BS EN 15878:2010

BSI Standards Publication

Steel static storage systems — Terms and definitions

National foreword

This British Standard is the UK implementation of EN 15878:2010.

The UK participation in its preparation was entrusted to Technical Committee MHE/8, Steel shelving, bins and lockers.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

ISBN 978 0 580 63804 6

ICS 01.040.53; 53.080

Compliance with a British Standard cannot confer immunity from legal obligations.

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 August 2010

Amendments issued since publication

Date	Text affected

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 15878

July 2010

ICS 01.040.53; 53.080

English Version

Steel static storage systems - Terms and definitions

Système de stockage statiques en acier - Termes et définitions

Ortsfeste Regale aus Stahl - Begriffe

This European Standard was approved by CEN on 19 June 2010.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and United Kingdom.

EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: Avenue Marnix 17, B-1000 Brussels

Ref. No. EN 15878:2010: E

Contents

Page

Foreword

This document (EN 15878:2010) has been prepared by Technical Committee CEN/TC 344 “Steel static storage systems”, the secretariat of which is held by UNI.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by January 2011, and conflicting national standards shall be withdrawn at the latest by January 2011.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

Introduction

This European Standard has been developed in order to rationalize the position which has been built up over the years resulting in a multiplicity of terms used by manufacturers and users, varying geographically and even across organizations.

This standard will clarify this position and result in a positive identification of the various items of storage equipment.

1 Scope

This European Standard specifies terms and definitions for steel storage systems, as listed in Table 1, and their basic components and accessories.

NOTE Terms and definitions for mechanical handling equipment and load make-up accessories are included in informative annexes.

2 Normative references

Not applicable.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1 Storage system

3.1.1
storage system
steel racking or shelving structure designed to store unit loads in a safe and organized way

NOTE Table 1 shows the types of storage systems.

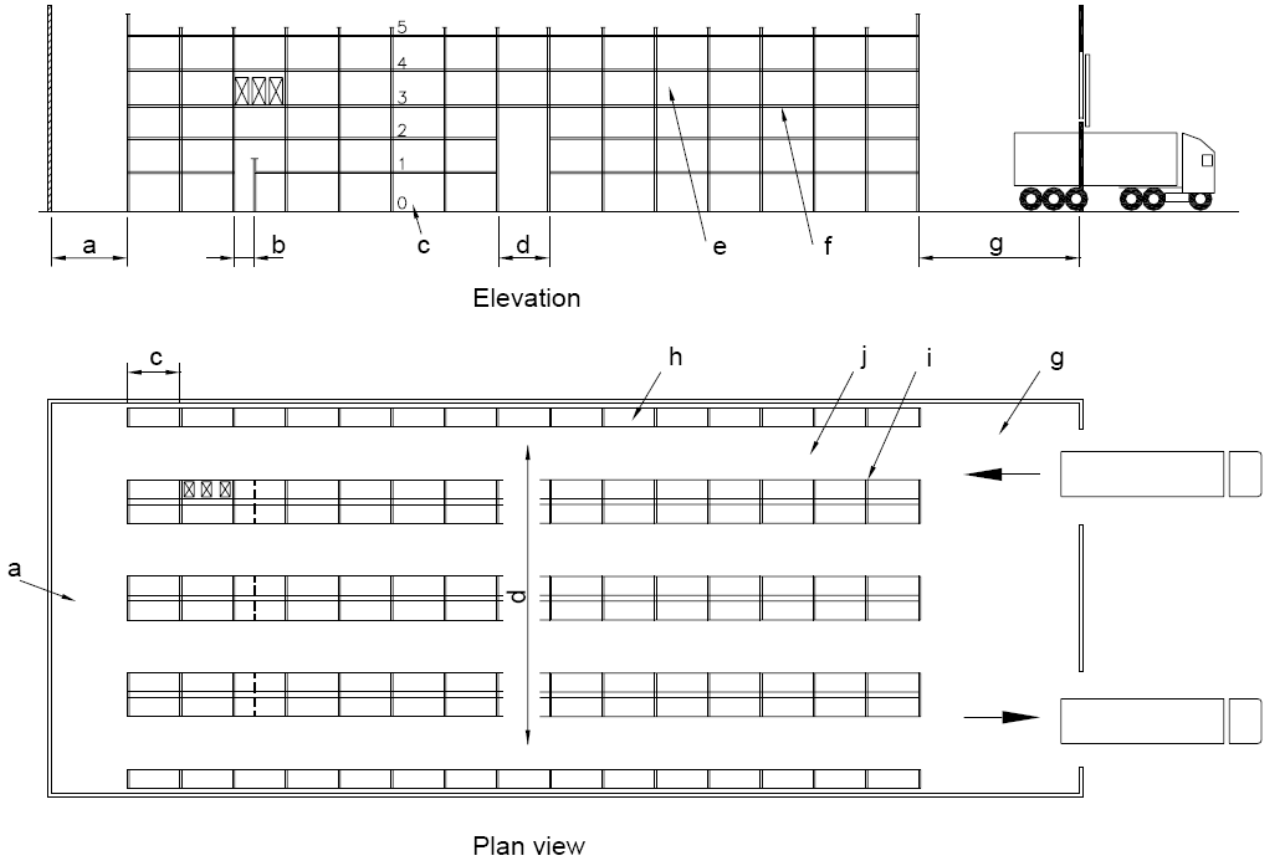
Table 1 — Types of storage systems

Section	Type of Unit Load	Section	Storage System
5.1	Palletized Goods	5.1.1	Adjustable pallet racking
		5.1.2	Drive-in and drive-through pallet racking
		5.1.3	S/R machine pallet racking
		5.1.4	Open face pallet racking
5.2	Small Parts Mechanically Handled	5.2.1	Open face miniload racking
		5.2.2	Multi-location miniload racking
5.3	Small Parts Hand Loaded	5.3.1	Shelving
		5.3.2	Multi-tier shelving
		5.3.3	Cantilever shelving - Gondola
5.4	Long Unit Loads	5.4.1	Cantilever racking
		5.4.2	Cassette racking
5.5	Dynamic Storage Palletized Goods	5.5.1	Mobile racking
		5.5.2	Pallet live storage
		5.5.3	Shuttle racking
5.6	Dynamic Storage Small Parts	5.6.1	Mobile shelving
		5.6.2	Carton live storage
		5.6.3	Carousels
		5.6.4	Storage lifts
5.7	Various	5.7.1	Mezzanine floor
		5.7.2	Raised floor
		5.7.3	Rack-clad

3.2 General definitions for any type of storage system

3.2.1
general arrangement
plan view and elevation of the installation

NOTE See Figure 1.



Key

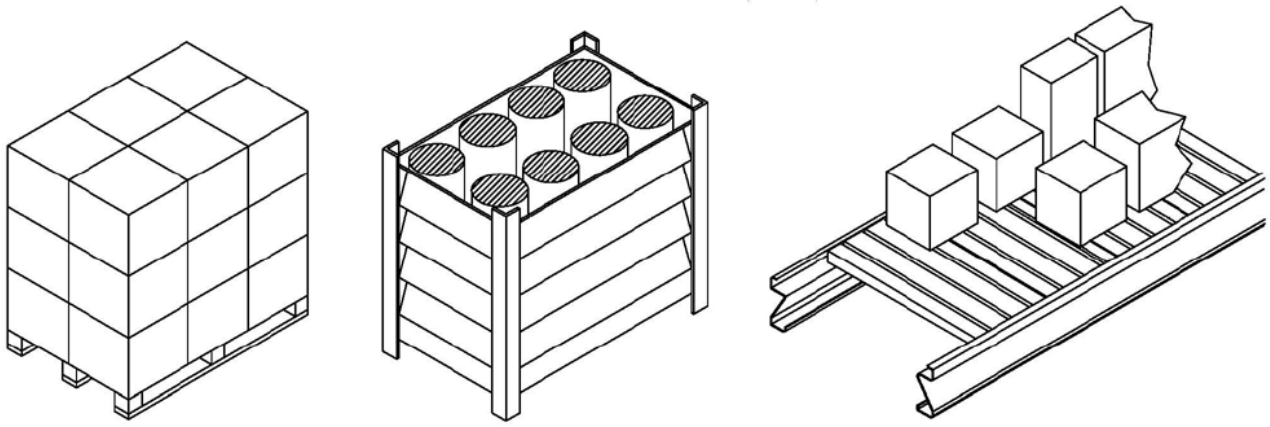
a gangway
b pedestrian passageway
c bay
d passageway
e compartment
f storage level
g marshalling area
h single entry run
i double entry run
j operating aisle

Figure 1 — Example of racking general arrangement

3.2.2
unit load
individual item which can be placed or retrieved in one operation, e.g. a pallet or a container with goods in a racking system or an individual box or a package in a shelving system

NOTE 1 See Figure 2.

NOTE 2 More than one unit load may be handled in one operation.



a) Loaded pallet **b) Loaded container** **c) Individual boxes**

Figure 2 — Examples of unit loads

3.2.3
bay
module between uprights or upright frames

3.2.4
run
series of connected bays

3.2.5
warehouse
building for storing and handling unit loads

3.2.6
compartment
volume limited by adjacent frames down-aisle and adjacent storage levels in height

3.2.7
storage level
area or set of components intended to support the stored unit loads at a particular height

3.2.8
compartment load
load which can be stored in one compartment

3.2.9
bay load
total allowable weight of all the unit loads in a bay not including unit loads which might be stored on the floor of the bay

3.2.10
single entry rack
run of racking or shelving accessible from one operating aisle only

3.2.11
double entry rack
run of racking or shelving accessible from two operating aisles

3.2.12
single deep racking
racking in which unit loads can be stored one deep from one operating aisle

3.2.13
double deep racking
racking in which unit loads can be stored two deep from one operating aisle

3.2.14
down-aisle direction
direction parallel to a run

3.2.15
cross-aisle direction
direction perpendicular to a run

3.2.16
clearance
nominal dimension between items to ensure safe operation related to a tolerance-free, undeformed system

3.2.17
operating aisle
space giving direct access to picking and loading faces

3.2.18
operating aisle width
minimum dimension across the aisle at any level between either unit loads located in their nominal position or between the rack structure components

3.2.19
gangway
space for movement or transport but not giving direct access to picking or loading faces

3.2.20
passageway
gangway resulting from eliminating one or more levels so the MHE can pass under the remaining levels

3.2.21
pedestrian passageway
space for pedestrian use only

3.2.22
escape route
space giving pedestrians access to emergency exits

3.2.23
marshalling area
area to receive or collate unit load

3.3 Components

3.3.1
upright
vertical component (often perforated) on which beams, arms, supports, etc. are fixed, supporting the loads transmitted by them

NOTE See Figure 4.

3.3.2
base plate
structural component connected to an upright to spread the load on the floor and to allow fixing to the floor

NOTE See Figure 4.

3.3.3
upright frame
two or more upright sections linked together by means of a lattice or battens and fitted with base plates, intended to support the storage levels

NOTE See Figure 4.

3.3.4
anchor bolt
device that connects the base plate to the floor

NOTE See Figure 4.

3.3.5
shim
component located beneath the base plate to level the storage system

NOTE See Figure 4.

3.3.6
non-shrink grout
special mortar placed on site under the base plate to level the storage system

3.3.7
upright protector
free standing component to protect the lower part of uprights against accidental impact from MHE

NOTE See Figure 4.

3.3.8
frame barrier
free standing component(s) to protect the lower part of upright frames at the ends of runs and at passageways against accidental impact from MHE

NOTE See Figure 4.

3.3.9
beam
horizontal load carrying member linking adjacent frames, parallel to the operating aisle

NOTE See Figure 4.

3.3.10
beam end connector
component welded to or otherwise formed as an integral part of the beams which has hooks or other devices which engage in holes or slots in the upright

NOTE See Figure 4.

3.3.11
beam connector lock
device, independent or built into the connector, to reduce the risk of accidental vertical dislodgement of the beam

NOTE See Figure 4.

3.3.12
shelf
load carrying surface, supported by uprights or beams

3.3.13
pick up and deposit station
P&D station
structure at the end of an operating aisle used as an interface between different types of mechanical handling equipment

NOTE The P&D station can also be used to accurately fix the location of the unit load relative to the racking. This is often used by trucks or S/R machines having a fixed length of fork stroke and ensures accuracy in the down and cross-aisle directions when placing the unit load onto the rack beams.

3.3.14
run spacer
component connecting and spacing two upright frames back to back

NOTE See Figure 4.

3.3.15
deck
load carrying surface, supported by beams or arms

NOTE It might consist of shelves, steel panels, chipboard, mesh, etc.

3.3.16
deck support
structural component spanning between beams cross-aisle to increase the load carrying capacity of the deck

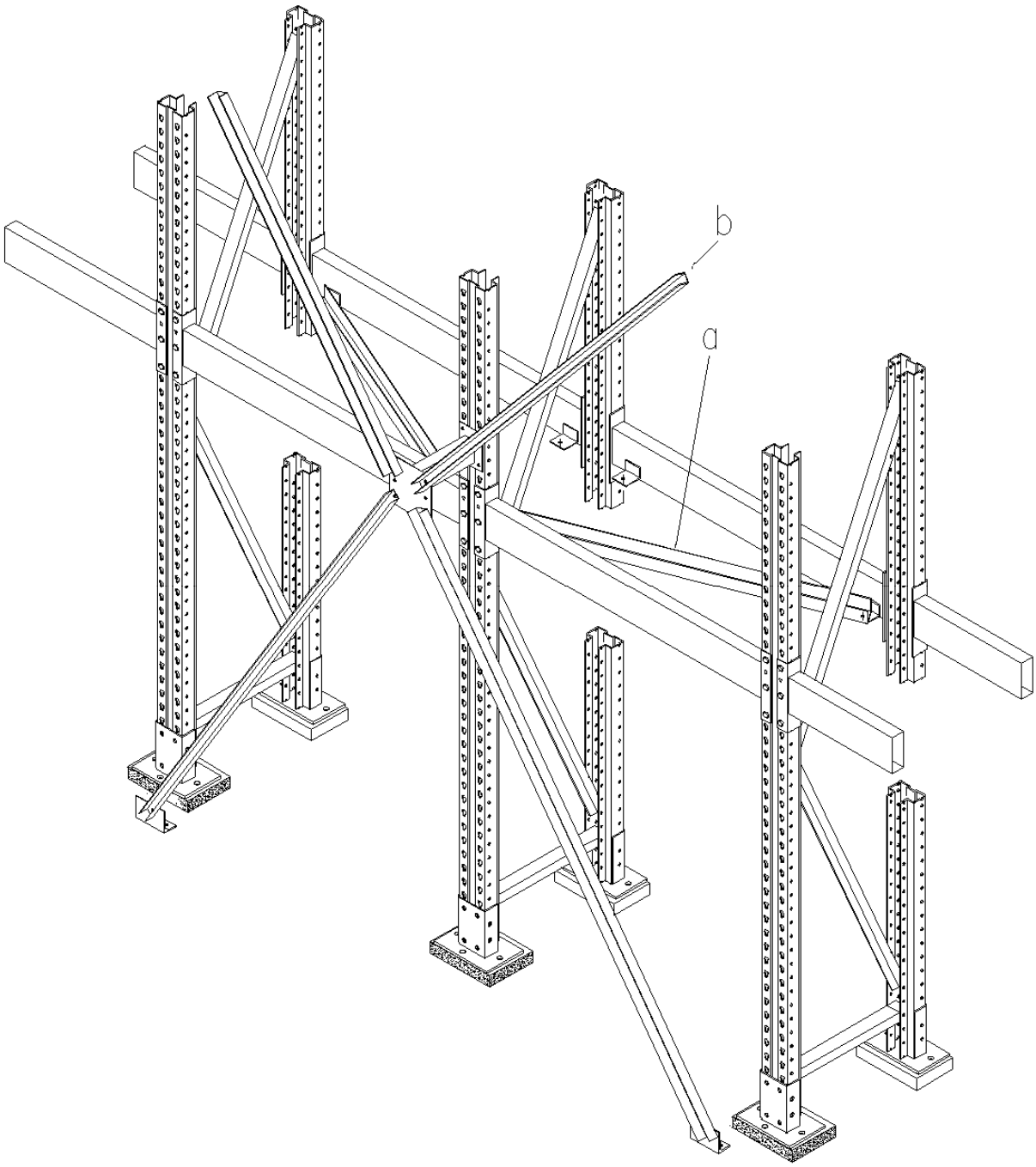
3.3.17
plan bracing
horizontal structure in the run at load levels which, together with the spine bracing, provides stability to the storage system

NOTE See Figure 3.

3.3.18
top plan bracing
top horizontal structure which, together with the spine bracing, provides stability to the storage system

3.3.19
spine bracing
set of components in the vertical plane which, together with the plan and/or top plan bracing, provides stability to the storage system in the down aisle direction

NOTE See Figure 3.



Key

a plan bracing

b spine bracing

Figure 3 — Plan and spine bracing

3.3.20
tie beam
horizontal structural component which does not support unit loads and is generally part of the plan bracing system

3.3.21
portal tie beam
horizontal structural component which may support the upper guide rail and transmit the forces imposed by S/R machines

3.3.22
arm
load bearing component fixed to uprights

3.3.23
beam rail
horizontal component perpendicular to the operating aisle, directly supporting the unit loads at each storage level

3.3.24
fork spacer
component supported by the beams to provide a fork entry beneath the unit load

NOTE These may sometimes be referred as top-hats.

3.3.25
pallet support bar
structural component spanning between beams in the cross-aisle direction for the safe support of the pallet on the compartment

NOTE See Figure 4.

3.3.26
stop
component intended to retain unit loads, restricting their sliding or rolling when stored

3.3.27
safety back stop
component used to prevent accidental collision of a moving object with other unit loads or equipment when the unit load is placed or removed from its storage location

NOTE In EN 528 safety back stops are used to prevent unintentional unit load movement.

3.3.28
buffer back stop
component used as an aid for MHE to deposit the unit load in the correct position in the racking

3.3.29
upper guide rail
structural component, fixed to the portal tie beams of the storage system, used to provide horizontal support and guidance to the S/R machine

3.3.30
bottom rail
structural component to support and guide the base of the S/R machine or other handling equipment

3.3.31
busbar support
structural component mounted on the floor or storage system to support the power supply to the S/R machine

3.3.32
S/R machine run-outs
top structure located at one or both ends of the operating aisle extending the upper guide rail to facilitate the S/R machine operations

3.3.33
truck guide rails
one or two sections, within the operating aisle or lane, to control the position of the truck within the aisle or lane

3.3.34
mezzanine floor
surface supported by means of a free standing structure to carry the load of mechanical equipment, personnel, unit loads, etc.

3.3.35
raised floor
surface supported by means of a racking/shelving system to carry the load of mechanical equipment, personnel, unit loads, etc.

3.3.36
pallet loading gate
assembly located at the edge of a raised or mezzanine floor, allowing depositing and retrieval of unit loads safely

3.3.37
handrailing
protection system comprising handrail, knee rail, kick plate and sometimes infill panels, to prevent a fall over an exposed edge

3.3.38
safety mesh
component fixed to the storage system to prevent goods from falling

3.3.39
safety fencing
component fixed to the floor to prevent personnel to access to restricted areas

3.3.40
back sheet
cladding used to close the back of a bay

3.3.41
bin front
component fitted to the front edge of a shelf or compartment level to retain goods

3.3.42
divider
vertical component used to horizontally subdivide the compartment

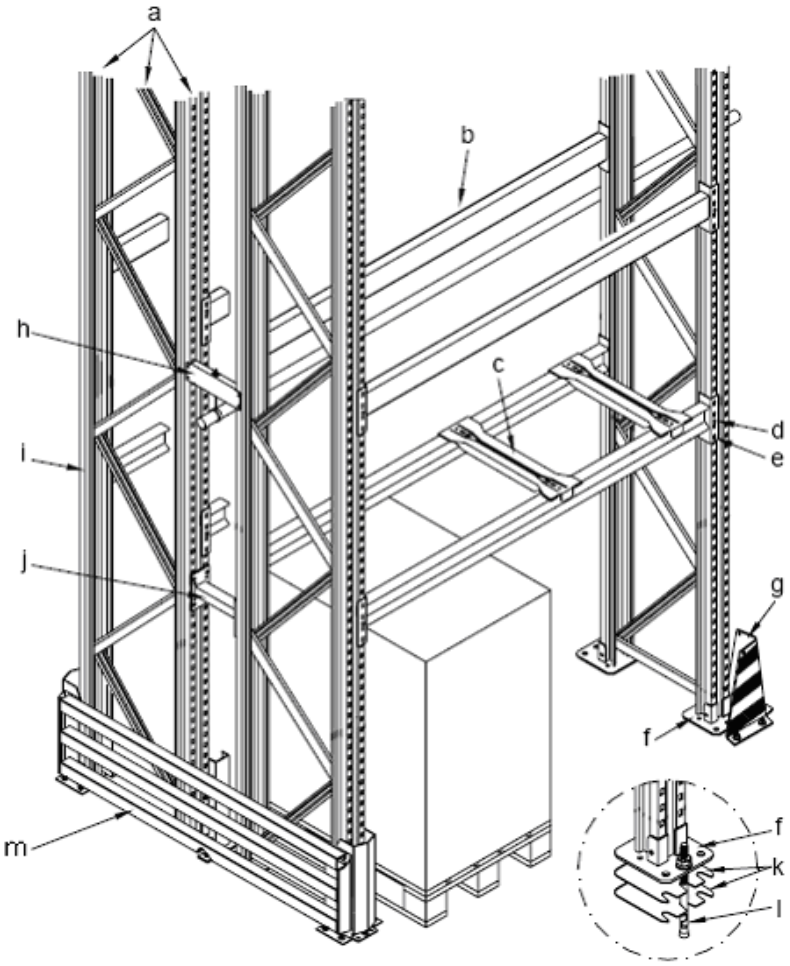
3.3.43
plinth
component closing the gap between the bottom shelf and the floor

3.3.44
sprinkler support
structural component fixed to the storage system to support the piping for the fire extinguishing system

NOTE See Figure 4.

