction should be provided?

200 Most of the safety information needed by employees should be contained in the employer's own documentation, for example risk assessments, delivery plans, safety policy, systems of work etc. An assessment of each employee's knowledge and capabilities will show any gaps in their understanding and identify any requirements for further training. Employees will need to know:

- the nature of any workplace hazards;
- the findings and conclusions of risk assessments;
- the company's safety policy;
- delivery planning arrangements;
- hazardous/safe areas;
- warning signs;
- foreseeable abnormal conditions (for example a stack becoming unstable or collapsing; loads on delivery vehicles that are unstable or unfit for unloading) and the dangers associated with them; appropriate warning indicators of unsafe conditions, and the action to be taken under such circumstances;
- the limitations on manual handling, ie when manual handling is/is not appropriate and how/under what circumstances to avoid it;
- the dangers from site transport and arrangements for protecting people from the risks from moving vehicles or vehicles being (un)loaded;
- the importance of good housekeeping and how to avoid slips, trips and falls;
- PPE and its use (including arrangements for its safe storage and maintenance).

How to plan/organise safety training for employees

201 Training should be:

- prioritised;
- planned;
- given before employees are exposed to risk;
- delivered in a way that is readily understood;
- recorded (an example of a company training record is given in Appendix 2);
- resourced. [33]

202 Planning for health and safety training should be an integral part of overall business planning/budgeting. When planning training programmes, employers should consider:

- who requires training;
- the aims/purpose of the training;
- what training is appropriate/necessary to achieve those aims;
- how is training to be structured/delivered;
- who is competent to deliver that training;
- when that training should be given;
- what resources are needed;
- what records are to be kept of training given;
- how the effectiveness of the training is to be monitored;
- what requirements there are for further or 'refresher' training.

Who needs training?

203 Everyone at work must be adequately trained so that they can carry out their work safely. They may need general safety training, for example awareness of workplace hazard and risk, or specific training, for example safe slinging of loads. When planning training, employers should consider:

- all users of storage and handling equipment, for example cleaning staff and maintenance engineers, system operators, drivers etc;
- those with responsibility for inspections, for example racking, handling equipment;
- managers, supervisors and trainers;[34]
- specialists, for example fork-lift truck operators, delivery drivers, crane operator and slingers;
- designers and equipment purchasers.

What training should be given?

204 Training should be relevant to the requirements of a particular job. Users of work equipment will need to understand:

- how it is to be operated, what it is designed to do, and what its limitations are;
- the hazards in its use and how to recognise hazardous conditions;
- inbuilt safety features (for example guarding, warning devices);
- safe systems of work;
- inspecting/monitoring and the arrangements for correcting any defects identified;
- maintenance requirements and safe procedures (including isolation from power).

205 Other areas where training should be considered include:

- delivery plans - their importance, how to interpret them and how to implement them;
- safe lifting operations;[35]
- safe use of fork-lift trucks;[36]
- how to inspect racking and storage systems;
- safe manual handling methods;
- emergency procedures;
- how to manage workplace hazard and risk.[37]

Where to get help to provide training

206 Training providers should be carefully selected. Sources of training include:

- suppliers/designers of the equipment or systems;
- material suppliers;
- trade associations, for example the Storage Equipment Manufacturers' Association (SEMA);
- professional bodies, for example the Institution of Occupational Safety and Health (IOSH);
- voluntary bodies, for example the Royal Society for the Prevention of Accidents (RoSPA), the British Safety Council (BSC).

207 Incident investigation reports can provide useful material for in-house training.[38]

How to ensure employees are adequately supervised

208 Supervisors/first-line managers must be trained and competent for their work. Their health and safety responsibilities should be clearly defined and they should be given the necessary time, resources and support from senior management to meet them.

209 Supervisors should ensure, for example, that in their areas of control:

- they fully understand the nature of the associated hazards and risks and the range of necessary risk control measures;
- best practices are followed;
- dangerous working practices do not develop;
- work equipment is inspected and maintained;
- lifting operations are planned;
- stock deliveries are planned and all delivery plans followed.

210 They should ensure that their staff have the necessary information, instruction and training to enable them to work safely. Where multi-skilling and flexible working is practised, supervisors should remember that staff new to the task may need closer supervision. Also, refresher training may be required for those who have not done a particular job for a long time.

211 Health and safety performance standards should be set for supervisors/managers and their performance should be monitored.

