BRITISH STANDARD

BS 5073:1982

Incorporating Amendment Nos. 1 and 2

Guide to

Stowage of goods in freight containers

UDC 656.073.235:621.869.888

Cooperating organizations

The Packaging and Freight Containers Standards Committee, under whose direction this British Standard was prepared, consists of representatives from the following:

Association of Drum Manufacturers
British Bag Federation
British Fibreboard Packaging Association
British Paper and Board Industry Federation (PIF)
British Stationery and Office Products Federation
Chemical Industries Association*
Collapsible Tube Manufacturers' Association
Department of Transport*
General Council of British Shipping*
Glass Manufacturers' Federation
Institute of Packaging
Institute of Trading Standards Administration
Institution of Production Engineers
Metal Packaging Manufacturers' Association
Ministry of Defence*
Oil Companies Materials Association
Paintmakers Association of Great Britain Ltd.
Pira (the Research Association for the Paper and Board, Printing and Packaging Industries)
Soap and Detergent Industry Association
Society of Motor Manufacturers' and Traders Limited*
Timber Packaging and Pallet Confederation
Timber Research and Development Association
Coopted member

The organizations marked with an asterisk in the above list, together with the following, were directly represented on the Technical Committee entrusted with the preparation of this British Standard:

Aluminium Federation
Association of British Railway Carriage and Wagon Manufacturers
British Airways
British Ports Association
British Railways Board
British Shippers Council
Freight Transport Association Limited
Health and Safety Executive
Home Office
Institute of Freight Forwarders Limited
Institute of Materials Handling
International Institute of Container Lessors
National Freight Corporation (nfc) Ltd.
Road Haulage Association Ltd.
Coopted member

This British Standard, having been prepared under the direction of the Packaging and Freight Containers Standards Committee, was published under the authority of the Board of BSI and comes into effect on
30 September 1982

First published April 1974
First revision September 1982

The following BSI references relate to the work on this standard:
Committee reference PKM/505
Draft for comment 80/63077 DC

ISBN 0 580 12834 2

Amendments issued since publication

Amd. No.	Date of issue	Comments
6198	July 1990	
7761	July 1993	Indicated by a sideline in the margin

Contents

Foreword

This British Standard has been prepared under the direction of the Packaging and Freight Container Standards Committee. It is a revision of BS 5073:1974 "Recommendations on the carriage of goods in freight containers" which is withdrawn.

This revision concentrates more on guidance for those concerned with the stowage of goods in containers and the title has been changed to reflect this.

The principles set out in the "ILO/IMO Guidelines for packing cargo in freight containers or vehicles"[1)] have been followed where applicable.

The attention of users is drawn to the national regulations or administrative arrangements in various countries which implement international agreements and conventions, amongst others:

International Convention for Safe Containers (CSC) 1982[1)]
Freight Containers (Safety Convention) Regulations 1984, SI 1984 No. 1890[2)]
HSE, 1984. Arrangements in Great Britain for the approval of containers[3)]
HSE 1984. Conditions for approval of examination schemes or programmes[4)]
Health and Safety Commission. Docks Regulations 1988. Approved Code of Practice and Guidance[2)]
Health and Safety Commission. Dangerous Substances in Harbour Areas Regulations 1987. SI 1987/37[2)]
Customs Conventions on Containers 1956 and 1972[2)]
Customs (TIR) Conventions 1959 and 1975[2)]
European Agreement concerning the carriage of dangerous goods by road (ADR)[2)]
International Maritime Dangerous Goods Code, Section 12, Freight Container Traffic[1)]
International Regulations concerning the carriage of dangerous goods by rail (RID)[2)]
European Agreement on international carriage of perishable foodstuffs and on the special equipment to be used for such carriage (ATP) 1970[2)]

Additional safety guidance is given in HSE Guidance Note PM69 Safety in the use of freight containers and a list of other publications providing information which may be relevant is included in Appendix D.

The specification and test requirements for freight containers and their corner fittings, together with information on the handling and securing of freight containers, are covered in BS 3951-1 and BS 3951-2 which are identical with the international standards on this topic published by the International Organization for Standardization (ISO).

A British Standard does not purport to include all the necessary provisions of a contract. Users of British Standards are responsible for their correct application.

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 12, an inside back cover and a back cover.

This standard has been updated (see copyright date) and may have had amendments incorporated. This will be indicated in the amendment table on the inside front cover.

[1)] Obtainable from IMO, IMCO House, 4 Albert Embankment, London SE1 7SR.

[2)] Obtainable from HMSO.

[3)] Obtainable from SPISD, C3 enquiry point, Baynards House, Chepstow Place, London W2 4TF.

[4)] Obtainable from Docks National Industry Group, East Anglia Area Office, 39 Baddow Road, Chelmsford CM2 0HL.

0 Introduction

The advantages offered by the use of freight containers, especially where door to door operation is possible, are well known. But as with all equipment, if containers are not properly looked after, or are wrongly used, various problems may arise.

Improper or careless stowage of goods in a freight container can lead to personal injury, damage to cargo, damage to the container itself or damage to the container's handling or transport equipment.

