Containers and Associated Cargo Equipment

Manuel Ventura

Ship Design I

MSc in Marine Engineering and Naval Architecture

Containers

Manuel Ventura
Containers - Dimensions

Origin
- The container was invented by the American Malcom McLean in the years 1930. McLean was the founder of the company Sea-Land in 1960.

Dimensions
- The first international standards were issued in 1965 by ISO (International Standards Organization).
- In 1979, ANSI (American National Standards Institute) enlarged the standards adding the heights of 9' and 9 ½'.

Standard ANSI Dimensions

<table>
<thead>
<tr>
<th>Type</th>
<th>L  [ft (mm)]</th>
<th>W  [ft (mm)]</th>
<th>H   [ft (mm)]</th>
<th>Qmax [kg]</th>
<th>W (approx.) [kg]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1A</td>
<td>40' (12190)</td>
<td>8’ (2435)</td>
<td>8’ (2435)</td>
<td>30480</td>
<td>3500</td>
</tr>
<tr>
<td>1AA</td>
<td></td>
<td></td>
<td>8’ ½ (2591)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1B</td>
<td>30’ (9125)</td>
<td>8’ (2435)</td>
<td>8’ (2435)</td>
<td>25400</td>
<td></td>
</tr>
<tr>
<td>1BB</td>
<td></td>
<td></td>
<td>8’ ½ (2591)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1C</td>
<td>20’ (6055)</td>
<td>8’ (2435)</td>
<td>8’ (2435)</td>
<td>20320</td>
<td>2000</td>
</tr>
<tr>
<td>1CC</td>
<td></td>
<td></td>
<td>8’ ½ (2591)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1D</td>
<td>10’ (2990)</td>
<td>8’ (2435)</td>
<td>8’ (2435)</td>
<td>10160</td>
<td></td>
</tr>
</tbody>
</table>
Containers - Loads

Design Loads

- Corners dimensioned for a stack of 6 containers height submitted to accelerations of 0.8g
- Side walls designed for heeling angles up to 30° and for a period of roll of 13 seconds
- Top dimensioned to carry the load equivalent to the weight of 2 men
- Structure designed to be handled only through the use of spreaders

Containers - ISO Loads

Standard Design Loads

- According to ISO 1496-1:1990 standard, fully loaded containers must be capable of nine high stacking.
- This corresponds on the bottom container to a load of 8 x 24,000 kg = 192,000 kg.
- Typically, container manufacturers do not comply to this value
## Container Identification (1)

- ISO 6346 is an international standard managed by the International Container Bureau (BIC) for coding, identification and marking of intermodal containers (shipping containers) used within intermodal freight transport as part of containerization. It establishes:
  - an identification system with:
    - an owner code, commonly known as BIC code
    - an equipment category identifier
    - a serial number
    - a check digit
  - a size and type code
  - a country code
  - operational marks

## Container Identification (2)

**Owner Code**
- Consists of 3 capital letters of the Latin alphabet to indicate the owner or principal operator of the container.
- Code needs to be registered at the Bureau International des Containers in Paris to ensure uniqueness worldwide.

**Equipment Category Identifier**
- Consists of 1 of the following 3 capital letters of the Latin alphabet:
  - U for all freight containers
  - J for detachable freight container-related equipment
  - Z for trailers and chassis

![Container Identification Diagram]
Container Identification (3)

Serial Number
• Consists of 6 (Arabic) numeric digits, assigned by the owner or operator, uniquely identifying the container within that owner/operator’s fleet.

Check Digit
• Consists of 1 (Arabic) numeric digit to validate the recording and transmission accuracies of the owner code and serial number.

CSQU3054383

Container Construction
**Container Stowage**

**Transverse separation 80 mm (c/c 258 mm)**

![Diagram showing container stowage with 80 mm transverse separation](image)

**Transverse separation 25 mm (c/c 203 mm)**

![Diagram showing container stowage with 25 mm transverse separation](image)
ISO Corner Fittings

