Multimodal transport

Definitions of multimodal transport

- **Multimodal transport** is transport by using two or more different means of transport through the use of transhipment (intermediate handling),

  organized by one carrier (Multimodal Transport Operator),

  under one contract,

  with one freight document,

  under one liability,

  and one price.

- **Intermodal transport** is the use of several means of transport (multimodality) while the goods remain in the same loading unit (e.g. container), without intermediate handling (road vehicle, trailer, container). It arises from the encounter between a commercial necessity and a fundamental technological innovation.

- **Combined transport** is intermodal transport, which is principally carried out by rail, inland waterways, or by sea, with the trips beginning and ending by road. This definition taken from the European conference of Transportation Ministers (in French: ECMT) encompasses the following techniques.

  - Piggyback systems (a blend of road and rail transport)
  - Roll-on Roll-off systems (a blend of road and water transport).

Overview of multimodal transport systems

There are several possibilities to structure multimodal transport. One of them is taking into consideration the technical aspect. Figure 2.40 shows this technical aspect of multimodal transport of which some where discussed previously in this chapter.

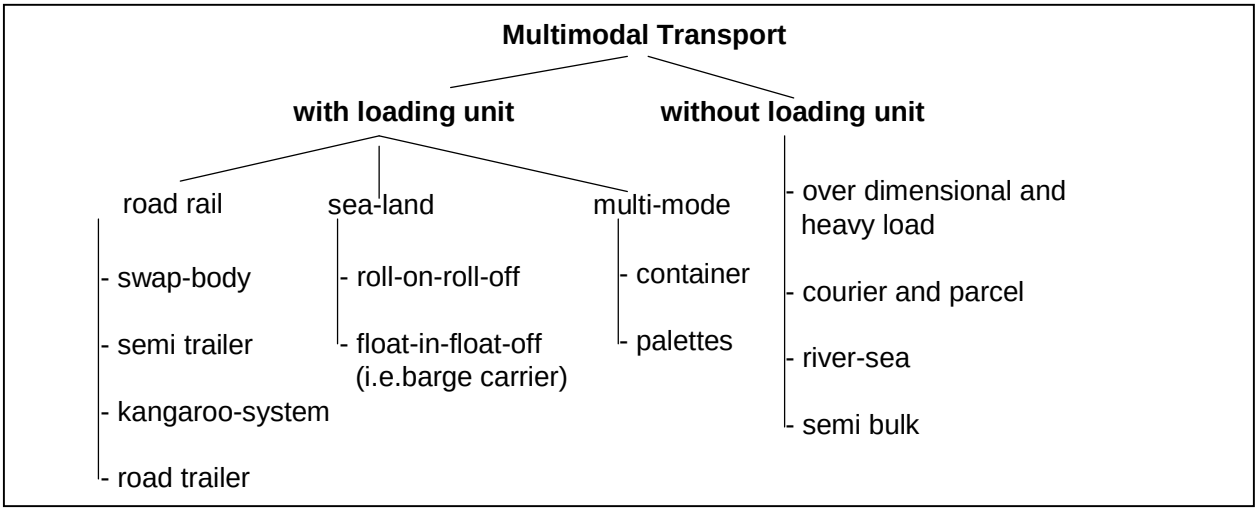


Figure 2.40; *Technical aspects of multimodal transport.*

In brief some explanation of selected technical aspects of multimodal transport.

Swap-body

An inter-changeable body system where the truck body is lifted off the chassis, transported by rail and, at the point of destination, placed on another truck chassis for final delivery. This type of technology does not significantly differ from the container system.