It is important that consideration is given to quarantine requirements, pest control, and the possibility of contamination. Because freight containers are re-usable thought should be given to problems which may arise by reason of the nature of previous cargoes.

The person who packs and secures cargo into a container may be the last person to look inside until it is opened by the consignee at its final destination. Consequently, a great many persons will rely on his skill; drivers of road vehicles and other highway users when the container is carried by road, railway personnel and others when the container is carried by rail, dock workers when the container is lifted on or off a ship, the crew of the ship, and the final consignees. Anyone may be at risk from a poorly packed container.

1 Scope

This British Standard provides general guidance to those concerned with the stowage of goods in freight containers designed for movement by surface modes of transport (road, rail, inland water and sea), with special emphasis on ways of achieving satisfactory levels of safety and minimizing damage to cargo. It does not cover the special precautions which have to be taken when stowing containers for transport by air.

The standard does not cover the special requirements applicable to the stowage of goods requiring temperature or atmosphere control, e.g. the provision of optimum air circulation paths in refrigerated, insulated or ventilated containers, nor the additional requirements relating to the stowage of dangerous goods. It does not cover the stowage of bulk cargoes.

NOTE The requirements relating to dangerous goods are covered in the IMCO IMDG Code (in particular, see Section 12 of the general introduction to that code) for carriage by sea and in the relevant national and international regulations for transport by road and rail (see foreword).

NOTE The titles of the publications referred to in this standard are listed on the inside back cover.

2 Factors affecting the stowage of goods in freight containers

2.1 Mechanical hazards

2.1.1 The principal mechanical hazards to the container and contents are acceleration and deceleration effects and vibrations. In addition vertical impacts can occur if the container is set down carelessly or carried by road with insufficient regard to road surface conditions. Where containers are carried on loosely coupled rail wagons there is a possibility of longitudinal impacts but these are virtually eliminated when close coupled wagons or special block trains, i.e. with bar couplings, are used.

2.1.2 Where containers are carried by sea they may be subject to additional forces of vertical, lateral and longitudinal acceleration due to the motion of the ship. (See Appendix A for more detailed information.)

2.1.3 Guidance on packing and securing cargoes in containers to minimize the effects of these movements is given in **5.4**.

2.2 Climatic conditions

2.2.1 When stowing goods in freight containers account should be taken of the information given in **2.2.2** to **2.2.15**.

2.2.2 Conditions to which goods in transit and storage are subjected may lead to the deterioration of the goods. These conditions may be influenced by extremes of temperature and humidity, cyclic changes of temperature and humidity, wetness, snow, etc. that may be encountered by a container on any particular journey.

2.2.3 The use of a totally closed container will have some obvious effects on the conditions to which cargoes are subjected, and some less obvious. The outer skin of the closed container, or the cover of an open container will obviously give protection against rain or spray, provided it is in good condition.

Less obvious temperature and condensation effects are described in **2.2.4** to **2.2.15**.

2.2.4 Direct exposure to solar radiation can produce air temperatures under the skin of a non-insulated container which are significantly higher than external air temperatures. Radiation from the container at night can produce air temperatures under the skin of the container that are marginally lower than external temperatures. The combination of these effects can result in a range of day and night cycle temperature variations in the air just inside the skin of a non-insulated container which is greater than the corresponding range of air temperatures just outside the skin.

2.2.5 The effects of temperature variations (see **2.2.4**) are so much reduced with well insulated containers, that, even without refrigeration, the air temperature ranges at any point inside the container will always be less than the range of air temperatures outside it.

2.2.6 Longer term changes in temperature conditions external to the container, either seasonal or due to movement of the container from one prevailing climatic condition to one significantly different, will sometimes have to be taken into account. Only a container in which the internal conditions are artificially controlled, e.g. by refrigeration, will provide internal conditions unaffected, or not significantly affected by such long term temperature changes.

2.2.7 Goods closest to the container skin will be more affected by external variations than those in the centre of the container, but, whenever the possible extent of temperature variations or their full significance is not known, advice should be obtained from specialists.

2.2.8 Under certain circumstances condensation may be encountered in most types of containers, either on the surface of cargo (cargo sweat) or on the inside surfaces of a container (container sweat) both during transport and when the container is opened for discharge or for any other reason.

An understanding of condensation phenomena is important because condensation may lead to such damage as rust, discoloration, dislodging of labels, collapse of fibreboard packages, mould formation, caking and clogging.

2.2.9 The main factors leading to condensation inside the container are:

a) sources of moisture inside the container which, depending on ambient temperature conditions, will affect the moisture content of the atmosphere in the container;

b) a difference between the temperature of the atmosphere within the container and the surface temperature of either the cargo or the inner surfaces of the container itself;

c) changes in the temperature of the outer surface of the container which affect factors a) and b).