Container Securing

Corner Fittings for ISO containers

M. Ventura  Container and Cargo Equipment  13

M. Ventura  Container and Cargo Equipment  14
### Lashing Components – Fixed (1)

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>PURPOSE</th>
<th>IMAGE</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flush Socket</td>
<td>Locating of base bittblocks or stacking canes in the cargo hold.</td>
<td></td>
<td>Normally fitted over a small recess to ensure watertightness. Clean and remove debris before use.</td>
</tr>
<tr>
<td>Raised Socket</td>
<td>Locating of base bittblocks or stacking canes on deck.</td>
<td></td>
<td>Clean and remove debris before use.</td>
</tr>
<tr>
<td>Lashing Plate or ‘Pit-eye’</td>
<td>Tie-down point for turnbuckle on deck or hatchcover.</td>
<td></td>
<td>Designed only for in-plane loading. An out-of-plane load could bend the plate and may crack the connecting weld.</td>
</tr>
<tr>
<td>D Ring</td>
<td>Alternative tie-down point for a turnbuckle.</td>
<td></td>
<td>Corrosion of the pin ends can weaken a D Ring. Suitable for in-plane and out-of-plane loading.</td>
</tr>
</tbody>
</table>

### Lashing Components – Fixed (2)

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>PURPOSE</th>
<th>IMAGE</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dowell Foundation</td>
<td>Base for sliding twistlock.</td>
<td></td>
<td>Clean before use. Check for damage or wear.</td>
</tr>
<tr>
<td>Fixed Stacking Cone</td>
<td>To prevent horizontal movement of 20-foot containers in 40-foot cell guides.</td>
<td></td>
<td>Often found at the base of a cell guide.</td>
</tr>
<tr>
<td>Mid-leg Guide</td>
<td>To prevent transverse movement of 20-foot containers in 40-foot guides. Fitted at tank top level.</td>
<td></td>
<td>Does not interfere with general stowage of 40-foot containers.</td>
</tr>
</tbody>
</table>
## Lashing Components - Loose Fittings (1)

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>PURPOSE</th>
<th>IMAGE</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lashing Rod</td>
<td>To provide support for container stacks on deck, located in conjunction with tambourde.</td>
<td><img src="image1.png" alt="Image" /></td>
<td>Regularly handle loads, very long lashing bars can be difficult to handle and difficult to locate on container corners. Overtightening can cause damage.</td>
</tr>
<tr>
<td>Extension Piece</td>
<td>To extend a lashing rod when securing high-cable containers.</td>
<td><img src="image2.png" alt="Image" /></td>
<td>Overtightening causes damage to the container.</td>
</tr>
<tr>
<td>Tambourde (tambourde)</td>
<td>To connect a lashing rod to a lashing plate or D ring. Tightening puts tension into a lashing rod.</td>
<td><img src="image3.png" alt="Image" /></td>
<td>Regularly used to secure the lashing tight. Overtightening can cause damage to the container.</td>
</tr>
<tr>
<td>Penguin Hook</td>
<td>Used as a supporting device in conjunction with a special lashing rod with an eye-end.</td>
<td><img src="image4.png" alt="Image" /></td>
<td>Likely to be put in place where container is loose. Caution: difficulty in lifting when on vessel. Risk of injury if it falls out when container is lifted aboard.</td>
</tr>
</tbody>
</table>

---

## Lashing Components - Loose Fittings (2)

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>PURPOSE</th>
<th>IMAGE</th>
<th>NOTES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sliding Gears</td>
<td>Placed between containers to lock and facilitate corner adjustments.</td>
<td><img src="image5.png" alt="Image" /></td>
<td>Maximum horizontal force, many times used. May be locked into bottom corner fittings prior to lifting or container on vessel.</td>
</tr>
<tr>
<td>Twedlock</td>
<td>Placed between containers to lock and facilitate corner adjustments.</td>
<td><img src="image6.png" alt="Image" /></td>
<td>As above, but with vertical separations. Each fitting requires deployment after lifting. Latch and lift by hand, securing assistance whether a fitting is locked or not.</td>
</tr>
<tr>
<td>Semi-automatic Twedlock</td>
<td>Placed between containers to lock and facilitate corner adjustments.</td>
<td><img src="image7.png" alt="Image" /></td>
<td>As above. Can be locked on ships and facilitate locking of the lower connection when placed on top. It is easier to determine whether it is locked or not when compared to manual methods. Tightly translates.</td>
</tr>
<tr>
<td>Fully automatic Twedlock</td>
<td>Placed between containers to lock and facilitate corner adjustments.</td>
<td><img src="image8.png" alt="Image" /></td>
<td>A new and innovative design. Automatic unlocking during lifting. Easily opened for a vertical lift, with a twisting fit.</td>
</tr>
<tr>
<td>Sliding Twedlock</td>
<td>To connect lashing containers to the ship.</td>
<td><img src="image9.png" alt="Image" /></td>
<td>Fits into a dovetail flange, used on both containers and on vessels when a rapid accident can cause an obstruction.</td>
</tr>
</tbody>
</table>
Lashing Components - Loose Fittings (3)