Key questions for employers

Have you:

- assessed the information and training needs of all your employees involved in stock storage and handling operations (including supervisors and managers)?
- prepared and resourced a health and safety training plan, with a timetable for its implementation?
- appointed competent training providers?
- set appropriate health and safety performance standards for first-line supervisors/managers?
- made arrangements for monitoring the health and safety performance of supervisors/managers?
- made arrangements for the setting up/maintenance of suitable training records?
- made arrangements for providing (health and safety) induction training to new employees (or those returning to key areas of work after a period of absence from them)?
- made arrangements to monitor the effectiveness of training and ensure that it is put into practice?

Appendices

Appendix 1 - Typical racking inspection report

NOTE: **- Do not use any racking considered unsafe for use; in such cases fence it off and mark up as 'Not Safe for Use'**
- Report any faults, immediately after inspection, to the General Manager

Inspection checks to be carried out weekly - it is the responsibility of the General Manager to ensure that the racking is safe and that weekly inspections are carried out

Racking details				Floor condition (damaged/ uneven ect)	Guide rails/ protection barriers in place	Safe Working Load (SWL) clearly marked	Racking is within its SWL	Stock is safely stacked	Racking/ stock free of accident related damage	Racking free of broken, damaged or cracked components	Other comments
Location	Type of racking ie Ladder, Toast etc	Products stored	SWL of racking								
The above racking was found IN ORDER with the following exceptions: (Where necessary list additional observations on another sheet)											
Competent person carrying out the in-spection				Print name:			Sign:			Date:	

To be completed and signed off by General Manager

Follow-up action required:		
Signed: (General Manager)		Date follow-up action completed:

Appendix 2 - Example of employer's training record for flat-bed drivers

The authorised trainer of …….....is …….....

(Company) (Name of trainer)

Date …….....

This is to certify that:

(a) I have carried out training, as indicated, in the areas listed below:

(b) I am satisfied that the people named below have demonstrated competence in the following areas and have met all the specified training objectives for those areas of work, including:

(1) a full knowledge and understanding of the hazards and risks associated with metal stock and its transport on flat-bed vehicles;
(2) the use and limitations of load restraint systems; the types of such systems (including restraint equipment and anchorage devices) on the Company's vehicles; how those systems are to be safely used and maintained;
(3) the reasons for regular inspection of load restraint systems and the inspection arrangement applicable to the Company's systems;
(4) what the common defects are in load restraint systems and the ways in which they are used; the dangers that can arise from such defects; the checks that drivers themselves should carry out on the load restraint systems fitted to their vehicles; and what to do in the event of finding any defects;
(5) the Company's policy on safe transport of metal stock; the responsibilities of key individuals, including drivers themselves, as set out in the Policy Statement;
(6) the importance of Safe Delivery Plans, what should be contained in them, how they should be agreed with loading/unloading staff, the importance of following them;
(7) the risks of slips, trips and falls; the principals of safe access to vehicles during loading/unloading; the Company's policy with regard to safe loading/unloading procedures; the findings of the Risk Assessment for safe loading, transport and unloading of stock;
(8) the personal protective equipment that should be worn, why it should be used, its limitations, how and when to use it, how to maintain it, when and how to replace it;
(9) the risks associated with manual handling of material; the dangers of 'barring-off' and why it should not be practised;
(10) the arrangements for supervising and monitoring operators' safety performance, and action to be taken in the event of failure to carry out their work in accordance with their training and instructions.

Signed …… (Trainer)

	Area of training - see list above									
Operator's name	1	2	3	4	5	6	7	8	9	10
J Brown										
D Smith										
C White										

Glossary

Aisle
Space giving access to picking or loading faces of racking systems or storage areas.

Banding
Metal strapping put around stock, for example to form bundles or hold coils in shape, and around stock on pallets/timbers to secure it to the pallet. Plastic and fabric strapping is sometimes used as an alternative.

Barriers (or stops)
Substantial fixed structures capable of retaining stock and preventing movement, for example preventing a stack of coils from rolling.

Barring-off
The use of levers, for example metal bars, to physically lever product off a delivery vehicle.

Battens
Spacing pieces (made of hardwood or metal) for separating stock; usually placed horizontally between bundles or individual plates or sections. Only similar-sized battens should be used together.

Bearer
Support for stored stock (usually wood or plastic). They provide separation of components and enable easier/safer access for attachment of lifting accessories.

Chocks (or wedges)
Pieces of hardwood or plastic, usually wedge-shaped, for supporting individual stock components and preventing unexpected movement, for example rolling of coils.

Consignment
The point at which delivered goods become the customer's responsibility. It is the end point of delivery and is likely to be the same point at which financial liability for damage or loss transfers from supplier to customer.