2.2.10 When the outside of the container is heated, e.g. by the heat of the sun during the day, then, unless the container is insulated and perhaps refrigerated as well, the air inside the container will become heated and absorb moisture from the goods, the packaging and any pallets or dunnage used. Where the container has a wooden floor or lining, moisture may be absorbed from these as well. This can lead to high humidity conditions and, eventually, to the air becoming saturated with moisture.

2.2.11 If, under these conditions, some of the cargo has a surface temperature lower than the dewpoint[5)] of the air adjacent to it, condensation will form on the cargo and damage can occur.

2.2.12 If, after a high humidity has been established inside the container, the outside of the container is cooled, e.g. at night, then the temperature of the container skin may fall below the dewpoint of the air inside it. Under these circumstances moisture will form on the inside surfaces of the container. After forming under the roof, it may drop on to the cargo and lead to rain stains and the other problems listed in **2.2.8**.

2.2.13 Cyclical repetition of the cargo/container sweat phenomena can result in a greater degree of damage.

2.2.14 Condensation can also occur immediately after the doors of the container are opened if the air inside the container is humid and the outside air is relatively cool. Such conditions can produce a fog and even precipitation, but, because this phenomenon usually occurs only once, it seldom results in serious damage.

2.2.15 Somewhat different condensation phenomena may be encountered in insulated and in refrigerated containers, e.g. where warm moist air is allowed to enter such a container at the time of loading, ice or frost may form on the cargo and, especially if the container is pre-cooled, on the inner surfaces of the container as well. This can have a significant effect on the subsequent performance of refrigeration equipment and care should be taken at the time of loading to minimize the amount of moisture admitted.

The practice of running refrigeration equipment at the time of loading should be avoided as this tends to exacerbate the problem.

2.3 Contamination

2.3.1 *General.* The principal types of contamination are taint and infestation. Infestation by pests or micro-organisms is dealt with in Appendix B.

[5)] Dewpoint is the temperature at which air saturated with moisture at the prevailing air pressure will start to shed moisture by condensation.

2.3.2 *Taint.* Taint (or chemical contamination) may be caused by any of the following:

a) incompatible substances in the cargo;

b) residues and odours from previous cargoes;

c) cleansing agents or pesticides;

d) unsuitable dunnage or securing materials;

e) contaminated pallets;

f) materials used in the construction of a container.

3 Selection of containers

3.1 This is very much a matter for consultation between the shipper and the supplier of the containers. Factors affecting the choice of a particular size and type of container include:

a) the characteristics of the goods to be carried;

b) the ways in which the goods may be loaded into and unloaded from the container;

c) the nature of the route the container is likely to take (see also **2.2**);

d) the availability of the preferred containers.

3.2 Certain cargoes are liable to suffer damage from extremes of temperature; others may require atmosphere control. Such factors should be taken into account when selecting the type of container. Account should also be taken of the degree of temperature or atmosphere control which equipment could be expected to provide in the climatic conditions which may be encountered in the various stages of the container's journey.

3.3 Consideration should also be given to the overall dimensions and gross mass of the loaded container in relation to the road and rail traffic regulations applicable en route.

4 Actions prior to loading

4.1 General. The container should be inspected both inside and out before it is loaded with cargo. If a container appears to be damaged to the extent that it could pose a safety risk either to personnel or to the cargo, the supplier of the container should be contacted with a view to obtaining a replacement. The points outlined in **4.2** and **4.3** may be used as a guide to inspecting the container before loading.

4.2 Examination of the exterior of the container

4.2.1 The structural strength of the container depends to a great extent on the integrity of its main framework comprising the corner posts, corner fittings, main longitudinals and the top and bottom end transverse members which form the end frame. If there is evidence that the container is severely weakened, it should not be used.

4.2.2 The walls, floor and roof should be in good condition and not significantly distorted.

4.2.3 The doors of the container should work properly and be capable of being securely locked and sealed in the closed position, and properly secured in the open position. Door gaskets and weather strips should seal tightly upon closing the doors.

4.2.4 In the case of insulated containers, the outer skin should be checked for damage which could lead to the ingress of moisture which could eventually result in the destruction of the insulating characteristics of the container.

4.2.5 If an empty container carries a dangerous goods label, any requirement for decontamination should be checked. When any necessary action has been taken it is essential that the dangerous goods label be removed.

4.3 Examination of the interior of the container

4.3.1 The container should be free from major damage, with no broken floor planks or protruding nails which could cause injury to persons or damage to the cargo.

4.3.2 The container should be clean, dry, and free of residue, infestation and persistent odours. If infestation of a container is detected the container should be disinfested by fumigation or the use of a suitable pesticide. Disinfestation should be followed by airing and a thorough cleansing operation. (See Appendix C for guidance on cleaning and disinfestation.)

4.3.3 The container should be weatherproof unless it is so constructed that this is obviously not feasible. Previous patches or repairs should be carefully checked for possible leakage. Potential points of leakage may be detected by observing if any light enters a closed container. In carrying out this check care should be taken to ensure that no person becomes locked inside the container.

4.3.4 Cargo tie-down cleats or rings, where provided, should be in good condition and well anchored. Where it is intended to use such cleats or rings, their ratings should be checked with the supplier of the container and the adequacy of the ratings assessed in relation to the loads which may be imposed on them (see also **5.1.1** and **5.4.9**).