**Description**
- **Dinghy Fitting**: To link top containers of two adjacent stacks together. Can be used in stacks of two containers.
- **Wedge Lock**: Prevents containers from being moved or tilted. They can be used in stacks of two or more.
- **Bollard**: Extends support for container stacks in a yard.
- **Double Stacking Cone**: To limit adjacent stacks, particularly those at line with bollards.
- **Load Equalizing Device**: To balance the loads between two joined lashing points.

**Notes**
- Wedge lock and compensation for use. Prevents full hazard for simultaneous opening placement.
- Bollard: Tolerated and separable features. Ribbed to withstand of impact, to provide supplementary resistance. They automatically lock into lower containers when placed in yard.
- Can resist compressive and vertical forces. Must be used in conjunction with larger strength bollard standing. Comes at stack jacks and fixed with side support structure.
- Double stacking cone: Allows convenient handling of container stacks.
- Load equalizing device: Enables free connections to two containers with both loading and unloading hooks.

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**Container Securing**

*Corner Fittings for ISO containers*

[Diagram showing corner fittings for ISO containers]

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Conventional securing system, without cell guides

The piles are fixed to the side shell through pressure/tension elements

Horizontal and vertical securing between stacks
Securing - Disadvantages of the Conventional System

- If one container fails, it is not only one stack that is affected, but the entire pile of containers.

- Due to the dimensional tolerances, ware and deformation of the twistlocks, an entire block can be submitted to continuous motions in rough seas, which may lead the intermediate cones to break and the complete block to collapse.

Container Securing - Deck

- The containers in the bottom tier are positioned in sockets.
- Double cones are used in the intermediate tiers.
- This system is not flexible.
- When handling a stack, the adjacent stacks must be handled too.
Container Securing - Deck

- Sockets can be embedded or not
- Socket on hatch covers are generally not embedded

Container socket and lashing points on top of hatch cover

- Often used nowadays
- The containers are stacked connected vertically with twistlocks
- Stacks are not connected to each other
- Cables are used for vertical securing (lashing)

This system allows the load and unload of a single stack
Containers on Hatch Covers

- Pillars are positioned at deck side to allow the carriage of an extra stack of containers (at each side) between the hatch cover and the ship side
- The pillars have container sockets
- The pillars are spaced at 20' modules and are designed to allow the access of the crew to the bow through them

Cellular Guides (Fixed/Movable)

Guides inside Holds
Cellular Guides (Fixed/Movable)

Guides inside Holds
Lashing Bridges (1)

• When the required stack load for 40’ containers exceeds the limit of approx. 100 tons, lashing from hatch cover level might no longer be sufficient.

• Lashing bridges are fitted on large ships over 5,000 TEU, installed between 40’ hatches, and designed to restrain racking forces from container stack loads and create free maintenance space for reefer containers.

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Lashing Bridges (2)

• Higher container weights can be used in the upper tiers while the lashing system can be simplified, i.e. double cross short lashing system (Para-Lash) to be used for 40’ containers from lashing bridge level.

• The installation of lashing bridges does not have any effect on 20’ stack loads because 20’ containers still have to be lashed from hatch cover level at mid-hatch position.

• The possibility to stow non-standard containers others than 20’/40’ ISO containers is restricted.

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Guides on Deck

The vertical guides are generally built by L profile sections of equal flanges, with thickness ≥ 12 mm, raising up to a height sufficient to provide uniform support to the containers.

The guides shall be connected between them and to the side shell structures by cross-ties and by longitudinal elements to avoid deformations due to the action of the forces transmitted by the containers.
Cellular Guides (2)

• In general, the spacing between cross-ties connecting the guides shall not exceed 5 meters, and their position shall coincide as much as possible with the corners of the containers.

