Roll cages and wheeled racks in the food and drink industries: Reducing manual handling injuries

Food Information Sheet No 33

Introduction

Roll cages and wheeled racks are in common use in the food and drink industries and are used during manufacture, storage and distribution. The movement and loading of these pieces of equipment results in many injuries, mainly related to manual handling.

This guidance sets out advice on good design and best practice and will be useful to managers, purchasers and those carrying out risk assessments. Following the guidance will help reduce injuries and costs.

Roll cages

Description and types

Roll cages (also known as roll containers or roll pallets) are half-pallet-sized platforms, with four running castors beneath and with a wire cage mounted on the platform to contain goods during transport.

Roll cages may be used to transport goods within the factory, by lorry to a warehouse or retail store and within the store. Since they were introduced, roll cages have become widely used and it is estimated that several million are in use in the UK.

Roll cages are supplied in four main types: nesting; demounting; folding and rigid. The rigid type is basically a box on wheels whereas the other three types can all be disassembled or folded when empty to reduce storage space. Two- or three-sided cages are normally supplied with straps to pull the sides together and partially restrain the load.

When fully loaded, roll cages can generally carry up to 500 kg of goods but some manufacturers rate the capacity of their containers as high as 700 kg.

Roll cages are supplied in a variety of heights, ranging from 1550 mm up to 1830 mm (most operators cannot see over 1400 mm). Two wheel sizes are commonly used, 100 mm diameter and 125 mm diameter, the latter being the most common. The typical roll container is fitted with two fixed castors at one end and two swivel castors at the other.

Injuries

Manual handling causes 30 per cent of injuries reported to HSE by the food and drink manufacturing industries. Analysis of these injuries has highlighted the pushing and pulling of roll cages, wheeled racks, trolleys and similar equipment as one of the five main causes of injury.

Comprehensive industry data is not available but some companies that use roll cages continuously have found up to a third of their accidents are roll-cage-related.

Musculoskeletal and other injuries arise from:

- pushing/pulling loaded roll cages, especially up slopes or over steps;
- trying to prevent roll cages overbalancing (and crush injuries where this was not successful);
- repetitive loading and unloading of roll cages;
- trapping hands while assembling/dismantling cages;
- trapping hands and other parts of the body between the roll cage and a wall, side of vehicle etc;
- feet being trapped under the castors; and
- roll cages falling off lorries (eg from the tail lift) during loading and unloading, often causing the most serious injuries.

Designs to reduce injuries

The most important design features that will help reduce roll cage incidents are:

- the use of large-diameter wheels, to reduce pushing/pulling forces and to make these less sensitive to surface imperfections (eg the forces required to overcome a small step are typically 12-24 per cent greater if using a 100 mm diameter wheel, as opposed to a 125 mm diameter wheel);
- the careful selection of wheel material - hard materials such as nylon will lower rolling resistance and, unlike cast iron, should not damage floors or make too much noise, although polyurethane wheels are quieter and produce less vibration on rough surfaces;
- good quality castors, each with a well maintained wheel bearing (ball bearings offer the least rolling resistance, followed by roller bearings and then plain bearings, as used on nylon wheels, although the latter require less maintenance);
- castors close to corners to improve stability;
- incorporating handles (at a height of approximately 1000 mm) to move fingers away from the corners of containers where they are

vulnerable to impact and, when cages are pulled, to keep feet further from the castors; and
- marked load height limits, to enable the operator to have a clear view when pushing load (a maximum load height of 1400 mm is recommended).

Risk assessment

A risk assessment should be carried out for each application of the roll cage covering, for both on-site and off-site risks:

- pushing/pulling options;
- forces required to move the roll cage;
- the effect of slopes and terrain/floor surface problems;
- availability of safe handles;
- visibility for the operator;
- hand/body/foot trapping risks;
- correct lifting methods for loading and unloading the roll cage; and
- risks associated with loading/unloading roll cages onto lorries (eg with tail lifts).

Pushing roll cages (rather than pulling) is the preferred option although, in practice, both pushing and pulling are necessary in most situations. Pushing has ergonomic advantages (two hands can be used and there is less twisting). There is also less risk of foot trapping or impact injury if the cage overruns or the operator slips.