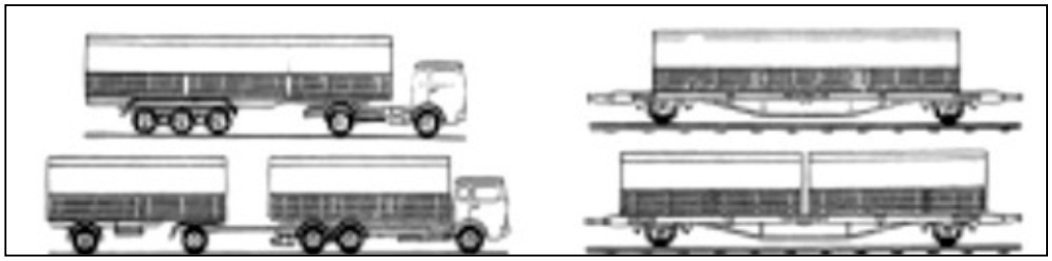


Figure 2.41; *Swap-bodies on road and rail transport.*

Container

A container is basically a metal box of various construction types used in international transport. There are various types and standards.

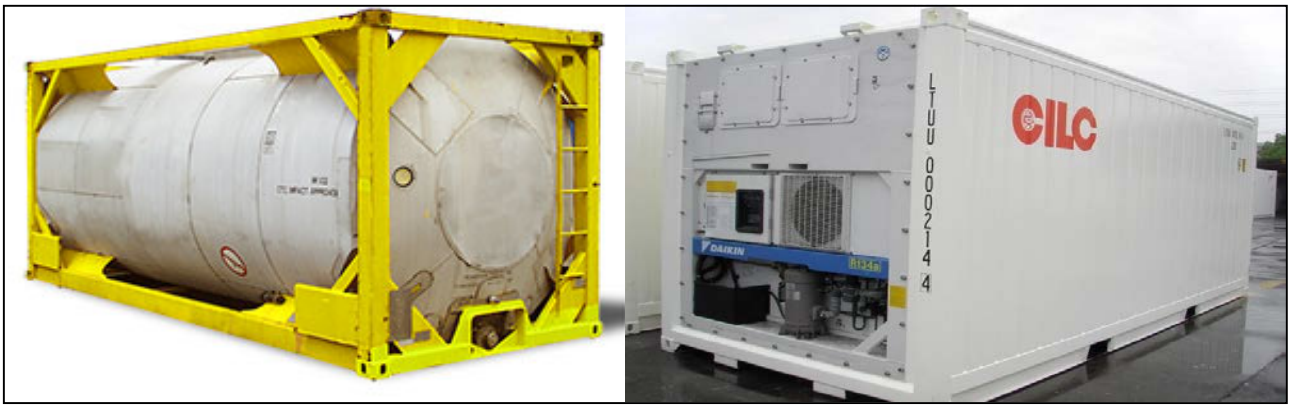


Figure 2.42; *Left; Tanktainer for liquid bulk. Right; Reefer for refrigerated cargo.*

Figure 2.43; *Different containers on the market.*

Pallet

A raised platform on which cargo can be stacked and constructed for easy movement by a forklift or sling. Standard form in the EU is 800mm x 1200mm (EU pallet).

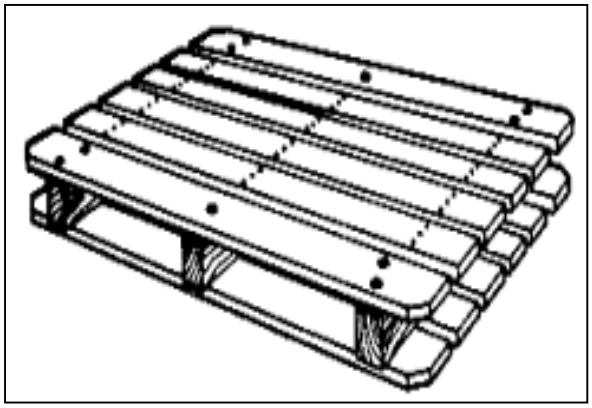


Figure 2.44; *Pallet for cargo transport.*

Roll-on/roll-off

A facility for road vehicles (trailers with or without tractors) to be driven on and off a ship, or as in the case of rolling road, a train.

Barge-carrier

A ship borne system in which the barges are loaded inland, linked together and pushed down an inland waterway to a point that can be reached by a ship, where the barges are lifted onto the mother ship with the use of gantry cranes or by lowering the mother ship. (See figure 2.29)

Piggyback

This is a flat car TOFC-system where semi-trailers are loaded onto flat cars (usually by crane) and transported as a unit. At the terminal of destination the semi-trailer is picked up by a tractor for final delivery.