Where securing points do not appear adequate for the securing arrangements envisaged, alternative arrangements should be worked out with the supplier of the container. On no account should additional securing fittings be added to a container without the agreement of the supplier of the container.

5 Stowage planning, packing and securing of goods in freight containers of various types

5.1 Stowage planning

5.1.1 A stowage plan should be worked out for the container before any packing is commenced. A plan should make it possible to produce either a tight or a secured stow, in which the compatibility of all items of cargo and the nature, i.e. type and strength, of any packages or packaging involved, is taken into account.

5.1.2 The planned load should not exceed the permitted payload of the container, which is usually indicated on the container itself, or such lesser load as may be dictated by the regulations applicable to the various modes of transport which may be involved, in any of the countries in which, or through which, the container may be moved. The container operator should be consulted in case of doubt.

5.1.3 Stowage plans should take account of the fact that containers are generally designed assuming the load to be evenly distributed over the entire floor area. Where substantial deviations from uniform loading could occur, specialist advice should be sought.

5.1.4 When loading an open top or open sided container the load should not project beyond the overall dimensions of the container, except where special transport arrangements can be made with the operator.

5.1.5 When planning the load in the container, it is necessary to bear in mind the problems which may be created for those who will unload it.

5.1.6 The use of freight containers may allow a reduction in the amount of packaging given to a particular commodity. This, however, will seldom apply to items of a fragile nature or dangerous goods, and in any case each type of cargo should be given individual consideration. It should always be remembered that a certain amount of shock or impact is likely to be encountered during loading or discharge.

5.2 Planning for protection against contamination

5.2.1 As a general rule dusty or dirty cargoes, or cargoes known to be liable to infestation, should not be packed in the same container as clean cargo, unless it is possible to ensure protection of the clean cargo, e.g. by the use of suitable packaging for either cargo.

5.2.2 Odorous cargo should not be packed in the same container as cargo that will be damaged by taint.

5.2.3 Foodstuffs should not be packed with poisons or other commodities potentially hazardous to health.

5.2.4 Where cargo has an inherent tendency to leak consideration should be given to appropriate precautionary measures, e.g. lining the floor with polyethylene or similar sheeting, possibly in conjunction with the use of an absorbent material such as sawdust (see **6.2.6**).

5.3 Action prior to packing

5.3.1 When a container on a vehicle is positioned at a loading dock or bay the vehicle's brakes should be applied or its wheels chocked before loading of the container begins. When a container is carried on a semi-trailer which is supported on landing legs situated well to the rear of the front end of the trailer, driving an industrial truck into the container may give rise to instability. In such a case the front end of the trailer should be propped.

5.3.2 Materials handling equipment used for packing should not apply loads in excess of those for which the container is designed and tested (see BS 3951-2). Due attention should be given to possible problems caused by exhaust fumes when industrial trucks powered by internal combustion engines are used inside containers.

5.3.3 The provision of an adequate level of illumination in freight containers will improve safety and considerably facilitate packing. Any electrical cables should be protected against physical damage. Safe means of access should be provided to permit safe handling of cargo, tilts and moveable or removeable components.

5.3.4 Folding containers or other containers with moveable or removeable components should either be correctly assembled or those removeable parts not in use should be packed and secured inside the container.

5.3.5 Any out of date temporary marks, such as those relating to previous cargoes, should be removed or covered with a permanent plain label.

5.3.6 Where a cargo which might suffer from unwanted ventilation is to be carried in a container with specific provision for ventilation care should be taken to blank off the ventilation facilities, as appropriate.

5.4 Packing and securing

5.4.1 It is essential to make the cargo in the container secure against any reasonably foreseeable movement (see **2.1**). At the same time the method of securing the cargo should not itself cause damage or deterioration either to the cargo or container.

5.4.2 Ideally, and especially where goods and packages of a regular shape and size are involved, it should be possible to obtain a tight stow by building individual items of cargo one against another with reasonable solidity from one side wall to the other. Minor void spaces can be tolerated where all of the items around the void are so restrained or are so mutually supportive that they will not move, but in cases of doubt, void spaces should be filled with dry dunnage material such as timber, folded corrugated board, hardboard, high density foam, air bags, etc. Where timber is used, due account should be taken of any quarantine requirements which may be applicable in the country of destination (see **6.2.6**).

5.4.3 Cartons of a similar shape and size but of a size which is not an ideal module for the container should be packed with one row starting from one side of the container and the next row starting from the other. By staggering each successive layer in a similar way a tight interlocking and self restraining stow may be obtained. A tight stow can be obtained with bagged cargo by alternating layers with the bags crosswise and layers with bags lengthwise.

5.4.4 Where it is necessary to secure cargo by means of lashing or netting, e.g. because particular items cannot be either tightly stacked or fully secured by means of wedges or struts, such lashing points as may have been provided in the container should be used. Care should be taken to ensure that lashing points are not overloaded and the owner of the container should always be consulted before any improvised lashing points are used (see also **4.3.4**).