• The cross-ties shall be constrained longitudinally at one or ore points so that their elastic deflection due to the action of the longitudinal load of the containers does not exceed 20 mm at any point.

Cellular Guides (3)

Arrangement of the Fixed Cell Guides

• When stowing the containers in the guides, the nominal tolerance between the container and the guide shall not exceed 25 mm in the transverse direction and 38 mm in the longitudinal direction.

• The upper end of the guides shall be provided with a block designed to facilitate the entrance of the containers, that shall be robust to resist to impact and ware.

Arrangement of Movable Cell Guides

• The movable cell guides systems shall constitute system as independent as possible from the shell structure.

• Generally they are screwed to the shell structure.
Cellular Guides (4)

- There is an ISO standard that regulates the guides for containers.

- In a recent study it was verified that the port crane operators manage to execute complete crane cycles to remove and position containers at speeds between the 30 and 60 containers per hour.

Movable Guides

- MacGregor supplies movable cell guide systems for containers with ISO width (2.438 m) that may be adjusted to secure containers with lengths of 20’, 30’, 40’, 45’, 48’ and 49’.
- The container heights can be 8’, 8.5’ and 9.5’.

Feeder Ship "Geestdijk"
Damen Shipyards (NL) – 2005
Lpp = 130.00 m
B = 21.80 m
D = 9.50 m
812 TEU

www.damen.nl
The concept of hatchless or open-top container carrier has appeared in the beginning of the 1990s.
The objective is to maximize the efficiency of loading/discharging.
These ships have continuous cell guide from the bottom up to the last tier.

- The first hatchless ship was the SV15 “Bell Pioneer” (1990)

Bell Pioneer

Built by the Teraoka Shipyard Co.
6111 GT
Advantages of Hatchless Ships (1)

Stowage
- Increase of capacity due to the non-interruption of the stack above the hatch cover
- Reduction of the weight of the equipment (hatch covers)

Lashing
- Lashing of cargo is not necessary
- Reduces the time on port, at arrival and departure
- Reduction of costs with lashing equipment
- Possible savings in labour costs

Hatch Covers
- Reduction of the capital and operating costs (hatch covers)
- No loss of time opening/closing the hatch covers
- No problem with load limitations on the hatch covers

Advantages of Hatchless Ships (2)

Loading/Discharging Operations
- More effective stowage, the ship has a lower CG
- The ship can be loaded and unloaded simultaneously, because each bay is accessible from bottom to top
- Container capacity maximized due to the combination of more accessibility and lower CG
- More load possible per container
- More loads per stack
- The time cycle of the cranes can be optimized

Safety
- Most fatal or serious accidents in container ships occur during the cargo lashing/unlashing operations

Multi-port calls
- Less time in each port

Disadvantages of Hatchless Ships

**Hazardous cargo**
- The open spaces above deck do not qualify for the carriage of hazardous cargo in containers or ISO tanks

**Cell Guides System**
- Risk of damaging the guides, that raise above the deck
- Longer crane motions

**Tonnage**
- Values of GT about 50-70% larger in comparison with the conventional ships of similar capacity

**Cost**
- Ships cost about 10-12% more because they are wider and taller than the equivalent conventional ones

**Load per Stack**
- The load per stack can be a problem because it is not divided between the hold and the deck

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Basic Principles for Container Securing

- The IMO document "IMO Code of Safe Practice for Cargo Stowage and Securing" contains some basic recommendations for cargo securing on board ships
• The Maximum Securing Load (MSL) of the securing devices is the equivalent of the Safe Working Load (SWL) for the lifting devices. It is the concept used to define the load capacity of a securing device.

• The total of the MSL values of the securing elements in each side (PS and SB) of the cargo unit shall be equal to the weight of the unit.

• The relevant data required to specify the stowage and securing of any type of cargo is:
  - Weight, in metric tons
  - Main dimensions (with drawing, if possible)
  - Location of the center of gravity
  - Footprint and local reinforcements
  - Lifting points or slinging positions
  - Lifting device supplied with the cargo, if any, together with the tests certificates
  - Safety arrangements on board the ship
  - Preparations for transport, on shore
• Quando se estuda a localização da carga estivada, as forças de aceleração devem ser tidas em consideração:

- As forças de aceleração mais baixas ocorrem na zona a meio navio, sob o convés, na célula na posição mais baixa e tão próximo quanto possível do plano de mediania.