Delivery
Delivery covers the period from arrival at the delivery address to the pre-agreed point at which the stock is to become the customer's responsibility. It may or may not include unloading of the vehicle.

Drops
The number of individual deliveries a vehicle will make to fully discharge its load.

Dunnage
Packing supports used to separate/secure stock on the back of a vehicle while in transit. Can be made of wood, plastic, steel bars or hollow steel sections. Use of dunnage provides access for easier/safer attachment of lifting accessories and helps to prevent load movement.

Exclusion zone
A clearly defined area around a vehicle being loaded or unloaded from which all pedestrians and unauthorised persons are excluded while (un)loading is taking place.

Fixed supports/Uprights
Vertical members designed to retain stock, usually sheet and plate, in the vertical plane.

Frame
Two or more uprights, joined by bracing members.

Gangway
Space for movement or transport between rackings or storage areas but which does not give direct access to picking or loading faces.

Pallet
A portable platform, with or without superstructure, used for the storage and transit of stock.

Plate
Flat, rectangular stock, usually between 25-300 mm thick.

Racking
A skeleton framework of supports of fixed or adjustable design to support loads without the use of shelves.

Sheet
Flat processed steel made from broad coil.

Stillage
Two parallel horizontal supports fitted with cross members and vertical supports - for storage of long product or bore-horizontal coil.

Stock
Steel (or other metal) in its raw material form used for manufacture of metal products. In this guidance it refers to the common forms of steel stock - long product, coil and sheet. It does not include wire or metal products.

Stops
See ‘Barriers’.

Strapping
Plastic or fabric strip used as an alternative to metal banding.

Wedges
See ‘Chocks’.

References

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The Stationery Office 1974 ISBN 0 11 141439 X

2 *Management of health and safety at work. Management of Health and Safety at Work Regulations 1999.* Approved Code of Practice and guidance L21 (Second edition) HSE Books 2000 ISBN 0 7176 2488 9

3 *Safe use of lifting equipment. Lifting Operations and Lifting Equipment Regulations 1998. Approved Code of Practice and guidance* L113
HSE Books 1998 ISBN 0 7176 1628 2

4 *Safe use of work equipment. Provision and Use of Work Equipment Regulations 1998. Approved Code of Practice and guidance* L22 (Second edition)
HSE Books 1998 ISBN 0 7176 1626 6

5 *Personal protective equipment at work. Personal Protective Equipment at Work Regulations 1992. Guidance on Regulations* L25 HSE Books 1992
ISBN 0 7176 0415 2

6 *Manual handling. Manual Handling Operations Regulations 1992. Guidance on Regulations* L23 (Second edition) HSE Books 1998 ISBN 0 7176 2415 3

7 *Workplace health, safety and welfare. Workplace (Health, Safety and Welfare) Regulations 1992. Approved Code of Practice* L24 HSE Books 1992
ISBN 0 7176 0413 6

8 *A guide to the Health and Safety (Consultation with Employees) Regulations 1996. Guidance on Regulations* L95 HSE Books 1996 ISBN 0 7176 1234 1

9 *A guide to the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995* L73 (Second edition) HSE Books 1999 ISBN 0 7176 2431 5

10 Proposed Work at Height Regulations (due out 2005 and available from The Stationery Office when published)

11 *Five steps to risk assessment* Leaflet INDG163(rev1) HSE Books 1998 (single copy free or priced packs of 10 ISBN 0 7176 1565 0)

12 *Load safety* (available from: National Association of Steel Stockholders (NASS), 6th Floor, McLaren Building, Dale End, Birmingham B4 7LN, Tel: 0121 200 2288)

13 *Safety guidelines for steel stock holders and processors* (available from: National Association of Steel Stockholders (NASS), 6th Floor, McLaren Building, 35 Dale End, Birmingham B4 7LN, Tel: 0121 200 2288)

14 *Directors' responsibilities for health and safety* Leaflet INDG343
HSE Books 2001 (single copy free or priced packs of 10 ISBN 0 7176 2080 8)

15 *Involving employees in health and safety: Forming partnerships in the chemical industry* HSG217 HSE Books 2001 ISBN 0 7176 2053 0

16 *Successful health and safety management* HSG65 (Second edition)
HSE Books 1997 ISBN 0 7176 1276 7

17 BS 5950: 1990 *Structural use of steelwork in building*
British Standards Institution

18 *Slips and trips: Guidance for employers on identifying hazards and controlling risks* HSG155 HSE Books 1996 ISBN 0 7176 1145 0