3.3.45
load warning notice
component fixed in prominent locations to provide personnel with important information about the safe use of the storage system

3.3.46
notice
informational component used to provide personnel with useful information



Key

a upright frame
b beam
c pallet support bar
d beam connector lock
e beam end connector
f base plate
g upright protector
h sprinkler support
i upright
j run spacer
k shim
l anchor
m frame barrier

Figure 4 — General system components

4 Abbreviations

MHE Mechanical Handling Equipment

S/R Storage and Retrieval

VNA Very Narrow Aisle

P&D Pick and Deposit

APR Adjustable Pallet Racking

FIFO First In – First Out

LIFO Last In – First Out

DM Defined Movement

FM Free Movement

LMA Load Make up Accessory

PRS Person Responsible for Safety

DIR Drive In Racking

RSA Raised Storage Area

5 Storage Systems: Types, specific definitions and components

5.1 Palletized Goods

5.1.1 Adjustable pallet racking − APR

5.1.1.1 General

System of upright frames connected by horizontal beams to provide unit load storage levels which can be adjusted vertically (see Figure 5).

5.1.1.2 Definitions

In addition to the definitions given in 3.3, the following specific definitions apply to this system.

5.1.1.2.1
coil/reel cradle
component to locate and support coils/reels between beams with their longitudinal axis located horizontally and perpendicular to the operating aisle

5.1.1.2.2
drum chock
component to locate cylindrical unit loads between beams with their longitudinal axis located horizontally and perpendicular to the operating aisle

5.1.1.2.3
container support
component spanning the beams to support stillage/container feet

5.1.1.3 Basic components

See 3.3 for definitions and Figure 5 for the system basic components (depending on the system design not all basic components may be required):

— upright frame;

— base plate;

— shim;

— anchor bolt;

— run spacer;

— beam;

— beam connector lock;

— plan bracing;

— spine bracing;

— upright protector;

— load warning notice.

5.1.1.4 Accessories

See 3.3 for definitions and Figure 5 for the system accessories, except where indicated otherwise:

— non-shrink grout;

— notice;

— mesh guard;

— safety fencing;

— safety back stop;

— buffer back stop;

— pick up and deposit (P&D) station;

— frame barrier;

— top hat;

— fork spacer;

— coil/reel cradle (see 5.1.1.2.1);

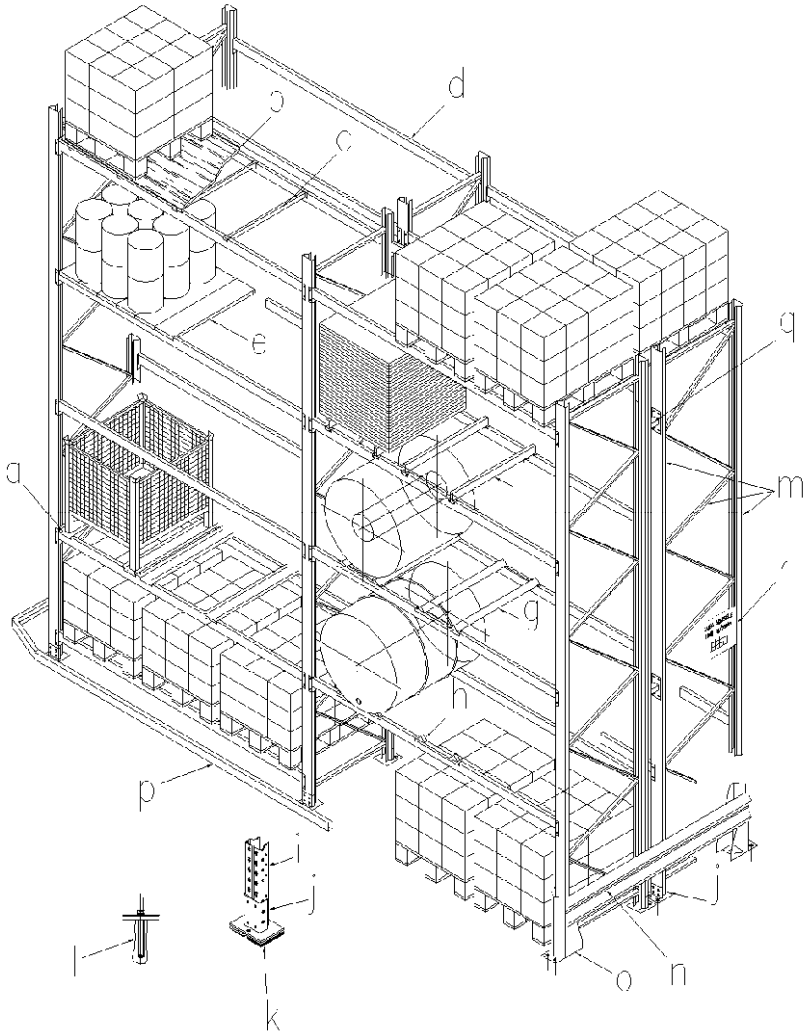
— drum chock (see 5.1.1.2.2);

— container support (see 5.1.1.2.3);

— sprinkler support;

— VNA truck guide rail;

— top tie beam.



Key

a container support
b deck
c deck support
d beam
e shelf panel
f fork spacer
g coil cradle
h drum chock
i upright
j base plate
k shim
l anchor bolt
m upright frame
n frame barrier
o upright protector
p VNA truck guide rail
q run spacer
r load warning notice

Figure 5 — Adjustable pallet racking – APR

5.1.2 Drive-in and drive-through pallet racking

5.1.2.1 General

System of racking that provides blocks of storage where pallets are stored two or more deep and where access is gained by driving a forklift truck into a lane with pallets supported along their sides on beam rails supported from the uprights.

In the drive-in racking, the forklift truck drives into a lane and reverses out.

In the drive-through, the forklift truck could drive through the lane if there are no pallets in the lane.

5.1.2.2 Definitions

In addition to the definitions given in 3.3, the following specific definitions apply to this system.

5.1.2.2.1
lane
space between frames, perpendicular to the operating aisle, allowing the stacker or forklift truck to enter the space and to pick and deposit unit loads in depth and height

5.1.2.2.2
block
group of interconnected lanes

5.1.2.2.3
pallet entry guard
component to help the operator to visually centre the unit load at the lane entry

5.1.2.2.4
pallet guard rail
member parallel to the beam rail, or and integral part of it, which provides guidance in the positioning of pallets on the beam rail

5.1.2.2.5
upright spacer
structural component joining a single upright (mono-post) with an upright frame in the down-lane direction

5.1.2.2.6
bump stop
component fixed to the floor to limit the travel of the MHE

5.1.2.3 Basic components

See 3.3 and Figure 6 for definitions of the system basic components (depending on the system design, not all basic components may be required):

— upright frame;

— base plate;

— shim;

— anchor bolt;

— top tie beam;

— arm;

— beam rail;

— beam connector lock;

— upright spacer;

— top plan bracing;

— spine bracing;

— upright protector;

— load warning notice.

5.1.2.4 Accessories

See 3.3 and Figure 6 for definitions of the system accessories, except where indicated otherwise:

— notice;

— pallet entry guide (see 5.1.2.2.3);

— non-shrink grout;

— frame barrier;

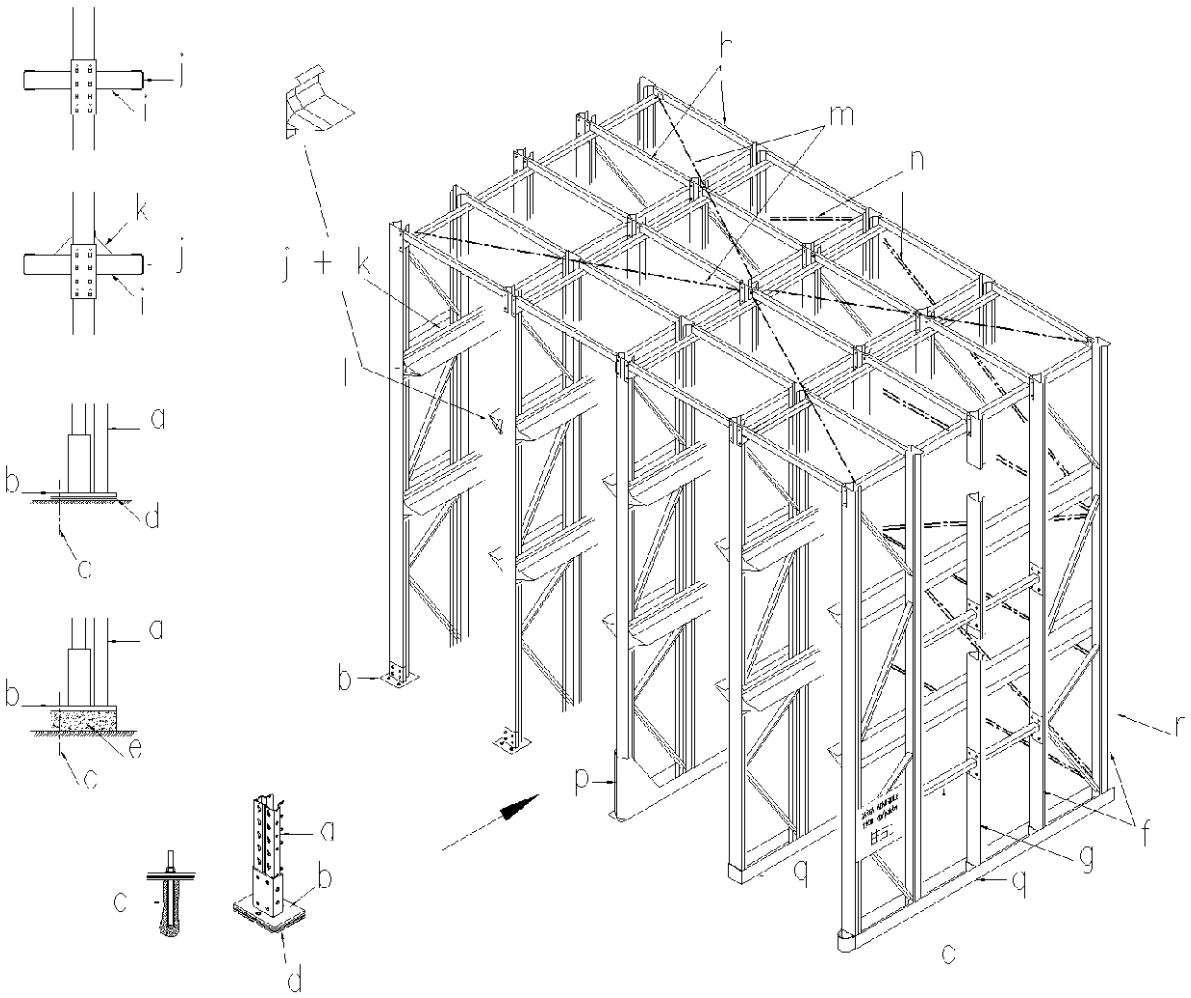
— safety back stop;

— buffer back stop;

— truck guide rail;

— pallet guard rail (see 5.1.2.2.4);

— bump stop (see 5.1.2.2.6).



Key

a upright
b base plate
c anchor bolt
d shim
e non-shrink grout
f upright frame
g mono-post
h tie beam
i arm
j beam rail
k pallet guide rail
l pallet entry guard
m top plan bracing
n spine bracing
o upright spacer
p upright protector
q forklift truck guide rail
r load warning notice

Figure 6 — Drive-in pallet racking – DIR

5.1.3 S/R machine pallet racking

5.1.3.1 General

This system consists of frames joined by beams. The beams are the load levels, which are accessed using S/R machines.

5.1.3.2 Definitions

Definitions given in 3.3 apply.

5.1.3.3 Basic components

See 3.3 and Figure 7 for definitions of the system basic components (depending on the system design, not all basic components may be required):

— upright frame;

— base plate;

— non-shrink grout;

— shim;

— anchor bolt;

— beam;

— beam connector lock;

— top beam;

— portal tie beam;

— spine bracing;

— plan bracing;

— top plan bracing;

— upper guide rail;

— bottom rail;

— S/R machine run-out;

— load warning notice.

5.1.3.4 Accessories

See 3.3 and Figure 7 for definitions of the system accessories, except where indicated otherwise:

— notice;

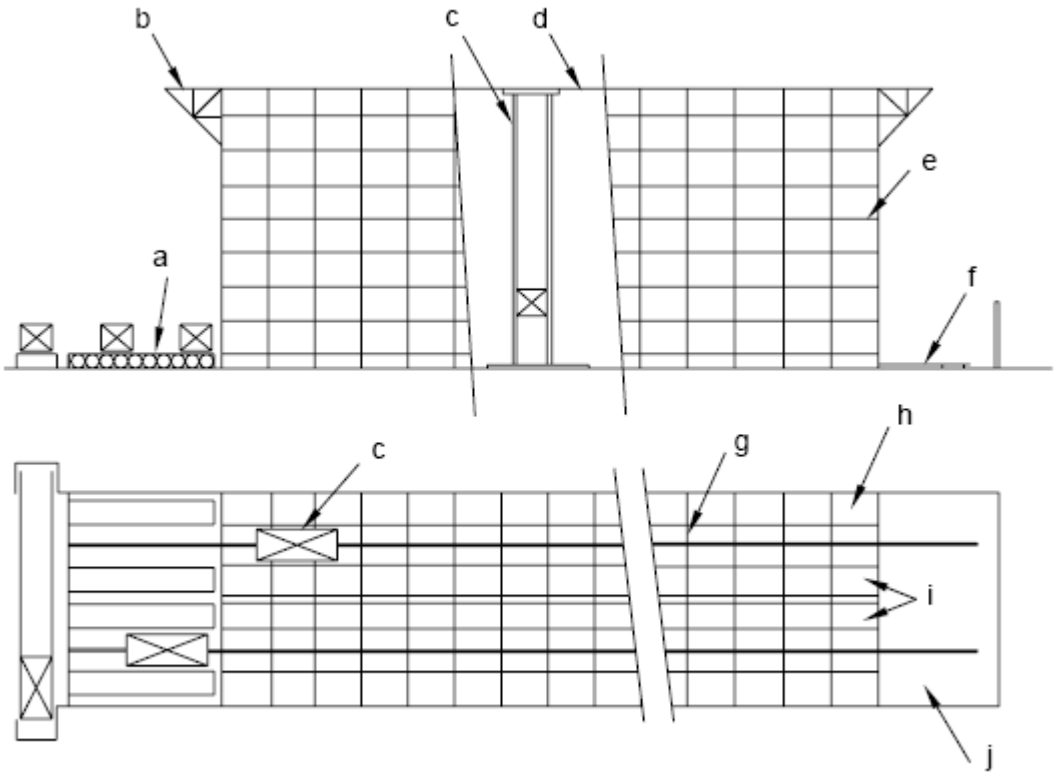
— mesh guard;

— safety fencing;

— P&D station;

— busbar support;

— sprinkler support.



Key

a conveyors
b S/R machine run-out
c S/R machine
d upper guide rail
e beam
f bottom rail
g portal tie beam
h single entry run
i double entry run
j maintenance area

Figure 7 — S/R machine pallet racking

5.1.4 Open face pallet racking

5.1.4.1 General

System consisting of upright frames joined by top and tie beams in order to provide stability to the system. Storage levels for unit loads consist of beam rails with or without arms or just arms and are accessed by forklift trucks or S/R machines.

5.1.4.2 Definitions

In addition to the definitions given in 3.3, the following definitions specifically apply to this system.

5.1.4.2.1
reel shaft support
component, with its longitudinal axis located horizontally and perpendicular to the operating aisle, fixed to the frame and used to correctly and safely place reels, with the reel shaft being the supported item

5.1.4.2.2
ledger angle
horizontal component fixed to the upright in the cross-aisle direction which supports the unit loads at each level

5.1.4.3 Basic components

See 3.3 and Figure 8 for definitions of the system basic components (depending on the system design, not all basic components may be required):

— upright frame;

— base plate;

— shim;

— anchor bolt;

— tie beam;

— arm;

— ledger angle (see 5.1.4.2.2);

— portal tie beam;

— spine bracing;

— plan bracing;

— top plan bracing;

— upper guide rail;

— bottom rail;

— S/R machine run-out;

— VNA truck guide rail;

— upright protector;

— load warning notice.

5.1.4.4 Accessories

See 3.3 and Figure 8 for definitions of the system accessories, except where indicated otherwise:

— notice;

— non-shrink grout;

— mesh guard;

— safety fence;

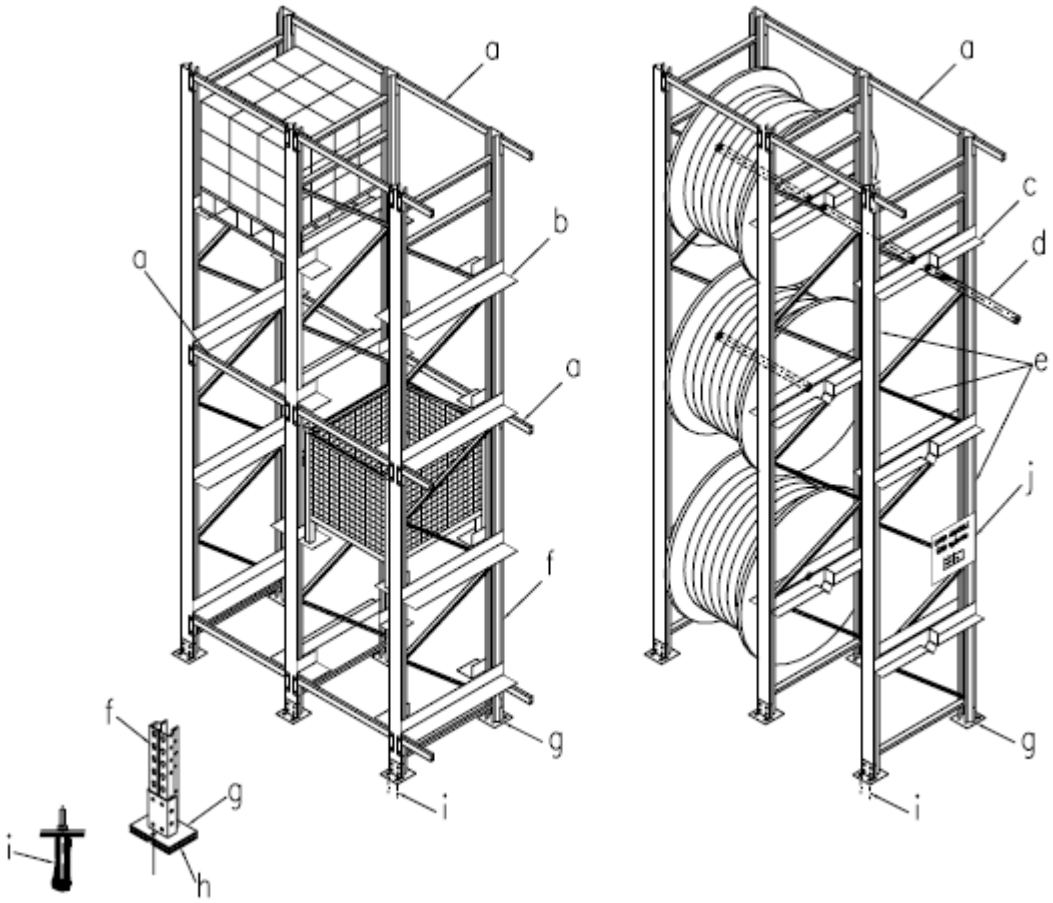
— P&D station;

— reel shaft support (see 5.1.4.2.1);

— busbar support;

— sprinkler support;

— frame barrier.



Key

a tie beam
b ledger angle
c reel shaft support
d reel shaft
e upright frame
f upright
g base plate
h shim
i anchor bolt
j load warning notice

Figure 8 — Open face pallet racking

5.2 Small Parts – Mechanically Handled

5.2.1 Open face miniload racking

5.2.1.1 General

System consisting of upright frames joined by top and tie beams in order to provide stability to the system. Storage levels for unit loads consist of support profiles and are accessed by S/R machines; unit loads are usually boxes or trays.

5.2.1.2 Definitions

In addition to the definitions given in 3.3, the following definition specifically applies to this system.

5.2.1.2.1
ledger angle
horizontal component fixed to the upright in the cross-aisle direction which supports the unit loads at each level

5.2.1.3 Basic components

See 3.3 and Figure 9 for definitions of the system basic components (depending on the system design not all basic components may be required):

— upright frame;

— base plate;

— non-shrink grout;

— anchor bolt;

— tie beam;

— ledger angle (see 5.2.1.2.1);

— portal tie beam;

— spine bracing;

— plan bracing;

— top plan bracing;

— upper guide rail;

— bottom rail;

— S/R machine run-out;

— load warning notice.