- As forças de aceleração mais altas ocorrem nas extremidades do navio, nas posições mais elevadas acima do convés e na proximidade do costado do navio.

• Quando o equipamento de fixação (lashing) não é especificado (diâmetro do cabo, etc.) pelo despachante (forwarder) a companhia de estiva (lashing company) procederá à fixação da carga de acordo com as suas regras e experiência próprias.

• Nem toda a carga tem necessariamente de ser fixada (lashed). A melhor maneira de estivar uma carga consiste muitas vezes em apertá-la contra outra de modo a que se suporte mutuamente.
Bibliography

- "International Convention for Safe Containers", 1972, IMO (CD-ROM#37)
- "A Master's Guide to Container Securing", Lloyds Register of Shipping (CD-ROM#37)
Hatch Covers (1)

Most common types:
- Pontoon
- Side-rolling
- Folding
- Single pull
- Piggy-back
- Telescopic

Pontoon Type

- Navios porta-contentores
- Abertura da escotilha totalmente acessível
- Dimensionadas para uma carga correspondente à pilha de contentores (máx. 6 camadas)
- Movimentadas pelos meios de carga/descarga dos contentores
- Dimensões geralmente limitadas ao peso máximo possível de movimentar com a grua dos contentores
Pontoon Type

- Bulk carriers and combined ships
- Hatch opening totally accessible
- Small interval between hatches
- Hydraulic driven

Side-Rolling Type

- Bulk carriers and combined ships
- Hatch opening totally accessible
- Small interval between hatches
- Hydraulic driven
Folding Type

- Navios carga geral
- Accionamento hidráulico
- Apropriado para escotilhas de grandes dimensões

- Abertura da escotilha parcialmente acessível
- Espaço de convés desperdiçado para estiva das tampas mínimo

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59
Single-Pull Type

- Driven by steel wires
- Does not require hydraulics

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Piggy-Back Type

- Bulk carriers, combined carriers, container vessels, multi-purpose
- Hatch opening only partially accessible
- Does not use deck space to stow the covers
- Lifting by hydraulic jacks

Allows opening up to 80% of the hatch length
Multiple Piggy-Back

- More than 2 panels can stacked

The horizontal displacement is driven by:
- Embedded electrical motors
- Hydraulic motors acting on chains

Telescopic Type

- Barcaças, batelões e embarcações fluviais
- Accionamento manual
Equipment for Container Terminals

Manuel Ventura

Gantry Cranes
Automobile Transporter

Max. Load | 40 t
Speed of travel | 0 – 14 km/h
Types of Containers | 20, 40, 45 e 50 ft

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Spreader

Comprimento: 6052 mm (20ft), 9118 mm (30ft), 12185 mm (40ft)
Largura: 2430 mm
Altura: 500 mm (estrutura apenas)
Peso (*): 950 kg (20ft), 1100 kg (30ft), 1200 kg (40ft)
(*) cabos não incluídos
SWL: 25.000 kg-40.000 kg (20ft), 32.000 kg-40.000 kg (30ft, 40ft)

M.Ventura Container and Cargo Equipment 67
Double Spreader

- O aumento contínuo da capacidade de TEU dos navio coloca novas exigências ao equipamento de carga/descarga
- Existem spreaders duplos que podem movimentar 2 contentores de 40’ ou 45’ em simultâneo (ou 4 de 20’)
- Capacidade de elevação até 2 x 51 t (ou 4 x 32,15 t)

Bromma Tandem Line
(www.bromma.com)

Vertical Tandem Lifting (VTL)

- It is common practice to lift 2 or more containers linked as a single load
- ISO TC104 determines that a stack with a maximum of 3 containers can be linked together to constitute one VTL unit
- The total weight of a VTL can not exceed 20,000 kg
- The twistlocks or latchlocks used in the VTL operation must be certified for lifting with a SWL > 10,000 kg
Container Security

Evolution of the Standards for Marine Containers

- **United States**
  - Container Security Initiative (CSI)
  - C-TPAT

- **WCO (World Customs Organization)**
  - Revision of the Convention on Customs Safety of Containers (CCC)

- **IMO**
  - ISPS Code
Container Security (1)

- Estão a decorrer esforços conjuntos da IMO e da WCO (World Customs Organization) para desenvolver medidas de protecção dos contentores