When considering pushing/pulling forces, the risk assessment should take into account the sex and weight of the person pushing the roll cage. Female workers can typically exert only 60 per cent of the force of male workers, and older workers (male and female) exert less force than younger workers.

When used on a flat level surface, the maximum force to manoeuvre a cage will typically be two per cent of the load with wheels aligned with the direction of travel and five per cent of the load with the wheels at right angles to the direction of travel. With a load of 500 kg, these forces are just within the guideline maximum of about 25 kg (250 N) for male operators but above the guideline of 16 kg (160 N) for female operators.

For pushing/pulling on slopes, the risk assessment should be particularly cautious. For example, a roll container with a load of 400 kg and a slope of 1 in 12 (4.8°) would require a force of 33 kg (330 N), well above the force a man might be expected to handle and double the force a woman might be expected to handle. Slips are also more likely on slopes, especially with the extra pushing forces required.

With uneven surfaces, the maximum starting force could rise to 10 per cent of the load. It is therefore clear that the movement of heavily loaded roll containers is likely to place lone operators at risk of injury, even on level surfaces.

Steps as low as a few millimetres in height are problematic for loaded cages. For example, critical step heights at which overturning may occur (due to the extra pushing/pulling forces required) for 100 mm and 125 mm diameter wheels are typically 6.6 mm and 8.2 mm respectively.

Safe working

The following precautions have been shown to reduce injuries. Operators should:

- only move one roll cage at a time;
- use the handles provided;
- move the roll cage no faster than walking speed;
- wherever possible, push the cage rather than pull as this is ergonomically better and will reduce the risk of foot trapping;
- seek help from another person when moving a roll cage up or down a ramp or on an uneven surface or when a cage is heavily loaded;
- not ride in, or on, roll cages as they can easily overturn or trap the operator;
- wear gloves and safety shoes when moving roll cages - softer sole shoes will reduce slips;
- wear gloves when assembling cages to protect hands and fingers;
- stack heavier items at the bottom of the roll cage to keep the centre of gravity as low as possible (the correct lifting technique is particularly important at this low level);
- not load the cage above the load line or above the level where the operator can see over the load; and
- move no more than three to five empty, nested roll cages at one time (see manufacturer's recommendations).

Tall wheeled racks

Description and types

Wheeled racks (or trolleys) of similar heights and dimensions to roll cages are in widespread use in the food and drink industries to transport part-completed product or finished product (eg loaves of bread, milk containers) around the factory or into storage.

Designs of wheeled racks vary but they typically comprise a tall, metal frame fitted with up to 20 shelves, which are often removable. The racks usually run on four swivelling running castors.

Maximum loads that racks can carry vary but can be as high as 400 kg or more.

Although not usually subject to the rough handling demands of roll cages, wheeled racks are frequently used to hold produce in ovens and freezers and this places high demands on castor wheels and bearings.

Injuries

Manual handling causes nearly a third of food and drink industry injuries reported to HSE and one of the main causes arises from the pushing and pulling of wheeled racks, trolleys and similar equipment.

Musculoskeletal and other injuries arise from:

- pushing/pulling loaded wheeled racks, especially if the racks are heavy or the activity is carried out for long periods;
- repetitive loading/unloading of wheeled racks (including trapping hands and fingers and burns);
- trapping hands and other parts of the body between the wheeled rack and a wall, another rack etc; and
- foot trapping under the castors.

Designs to reduce injuries

The most important design features that will help reduce incidents involving tall wheeled racks:

- a suitably robust and rigid frame with shelf arrangements that will withstand long-term use;
- castors selected with an adequate load margin (for example fitting four 100 kg rated castors to a 400 kg load rack might not be adequate for dynamic loads, poor surfaces etc);
- fitting castors close to the corners to improve stability; and
- good quality castors with wheels and bearings that can withstand:
  - oven temperatures (around 280 °C) and/or freezer temperatures (around -30 °C) if required; and
  - pressure washing or other wet cleaning methods for hygiene purposes.