5.2.1.4 Accessories

See 3.3 and Figure 9 for definitions of the system accessories, except where indicated otherwise:

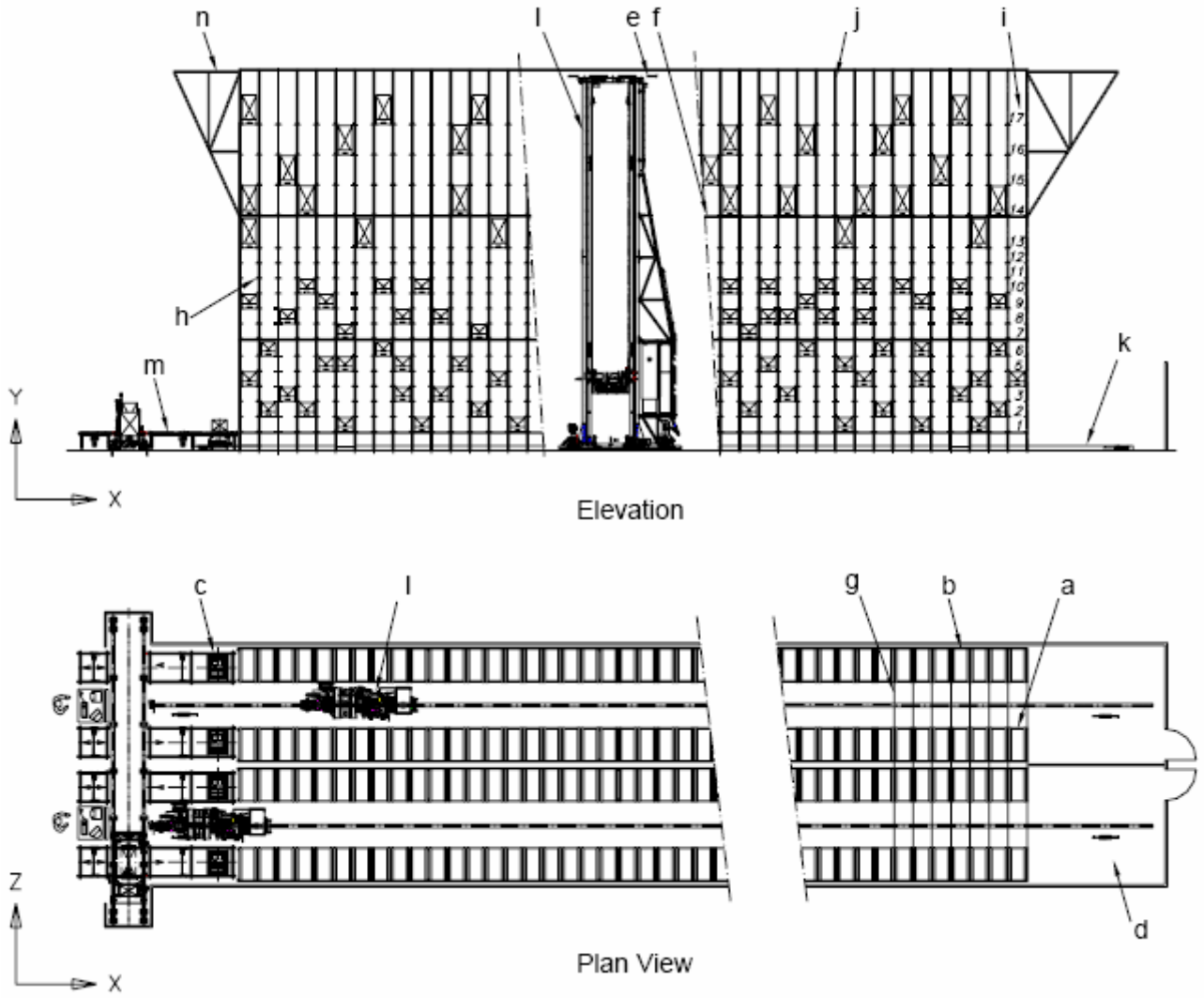
— notice;

— mesh guard;

— safety fencing;

— busbar support;

— sprinkler support.



Key

a double entry run
b single entry run
c input/output area
d maintenance area
e upper guide rail
f tie beam
g portal tie beam
h ledger angle
i storage levels
j upright
k bottom rail
l S/R machine
m conveyors
n S/R machine run-out

Figure 9 — Open face miniload racking

5.2.2 Multi-location miniload racking

5.2.2.1 General

System consisting of upright frames joined by beams that constitute the compartment levels; these levels for unit loads consist of beams combined with cross support profiles or decks (steel panels, mesh panels, support bars, etc.), unit loads are usually boxes which are accessed using S/R machines.

5.2.2.2 Definitions

In addition to the definitions given in 3.3, the following definition specifically applies to this system.

5.2.2.2.1
cross support profile
horizontal component generally fixed to the beams in the cross-aisle direction which supports the unit loads at each level

NOTE See Figure 11.

5.2.2.3 Basic components

See 3.3 and Figure 10 for definitions of the system basic components (depending on the system design, not all basic components may be required):

— upright frame;

— base plate;

— non-shrink grout;

— anchor bolt;

— beam;

— beam connector lock;

— deck;

— cross support profile (see 5.2.2.2.1);

— portal tie beam;

— spine bracing;

— plan bracing;

— top plan bracing;

— upper guide rail;

— bottom rail;

— S/R machine run-out;

— load warning notice.

5.2.2.4 Accessories

See 3.3 and Figure 10 for definitions of the system accessories:

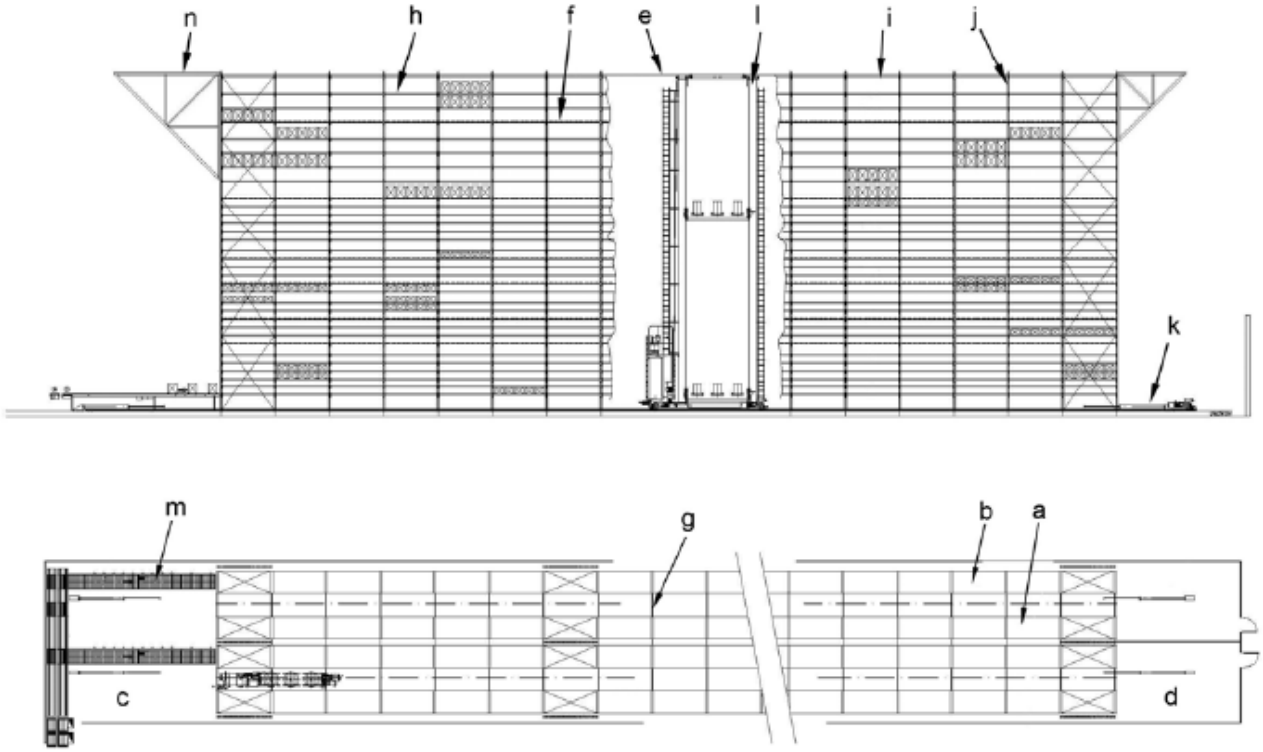
— notice;

— mesh guard;

— safety fencing;

— busbar support;

— sprinkler support.



Key

a double entry run
b single entry run
c input/output area
d maintenance area
e upper guide rail
f beam
g portal tie beam
h deck
i storage levels
j upright
k bottom rail
l S/R machine
m conveyors
n S/R machine run-out

Figure 10 — Multi-location miniload racking – Cross support profile

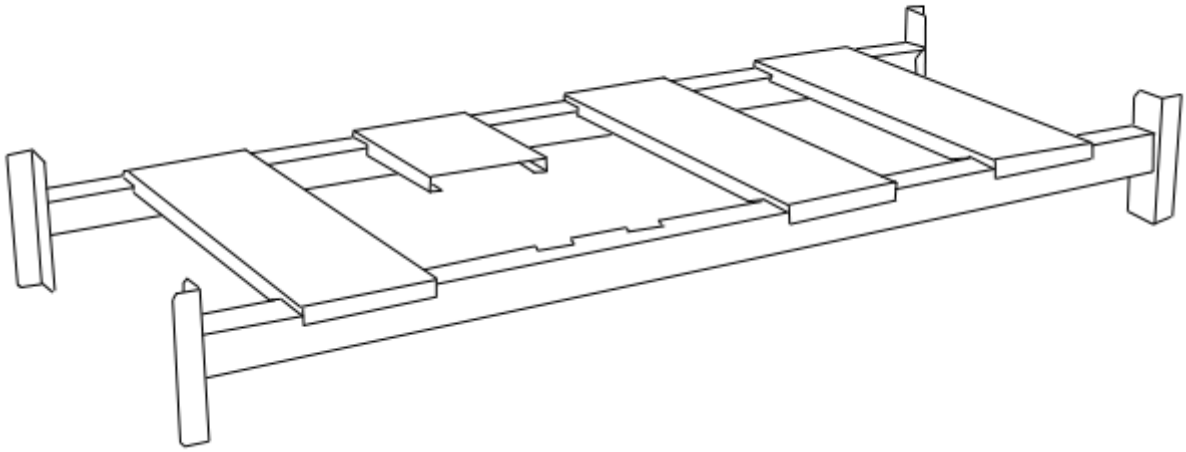


Figure 11 — Multi-location miniload racking – Cross support profile

5.3 Small Parts − Hand Loaded

5.3.1 Shelving

5.3.1.1 General

System of upright frames connected by horizontal shelves or beams with decks to provide unit load storage levels which can be adjusted vertically.

5.3.1.2 Definitions

In addition to the definitions given in 3.3, the following specific definitions apply to this system.

5.3.1.2.1
top dust cover
surface not supporting unit loads, covering the top of the shelving system

5.3.1.2.2
corner plate
component fixed to the upright and shelf used as an alternative to spine bracing to stabilize the shelving

5.3.1.2.3
card holder
component fixed to the front edge of a shelf to hold an identification card or label

5.3.1.2.4
drawer guide
component allowing the sliding in and out of a drawer

5.3.1.2.5
side sheet
cladding to close the side of a bay

5.3.1.2.6
shelf reinforcement
structural component fixed to the underside of the shelf to increase its load carrying capacity

5.3.1.2.7
shelf clip
component connected to the upright and supporting the shelf

5.3.1.2.8
lug
feature pressed out of the upright or the shelf and performing the same function as a shelf clip

5.3.1.2.9
aesthetic end panel
decorative cladding at the end of a run

5.3.1.3 Basic components

See 3.3 and Figure 12, Figure 13 and Figure 14 for definitions of the system basic components (depending on the system design, not all basic components may be required):

— upright frame;

— upright;

— base plate;

— shim;

— anchor bolt;

— shelf;

— shelf clip (see 5.3.1.2.7);

— corner plate (see 5.3.1.2.2);

— beam;

— spine bracing;

— load warning notice.

5.3.1.4 Accessories

See 3.3 and Figure 12, Figure 13 and Figure 14 for definitions of the system accessories, except where indicated otherwise:

— notice;

— top dust cover (see 5.3.1.2.1);

— card holder (see 5.3.1.2.3);

— back sheet;

— bin front;

— drawer guide (see 5.3.1.2.4);

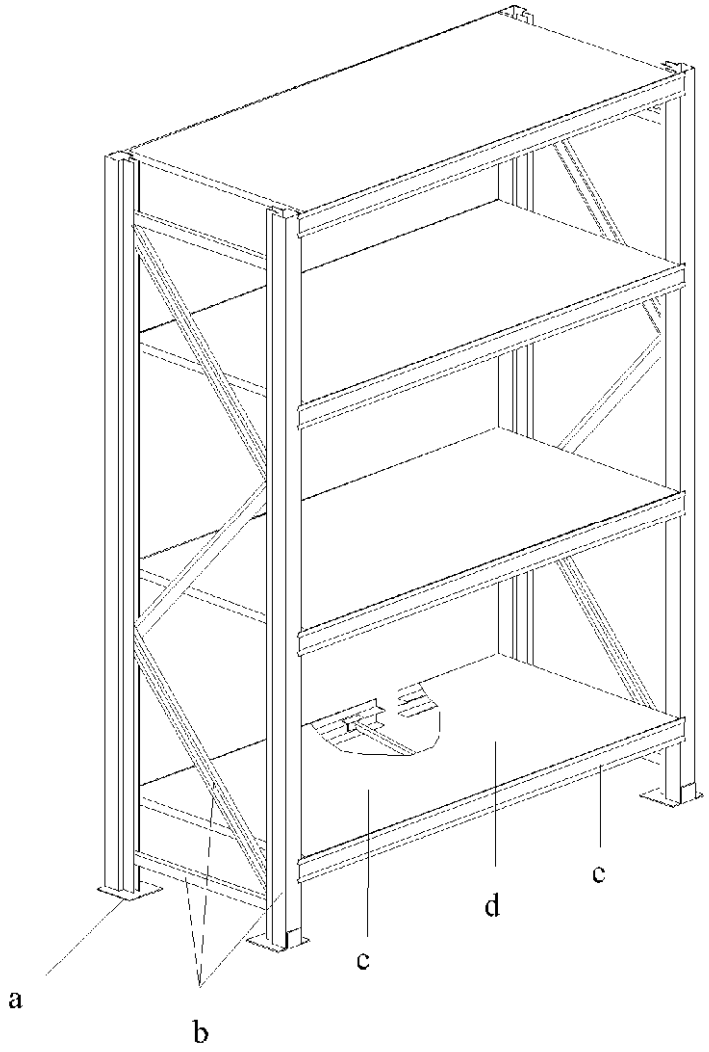
— side sheet (see 5.3.1.2.5);

— shelf reinforcement (see 5.3.1.2.6);

— divider;

— shelf cladding support;

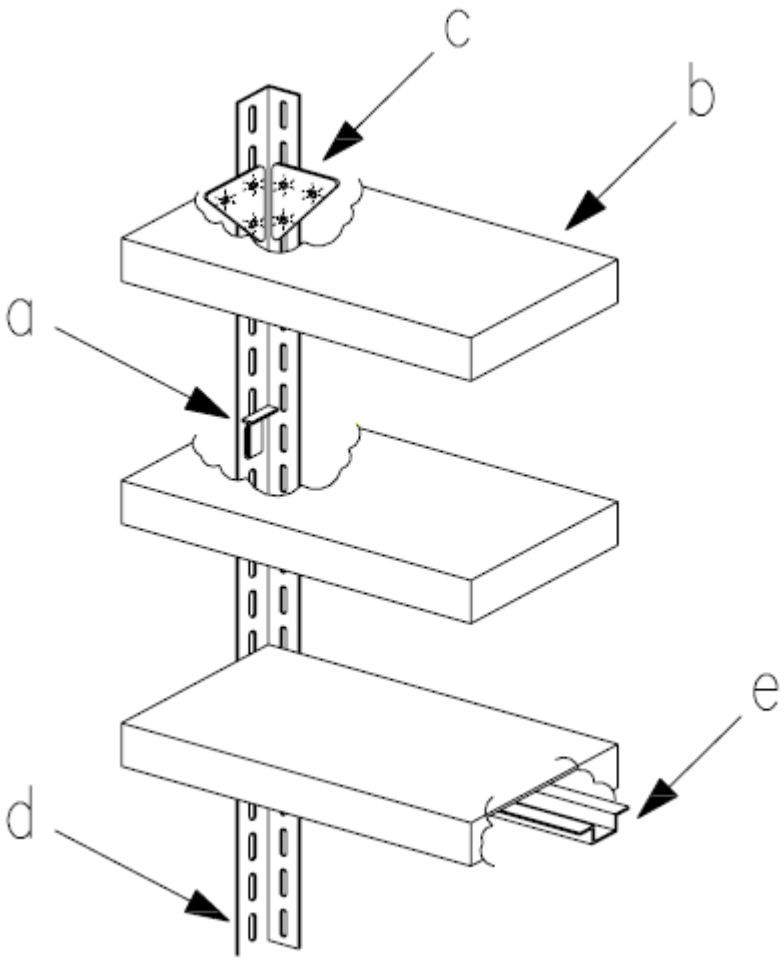
— plinth.



Key

a base plate
b upright frame
c deck support
d deck
e beam

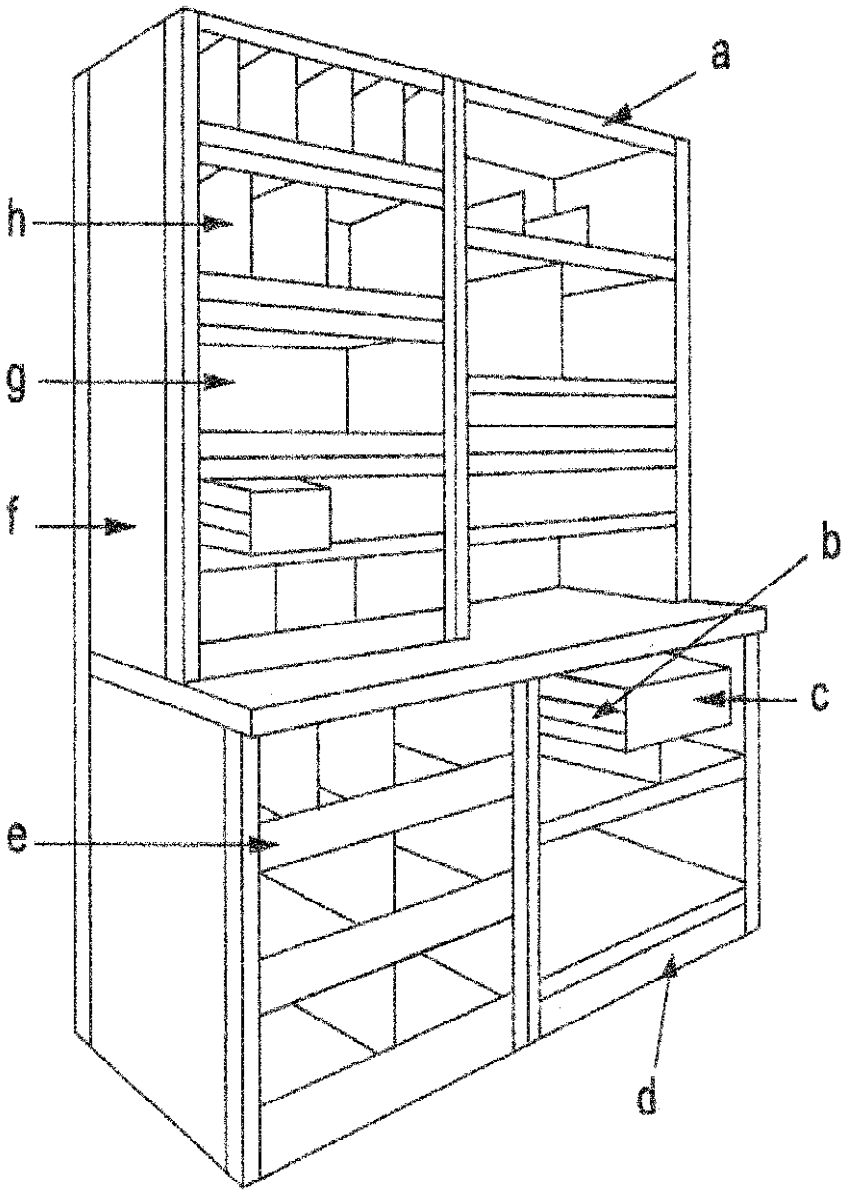
Figure 12 — Beam shelving system



Key

a shelf clip
b shelf
c corner plate
d upright
e shelf reinforcement

Figure 13 — Unbraced frame shelving detail



Key

a top dust cover
b drawer guide
c drawer
d plinth
e bin front
f side sheet
g back sheet
h divider

Figure 14 — Shelving accessories

5.3.2 Multi-tier shelving

5.3.2.1 General

System of upright frames connected by horizontal shelves or beams with decks to provide unit load storage levels which can be adjusted vertically, with two or more personnel accessible floor levels (tiers).

5.3.2.2 Definitions

Definitions given in 3.3 apply.

5.3.2.3 Basic components

See 3.3 and Figure 15 for definitions of the system basic components (depending on the system design, not all basic components may be required):

— upright frame;

— upright;

— base plate;

— shim;

— anchor;

— beam;

— beam connector lock;

— shelf;

— shelf clip (see 5.3.1.2.7);

— handrailing;

— staircase;

— floor;

— spine bracing;

— plan bracing;

— load warning notice.