- As autoridades alfandegárias norte-americanas (US Customs) aprovaram em 2002 a "US Container Security Initiative" (CSI) que também está ser usada em 18 portos estrangeiros

- A WCO adoptou uma resolução em 2004 que define linhas de orientação sobre transmissão electrónica de informação e uma nova Convenção internacional sobre o assunto

- A IMO publicou em 2003 especificações para mecanismos de selagem de alta segurança para os contentores

- Foi publicada uma norma ISO para os sistemas de selagem (Publicly Available Specification 17712, ISO)

Container Security (2)

- **Medidas do CSI (Container Security Initiative)**
  - Uso de sistemas de informação automatizados para identificar e localizar contentores de alto risco
  - Uso intensivo de tecnologia de detecção (máquinas de Raios-X para contentores e detectores de radiação) para inspeccionar os contentores de alto risco
  - Uso de contentores com meios de selagem electrónicos que alertem as autoridades em caso de violação em transito

- **Outras medidas da US Customs**
  - Exigência de transmissão electrónica do manifesto de carga detalhado 24 horas antes da carga do contentor
  - Aplica-se a todos os transportadores de qualquer país que enviem carga para os EUA
  - Os contentores que não passem na inspecção inicial ou cujo manifesto seja demasiado vago ou tardia recebem ordem de "Não Carregar" até que tudo esteja esclarecido
Bibliography


Annex A. Relevant Standards
ISO Standards (1)

Freight Containers
- ISO 3874:1997 Series 1 freight containers -- Handling and securing
- ISO 3874:1997/Amd 1:2000 Twistlocks, latchlocks, stacking fittings and lashing rod systems for securing of containers
- ISO 14829:2002 Freight containers -- Straddle carriers for freight container handling -- Calculation of stability
- ISO/TR 15069:1997 Series 1 freight containers -- Handling and securing -- Rationale for ISO 3874 Annex A

ISO Standards (2)

TC 104/SC 2
- ISO/TR 15070:1996 Series 1 freight containers -- Rationale for structural test criteria
- ISO 1496-3:1995/Amd 1:2006 Testing of the external restraint (longitudinal) dynamic
Relevant ISO Standards (3)

TC 104/SC 2
- ISO 1496-4:1991/Amd 1:1994 1AAA and 1BBB containers
- ISO 9669:1990 Series 1 freight containers -- Interface connections for tank containers
- ISO 9669:1990/Amd 1:1992 Sections 3 and 4
- ISO 10368:2006 Freight thermal containers -- Remote condition monitoring

M.Ventura Container and Cargo Equipment 78

Relevant ISO Standards (4)

TC 104/SC 4
- ISO 6346:1995 Freight containers -- Coding, identification and marking
- ISO 9711-1:1990 Freight containers -- Information related to containers on board vessels -- Part 1: Bay plan system
- ISO 9897:1997 Freight containers -- Container equipment data exchange (CEDEX) -- General communication codes
- ISO 9897:1997/Cor 1:2001
- ISO 18185-3:2006 Freight containers -- Electronic seals -- Part 3: Environmental characteristics

M.Ventura Container and Cargo Equipment 79
Annex B. Types of Containers

Types of Containers (1)

Open Tops (20’/40’)

- Soft detachable roof tarpaulin or tilt
- Machinery requiring top loading and overheight cargo.
Types of Containers (2)

Half Heights (20’/40’)
- Soft detachable roof tarpaulin or tilt, half height
- High-density cargoes such as ingots, heavy steelwork, drums.

Types of Containers (3)

Flatracks (20’/ 40’)
- No sidewalls or roof (and ends may be collapsible)
- For out of gauge cargoes and restricted loading situations
Types of Containers (4)

Platforms (20’/40’)
- Flatbed with corner castings.
- Limited numbers of high rated equipment;
- Over-length cargoes and special projects.

Types of Containers (5)

Fantainers (20’/40’)
- Extractor fan fitted; Agricultural products requiring ventilation to avoid condensation, e.g. onions, potatoes. Also used as a normal General Purpose container.

Highly Ventilated (20’)
- Side vents along top and bottom rails; Hygroscopic cargoes such as coffee, cocoa, tobacco and seeds.