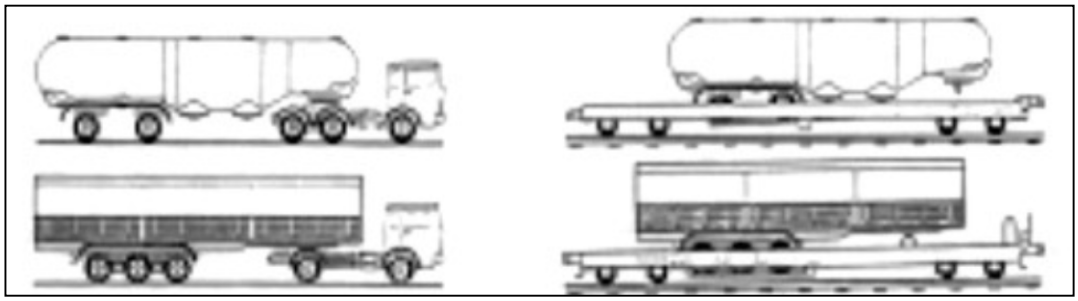


Figure 2.45; *Piggyback trailer system.*

Kangaroo-system

Hereby both trucks and trailers are transported by rail; this system is also referred to as the “rolling road”.

Figure 2.46; *Kangaroo system.*

Road-Railer

This is a bimodal service where the bogies from the chassis for road transport are exchanged in the rail terminal by rail bogies. The Road-Railers form a train are transported like wagons to the rail terminal of destination from where they continue travelling as normal road trucks after exchanging the bogies.

Figure 2.47; *Piggyback trailer system.*

Courier and parcel systems

A courier and parcel transport systems is part of the fast freight market. Fast freight includes the scheduled carriage of goods from door-to-door within a minimum of time. The fast freight market can be divided into four service segments with different products, structures and rules. The different operators on the market are:

- Courier service
- Express service
- Parcel service
- Integrators

Heavy lift transport

Heavy lift transport requires a solid preparation of the whole transport chain in advance. Specific projects for each individual transport problem have to be worked out. From the technological aspects every heavy lift transport has to be planned and carried out as a door-to-door transport. In this sense the commercial terms of multimodal transport should obviously also be applied. In fact heavy lift operators tend to use more multimodal transport especially in the framework of industrial project deliveries. They also offer carrier conditions for the main leg and “as agent“conditions for the pre- and

Figure 2.48; *Heavy lift by sea and road.*

River-sea shipping

River-sea shipping is shipping starting or ending at an inland port via inland waterways and ocean going traffic. River-sea ships are licensed for inland waterways and ocean going traffic. Main advantage is that there is no necessity for ocean port transhipment. River-sea ships have up to 4 metres draft and are able to load up to 5.000 tdw. At the moment about 2/3 of the European river-sea cargo is handled by 2.000 units and about 6-7 Milion DWt by units under Russian or CIS flag.

Figure 2.49; *River transport of liquid bulk by a tanker barge.*

The Multimodal Transport Operator

The Multimodal Transport Operator MTO offers and organizes multimodal transport. This MTO acts as a full responsible carrier and not as an intermediary. In his relation to the customer he offers one single contract, with one document, one liability (network or uniform liability system) and one price for the whole multimodal chain.