19 BS 10079: 1993 *Definition of steel products* British Standards Institution

20 *Safety in the use of pallets* Plant and Machinery Guidance Note PM15 (Third edition) HSE Books 1998 ISBN 0 7176 1522 7

21 *Safe unloading of steel stock* Leaflet INDG313 HSE Books 2000 (single copy free or priced packs of 15 ISBN 0 7176 1765 3)

22 *Code of practice: Safety of loads on vehicles* Department for Transport, The Stationery Office 2002 ISBN 0 11 552547 5

23 *Workplace transport safety: Guidance for employers* HSG136 HSE Books 1995 ISBN 0 7176 0935 9

24 *Managing vehicle safety at the workplace: A short guide for employers* Leaflet INDG199 HSE Books 1995 (single copy free or priced packs of 10 ISBN 0 7176 0982 0)

25 BS 7121: 2000 *Code of practice for safe use of cranes*
Part 1: *General*; Part 2: *Mobile cranes*; Part 4: *Lorry loaders*
British Standards Institution

26 BS 5744: 1979 *Code of practice for safe use of cranes (overhead/underhung travelling and goliath cranes, high pedestal and portal jib dockside cranes, manually-operated and light cranes, container handling cranes and rail-mounted low carriage cranes)* British Standards Institution

27 *Safety in working with lift trucks* HSG6 (Third edition) HSE Books 2000 ISBN 0 7176 1781 5

28 *The Supply of Machinery (Safety) Regulations* 1992 SI 1992/3073 The Stationery Office 1992 ISBN 0 11 025719 7 as amended by *The Supply of Machinery (Safety) (Amendment) Regulations 1994*
SI 1994/2063 The Stationery Office 1994 ISBN 0 11 045063 9

29 *Vacuum lifting attachments* HSE FOD operational circular OC234/9 (available via HSE's Infoline – see back cover)

30 *Getting to grips with manual handling: A short guide for employers* Leaflet INDG143(rev2) HSE Books 2000 (single copy free or priced packs of 15 ISBN 0 7176 2828 0)

31 *Manual handling: Solutions you can handle* HSG115 HSE Books 1994 ISBN 0 7176 0693 7

32 *Preventing injuries from the manual handling of sharp edges in the engineering industry* Engineering Information Sheet EIS16 HSE Books 1997

33 *Health and safety training: What you need to know* Leaflet INDG345 HSE Books 2001 (single copy free or priced packs of 15 ISBN 0 7176 2137 5)

34 *Managing health and safety: An open learning workbook for managers and trainers* HSE Books 1997 ISBN 0 7176 1153 1

35 *Lifting Operations and Lifting Equipment Regulations (LOLER) 1998: Open learning guidance* Guidance HSE Books 1999 ISBN 0 7176 2464 1

36 *Rider-operated lift trucks. Operator training. Approved Code of Practice and guidance* L117 HSE Books 1999 ISBN 0 7176 2455 2

37 *Provision and Use of Work Equipment Regulations 1998 (PUWER): Open learning guidance* Guidance HSE Books 1999 ISBN 0 7176 2459 5

38 *Investigating accidents and incidents: A workbook for employers, unions, safety representatives and safety professionals* HSG245 HSE Books 2004 ISBN 0 7176 2827 2

Further reading and training material

Responsibilities of suppliers, designers, manufacturers, installers, importers etc

Supplying new machinery: A short guide to the law and some information on what to do for anyone supplying machinery for use at work Leaflet INDG270
HSE Books 1998 (single copy free or priced packs of 15 ISBN 0 7176 1560 X)

Buying new machinery: A short guide to the law and some information on what to do for anyone buying new machinery for use at work Leaflet INDG271
HSE Books 1998 (single copy free or priced packs of 15 ISBN 0 7176 1559 6)

Training material

Moving steel by crane Video (available from National Association of Steel Stockholders (NASS), 6th Floor, McLaren Building, 35 Dale End, Birmingham B4 7LN (Tel: 0121 200 2288))

Code of practice for the design and use of cantilever racking systems Storage Equipment Manufacturers' Association (SEMA), 6th Floor, McLaren Building, 35 Dale End, Birmingham B4 7LN (Tel: 0121 200 2100)

Training courses on rack inspection (run by SEMA Tel: 0121 200 2100)

Training course on the installation of racking (run by SEMA through Metcom Training Tel: 01384 238377)

Further information

For information about health and safety ring HSE's Infoline Tel: 0845 345 0055 Fax: 0845 408 9566 Textphone: 0845 408 9577 e-mail: hse.infoline@natbrit.com or write to HSE Information Services, Caerphilly Business Park, Caerphilly CF83 3GG.

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