5.4.5 Cargo mass should be as evenly distributed over the length and breadth of the container as may be practicable. Where cargo items of varying mass are to be packed into a container, or where the container will not be full, either because of insufficient cargo or because the maximum allowable gross mass will be reached before the container is full, then the stow should be arranged and secured so that the approximate centre of gravity of the cargo is close to the mid length and mid width of the container.

5.4.6 In no case should more than 60 % of the load be at one end, in less than half of the length of the container. With the most heavily loaded container even 55 % of the load at one end, in one half of the length could lead to vehicle axles being loaded beyond the legal limits imposed by some countries. Even with more lightly loaded containers, excessive load at one end could lead to the nose diving of a semi-trailer under the circumstances envisaged in **5.3.1**.

5.4.7 As a general rule, heavy goods should not be stowed on top of lighter goods and, wherever possible, the centre of gravity of the loaded container should be below the mid point of its height.

5.4.8 When cargo includes heavy indivisible units it may be necessary to spread their weight over the container floor to give a reasonable approximation to a uniformly distributed load. This is normally done by using baulks of timber but metal structures are sometimes used. As well as providing adequate distribution of load, load spreading arrangements should be so devised that the localized bearing pressures on the floor are within the design capabilities of the container, even when allowance is made for dynamic effects. Specialist advice should be sought in cases of doubt.

5.4.9 If it proves necessary to slide a heavy object into a container, e.g. by coating dunnage with substances such as tallow or wax, it is essential that compensation for the reduction in the friction effect between the cargo and the supports, which will persist throughout the journey, should be provided by either arranging for a completely tight stow or by means of chocks, lashings or webbing load restraint assemblies (see BS 5759) specially arranged to take account of the reduction in the friction effect. Furthermore, arrangements should be made for the removal of the slippery substance at the end of the journey.

5.4.10 As indicated in **5.2** the stowage of incompatible goods in the same container should be avoided. For example, dust producing goods such as cement should not be stowed next to, or on top of, goods which are susceptible to damage by dust such as foodstuffs or fine machinery. Goods with sharp projections or unusual shapes should be stowed apart from other types of packages, particularly bags. If possible, separation material should be used to avoid damage.

5.4.11 Vertical crushing effects could be significant with certain cargoes, e.g. fibreboard packages, and some reduction of these effects may be secured by using planks or boards horizontally between layers to spread the load. This technique should also be used between layers of drums, barrels, etc., to reduce the likelihood of damage from vibration. Barrels should usually be packed with bungs uppermost.

5.4.12 Damaged packages should not be loaded into a container unless there is clear evidence that the contents will not spill or leak.

5.4.13 Because of the potential for damage by condensation (see **2.2.8**) and because the original moisture contents of goods, packaging, pallets, dunnage and the container itself are major factors leading to condensation, care should be taken to minimize the amount of moisture admitted into the container in any way whatever at the time of loading. Particular attention is drawn to the problems that can occur with hygroscopic cargoes, which should be as dry as possible at the time of loading, and with cargoes packed in fibreboard cases, the moisture content of which should be as low as possible at the time of loading.

5.4.14 Cargo in need of temperature control or ventilation should be so packed that the necessary circulation of air or gas round or through the cargo can be obtained. This is a subject on which specialist advice should be obtained.

5.4.15 After the packing of the container is complete, steps should be taken to ensure that the cargo will not fall out when the doors are opened. Suitably positioned lashing points and wire rope or strapping bands should be used to weave a restraining net across the face of the cargo, or a gate should be positioned to prevent direct pressure on the door. Where medium sized packages are concerned care should be taken to interweave the cargo itself so as to effectively build a wall and so reduce the need for a reliance upon lashings or nets alone.

6 Checking of containers prior to despatch

6.1 General. Before despatching loaded containers the procedures given in **6.2** and **6.3** should be carried out, where appropriate.

6.2 All containers

6.2.1 Check the distribution of the load and that the load is secure.

6.2.2 Ensure that any abnormal factors which could affect the satisfactory movement of the container, e.g. where over-height or over-width cargo is to be carried in an open-top or open-sided container, are drawn to the attention of, or confirmed to the carrier.

6.2.3 See that all closures are properly secured. Particular attention should be given to rigid removeable roofs or roof sections, hatch covers, manholes and ventilators (either closed or open as required).

6.2.4 Ensure that there are no loose sheets, ropes, nets, etc. and that no excessive billowing of the sheet can occur.

6.2.5 Check the security of the attachment of all name plates, data plates, approval plates and other permanent marks. Any temporary marks which may be required, e.g. because of the nature of the cargo or because fumigants have been used, or because a gaseous atmosphere is provided, should also be checked.

6.2.6 If goods are packed in wooden receptacles or if wood is used for securing purposes and if the goods are destined for Australia, New Zealand or other countries with wood treatment quarantine regulations, place a copy of the wood treatment certificate in a conspicuous place in the container.