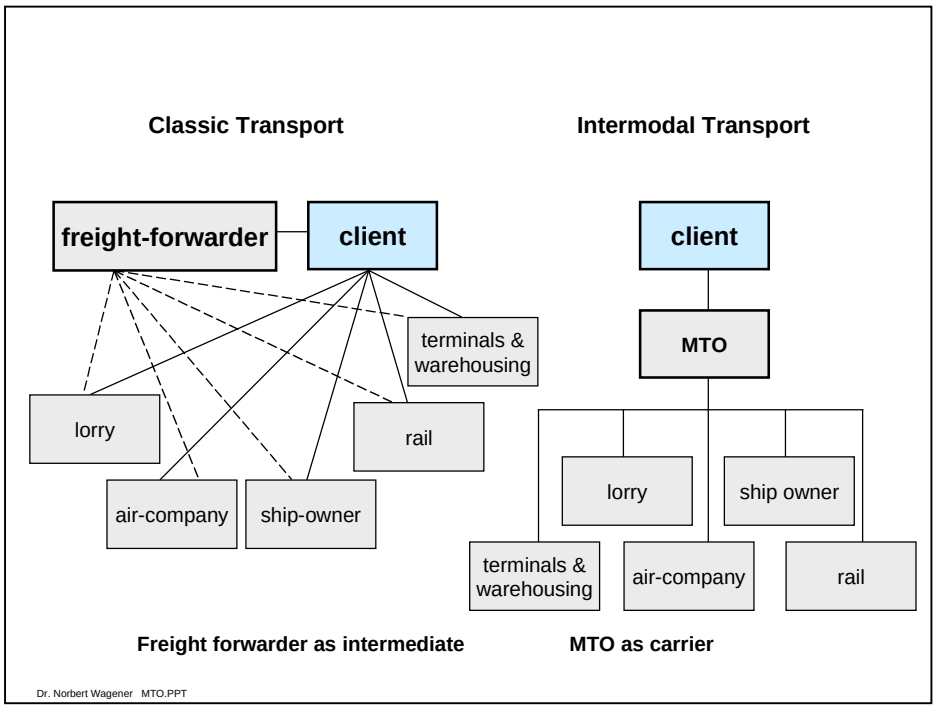


Figure 2.50; *Schematic presentation of classic transport and intermodal transport organisation.*

In his internal business relations he subcontracts different transportation, handling and ancillary services. The traditional freight forwarder acts only as an intermediary, the MTO acts as a genuine

carrier. This is illustrated in figure 2.56 where it becomes clear that the freight forwarder is not involved anymore.

Some freight forwarders diversify their business by operating as a MTO.

We distinguish between Carrier-MTO with vehicles of their own and Non-Carrier-MTO which do not possess their own vehicles. Carrier-MTO can be shipping lines (Vessel-Owning-MTO VO-MTO) or Forwarders and Non-Vessel-Owning-MTO (in USA according to US-Shipping Act 1984 NVOCC Non Vessel Operating Common Carrier).