5.3.2.4 Accessories

See 3.3 and Figure 15 for definitions of the system accessories, except where indicated otherwise:

— notice;

— mesh guard;

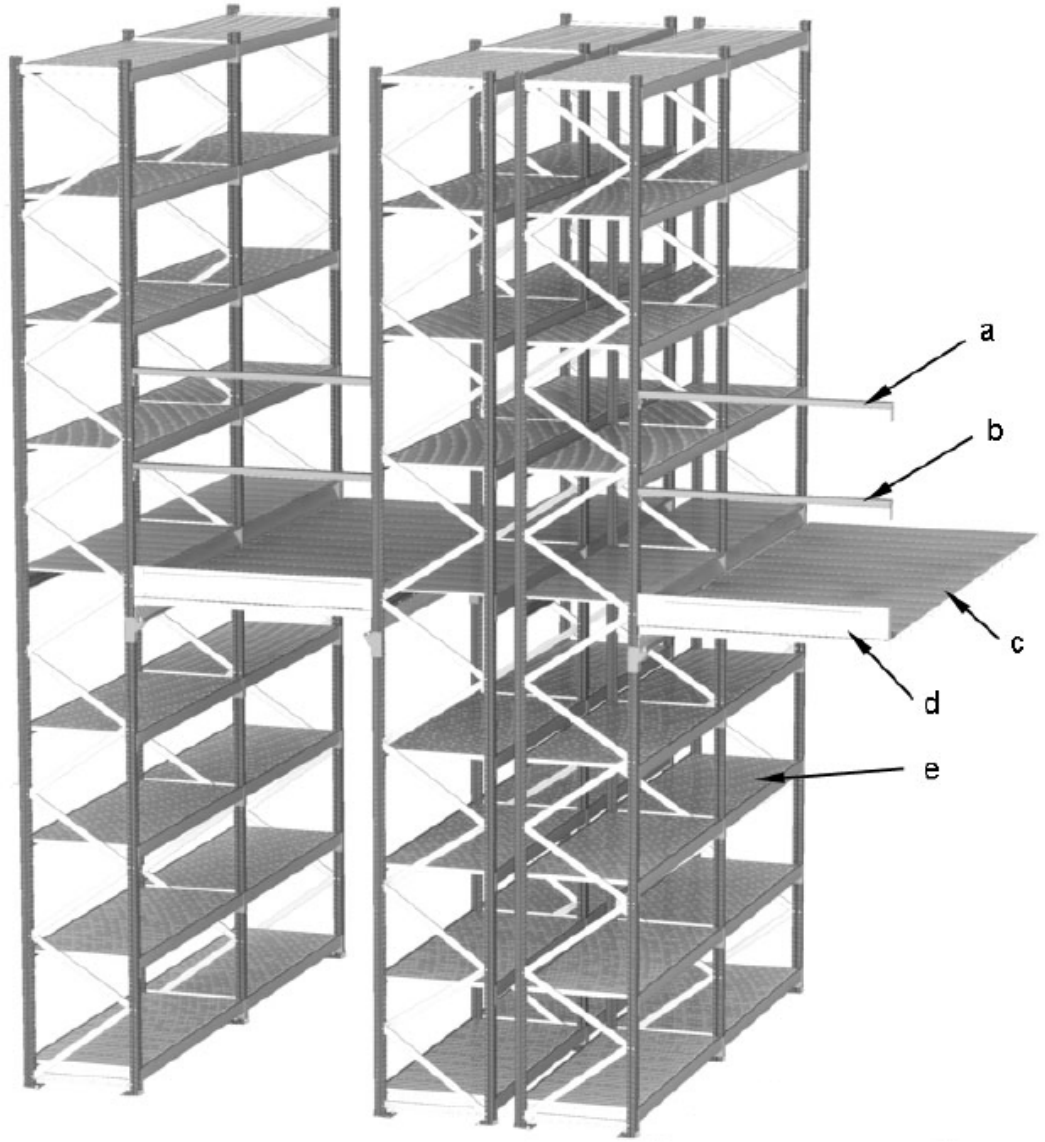
— run spacer;

— shelf reinforcement;

— bin front;

— divider;

— shelf cladding support.



Key

a handrail
b knee rail
c floor
d kick plate
e shelf

Figure 15 — Example of a two-tier shelving system

5.3.3 Cantilever shelving system − Gondola

5.3.3.1 General

System of uprights with shelves supported by horizontal cantilever arms.

5.3.3.2 Definitions

In addition to the definitions given in 3.3, the following specific definitions apply to this system.

5.3.3.2.1
bracket
cantilever horizontal component fixed to uprights

5.3.3.2.2
peg hook
exhibiting component normally fixed to the back of the racking for small products

5.3.3.2.3
fascia
cosmetic item located at the top of the shelving

5.3.3.2.4
base
horizontal structural component fixed to the bottom to upright, usually fitted with adjustable feet

5.3.3.2.5
column
assembly consisting of the upright and the base

5.3.3.2.6
label holder
component fixed to the front edge of a shelf to hold an identification card or label

5.3.3.2.7
module
set of two adjacent columns and the elements between them

5.3.3.2.8
adjustable foot
component fixed to the base to level the shelving system

5.3.3.2.9
crash bar
component located at the bottom of the shelving, normally fixed to the base, in order to minimize the effect of impacts from shopping trolleys, etc.

5.3.3.2.10
tie bar
component to join uprights down-aisle

5.3.3.3 Basic components

See 3.3 and Figure 16 for definitions of the system basic components (depending on the system design, not all basic components may be required):

— upright;

— base;

— adjustable foot (see 5.3.3.2.8);

— bracket (see 5.3.3.2.1);

— shelf;

— back sheet;

— tie bar;

— load warning notice.

5.3.3.4 Accessories

See 3.3 and Figure 16 for definitions of the system accessories, except where indicated otherwise:

— notice;

— peg hook (see 5.3.3.2.2);

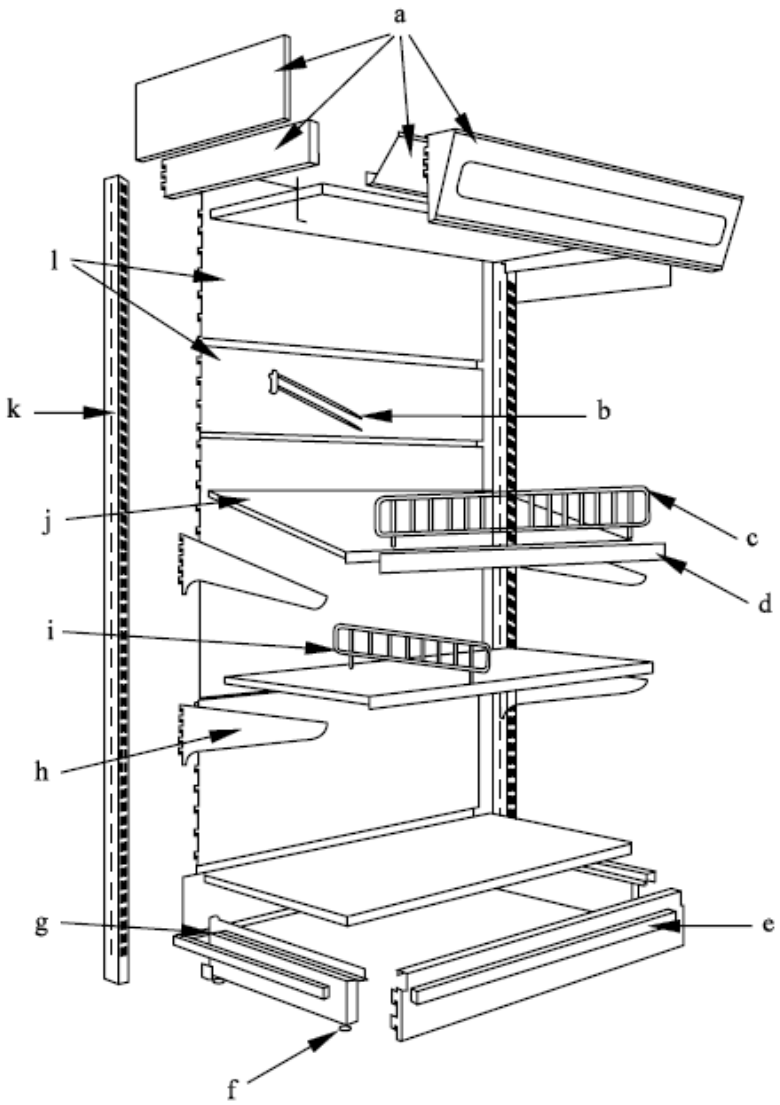
— fascia (see 5.3.3.2.3);

— label holder (see 5.3.3.2.6);

— bin front;

— crash bar (see 5.3.3.2.9);

— divider.



Key

a fascia
b peg hook
c bin front
d label holder
e plinth with crash bar
f adjustable foot
g base
h bracket
i divider
j shelf
k upright
l back sheet

Figure 16 — Cantilever shelving system – Gondola shelving

5.4 Long Unit Loads

5.4.1 Cantilever racking

5.4.1.1 General

System of uprights with horizontal cantilever arms connected in the down-aisle direction by tie beams and spine bracing; it can be loaded/unloaded by MHE or by hand.

5.4.1.2 Definitions

In addition to the definitions given in 3.3, the following specific definitions apply to this system.

5.4.1.2.1
column
vertical member supporting the cantilever arms that can either be single sided or double sided

5.4.1.2.2
base
horizontal structural component fixed to the bottom of the column and to allow load transfer and fixing to the floor

5.4.1.2.3
down-aisle support beam
structural down-aisle beam fixed to the arms and columns or bases to support unit loads

5.4.1.2.4
cross support bar
structural component joined to the down-aisle support beams cross-aisle to support unit loads

5.4.1.3 Basic components

See 3.3 and Figure 17 for definitions of the system basic components (depending on the system design, not all basic components may be required):

— column;

— base (see 5.4.1.2.2);

— shim;

— anchor bolt;

— tie beam;

— arm;

— spine bracing;

— load warning notice.

5.4.1.4 Accessories

See 3.3 and Figure 17 for definitions of the system accessories, except where indicated otherwise:

— notice;

— non-shrink grout;

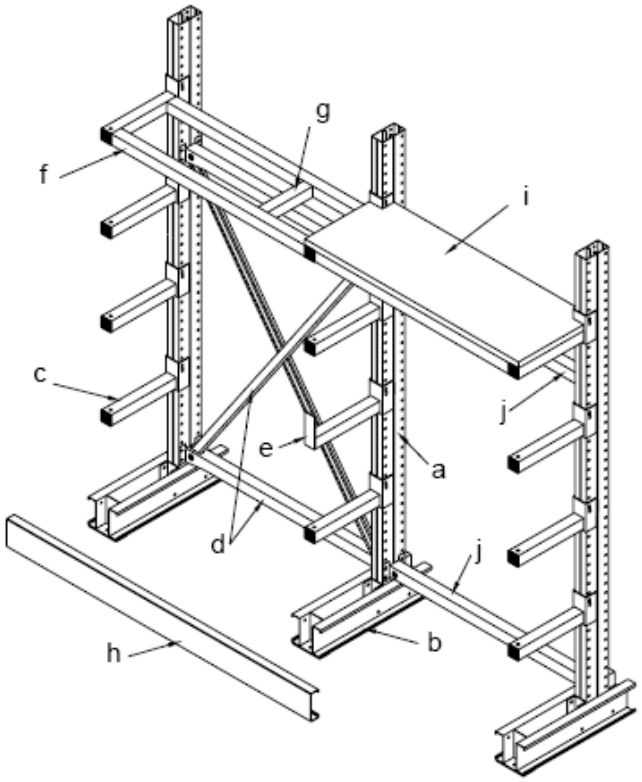
— deck;

— stop;

— down-aisle support beam (see 5.4.1.2.3);

— cross support bar (see 5.4.1.2.4);

— truck guide rail.



Key

a column
b base
c arm
d bracing
e stop
f down aisle support beam
g cross support bar
h truck guide rail
i deck
j tie beam

Figure 17 — Cantilever racking

5.4.2 Cassette racking

5.4.2.1 General

System consisting of frames joined by beams with perpendicular components in depth (beam rails, roller/wheel tracks, low friction bearers, etc.) fixed to them which support and guide the sliding platforms. The system is serviced by S/R machines.

5.4.2.2 Definitions

In addition to the definitions given in 3.3, the following specific definitions apply to this system.

5.4.2.2.1
cassette
captive container supporting long materials

5.4.2.2.2
roller track
horizontal frame arranged in the cross aisle direction, fixed to two or more beams, equipped with rollers which allow the sliding and support of the cassettes

5.4.2.2.3
low friction bearer
horizontal component arranged in the cross aisle direction, fixed to two or more beams, which allow the sliding of the cassettes

5.4.2.2.4
cassette retainer
component fixed to frames to stop the cassettes from moving into the aisle

5.4.2.3 Basic components

See 3.3 and Figure 18 for definitions of the system basic components (depending on the system design, not all basic components may be required):

— anchor;

— plan bracing;

— top plan bracing;

— spine bracing;

— base plate;

— upright frame;

— roller track (see 5.4.2.2.2);

— low friction bearer (see 5.4.2.2.3);

— beam;

— bottom rail;

— upper guide rail;

— S/R machine run-out;

— non-shrink grout;

— cassette retainer (see 5.4.2.2.4);

— beam rail;

— load warning notice.

5.4.2.4 Accessories

See 3.3 and Figure 18 for definitions of the system accessories, except where indicated otherwise:

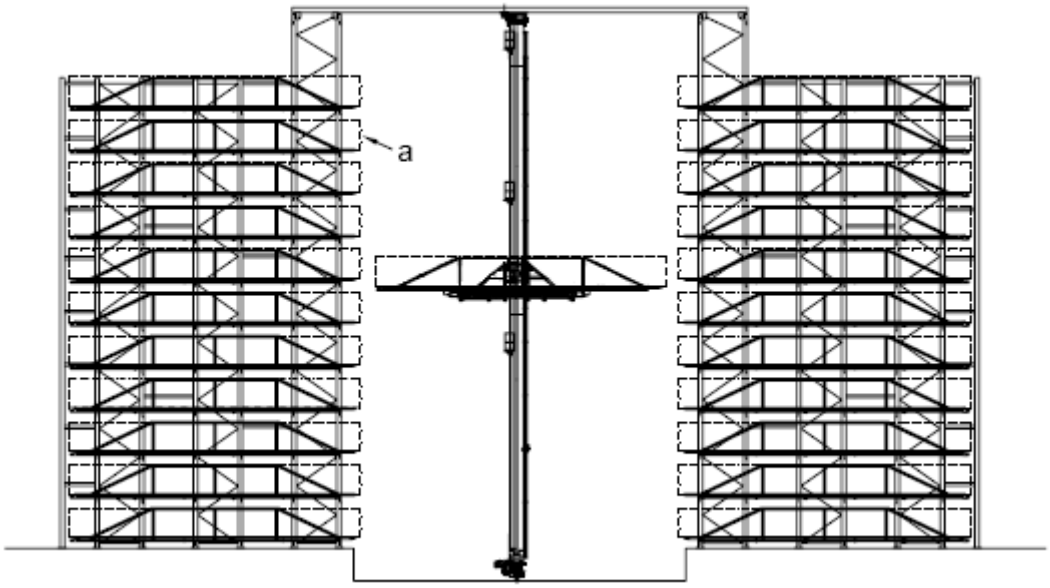
— notice;

— mesh guard;

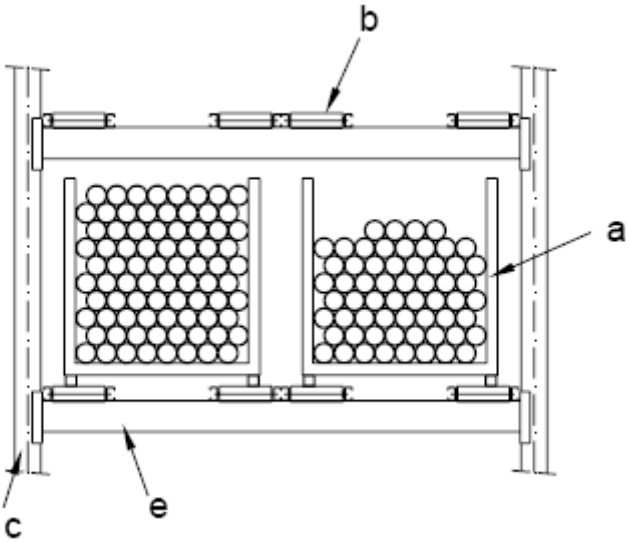
— safety fencing;

— busbar support;

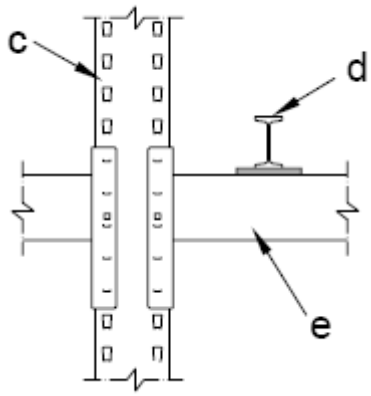
— sprinkler support.



a) Cross-aisle section



b) Storage location



c) Beam rail

Key

a unit load
b roller track
c upright
d beam rail
e beam

Figure 18 — Cassette racking

5.5 Dynamic Storage – Palletized Goods

5.5.1 Mobile racking

5.5.1.1 General

A skeleton framework of fixed or adjustable design supporting unit loads generally without the use of shelves. This skeleton framework is in turn fixed to moveable base units supported on wheels mounted in the base unit, which run on rails mounted in the floor.

5.5.1.2 Definitions

In addition to the definitions given in 3.3, the following specific definitions apply to this system.

5.5.1.2.1
master control panel
enclosure containing electrical equipment to isolate the mobiles from the power supply or when master control of a block of mobiles is required, for powered operated systems only

5.5.1.2.2
individual control panel
electric or electronic controls fitted to each mobile base, for powered operated systems only

5.5.1.2.3
wheel carriage
assembly fitted with wheels which run on rails

5.5.1.2.4
mobile base
assembly of wheel carriages joined by longitudinal sections and bracing

5.5.1.2.5
rail
steel section to provide a running surface for the wheels and to transfer and distribute the wheel loads into the concrete floor slab or foundation

5.5.1.2.6
guide rail
steel section shaped to provide guidance to the mobile base via the guide wheels and usually to transfer and distribute the wheel loads into the concrete floor slab or foundation

5.5.1.2.7
access photoelectric cells
safety device to stop or prevent base movement if a person or MHE enters the operating aisle, for powered operated systems only

5.5.1.2.8
safety kick plate
safety device (mechanical or photoelectric) used to stop the mobile base if there is an obstruction in the operating aisle, for powered operated systems only

5.5.1.3 Basic components

In addition to the components listed below, the basic components for the specific racking system used on the mobile bases shall be considered. See 5.5.1.2, Figure 19 and Figure 20 for definitions of the system basic components:

— mobile base;

— rail (see 5.5.1.2.5);

— guide rail (see 5.5.1.2.6);

— master control panel (see 5.5.1.2.1);

— individual control panel (see 5.5.1.2.2);

— access photoelectric cell (see 5.5.1.2.7);

— safety kick plate (see 5.5.1.2.8).

5.5.1.4 Accessories

In addition to the accessories listed below, the accessories for the specific racking system used on the mobile bases shall be considered. See 5.5.1.2, Figure 19 and Figure 20 for definitions of the system basic components.

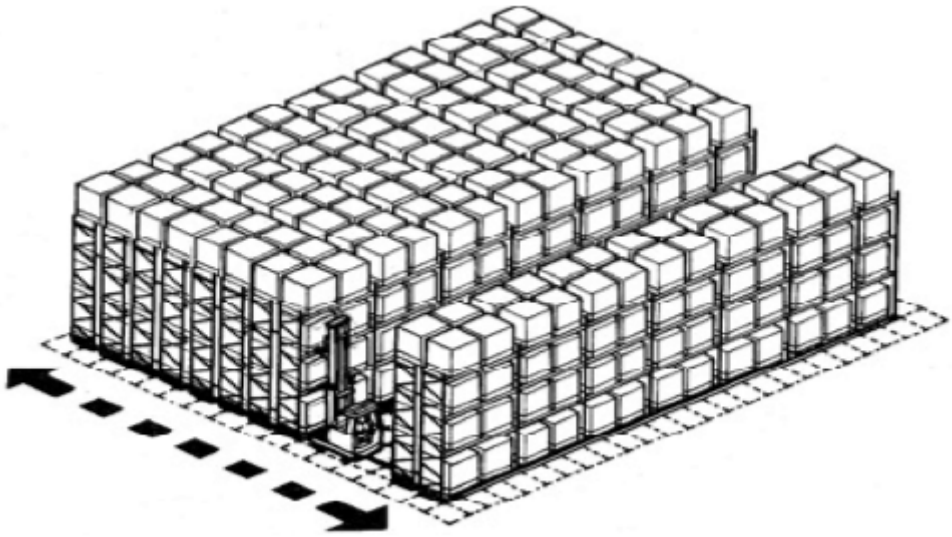
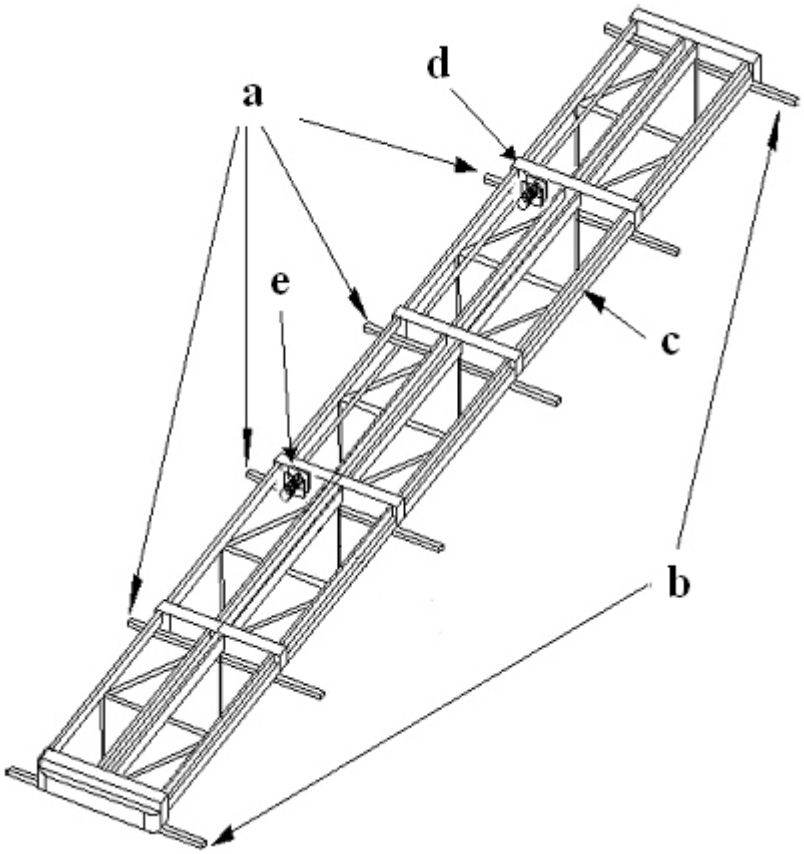


Figure 19 — Mobile pallet racking − General lay-out



Key

a rail
b guide rail
c mobile base
d wheel carriage
e gearmotor

Figure 20 — Mobile pallet racking

5.5.2 Pallet live storage

5.5.2.1 General

System consisting of upright frames and/or uprights joined to one another, allowing storage of pallets into the depth. It is equipped with rollers, wheels or trolleys to allow the movement by gravity of the unit loads. The system can be FIFO (First In First Out) or LIFO (Last In First Out), the latter also known as push-back systems.