6.2.7 If it is envisaged that a cargo known to be an infestation risk could require fumigation after it has been loaded into a box type container, then the guidance notes given in Appendix C should be consulted and the recommended procedures followed.

6.3 Checking of particular types of container

6.3.1 *General.* The safe operation of platform containers, platform based containers with fixed or folding ends and folding containers is dependent upon close attention to the points detailed in **6.3.2**, **6.3.3** and **6.3.4**.

6.3.2 *Flexible sheets, covers and side curtains.* Check that:

a) sheets are properly secured against the effects of container movements in either direction;

b) covers and side curtains are a good fit and properly secured;

c) there are no tears or loose ropes and that stretch ropes have not been used as a primary securement.

6.3.3 *Removable or folding framework.* Ensure that:

a) all such components are correctly fitted and secured, with any unused components properly stowed and secured;

b) no damaged component has been used unless its adequacy has been carefully assessed;

c) only components specially designed for the purpose have been used.

6.3.4 *Securement of load.* See that:

a) the cargo is properly secured with sufficient stanchions/panels fitted where necessary to contain the load within the overall dimensions of the container (see **5.1.4**);

b) lashings and securing nets are properly fixed.

7 Checking on unloading

7.1 Warning marking. Prior to opening the container doors and unloading cargo, note should be taken of any warning labels, dangerous goods labels, etc., and the appropriate precautions observed.

7.2 Refrigerated containers. Where expendable refrigerants, e.g. dry ice/liquid nitrogen are used, care should be taken to ensure that the gas produced from the refrigeration process has cleared from the inside of the container before any person is permitted to enter.

7.3 Fumigated containers. Care should be taken to ensure that the container is clear of fumigant before any person is permitted to enter (see Appendix C).

7.4 Care when opening doors. Persons opening the doors of containers should be alert to the possibility of cargo falling out. Once opened, doors should be secured in the fully-open position.

7.5 Use of industrial trucks. When a container on a vehicle is positioned at a loading dock or bay the vehicle's brakes should be applied or its wheels chocked before unloading of the container begins. When a container is carried on a semi-trailer which is supported on landing legs situated well to the rear of the front end of the trailer, driving an industrial truck into the container may give rise to instability. In such a case the front end of the trailer should be propped.

Materials handling equipment used for unloading should not apply loads in excess of those for which the container is designed and tested (see BS 3951-2). Due attention should be given to possible problems caused by exhaust fumes when industrial trucks powered by internal combustion engines are used inside containers.

Appendix A Acceleration effects on freight containers in transit

A.1 Acceleration effects. Acceleration effects, including vibration and shock effects, are the principal mechanical factors that affect a container and its contents. The order of magnitude of the accelerations that may be encountered under certain severe operating circumstances and that may last sufficiently long to be damaging when considered in relation to the principal axes of a container are as follows:

vertical	2*g*;
longitudinal	2*g*;
transverse	0.8*g*.

A.2 Vertical acceleration: 2*g*. This order of magnitude of mean vertical acceleration will be felt by a container when it is set down hard on a virtually non-yielding surface such as paved ground, a ship's structure or another container which is already on such a surface.

This lowering-to-ground effect is an impact or shock loading, lasting a few hundredths of a second in total. So far as the container structure is concerned, it may be regarded as a burst of high frequency oscillations involving accelerations measured in tens of *g*, but lasting less than a thousandth of a second. So far as the cargo is concerned, much of the shock effect is filtered out by the container structure.

For all but the most delicate of cargoes, an allowance of 2*g* deceleration, i.e. for each item of cargo to feel twice the pressure between itself and the container floor and twice the superimposed weight that it feels when the container is stationary, will normally suffice. Fragile or delicate cargoes may require special treatment and should always be packed and stowed by specialists. Under severe conditions at sea, peaks of vertical acceleration of the order of 1.8*g* may be encountered. These are cyclical (approximately sinusoidal) accelerations, mainly associated with the pitch and heave motions of a ship and varying between 0.2*g* and 1.8*g* in total, i.e. including the normal gravitational effect over a period of 5 s to 15 s, depending on the size of the vessel concerned and the nature of the sea encountered. Accelerations of this order of magnitude are rarely encountered for more than a few hours (Ship's Masters can usually adjust course and speed to reduce the effect of severe seas), but of course lesser accelerations of this type can continue for many days.

Vertical accelerations of the vibrational and/or shock types will be encountered in both road and rail operations but although these may be more or less continuous, they are usually of such low order of magnitude that goods packed to withstand other types of shock loading will hardly feel them at all.

A.3 Longitudinal accelerations: 2*g*. This order of magnitude of mean longitudinal acceleration or deceleration may be encountered in the more severe railway marshalling operations.

If a container were to be carried on a wagon not having satisfactory shock absorbing features and the wagon were to be hump shunted at excessive speed, then decelerations of more than 2*g* could be encountered, but this is not the practice of responsible railway operators. On those railways which use close coupled wagons or specially designed block trains, i.e. with bar couplings, for the carriage of containers, longitudinal decelerations will rarely exceed 1*g*.