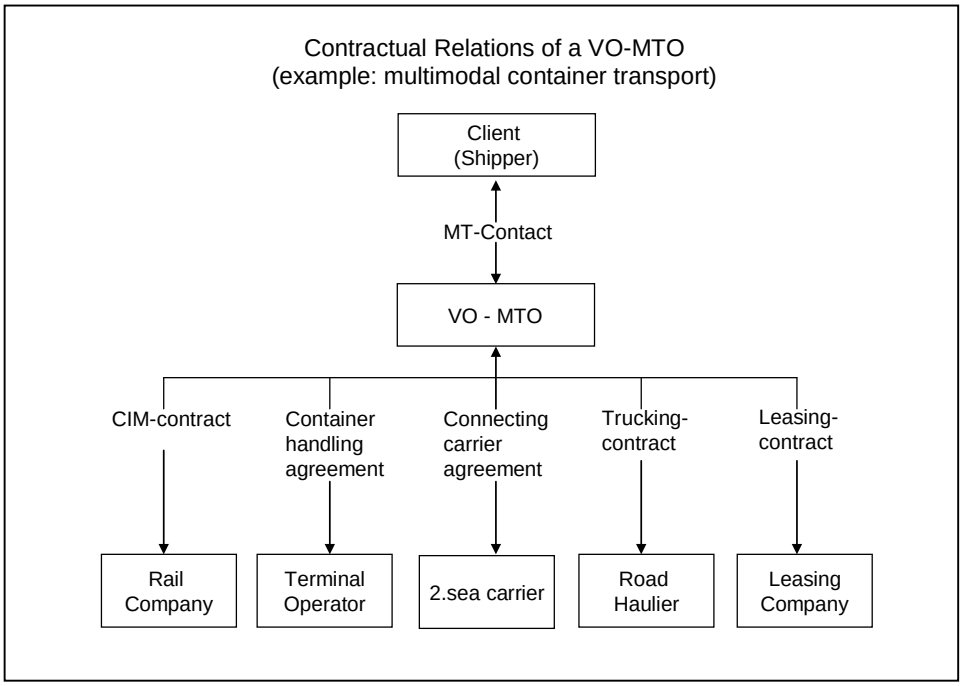


Figure 2.51; *Schematic illustration of relationships of a VO-MTO.*

Table 3; *Typical versions of MTO*

Possession of equipment	Possession of ships	Estimated market share (worldwide)	Main field of activities	Examples
Non-Carrier-MTO (NC-MTO) without own equipment	Non-Vessel-Owning-MTO (NVO-MTO) or Non-Vessel-Operating-Common-Carrier (NVOCC) (without own ships)	40%	Forwarder Ship's Agency Trucking company Airlines Railways	Kuehne + Nagel (CH) PAN Liner Agencies (UK) Federal Express (USA) CSX (USA)
Carrier-MTO (C-MTO) own equipment	Vessel-Owning-MTO (VO-MTO)(own ships)	60%	Port terminal Operator Conference-Carrier Non-Conference-Carrier Inland Navigation Carrier	Port of Seattle (USA) Hapag-Lloyd (D) Evergreen Lines

The commercial interests of an MTO differ according to its investment in infrastructure and vehicles. The functions of an MTO include, but are not limited to:

- To identify and to provide the proper means of carriage for the through transportation of shippers' goods.
- To schedule timetables to suit both the shipper and the receiver.

- To provide transportation traction for the entire journey.
- To provide a standardised documentation set to ensure a minimum delay in transit through national borders.
- To provide for a simple billing structure to minimise the number of invoices.
- To provide tracking and tracing facilities.
- To provide as much detail on each transit move as shippers require.
- To provide cargo-handling advice for stowage of goods in containers and swap-bodies.

The economic basis for multimodality is that transport modes can be integrated into a door-to-door transport chain in order to improve the overall efficiency of the transport system.

Benefits of multimodal transport

Several benefits for multimodal transport can be identified.

Economics of unitization

From individual cartons through pallets to containers, reduced handling gives savings in labour, packaging and damage costs. Risk of damage reduces when commodity is handled only two times, regardless of the number of mode changes. Packaging designed for specific mode, container, swap-body etcetera ensures less damage due to broken stowage. Cargo loss is eliminated or greatly reduced due to no pilferage or excessive movement in the transport module.

Economics of scale

Road haulage – large modern trucks give increased load capacity, fuel economy and less environmental damage due to the increased number of axles, lower emissions and air suspension systems. Improved efficiency in engine, gearbox and axle designs gives faster highway speeds.

Rail transport – full train loads i.e. container trains on scheduled services operate at maximum payload and computerised signalling systems minimise speed variations. Greater tractive effort from modern locomotives results in longer heavier trains with reduced manning.

Air transport – modern powerful engines give a huge increase in carrying capacity of large “jumbo” and wide body jet aircraft together with increased range. Smaller aircrew numbers with increased computer assistance reduce labour costs. Specially designed automated cargo terminals minimise human input and reduce cost.

River transport – larger vessels with lower crew numbers increases efficiency and computerised engine management systems reduce maintenance costs. Labour saving cargo-handling devices improves vessel turnaround time.

Deep sea vessels - huge savings are made through an increase in ship size. E.g. 6000 TEU post panamax vessels have a 21% cost advantage over 4000 TEU panamax vessels. This is however, *only at full slot utilisation*. Economy of scale with bigger ships may mean lower frequency reduced service, port constraints, bigger ships means greater costs if breakdowns occur, etc. Big ships can only be filled by using increased transhipment of boxes and this adds to the costs.

To achieve full benefit only big operators can provide ships, terminals, IT infrastructure and combined transport systems. Results are big ships on “around the world” or “pendulum” services between “mega hubs” being supported or fed by local feeder vessels.