5.5.2.2 Definitions

In addition to the definitions given in 3.3, the following specific definitions apply to this system.

5.5.2.2.1
roller/wheel tracks
assembly to support pallets comprising of rollers or wheels, support profiles, and may also include speed controllers and pallet separators

5.5.2.2.2
trolley
assembly with wheels to support the pallet, used in push-back systems

5.5.2.2.3
entry guide
device used to facilitate the proper placement of the pallet

5.5.2.2.4
guide
device used to keep the pallet correctly aligned when running through the system

5.5.2.2.5
speed controller
device limiting the speed of pallets when running through the system

5.5.2.2.6
pallet separator
device which separates the pallet from the pressure of other pallets behind it in the lane

5.5.2.2.7
end stop
component to hold the pallet at the output end of the lane

5.5.2.2.8
anti-return stop
component preventing the pallets from moving in the opposite way

5.5.2.2.9
bump stop
component fixed to the floor to limit the travel of the MHE

5.5.2.3 Basic components

See 3.3, Figure 21 and Figure 22 for definitions of the system basic components, except where indicated otherwise (depending on the system type, not all basic components may be required):

— upright frame;

— base plate;

— shim;

— anchor;

— beam;

— roller track (see 5.5.2.2.1);

— trolley (see 5.5.2.2.2);

— pallet separator (see 5.5.2.2.6);

— speed controller (see 5.5.2.2.5);

— end stop (see 5.5.2.2.7);

— upright protector;

— load warning notice.

5.5.2.4 Accessories

See 3.3, Figure 21 and Figure 22 for definitions of the system accessories, except where indicated otherwise:

— notice;

— non-shrink grout;

— safety fencing;

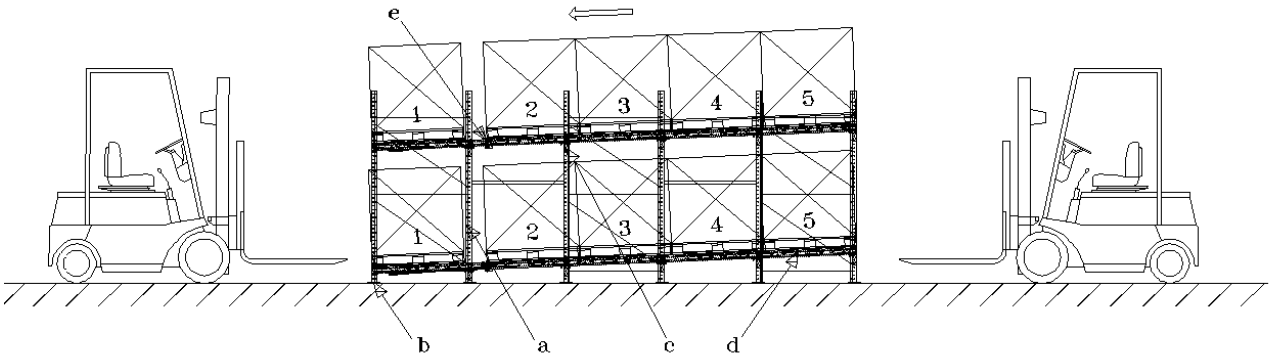
— entry guide (see 5.5.2.2.3);

— guide (see 5.5.2.2.4);

— anti-return stop (see 5.5.2.2.8);

— bump stop (see 5.5.2.2.9);

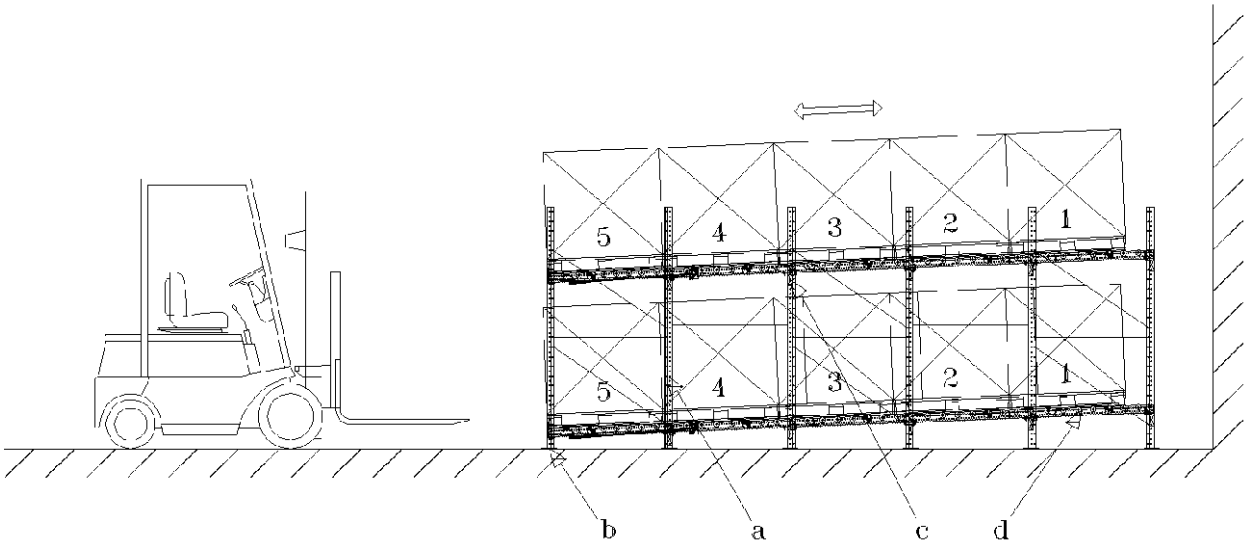
— frame barrier.



Key

a upright frame
b base plate
c beam
d roller track
e pallet separator

Figure 21 — Pallet live storage – FIFO



Key

a upright frame
b base plate
c beam
d roller track/trolley

Figure 22 — Pallet live storage − LIFO/push back system

5.5.3 Shuttle racking system

5.5.3.1 General

System consisting of upright frames and single uprights (mono-posts) joined by beams or tie beams with orthogonal beam rails fixed to the beams or arms. Both supporting beams or arms and beam rails constitute the lane which is accessed by the shuttle.

5.5.3.2 Definitions

In addition to the definitions given in 3.3, the following specific definitions apply to this system.

5.5.3.2.1
shuttle rail
horizontal component perpendicular to the operating aisle, directly supporting the unit loads at each storage level and supporting and guiding the shuttle when moving down lane

5.5.3.2.2
shuttle entry guide
component fixed to the shuttle rail at the entrance of the lane

5.5.3.3 Basic components

See 3.3 and Figure 23 for definitions of the system basic components (depending on the system design, not all basic components may be required):

— upright frame;

— non-shrink grout;

— anchor;

— beam;

— shuttle rail;

— portal tie beam;

— spine bracing;

— plan bracing;

— top plan bracing;

— upper guide rail;

— bottom rail;

— S/R machine run-out;

— load warning notice.

5.5.3.4 Accessories

See 3.3 and Figure 23 for definitions of the system accessories, except where indicated otherwise:

— notice;

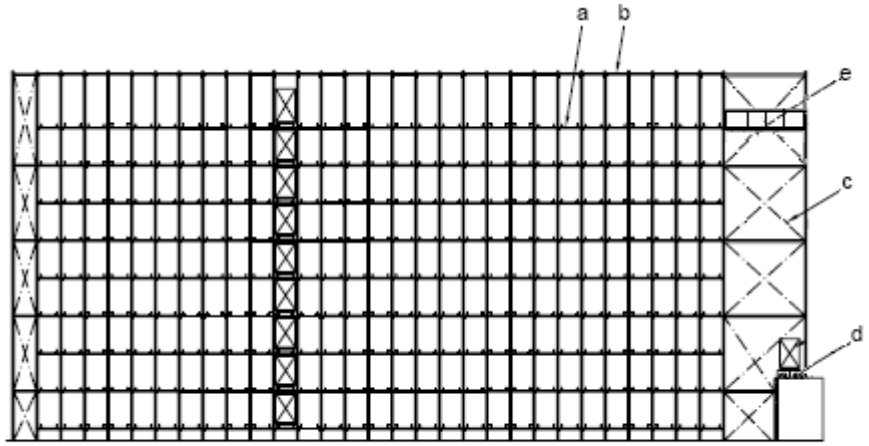
— mesh guard;

— safety fencing;

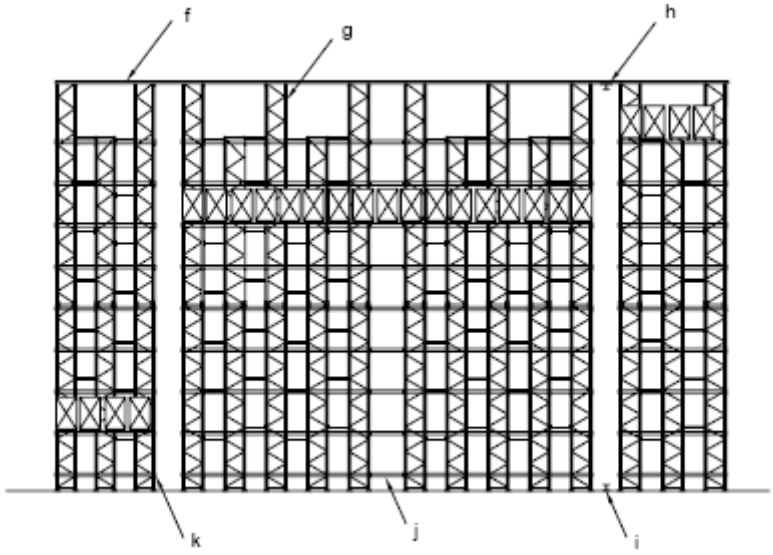
— shuttle entry guide (see 5.5.3.2.2);

— busbar support;

— sprinkler support.



a) Elevation



b) Cross-aisle section

Key

a beam
b tie beam
c spine bracing
d conveyor
e maintenance area
f top plan bracing
g frame
h upper guide rail
i bottom rail
j shuttle rail
k shuttle entry guide

Figure 23 — Shuttle racking system

5.6 Dynamic Storage – Small Parts

5.6.1 Mobile shelving

5.6.1.1 General

A series of hand loaded adjustable carrying surfaces (shelves) supported by upright frames, all of which are in turn fixed to a moveable base unit. This base unit is supported on wheels mounted in the base unit, which run on rails supported either in or on the floor.

5.6.1.2 Definitions

In addition to the definitions given in 3.3, the following specific definitions apply to this system.

5.6.1.2.1
wheel carriage
assembly fitted with wheels which run on rails

5.6.1.2.2
transverse member
structural component parallel to the wheel carriages to support the shelving uprights

5.6.1.2.3
mobile base
assembly of wheel carriages and transverse members joined by longitudinal sections and bracing

5.6.1.2.4
rail
section to provide a running surface for the wheels and to transfer and distribute the wheel loads into the floor

5.6.1.2.5
guide rail
section to provide guidance to the mobile base via the guide wheels and usually to transfer and distribute the wheel loads into the floor

5.6.1.2.6
master control panel
enclosure containing electrical equipment to isolate the mobiles from the power supply or when master control of a block of mobiles is required, for powered operated systems only

5.6.1.2.7
individual control
electric or electronic controls fitted to each mobile base, for powered operated systems only

5.6.1.2.8
access photoelectric cells
safety device to stop or prevent base movement if a person enters the operating aisle, for powered operated systems only

5.6.1.2.9
safety kick plate
safety device (mechanical or photoelectric) used to stop the mobile base if there is an obstruction in the operating aisle, for powered operated systems only

5.6.1.2.10
end stop
feature to retain the mobile bases at the end of the rails

5.6.1.2.11
anti-tilt
device either part of the rail/floor system or fixed to the top of the shelving to prevent overturning

5.6.1.2.12
infill floor
suspended flooring fitted around rails and guide rails fixed on top of the building floor

5.6.1.3 Basic components

In addition to the components listed below, the basic components for the specific shelving system used on the mobile bases shall be considered. See 5.6.1.2 and Figure 24 for definitions of the system basic components:

— mobile base (see 5.6.1.2.3);

— rail (see 5.6.1.2.4);

— guide rail (see 5.6.1.2.5);

— end stop (see 5.6.1.2.10).

5.6.1.4 Accessories

In addition to the accessories listed below, the accessories for the specific shelving system used on the mobile bases shall be considered. See 5.6.1.2 and Figure 24 for definitions of the system basic components:

— master control panel (see 5.6.1.2.6);

— individual control panel (see 5.6.1.2.7);

— access photoelectric cell (see 5.6.1.2.8);

— safety kick plate (see 5.6.1.2.9);

— anti-tilt (see 5.6.1.2.11);

— infill floor (see 5.6.1.2.12).

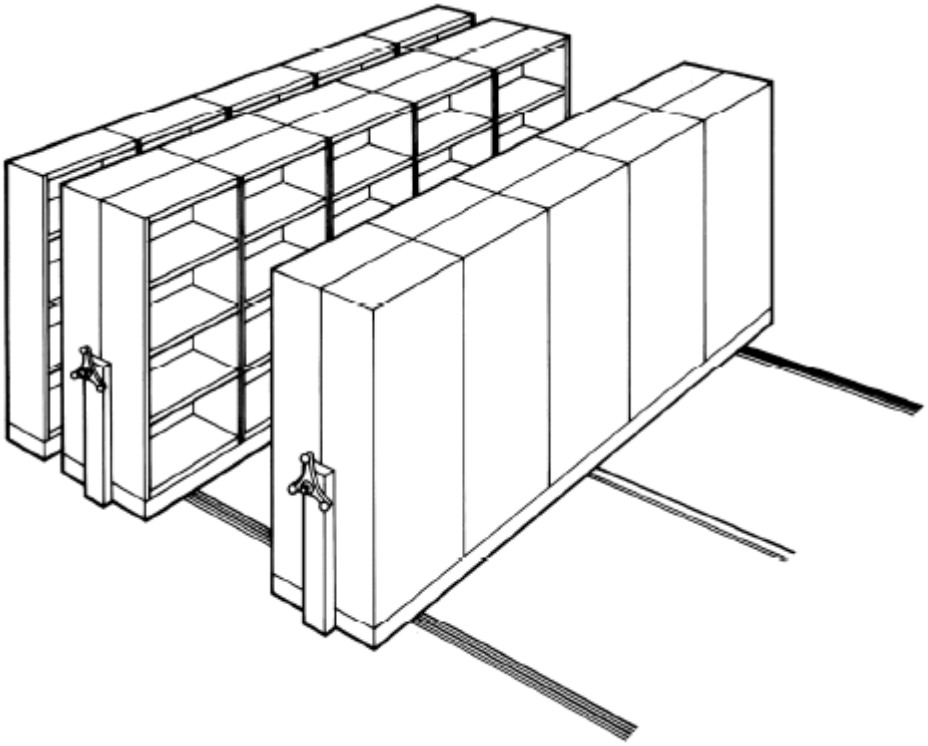


Figure 24 — Mobile shelving (mechanically assisted)

5.6.2 Carton live storage

5.6.2.1 General

System consisting of upright frames and uprights (mono-post) joined to one another, allowing the storage of cartons, boxes or containers into the depth. It is equipped with rollers or wheels to allow the movement by gravity of the unit loads. The system is usually FIFO (First In First Out).

5.6.2.2 Definitions

In addition to the definitions given in 3.3, the following specific definitions apply to this system.

5.6.2.2.1
roller/wheel bed
frame supported by the uprights or by beams equipped with roller/wheel tracks

5.6.2.2.2
picking tray
section on the picking face to provide access to goods from cartons, boxes or containers

5.6.2.2.3
guide
device used to keep the cartons, boxes or containers correctly aligned when running through the system

5.6.2.2.4
entry guide
device used to facilitate the proper placement of the cartons, boxes or containers

5.6.2.2.5
speed controller
device limiting the speed of the cartons, boxes or containers

5.6.2.2.6
separator
device which separates the cartons, boxes or containers from the pressure of others behind them in the lane

5.6.2.2.7
end stop
component to retain the cartons, boxes or containers at the end of the lane

5.6.2.2.8
anti-return stop
component preventing the cartons, boxes or containers from moving in the opposite way

5.6.2.2.9
loading tray
section on the loading face used for initial placement of the boxes or containers prior to entry onto the rollers

5.6.2.3 Basic components

See 3.3 and Figure 25 for definitions of the system basic components, except where indicated otherwise (depending on the system design, not all basic components may be required):

— upright frame;

— base plate;

— shim;

— anchor;

— roller/wheel bed (see 5.6.2.2.1);

— tie beam;

— load warning notice.

5.6.2.4 Accessories

See 3.3 and Figure 25 for definitions of the system accessories, except where indicated otherwise:

— notice;

— non-shrink grout;

— picking tray (see 5.6.2.2.2);

— guide (see 5.6.2.2.3);

— entry guide (see 5.6.2.2.4);

— speed controller (see 5.6.2.2.5);

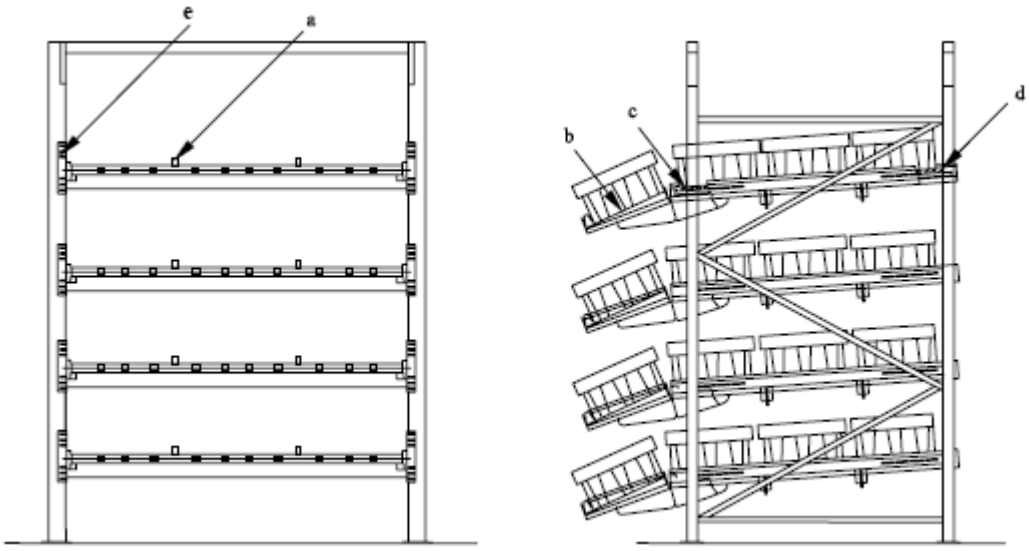
— separator (see 5.6.2.2.6);

— end stop (see 5.6.2.2.7);

— anti-return stop (see 5.6.2.2.8);

— loading tray (see 5.6.2.2.9);

— frame barrier.



a) Elevation **b) Side View**

Key
a guide
b picking tray
c speed controller
d roller bed
e roller bed support

Figure 25 — Carton live storage

5.6.3 Carousels

5.6.3.1 General

Horizontal and/or vertical circulating storage equipment with load carriers either freely suspended, suspended on rods or by other means. They can be provided with one or more access openings.

5.6.3.2 Definitions

In addition to the definitions given in 3.3, the following specific definitions apply to this system.