The very fact that containers whose end walls have been tested to a load equivalent to 0.4 times the containers rated payload have proved perfectly satisfactory for all but the most extreme eventualities, which usually involve inadequately secured cargo with low friction factors, demonstrates that normal mean longitudinal deceleration levels will be significantly less than 2*g*.

Nevertheless, because some railway marshalling operations involve decelerations of a complex semi-shock nature, it is advisable to pack and secure cargo against a nominal 2*g* longitudinal deceleration. Again, specialist advice should be sought for packaging and stowage of fragile or delicate cargo.

The longitudinal decelerations encountered on road vehicles will normally be of a lower order of magnitude than those encountered on rail, and the longitudinal effects encountered at sea will be of a lower order still.

A.4 Transverse accelerations: 0.8*g* This order of magnitude of peak transverse acceleration can be encountered under the most severe conditions at sea. Such accelerations are mainly due to ship's rolling motions. They are cyclical accelerations (approximately sinusoidal) varying between ± 0.8*g* over a period of 10 s to 20 s depending upon the characteristics of the vessel, the state of the sea and the ability of the Ship's Master to modify rolling effects by alteration of course and/or speed.

As with the longitudinal effect, the fact that containers whose side walls have been tested to a load equivalent to 0.6 times the container's rated payload have proved perfectly satisfactory in service, demonstrates that normal transverse accelerations will be significantly less than 0.8*g*.

Nevertheless, it is prudent to allow for a transverse acceleration of this order, i.e. to assume that cargo could feel a deceleration similar to that felt by the driver of a modern road vehicle when breaking hard.

It should also be remembered that while a container carrying vessel will very rarely roll as much as 30° to the vertical, larger rolls have been encountered in freak conditions.

The mean levels of the transverse effects encountered on road vehicles are of a lower order of magnitude than those encountered at sea, and those encountered on rail are of a lower order still.

The possibility of transverse vibration effects occurring either when a container is set down before all sideways motion has ceased, or when a rail wagon encounters discontinuity in rails at high speed, should not be ignored where the most delicate cargoes are concerned, but packaging which will protect such cargoes against the vertical and longitudinal shocks it may encounter should give more than adequate protection against transverse effects.

Appendix B Contamination (infestation) by pests and micro-organisms

B.1 Plant and animal health. Where pests and micro-organisms may be introduced into a country with particular products or materials and these pests and micro-organisms could be a danger to agriculture, horticulture, forestry or animal health, the importation of the products or materials may be controlled or even prohibited under Import Control, Health Control, Quarantine or other Regulations.

Such regulations may require consignments to be accompanied by certificates of freedom from pests or diseases at the point of origin, or of treatment prior to shipment.

Container operators are well aware of International Regulations with regard to quarantine as they relate to materials used in the construction of containers.

So far as animal health is concerned, most countries impose regulations as a protection for the health of their own native livestock, but some requirements are dictated by the animal health standards and control measures in the exporting country. As the pattern of animal diseases varies considerably from country to country so do the conditions applicable to the import of animals and animal products.

B.2 Food storage. Insects and mite pests of stored food may enter containers at loading or unloading points, but are most likely to be introduced with the following:

a) foodstuffs for human consumption or feed for animals;

b) animal and plant products from which foodstuffs are manufactured;

c) inedible products such as dried bones and skins.

Primary agricultural products loaded in the tropics are most likely to be heavily infested.

Infested secondhand sacks, dunnage and other packing materials can be a source of infestation irrespective of the type of cargo.

It is important that containers are thoroughly cleaned after the carriage of foodstuffs to prevent any residue providing a breeding ground for pests and insects.

Before loading a container, the exporter or packer should satisfy himself as far as possible that a container is free from infestation. Any container found to be contaminated should be rejected and a replacement requested.

B.3 Public health. Exporters and packers should be made aware of the considerable risk to public health that might arise if rodents (rats and mice) were permitted to enter containers and should take appropriate precautions to prevent such infestation.

Appendix C Cleaning, disinfestation and decontamination of freight containers

C.1 Cleaning. Any cleansing operation envisaged should have regard to the nature of the cargo which has been carried and to the materials and finish used in the construction of the container itself. General guidelines are as follows.

a) Excessive wetting of woodwork should be avoided as this may aggravate humidity problems when the container is loaded. Woodwork should be thoroughly dry-brushed and, if it then appears necessary, washed with suitable detergent followed by clean fresh water.

b) High gloss or metal surfaces should be scrubbed down with hot fresh water and detergent followed by washing with fresh water.

c) Special care should be taken in cleaning thermal containers so that equipment or insulation are not damaged.

d) In all cases where the interior of the container has been wetted it should be allowed to dry out thoroughly before being put into use.

e) Any residues or sweepings produced by cleansing and disinfecting procedures should be removed from the vicinity of the container.