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Wheel diameter

The larger the diameter of wheel, the easier the rack will be to push or pull. For example, a rack fitted with 100 mm diameter wheels might typically require a 20 per cent higher starting force than if 125 mm wheels were fitted.

Wheel material

High-temperature rubber wheels are a good option for the food industry. These will handle the higher temperatures often experienced and are quiet in operation.

Thermosetting plastics (usually phenolic) are also suitable in many applications and will also handle higher temperatures. Although they have a slightly higher load rating than rubber wheels, they are not as quiet and can be a source of noise problems.

Thermoplastic wheels, recently developed for high temperature applications, are relatively new to the market. It is anticipated these wheels will have better impact-resistance than phenolic wheels but they do not have such a high temperature limit.

Cast iron wheels are not recommended for use in the food industry because they damage floor surfaces and are noisy.

Castor construction

Zinc-plated mild steel castors are subject to axle corrosion as the zinc plating on the axle is worn away by the hard material of the wheels. This can result in the need for increased pushing forces and can produce high noise levels of over 100 dB(A) from bearing screech, particularly where castors are exposed to high temperatures.

A solution to this problem, which has been widely implemented on the Continent*, is to use stainless-steel castors fitted with stainless-steel axles. The stainless-steel axles are sleeved in a PTFE tube, which allows self-lubrication. PTFE washers are also fitted each side of the wheel to further reduce wear, friction and noise.

An additional benefit of stainless-steel castors is that they are supplied with stainless-steel swivel bearings that do not require lubrication to prevent corrosion, whereas zinc-plated mild steel castors require lubrication of the swivel bearing to remain effective.

Risk assessment

A risk assessment should be carried out for all wheeled rack operations. The same considerations apply as in risk assessments for roll cages (see above) although temperature issues and noise may also need to be considered.

Safe working

The safe working considerations for wheeled rack operations are similar to those for roll cages (see above), where applicable. Job rotation should also be considered to ensure workers are not moving wheeled racks for long periods.

Maintenance

All roll cages and wheeled racks will require a regular safety maintenance programme. Particular attention should be paid to castors and wheels but, if high-quality (eg stainless-steel) castors are fitted, maintenance requirements will be far less.

*Continental castors are supplied with an 80 x 60 mm fixing plate (ISO class 2). Most UK castors are supplied with a 105 x 80 mm fixing plate (ISO class 3). So, if Continental castors are to be used, some drilling and fitting work will be required.

Legal considerations

Manual Handling Operations Regulations 1992

These Regulations require that manual handling (such as the use of roll cages and wheeled racks) must be avoided so far as reasonably practicable, for example by mechanisation. Where this is not possible, a risk assessment must be carried out and its findings implemented to reduce the risk. For example, an altered layout might eliminate or reduce unnecessary product handling.

Provision and Use of Work Equipment Regulations 1998

These Regulations require that equipment (such as roll cages and wheeled racks) is:

- suitable for its purpose;
- maintained in good repair; and
- inspected at suitable intervals and the inspection recorded.

Further reading

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

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

Moving food and drink: Manual handling solutions for the food and drinks industries HSG196 HSE Books 2000 ISBN 0 7176 1731 9

Injuries and ill health caused by handling in the food and drink industries Food Information Sheet FIS23 HSE Books 2000

Getting to grips with manual handling: A short guide for employers Leaflet INDG143(rev1) HSE Books 2000 (single copy free or priced packs of 15 ISBN 0 7176 1754 8)

Consulting employees on health and safety: A guide to the law Leaflet INDG232 HSE Books 1996 (single copy free or priced packs of 15 ISBN 0 7176 1615 0)

Rolling safely along: Your guide to roll cage safety Video (26 mins) HSE Books 2002 ISBN 0 7176 2555 9

Roll cage and pallet safety Video (23 mins) 2001 ISBN 1 870214 94 3 The Institute of Logistics and Transport, Earlstrees Court, Earlstrees Road, PO Box 5787, Corby NN17 4XG Tel: 01536 740100

Safety of roll containers RR009 HSE Books 2002 ISBN 0 7176 2535 4

The use of castors on racks in the food processing industry RR99 HSE Books 2002 ISBN 0 7176 2183 9

Further information

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

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