5.6.3.2.1
access opening
aperture to load and unload the carriers

5.6.3.2.2
carrier
device to store and to deliver goods to the access opening

5.6.3.2.3
control panel
enclosure containing electrical and electronic equipment to govern the functioning of the system

5.6.3.3 Basic components

See 3.3, Figure 26 and Figure 27 for definitions of the system basic components (depending on the system design, not all basic components may be required):

— access opening (see 5.6.3.2.1);

— carrier (see 5.6.3.2.2);

— control panel (see 5.6.3.2.3);

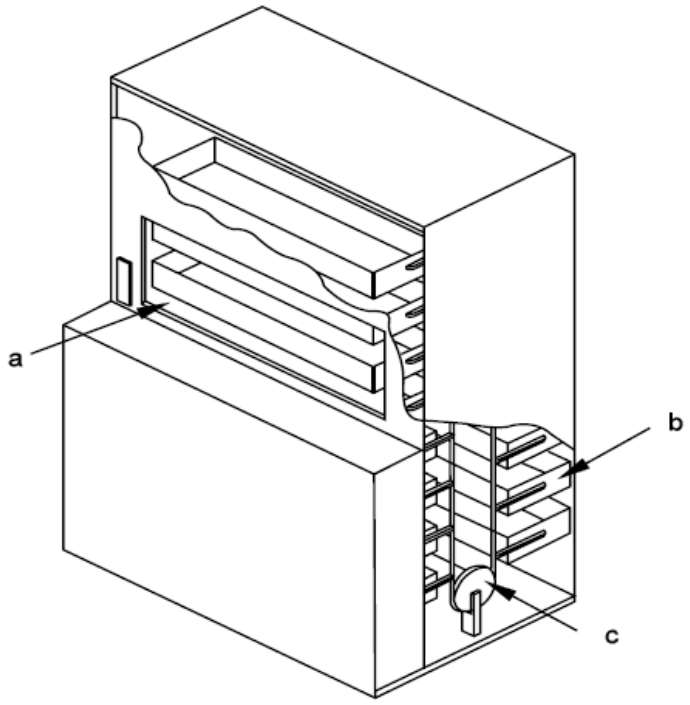
— load warning notice.

5.6.3.4 Accessories

See 3.3, Figure 26 and Figure 27 for definitions of the system accessories:

— notice;

— cladding.



Key
a access opening
b carrier
c drive system

Figure 26 — Vertical carousel

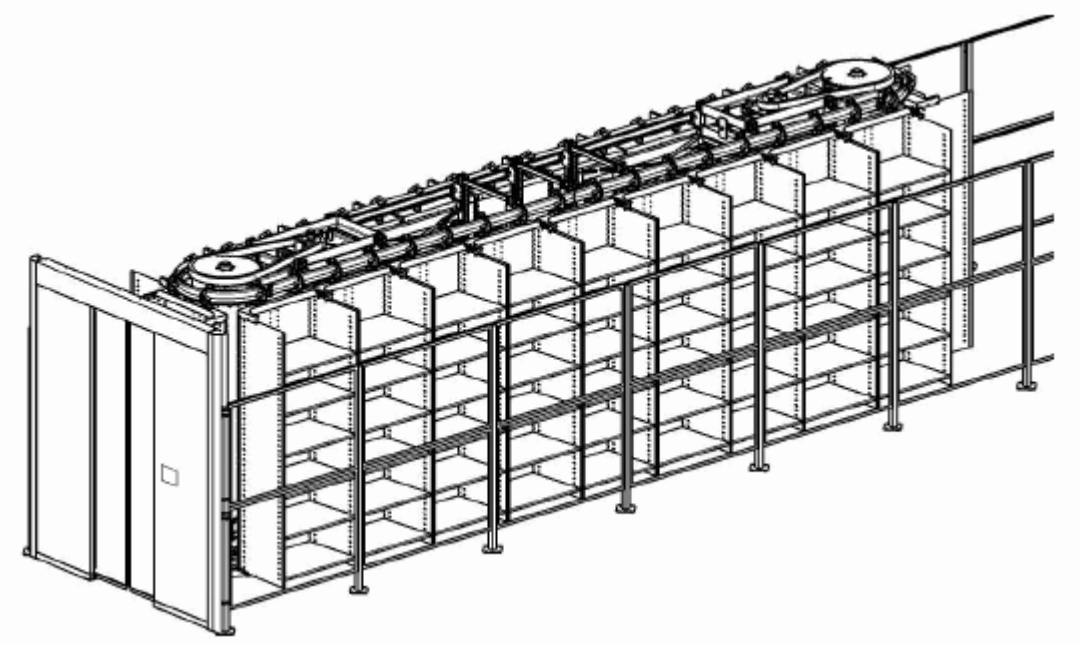


Figure 27 — Horizontal carousel

5.6.4 Storage lifts

5.6.4.1 General

Designed to take goods placed on load carriers (e.g. storage containers). The built in lift unit carries the load carriers from an access opening to storage locations in a racking tower and returns them as required by the operator. They can be provided with one or more access openings.

5.6.4.2 Definitions

In addition to the definitions given in 3.3, the following specific definitions apply to this system.

5.6.4.2.1
access opening
aperture to load and unload the carriers

5.6.4.2.2
carrier
device to store and to deliver goods to the access opening

5.6.4.2.3
control panel
enclosure containing electrical and electronic equipment to govern the functioning of the system

5.6.4.3 Basic components

See 3.3 and Figure 28 for definitions of the system basic components, except where indicated otherwise (depending on the system design, not all basic components may be required):

— access opening (see 5.6.4.2.1);

— carrier (see 5.6.4.2.2);

— control panel (see 5.6.4.2.3);

— load warning notice.

5.6.4.4 Accessories

See 3.3 and Figure 28 for definitions of the system accessories:

— notice;

— cladding.

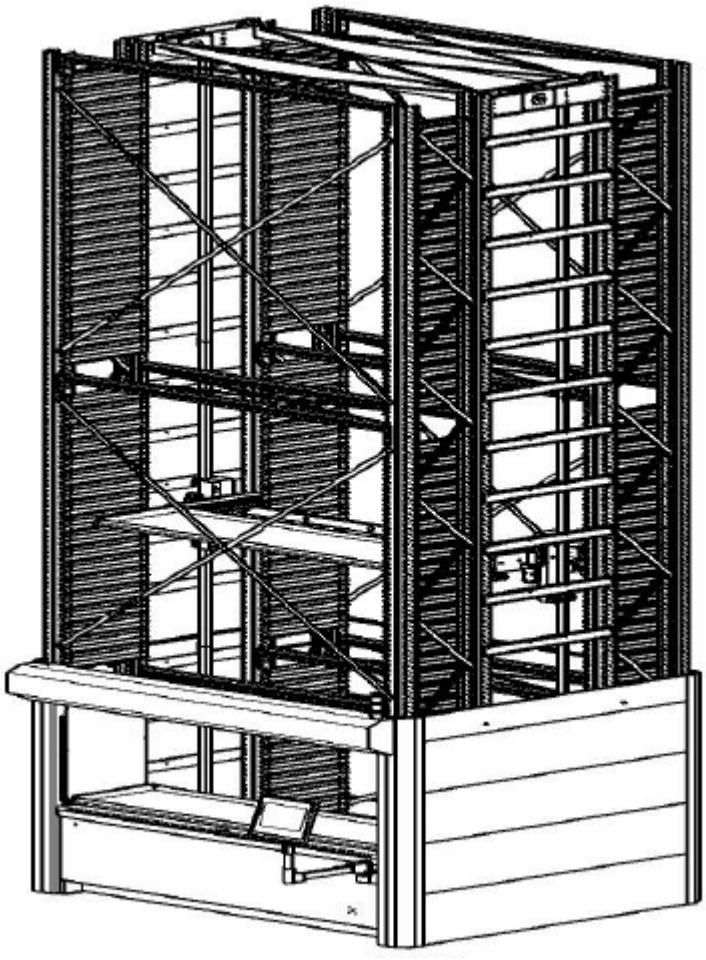


Figure 28 — Storage lift

5.7 Various

5.7.1 Mezzanine floor

5.7.1.1 General

Surface supported by a structure consisting of columns, main and secondary beams and the decking itself which allows for a general use of the floor (storage, circulation, support for other equipment, offices, etc.).

5.7.1.2 Definitions

In addition to the definitions given in 3.3, the following specific definitions apply to this system.

5.7.1.2.1
column
vertical profile fixed to the slab through its base plate, supporting the main beams of the structure

5.7.1.2.2
main beam
horizontal component fixed to the columns supporting the secondary beams

5.7.1.2.3
secondary beam (joists)
horizontal component directly supporting the floor

5.7.1.2.4
vertical bracing
sway bracing in the vertical plane which provides stability to the structure

5.7.1.2.5
decking
floor surface, normally of wood based products, steel plates or panels and grating

5.7.1.2.6
column protector
free standing component to protect the lower part of columns against accidental impact from MHE

5.7.1.3 Basic components

See 3.3 and Figure 29 for definitions of the system basic components, except where indicated otherwise (depending on the system design, not all basic components may be required):

— column (see 5.7.1.2.1);

— shim;

— anchor;

— main beam (see 5.7.1.2.2);

— secondary beam (see 5.7.1.2.3);

— vertical bracing (see 5.7.1.2.4);

— plan bracing;

— handrailing;

— staircase;

— load warning notice.

5.7.1.4 Accessories

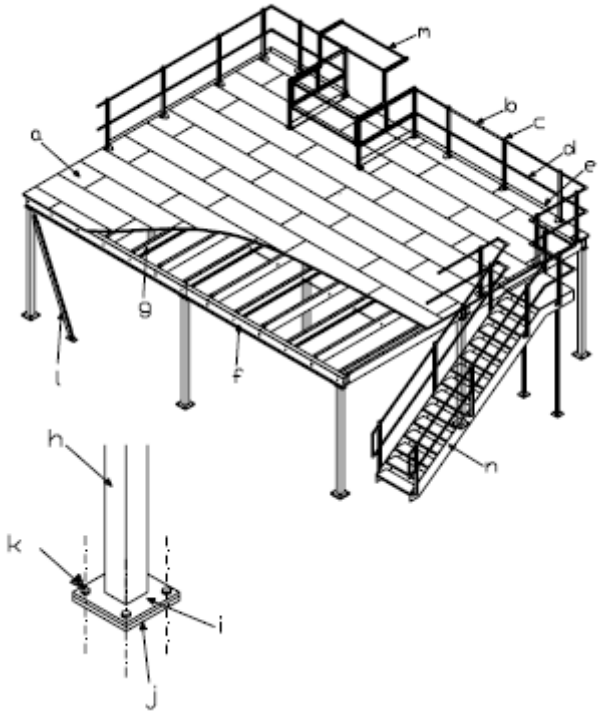
See 3.3 and Figure 29 for definitions of the system accessories:

— notice;

— non-shrink grout;

— pallet loading gate;

— column protector.



Key

a decking
b handrail
c handrail post
d knee rail
e kick plate
f main beam
g secondary beam
h column
i base plate
j shim
k anchor
l vertical bracing
m pallet loading gate
n staircase

Figure 29 — Free standing mezzanine floor

5.7.2 Raised floor

5.7.2.1 General

Surface supported by a racking or shelving system which allows for a general use of the floor (storage, circulation, support for other equipment, offices, etc.).

5.7.2.2 Definitions

Definitions given in 3.3 apply.

5.7.2.3 Basic components

See 3.3 and Figure 30 for definitions of the system basic components, except where indicated otherwise (depending on the system design, not all basic components may be required):

— main beam (see 5.7.1.2.2);

— secondary beam (see 5.7.1.2.3);

— decking (see 5.7.1.2.5);

— vertical bracing;

— plan bracing;

— handrailing;

— staircase;

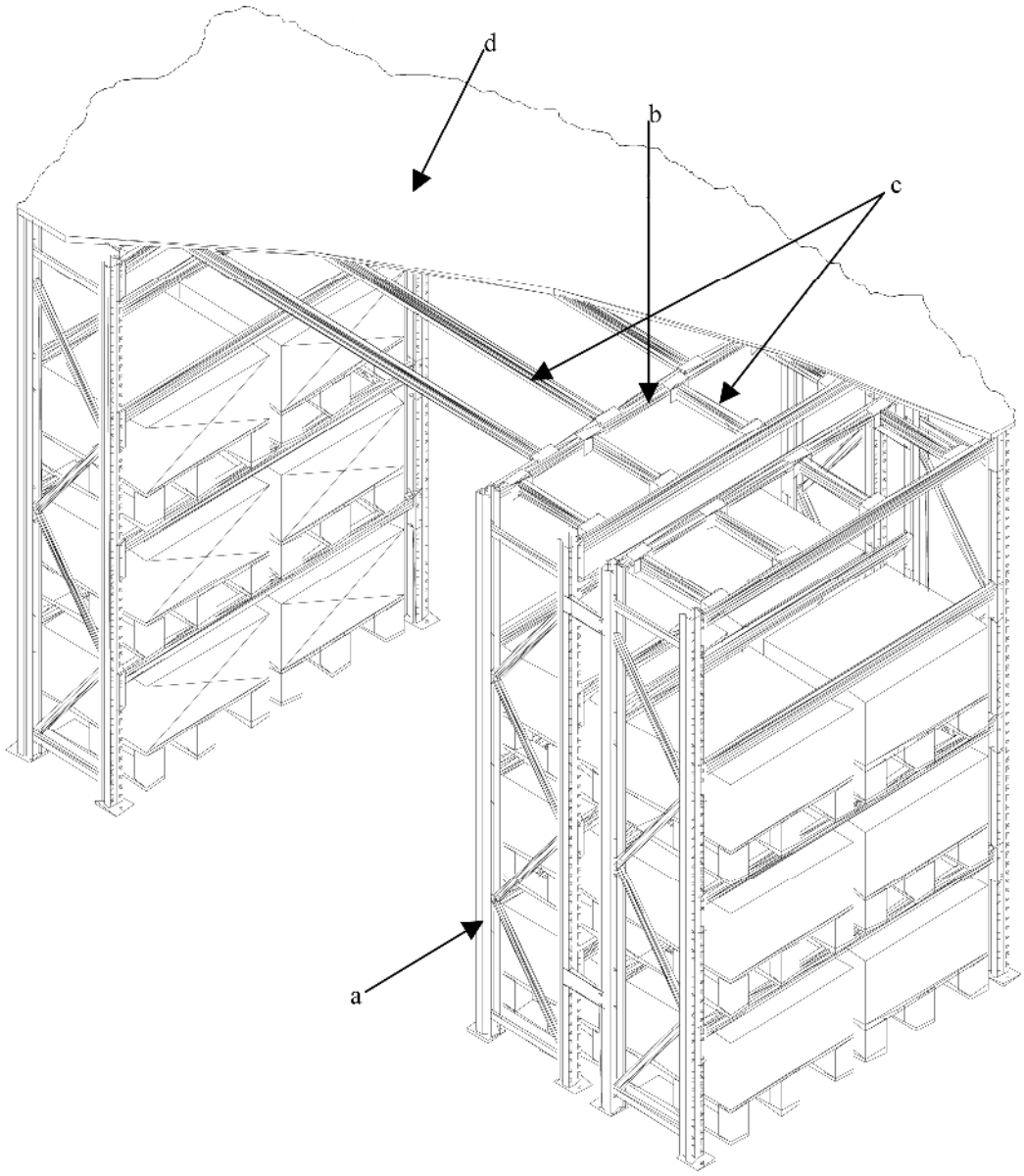
— load warning notice.

5.7.2.4 Accessories

See 3.3 and Figure 30 for definitions of the system accessories:

— notice;

— pallet loading gate.



Key

a upright frame
b main beam
c secondary beam
d decking

Figure 30 — Raised floor

5.7.3 Rack-clad storage system

5.7.3.1 General

System designed to support both the unit loads and the wall and roof cladding of the building thus additionally supporting loads and actions from building design standards.

The basic configuration is one of the following systems:

— adjustable pallet racking;

— drive-in and drive-through pallet racking;

— S/R machine racking;

— open face pallet racking;

— open face miniload racking;

— multi-location miniload racking;

— shelving;

— multi-tier shelving;

— cantilever racking;

— cassette racking;

— pallet live storage racking;

— shuttle racking.

5.7.3.2 Definitions

In addition to the definitions given in 3.3, the following specific definitions apply to this system.

5.7.3.2.1
purlin
component joined directly or indirectly to the roof trusses to which the roof cladding of the building is fixed

5.7.3.2.2
cladding rail
component joined directly or indirectly to the outer frames to which the wall cladding of the building is fixed

5.7.3.2.3
roof truss
component joined to the top of the frames to support the purlins

5.7.3.2.4
cladding rail bracket
horizontal component fixed to the upright frames to which the cladding rails are fixed

5.7.3.3 Basic components

In addition to the components listed below, the basic components for the specific storage system making the rack-clad system shall be considered. See 5.7.3.2 and Figure 31 for definitions of the system basic components.

— purlins (see 5.7.3.2.1);

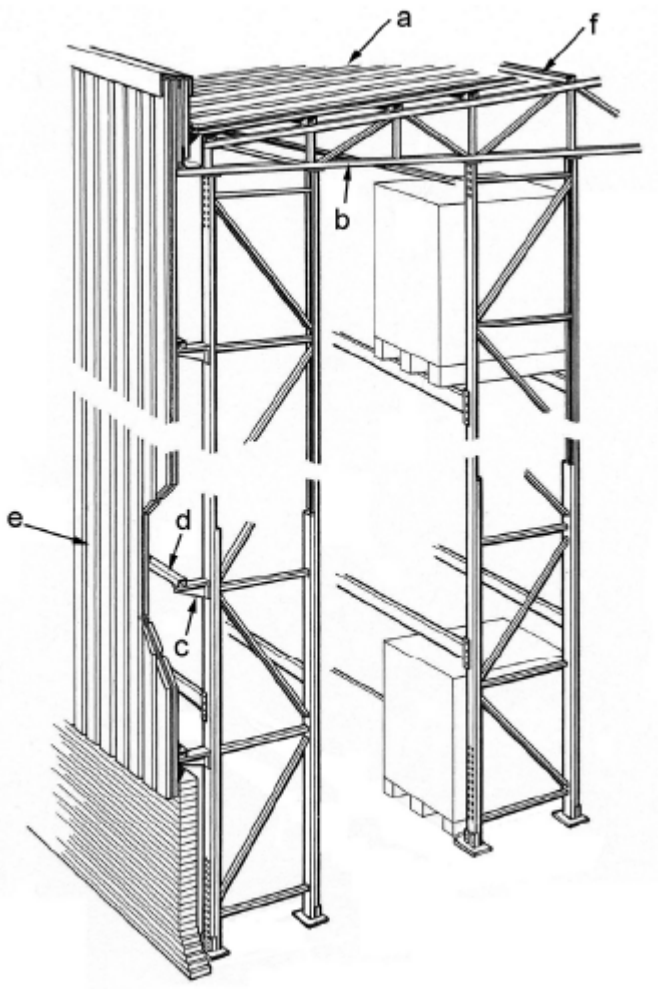
— cladding rails (see 5.7.3.2.2);

— roof truss (see 5.7.3.2.3);

— cladding rail bracket (see 5.7.3.2.4).

5.7.3.4 Accessories

The accessories for each specific racking system shall also be considered.



Key

a roof cladding
b roof truss
c cladding rail bracket
d cladding rail
e wall cladding
f purlin

Figure 31 — Rack-clad storage system

Annex A
(informative)

Mechanical handling equipment

A.1
mechanical handling equipment
MHE
mechanical or electromechanical equipment used to transport, lift, pick and deposit unit loads

A.2
hand pallet truck
hand-operated truck used to move pallets around on floors, where the tiller bar contains a brake and the pallet is lifted clear of the floor by raising and lowering a tiller bar that operates a hydraulic lifting device

NOTE See Figure A.1.

Figure A.1 — Hand pallet truck

A.3
powered hand pallet truck
hand-operated truck used to move pallets around on floors where the power for lifting and moving the pallet loads is provided by a battery and electric motor

NOTE See Figure A.2.

Figure A.2 — Powered hand pallet truck

A.4
stacker
electrically-powered machine manually operated by a pedestrian operator or a ride-on operator used to move pallets around on floors and to raise them into location in height

NOTE See Figure A.3 and Figure A.4.

Figure A.3 — Stacker

Figure A.4 — Ride-on stacker

A.5
counterbalanced truck
rider-operated machine, powered electrically or using an internal combustion engine, that carries the load outboard of its wheels and needs a special balance weight, and that is used to transport unit loads, load and unload trailers, and work within wide-aisle systems

NOTE See Figure A.5.

Figure A.5 — Four-wheel counterbalanced truck

A.6
reach truck
rider-operated machine, powered electrically, that carries the load inboard of its wheels and needs no special balance weight and that may be used to work in narrow aisle systems because their overall length is less than an equivalent counter balanced lift truck

NOTE See Figure A.6.

Figure A.6 — Reach truck

A.7
articulated counterbalanced pallet truck
rider-operated machine powered electrically, that carries the load outboard of its wheels and needs a special balance weight but the main body of the truck is articulated so it can work within narrow aisle systems

NOTE See Figure A.7.

Figure A.7 — Articulated counterbalanced pallet truck

A.8
very narrow aisle truck
VNA truck
electrically-powered machine, automatically operated or by a man-up or man-down driver, guided on the ground, for bilateral or trilateral loading, and used to work indoor and within very narrow-aisle pallet racking

NOTE See Figure A.8 and Figure A.9.

Figure A.8 — Very narrow aisle trilateral man-down pallet truck with rotating fork

Figure A.9 — Very narrow aisle trilateral man-up pallet truck with movable fork

A.9
four way truck
rider-operated machine, powered electrically or using an internal combustion engine, that carries the centre of gravity of the load inboard of its wheels and needs no special balance weight, that can make 90° turns just by turning its wheels 90° and that may be used to work within narrow aisle systems specially handling long unit loads such as tube or bar bundles

NOTE See Figure A.10.

Figure A.10 — Four way truck

A.10
transfer car
machine located at the end of the racking runs which moves an S/R machine from one operating aisle to another

A.11
shuttle
electrically powered machine, automatically operated from an S/R machine or other specific handling equipment, that is used to store unit loads in depth within lanes, running guided on two special rails that may also support the unit loads as well, and that is used for indoor work and within narrow and very narrow-aisle systems

A.12
lift
electrically powered elevation machine fixed to a self standing structure or fixed to a mezzanine floor structure, allowing loads, personnel, etc. to move between floor levels

A.13
cassette lift
electrically powered elevator machine, automatically operated from an S/R machine, which is vertically guided which consists of a cassette guided at each level, which is used to store unit loads in depth, and which is used for indoor work and within an operating aisle

A.14
storage and retrieval machine
S/R machine
S/R machine running on a floor rail and laterally supported at the top of the mast by an upper guide rail

NOTE See Figure A.11.