C.2 Disinfestation

C.2.1 *General.* Pesticides and disinfectants may be used in containers as a supplement to good hygiene. The type used will depend on the circumstances and in particular on the design of the container, the goods concerned and the pest or organism to be controlled. Care should be taken in their choice to avoid damage to containers and their cargo by taint or contamination. They should be applied in accordance with the recommendations of the manufacturers, which should include appropriate precautionary measures to safeguard those applying the treatment as well as those who may handle, load, discharge or otherwise come into contact with a treated container.

Particular attention should be paid to the ventilation of containers after the application of fumigants. Specialist advice should be sought on fumigation (see also Health and Safety Executive Guidance Notes CS10 and CS12[6)].

Phosphine and phosphine-based products which are generally in the form of tablets or powder should never be used without permission from the container operator since special arrangements have to be made for removal of residues. Furthermore, most operating companies will not allow any movement of containers under phosphine fumigation.

C.2.2 *Treatment of empty containers.* This may be achieved by the following means.

a) *Fumigation.* Fumigants act as gases even though some may be applied in the form of liquids or solids. For their effective and safe use against insect or rodent pests a container to be treated should, as far as possible, be capable of being rendered gas tight. This will depend on its method of construction and its state of repair being such as readily to permit effective sealing.

Since fumigants are poisonous to man and require special equipment and skill in application, they should be used only by trained staff working to a carefully prepared set of operating instructions.

A number of proprietary brands of fumigant are available the most common constituent being methyl bromide. Dosages required will vary and advice should be sought from specialists qualified to carry out fumigation.

It should be noted that few of the world fleet of containers are provided with fumigation insertion tubes.

b) *Rodenticides.* The operational problems that need to be overcome if baits incorporating a rodenticidal poison are to be used without hazard in containers, may well preclude their use. Where there is evidence of the presence of rodents in containers, fumigation is the most satisfactory method of control.

C.2.3 *Treatment of loaded containers.* Similar guidance to that outlined in **C.2.2** should be applied but it is possible to treat most closed containers in the loaded condition.

Certificates from suitably qualified pest control companies will include details of both the fumigation and subsequent ventilation procedures.

Some operating companies will not permit shipment of containers while under fumigation.

C.2.4 *Use of disinfectants.* All chemical disinfectants should be applied as a liquid solution. All dirt or soiling matter should first be removed either by a detergent wash prior to disinfection or by a combined detergent disinfectant process. The first is the more effective, though the latter followed by a treatment with further disinfectant may be required in some circumstances where non-indigenous bacteria are known to be present. The concentration should be to the manufacturer's recommendations. If available, hot water should be used for the disinfectant solution. Specialist advice should be sought where soiling cannot be removed by normal detergent washing. Disinfection cannot be achieved unless the soil or dirt on the surfaces to be disinfected is first removed.

C.3 Decontamination. If an empty container carries a dangerous goods label, any requirement for decontamination should be checked and the appropriate procedure carried out. When the necessary action has been taken it is essential that the dangerous goods label be removed.

[6)] Obtainable from HMSO.

Appendix D Publications providing further information

The following publications provide further information which may be relevant.

HSE Booklet HS (G) 7 Container Terminals[7)]

HSE Guidance Note CS10 Fumigation using phosphine[7)]

HSE Guidance Note CS12 Fumigation using methyl bromide (bromomethane)[7)]

HSE Guidance Note GS31 Safe use of ladders, step ladders and trestles 1984[7)]

HSE Guidance Note PM28 Working platforms on fork lift trucks 1981[7)]

Recommendations for the Safe Operation of Large Lift Trucks and Ro-Ro Terminals 1983[8)]

ICHCA booklet Safe handling of ISO freight containers by hooks and general guide to the container safety convention[9)]

Department of Transport Code of Practice. Safety of Loads on Vehicles. Second Edition 1984[7)]

BS 2770 Specification for pictorial marking of handling instructions for goods in transit[9)]

[7)] Obtainable from HMSO.

[8)] Obtainable from the National Association of Port Employers, 1/19 New Oxford Street, London SW1A 1DE.

[9)] Obtainable from the International Cargo Handling Co-ordination Association, 71 Bondway, London SW8 1SH.

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Publications referred to

BS 2770, *Specification for pictorial marking of handling instructions for goods in transit.*
BS 3951, *Freight containers.*
BS 3951-1, *General.*
BS 3951-1-1.1, *Specification for series 1 freight containers: Classification, dimensions and ratings.*
BS 3951-1-1.2, *Specification for corner fittings for series 1 freight containers.*
BS 3951-1-1.4, *Glossary of terminology.*
BS 3951-1-1.5, *Guide to the handling and securing of series 1 freight containers.*
BS 3951-1-1.6, *Specification for coding, identification and marking.*
BS 3951-2, *Specification and testing of series 1 freight containers.*
BS 3951-2-2.1, *General cargo containers for general purposes.*
BS 3951-2-2.2, *Thermal containers.*
BS 3951-2-2.3, *Tank containers for liquids, gases and pressurized dry bulk.*
BS 3951-2-2.4, *Non-pressurized containers for dry bulk.*
BS 3951-2-2.5, *Platform and platform-based containers.*
BS 5759, *Specification for webbing load restraint assemblies for use in surface transport.*

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