Top Ventilated (20’)
- Side vents along top rail; Hygroscopic cargoes such as coffee, cocoa, tobacco and seeds.
**Types of Containers (6)**

**Open Sides (20’)**
- Side gates and side curtains; Agricultural products requiring ventilation, livestock and side loading.

**Bulk (20’)**
- Top loading ports and door discharge shoot; Dry cargoes in bulk e.g. malt, sugar also used as a normal GP container.

**Tank Containers (20’)**
- Tank within an ISO frame of various types; Liquid cargoes in bulks including foodstuffs and hazardous.

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**Types of Containers (7)**

**Refrigerated Integral; 20/40; 8’6” and 9’6”;**
- Electrically powered self contained refrigeration unit;
- Refrigerated cargoes throughout the World with connection to terminals and ships electrical power sockets.
Types of Containers (8)

Refrigerated Insulated (20’x 8’ and 20’x8’6”)
- Top & bottom end ports and connects to ships refrigeration system
- Reefer cargoes on specialised ships operating in ANZ and SAF Trades.

SeaCell

The SeaCell units are designed so that:
- Can be handled by all types of equipment for containers
- Can be stowed either side by side, or with all the other types of ISO containers, in cell guides or not.
- Satisfy the ISO standards to stack up to 7 units of 40’ or 9 of 20’

Advantages over the ISO containers:
- Larger volume
- Higher load
- More palettes, because the standard size of 1200 mm (47”) can be stowed side by side, which is not possible in containers with 8’ width
**SeaCell**

<table>
<thead>
<tr>
<th>SeaCell</th>
<th>Volume</th>
<th>Cargo Weight</th>
<th>Euro palettes (1200 x 800 mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20’</td>
<td>+1.2 m³ (42 ft³)</td>
<td>30,480 kg</td>
<td>+3</td>
</tr>
<tr>
<td>40’ x 8’</td>
<td>+2.4 m³ (85 ft³)</td>
<td>34,000 kg</td>
<td>+5</td>
</tr>
<tr>
<td>45’ x 8’ 6”’</td>
<td>+2.7 m³ (95 ft³)</td>
<td>330,480 kg</td>
<td>+6</td>
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</tbody>
</table>

**Wooden Pallet Types**

- Two way entry pallet, close boarded, no base based
- Two way entry pallet, wing type
- Four way entry pallet, wing type
- Four way entry pallet, close boarded, 2 base
- Two way entry pallet, reversible
- Four way entry pallet, perimeter base
- Four way entry pallet, close boarded, perimeter base
- 1200 x 800 Euro Pallet
- Four way entry pallet, open boarded, 3 base
### ISO Pallet Standards

**ISO Standard 6780: Flat Pallets for Intercontinental Materials Handling - Principal Dimensions and Tolerances**

<table>
<thead>
<tr>
<th>Dim [mm]</th>
<th>Dim. [in]</th>
<th>Max. Load</th>
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<tbody>
<tr>
<td>1219 x 1016</td>
<td>48.00 x 40.00</td>
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</tr>
<tr>
<td>1000 x 1200</td>
<td>39.37 x 47.24</td>
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<tr>
<td>1165 x 1165</td>
<td>44.88 x 44.88</td>
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<tr>
<td>1100 x 1100</td>
<td>42.00 x 42.00</td>
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<tr>
<td>1067 x 1067</td>
<td>43.30 x 43.30</td>
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</tr>
<tr>
<td>800 x 1200</td>
<td>31.5 x 47.24</td>
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</table>

### EURO Pallet Standard

**CEN**

<table>
<thead>
<tr>
<th>Type</th>
<th>Dim. [mm]</th>
<th>Max. Load</th>
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<tr>
<td>EUR, EUR 1</td>
<td>800 x 1200</td>
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</tr>
<tr>
<td>EUR 2</td>
<td>1200 x 1000</td>
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</tr>
<tr>
<td>EUR 3</td>
<td>1000 x 1200</td>
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EURO Pallet Standard

ANSI Pallet Standards

ANSI Standard MH1

<table>
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</thead>
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<tr>
<td>1219 x 1016</td>
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<td>1219 x 1143</td>
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<td>48 x 48</td>
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<td>40 x 40</td>
<td>1219 x 508</td>
<td>48 x 20</td>
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Bibliography


Links

- www.macgregor-group.com
- www.sec-bremen.de