Figure A.11 — S/R machine

A.15
curve travelling storage and retrieval (S/R) machine
curve travelling S/R machine
S/R machine designed to move from one operating aisle to another by means of a cross rail located at the end of the runs, each manoeuvre being electrically controlled at several points

A.16
conveyor
machine used to transport unit loads on rollers, belts or chains, depending on the unit load type and/or its orientation

Annex B
(informative)

Load make up accessories

B.1 Pallets

B.1.1 General

A pallet is a rigid horizontal platform, of minimum height, compatible with handling by pallet trucks and/or forklift trucks and other appropriate handling equipment, used as a base for assembling, loading, storing, handling, stacking, transporting, or displaying goods and loads.

B.1.2 Definitions

B.1.2.1
free entry
pallet entry through which the fork arm wheel of hand pallet trucks can enter the pallet without leaving the ground

B.1.2.2
partial entry
pallet entry through which the fork arm wheel of hand pallet trucks must leave the ground to enter the pallet

B.1.2.3
two way
pallet accessible by forklift trucks and hand pallet trucks from two opposite directions only

B.1.2.4
four way
pallet accessible by forklift trucks and hand pallet trucks from all four directions

B.1.3 Types

B.1.3.1 General

Most commonly used pallets are made of wood, but they can also be made of plastic or steel.

Pallets can be classified according to multiple criteria; for example, whether they are single or double decked, whether they are reversible or not, whether forklift entries are on two or four sides, whether they have free entries for the wheels of pallet trucks, etc.

NOTE See EN ISO 445 for the various types of pallets and their terminology, and there are even more types of pallets both in their construction and in their dimensions (e.g. Chemical Industry Pallets, Pool pallets, CP pallets, etc.).

The most widely used types of pallets are described in B.1.3.2 to B.1.3.8.

B.1.3.2
European pallet
four way pallet with two way free entry

NOTE 1 See Figure B.1.

NOTE 2 EN 13698-1 and EN 13698-2 specify the construction features of these pallets.

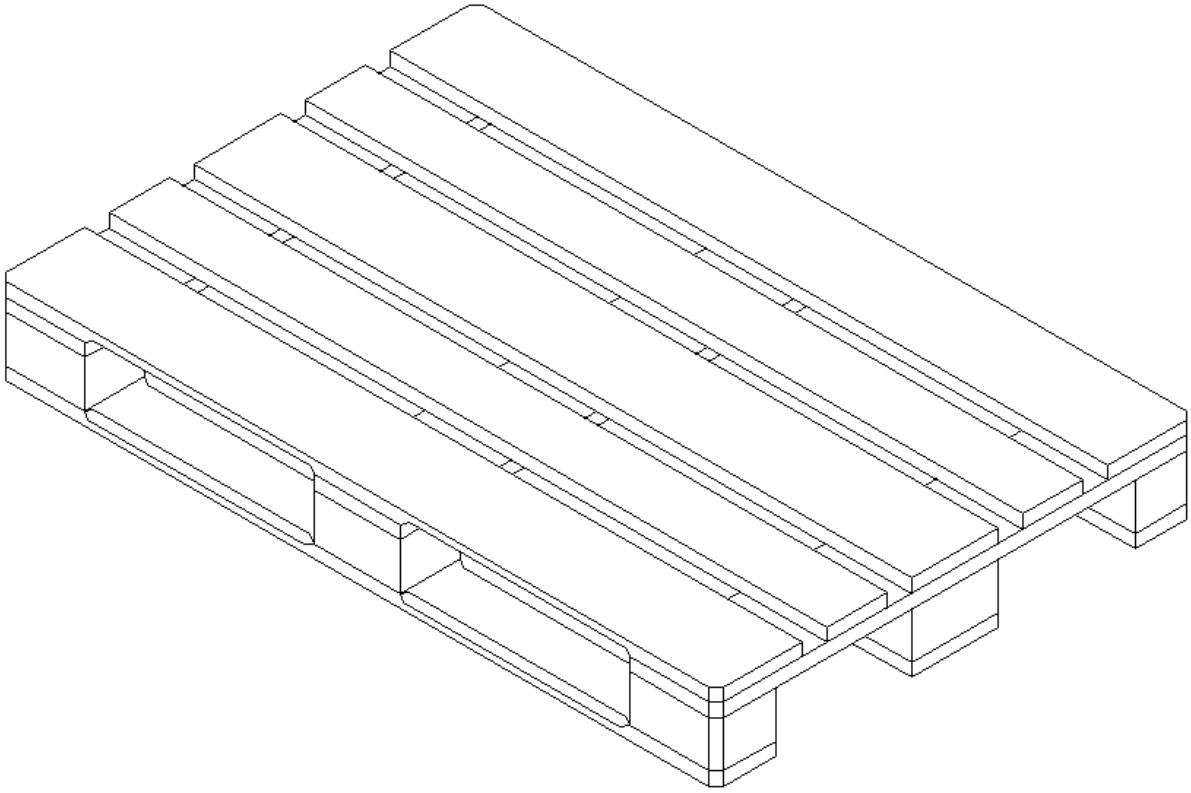


Figure B.1 — European pallet

B.1.3.3
perimeter base pallet
four way pallet with partial entry

NOTE See Figure B.2 and Figure B.3.

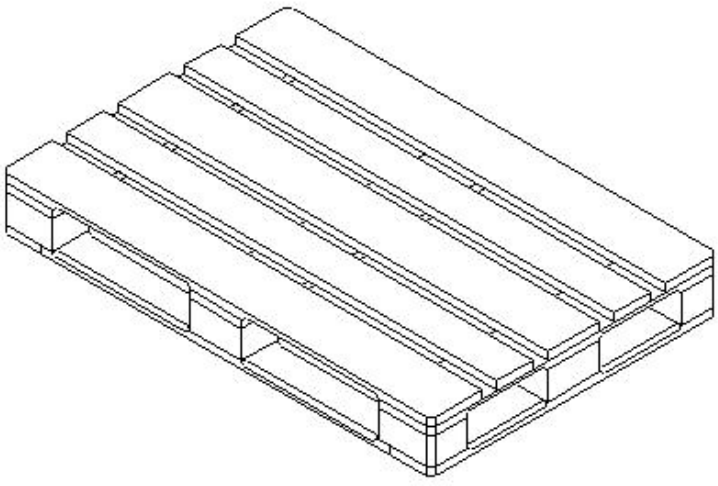


Figure B.2 — Perimeter base pallet (top view)

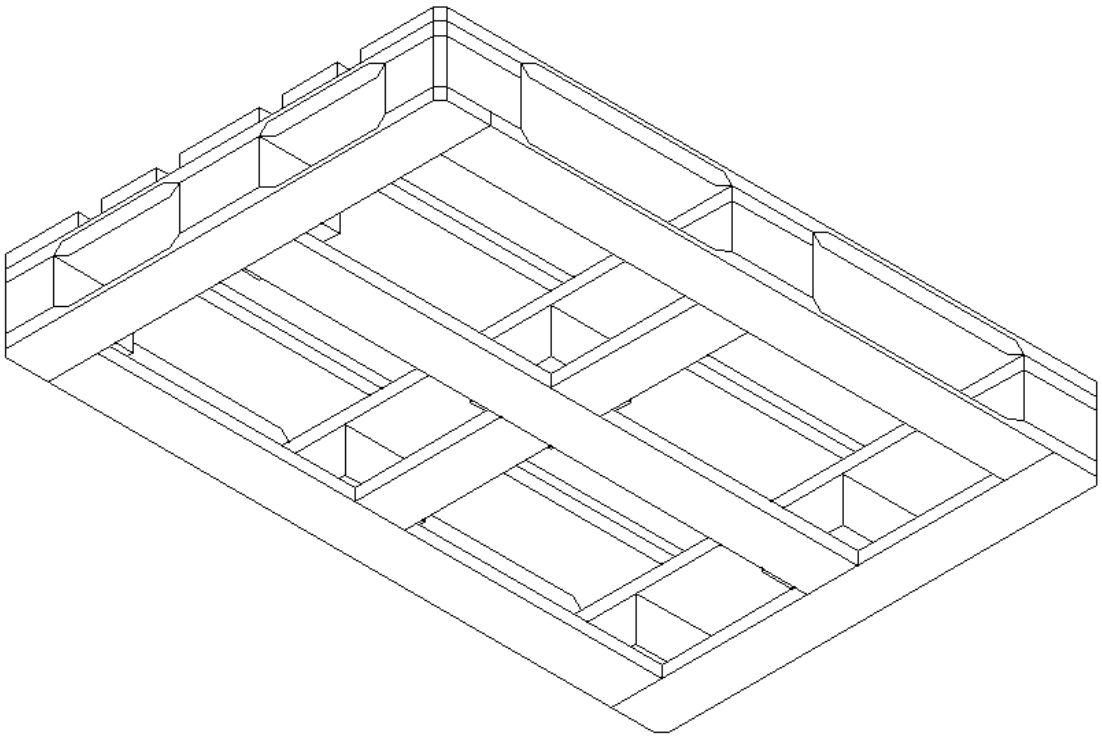


Figure B.3 — Perimeter base pallet (underside view)

B.1.3.4
three bearer pallet
two way pallet with partial entry

NOTE See Figure B.4.

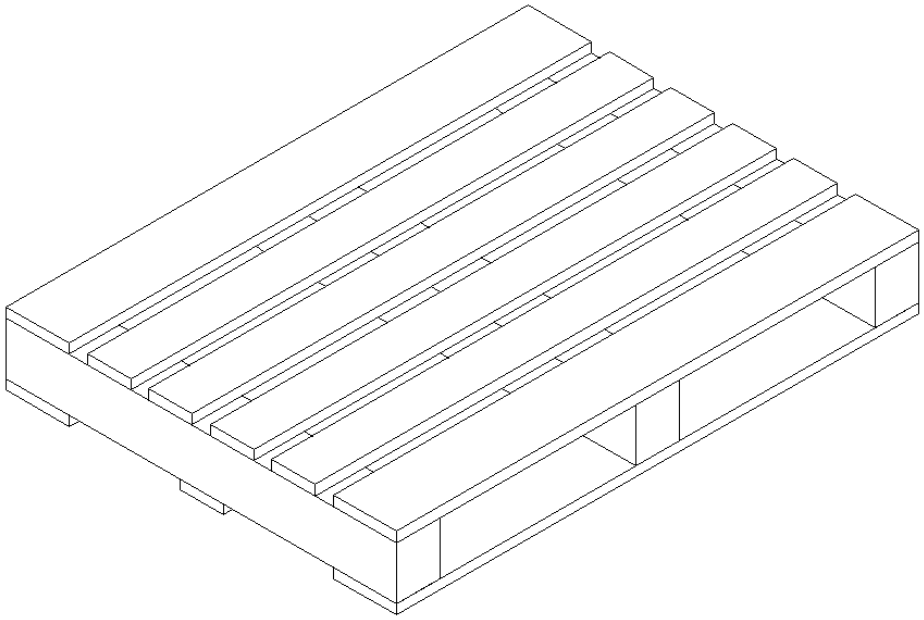


Figure B.4 — Three bearer pallet

B.1.3.5
double wing pallet
two way pallet with partial entry with both top and bottom decks extending beyond stringers, blocks, posts or stringer boards

NOTE See Figure B.5.

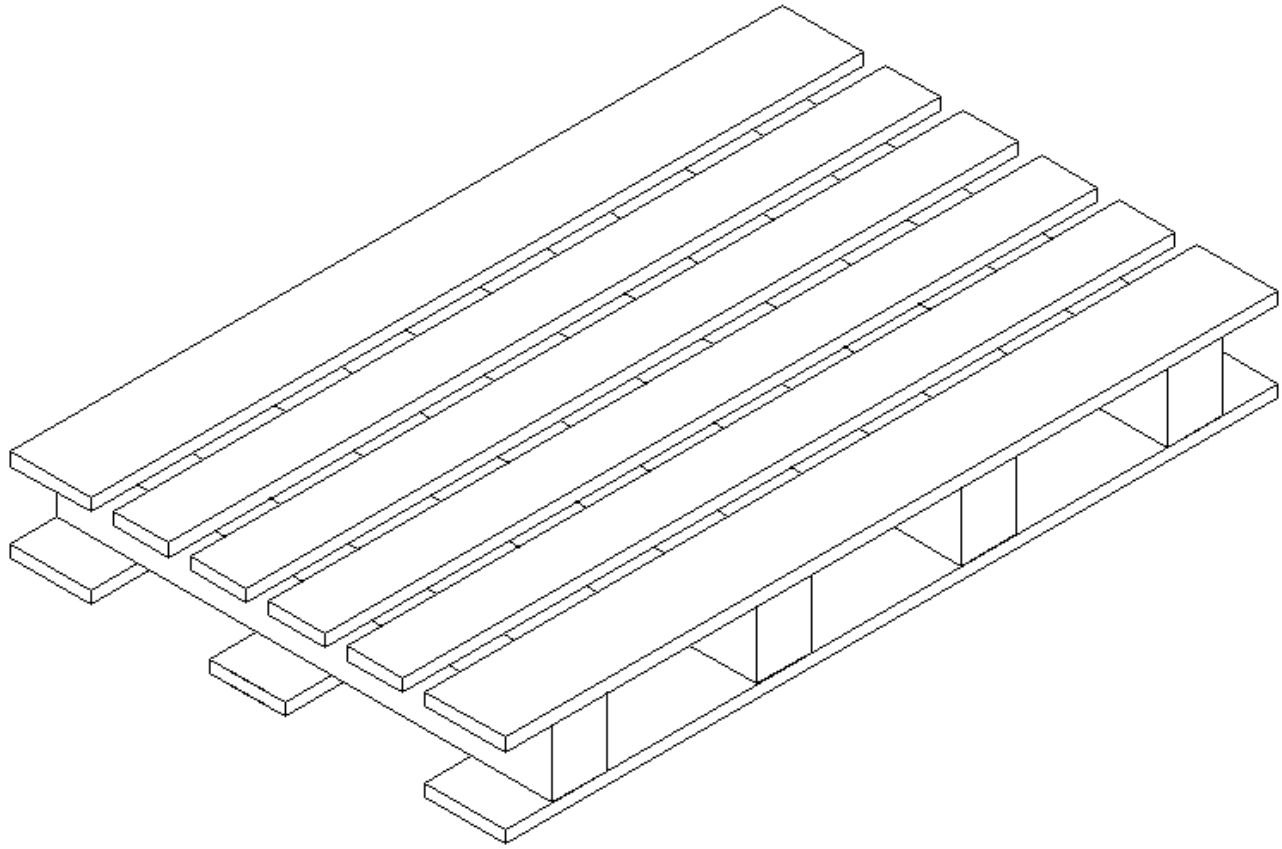


Figure B.5 — Double wing pallet

B.1.3.6
maritime pallet
double wing reversible pallet

NOTE See Figure B.6.

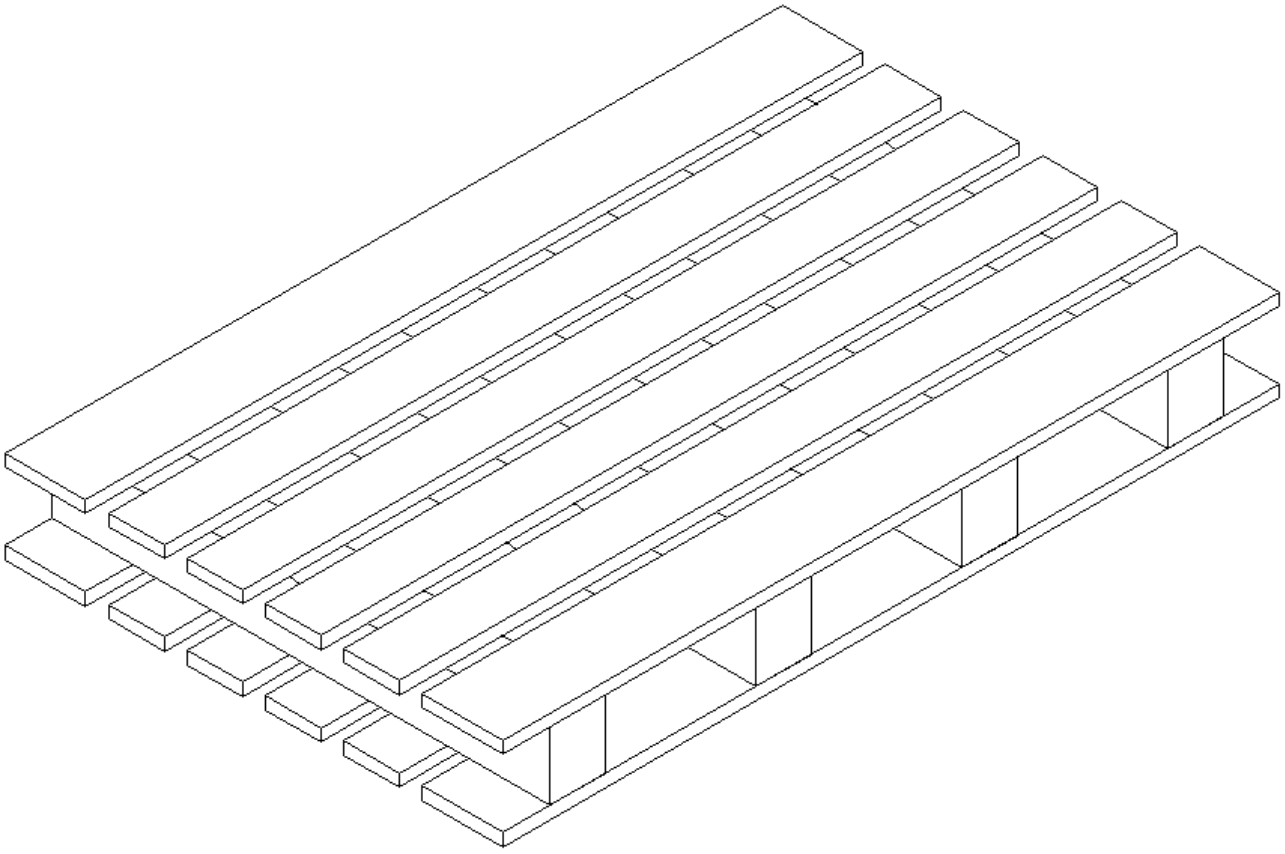


Figure B.6 — Maritime pallet

B.1.3.7
American pallet
four way pallet with two way free entry through two notches in the stringers

NOTE See Figure B.7.

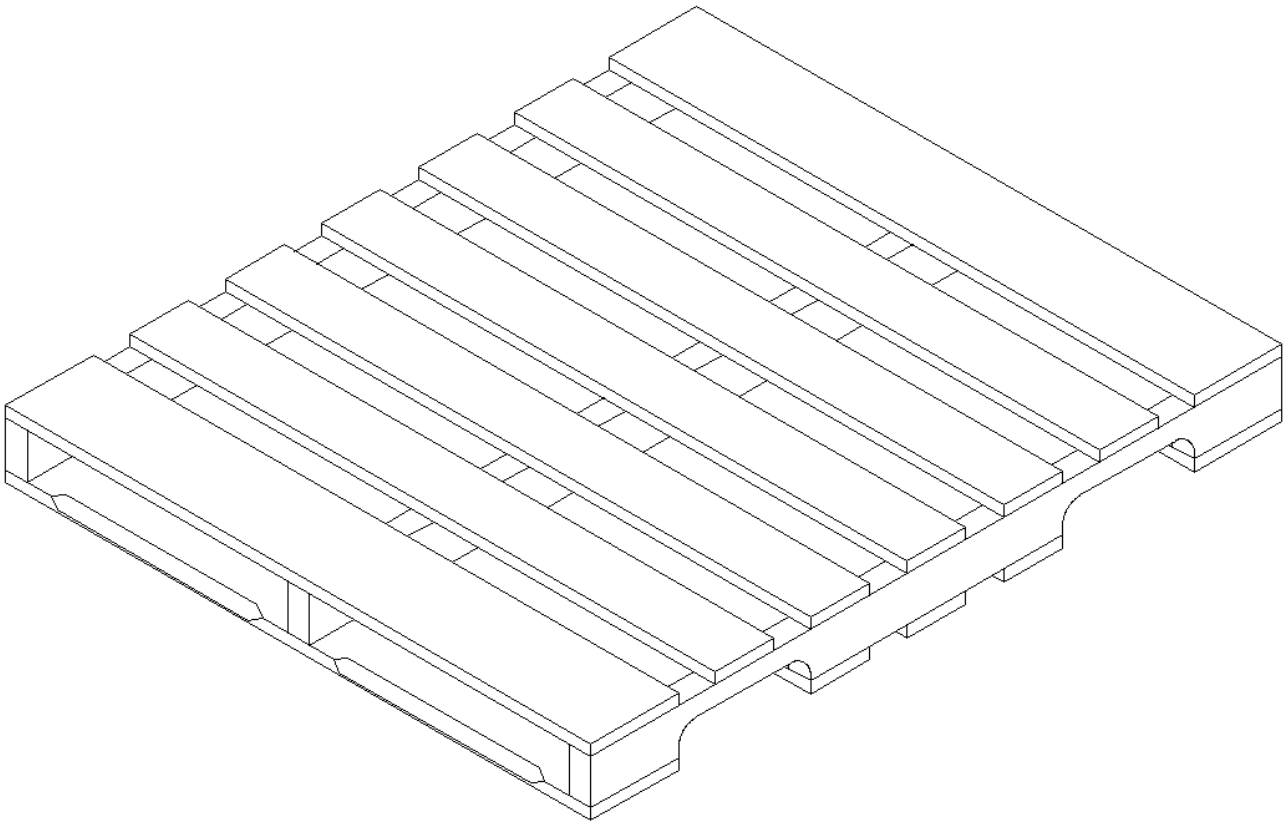


Figure B.7 — American four way entry pallet

B.1.3.8
stillage
platform with two bearers or four feet and with free entry depending on construction and dimensions

NOTE See Figure B.8.

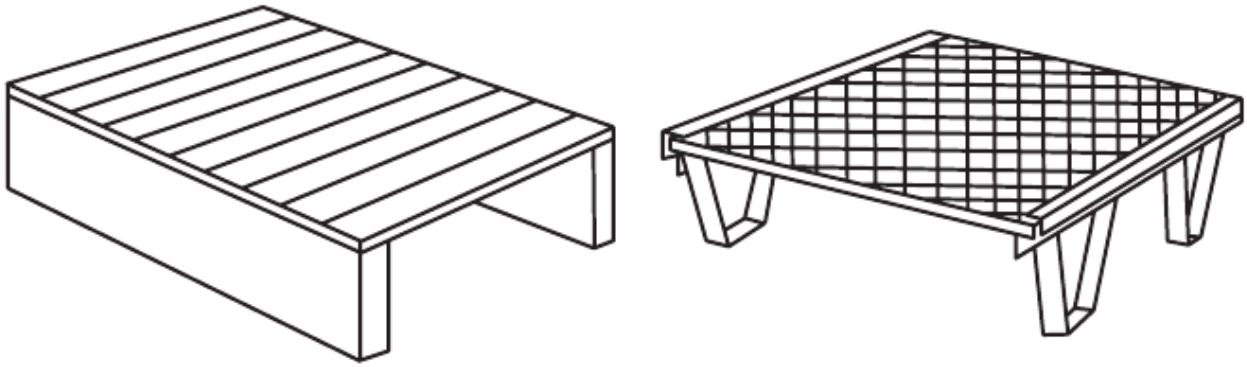


Figure B.8 — Stillage

B.2 Containers

B.2.1 General

Containers are components used to hold goods for handling and storage, either manually or using handling equipment. They can be made of several materials including steel, aluminium, timber, cardboard, plastic.

NOTE EN 13199-1 to -3 specify the features of some containers for manual or mechanical handling, but there is a wide range of containers in their construction and dimensions which are specific to individual manufacturers.

B.2.2 Main types of containers for manual handling

B.2.2.1
stacking container
container which can be stacked on top of another with positive location leaving a clear space between the contents and the base of the upper container, in which the stacking arrangement may be an internal bracket, a lipped edge, a base runner or inverted tapered sides

NOTE See Figure B.9.

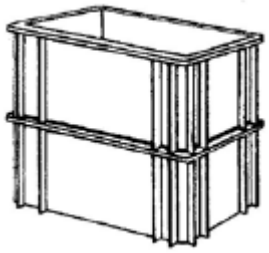


Figure B.9 — Stacking container

B.2.2.2
nesting containers
containers which can nest inside each other when not in use and which have tapered sides with the base smaller than the top

NOTE See Figure B.10.

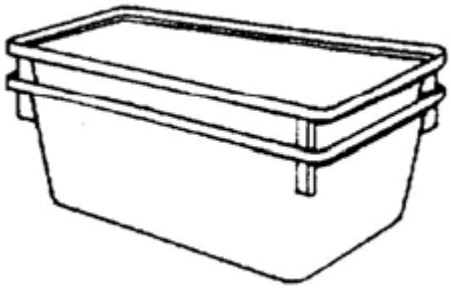


Figure B.10 — Nesting container

B.2.2.3
stack and nest containers
containers which are designed to stack on top of each other when in use and to nest inside each other when empty and which may have a drop-over handle or may have a shape that allows them to stack or nest according to the way in which they are offered to the container below

NOTE See Figure B.11.

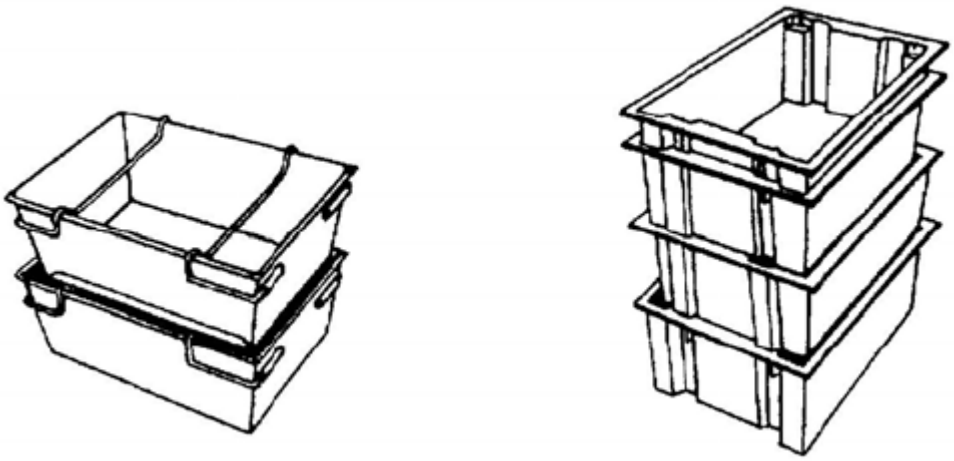


Figure B.11 — Stack and nest containers

B.2.2.4
open fronted container
container designed so that contents may be removed whilst the container is stacked or positioned within a shelving system

NOTE See Figure B.12.

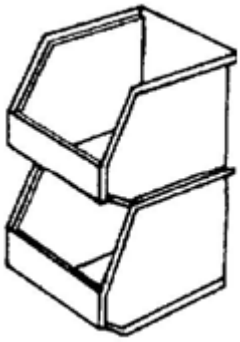


Figure B.12 — Open fronted container

B.2.2.5
hook-on container
container which is designed to hook onto and be cantilevered from a suitable vertical surface such as a rail or louvered panel and which may also have the facility to be stacked as if it were an open-fronted container

NOTE See Figure B.13.

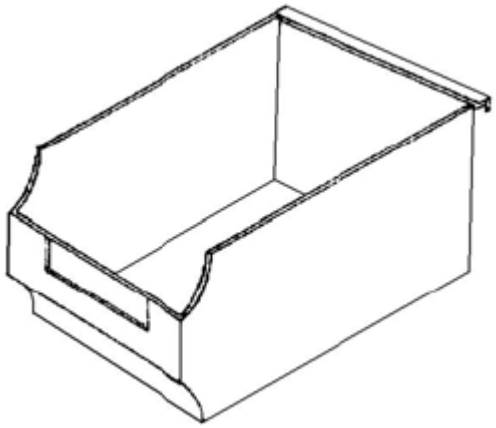


Figure B.13 — Hook-on container

B.2.3 Main types of containers for use with MHE

B.2.3.1
wire container
container which is built using wire mesh, typically with a collapsible side, and which can be vertically stacked by nesting its feet within another, leaving a clearance between them to facilitate handling

NOTE See Figure B.14.

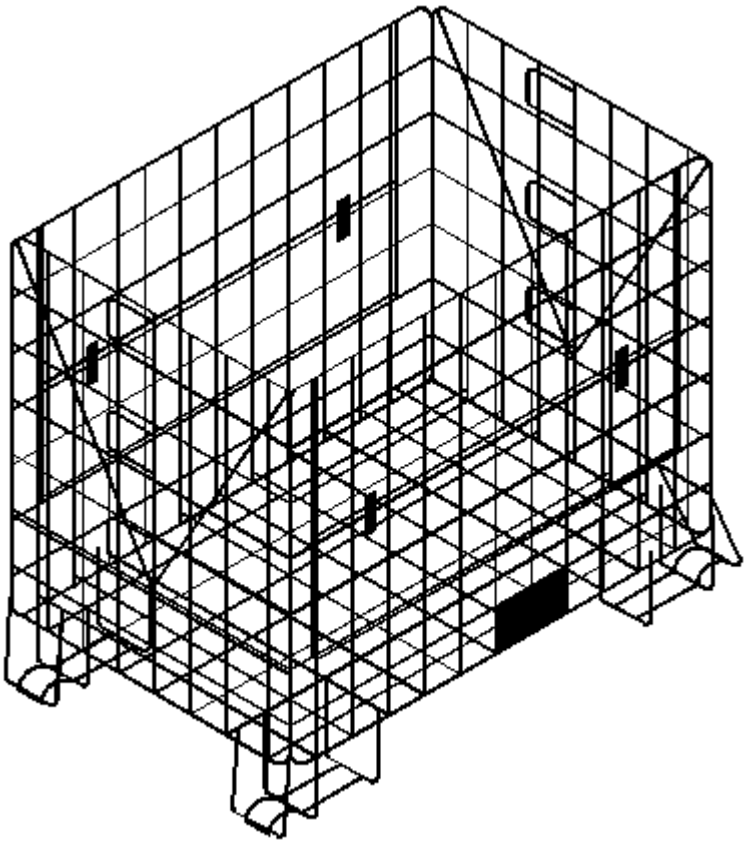


Figure B.14 — Wire container

B.2.3.2
skid container
container which is built using steel sheet and tube and which can be vertically stacked by nesting its skids within another, leaving a clearance between them to facilitate handling

NOTE See Figure B.15.

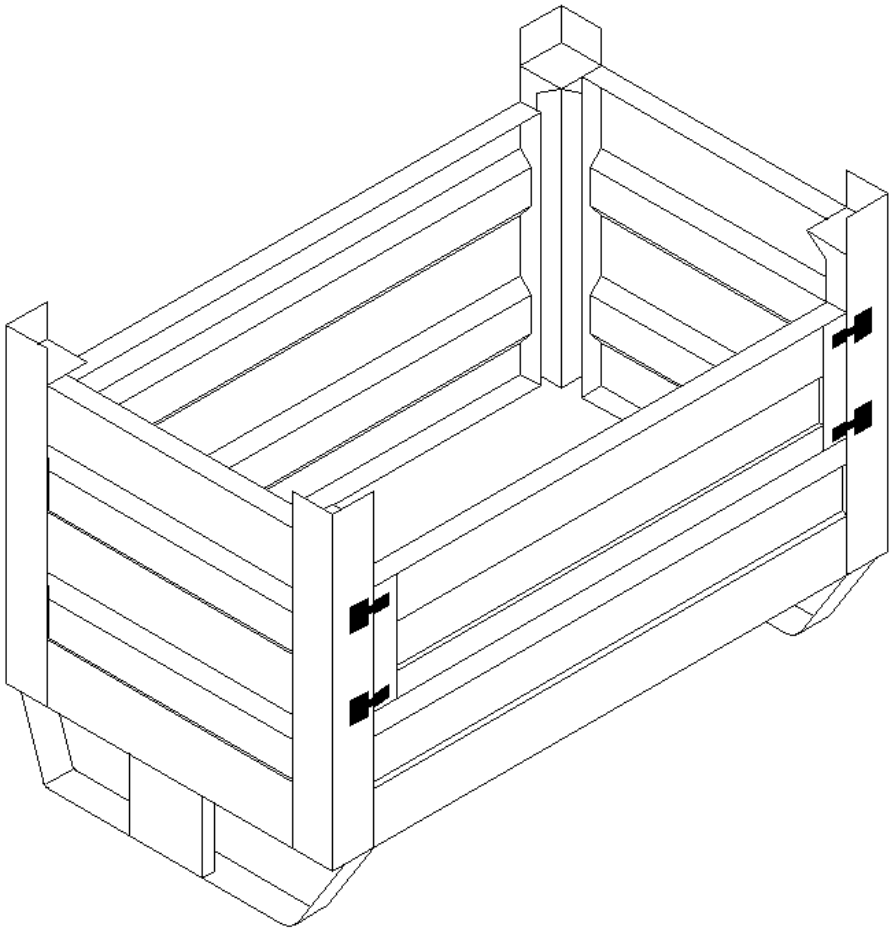


Figure B.15 — Skid container

B.2.3.3
leg container
container which is built using steel sheet and tube and which can be vertically stacked by nesting its legs within another, leaving a clearance between them to facilitate handling

NOTE See Figure B.16.

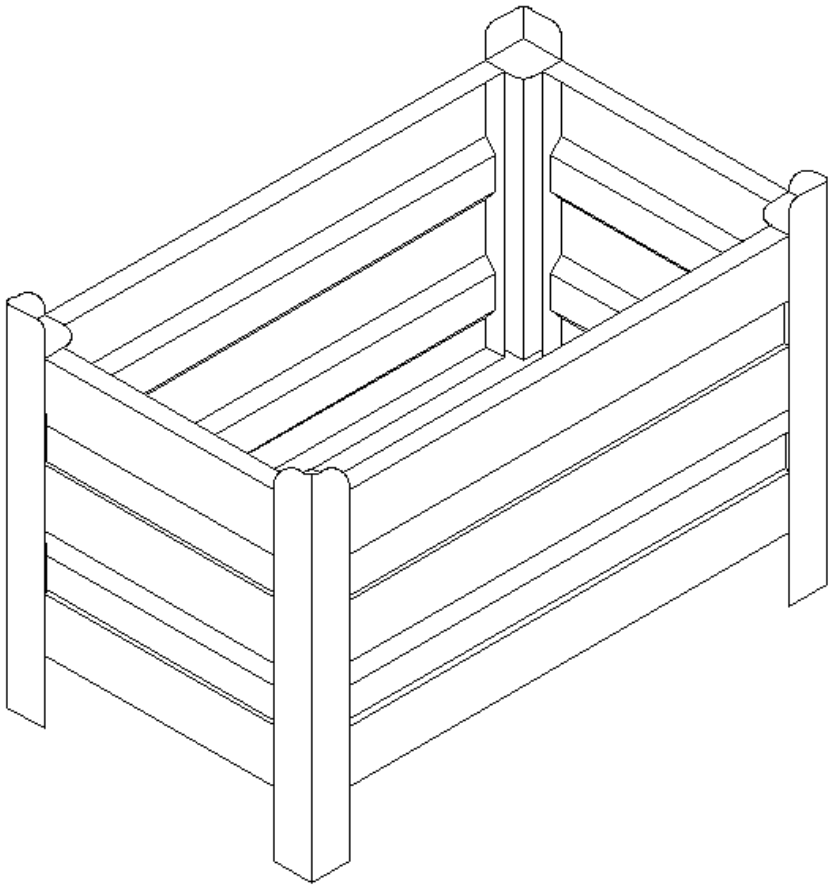


Figure B.16 — Leg container

B.2.3.4
European container
Eurobox
container built using steel sheet and tube, with meshed sides and bolted wooden deck, which can be vertically stacked by nesting its legs within another, leaving a clearance between them to facilitate handling

NOTE 1 See Figure B.17.

NOTE 2 EN 13626 specifies the features of containers for handling equipment, also called box pallets.

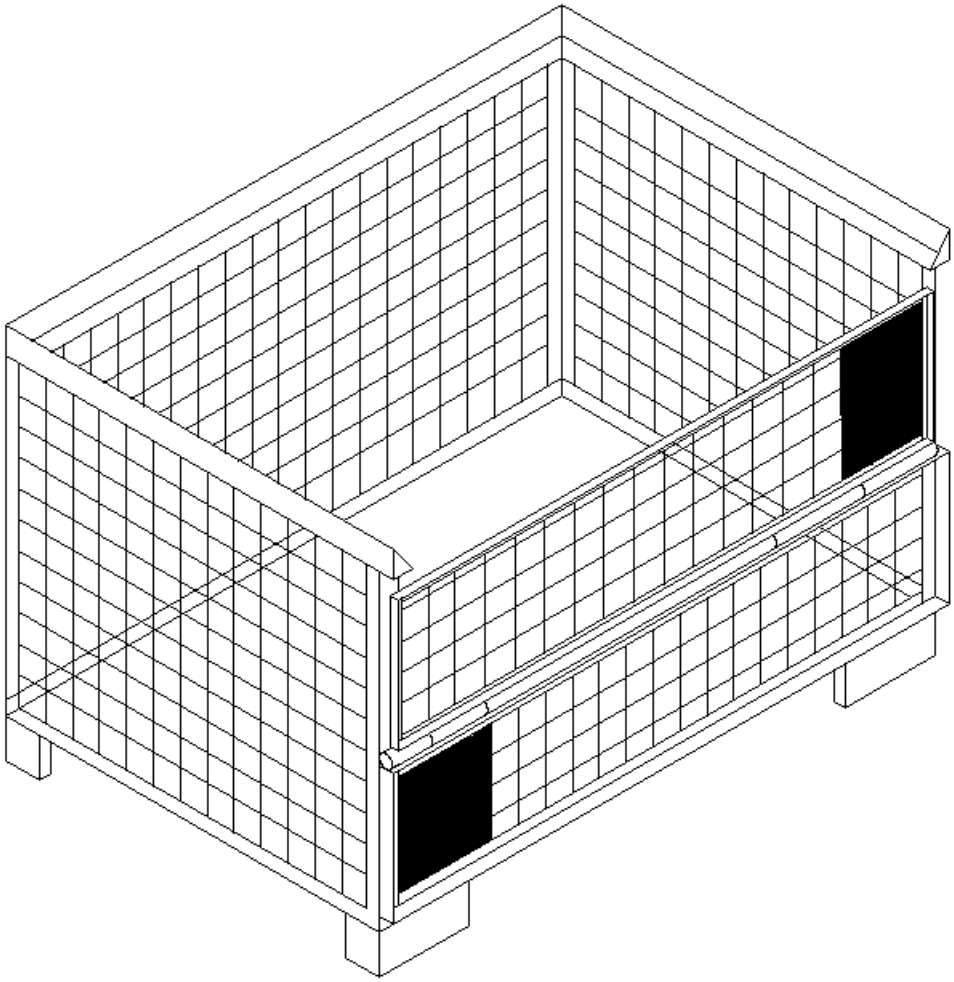


Figure B.17 — European container

Bibliography

[1] EN 528, *Rail dependent storage and retrieval equipment — Safety requirements*

[2] EN 13199-1, *Packaging — Small Load Carrier Systems — Part 1: Common requirements and test methods*

[3] EN 13199-2, *Packaging — Small Load Carrier Systems — Part 2: Column Stackable System (CSS)*

[4] EN 13199-3, *Packaging — Small Load Carrier Systems — Part 3: Bond Stackable System (BSS)*

[5] EN 13382, *Flat pallets for materials handling — Principal dimensions*

[6] EN 13626, *Packaging — Box pallets — General requirements and test methods*

[7] EN 13698-1, *Pallet production specification — Part 1: Construction specification for 800 mm × 1 200 mm flat wooden pallets*

[8] EN 13698-2, *Pallet production specification — Part 2: Construction specification for 1 000 mm × 1 200 mm flat wooden pallets*

[9] EN ISO 445, *Pallets for materials handling — Vocabulary (ISO 445:2008)*

[10] ISO 3394, *Dimensions of rigid rectangular packages — Transport packages*

[11] UNE 49902-4, *Wood pallets — Maritime wood pallet of 1 200 mm × 1 800 mm*

This page deliberately left blank

British Standards Institution (BSI)

BSI is the independent national body responsible for preparing British Standards and other standards-related publications, information and services.
It presents the UK view on standards in Europe and at the international level.

It is incorporated by Royal Charter.

Revisions

British Standards are updated by amendment or revision. Users of British Standards should make sure that they possess the latest amendments or editions.

It is the constant aim of BSI to improve the quality of our products and services. We would be grateful if anyone finding an inaccuracy or ambiguity while using this British Standard would inform the Secretary of the technical committee responsible, the identity of which can be found on the inside front cover.

Tel: +44 (0)20 8996 9001 Fax: +44 (0)20 8996 7001

BSI offers Members an individual updating service called PLUS which ensures that subscribers automatically receive the latest editions of standards.

Tel: +44 (0)20 8996 7669 Fax: +44 (0)20 8996 7001
Email: plus@bsigroup.com

Buying standards

You may buy PDF and hard copy versions of standards directly using a credit card from the BSI Shop on the website **www.bsigroup.com/shop.** In addition all orders for BSI, international and foreign standards publications can be addressed to BSI Customer Services.

Tel: +44 (0)20 8996 9001 Fax: +44 (0)20 8996 7001
Email: orders@bsigroup.com

In response to orders for international standards, it is BSI policy to supply the BSI implementation of those that have been published as British Standards, unless otherwise requested.

Information on standards

BSI provides a wide range of information on national, European and international standards through its Knowledge Centre.

Tel: +44 (0)20 8996 7004 Fax: +44 (0)20 8996 7005
Email: knowledgecentre@bsigroup.com

Various BSI electronic information services are also available which give details on all its products and services.

Tel: +44 (0)20 8996 7111 Fax: +44 (0)20 8996 7048
Email: info@bsigroup.com

BSI Subscribing Members are kept up to date with standards developments and receive substantial discounts on the purchase price of standards. For details of these and other benefits contact Membership Administration.

Tel: +44 (0)20 8996 7002 Fax: +44 (0)20 8996 7001
Email: membership@bsigroup.com

Information regarding online access to British Standards via British Standards Online can be found at **www.bsigroup.com/BSOL**

Further information about BSI is available on the BSI website at **www.bsigroup.com/standards**

Copyright

BSI Group Headquarters

389 Chiswick High Road London W4 4AL UK

Tel +44 (0)20 8996 9001
Fax +44 (0)20 8996 7001
www.bsigroup.com/standards

raising standards worldwide™