Hub & Spoke systems are a precondition to ensure both: the employment of bigger vehicles on the main leg and to offer a door-to-door-network. Additional costs through longer distances via the hub are compensated through less transport costs/units and through better service in time.

Environmental effects

The increasing success of road transport is resulting in ever worsening environmental conditions also due to the dominance of trucks in freight transport. Transport by truck is unavoidable over very short distances but in middle and long (international) transport distances other modes may be used. The switch from road to environmentally friendly modes may be achieved by raising structural costs and charges of the road freight sector as well as by the enhancement of intermodal / multimodal transport.

Conditions for multimodal transport

The implementation of the multimodal transport requires the synthesis of many elements.

Ideal practices for the transport modes involved

(Low transport cost, high frequency, high connectivity, quality of service).

No regulation prohibits the incoming sea containers to continue their journey by train, but if customs require that all containers should fully deconsolidate, to allow for a thorough cargo check, then the concept of intermodality is violated.

Adequate terminal infrastructure

(Sufficient capacity, fast handling, limited dwell time)

Efficient interfaces

(Existence of interoperable sea/rail/road networks, prompt information flow, effective documentation processing and customs clearance)

Implementation of actions and measures for the promotion of intermodal transport is required. Among them, vehicles used exclusively for road haulage in feeder or final delivery carriage by combined transport may be exempted (completely or partially) from some national taxes, exempted potentially from traffic constraints (weekend bans), allowed for increased laden weights etc.

Integrated infrastructure and transport means

(intensify intermodal design of the trans-European transport networks, enhance design and functions of intermodal transfer points, harmonise standards for transport means)

- Multimodal and interconnected operations.
  (Integration of freight freeways in an intermodal context, development of common charging and pricing principles, harmonise competition rules and state-aided regimes on an intermodal basis)
- Mode-independent services and regulations.

(harmonisation and standardisation of procedures and EDI). Information systems used for the management of freight transport are currently closed but modal systems are often provided by the carriers themselves as a value added service to their customers. The increasing use of new technologies allows accurate real time information to be shared between actors (e.g. through EDIFACT messages) and has the potential to integrate information from other systems (traffic management, supply chain management, emergency response etc).

- Establishing an appropriate multimodal liability regime.
  EC is working towards the promotion of a voluntary multimodal liability regime as part of a door-to-door intermodal service. In parallel, the discussion for the wide implementation of the United Nations Convention on International Multimodal Transport of Goods has been reopened.
- Increasing the awareness and understanding.
  Shippers are often unaware of the potential of intermodal transport and the information and skills to take advantage of intermodal transport alternatives. A new actor, the Freight Integrators, will attempt to arrange door-to-door transportation by selecting and combining without prejudice the most sustainable and efficient modes of transport
- Ensure that grants are not simply allocated to the transport mode organisations (e.g. railways) but are transferred to users or operators.

Containers

A container being the most common method of transporting in the world it is important to have a basic understanding of containers and the safety requirements. Basically a container is a large rectangular box which is:

- Strong enough to be packed and repacked with cargo many times.
- Designed to allow goods to be carried by several modes of transport without unpacking and repacking.
- Fitted with devices to allow easy handling.
- Designed to be packed and unpacked easily.

To be able to handle containers at any place in the world with standardised container handling equipment the containers are standardised through the **International Organization for Standardization** (**ISO**).

The ISO standard dimension for containers is:

- Lengths: 10, 20, 30 and 40 feet.
- Heights: 8’ (2.44 m), 8’6” (2.59 m) and less than 8’.
- Width: 8 feet.

The capacity of a container is being expressed in **Twenty Feet Equivalent Units** (**TEU**). This means that a 20 feet container is taken as 1 TEU. A 40 feet container is taken as 2 TEU. A container exists of

a steel frame with, corrugated steel, Aluminium alloy, Glass Fibre Reinforced Plastic (GRP) or plywood walls.

It is clear that the most important components from a point of view of strength and load bearing are the steel frame and the **corner castings** or **corner fittings.** The lifting devices of terminal handling equipment do need to fit precisely, and lock securely, in the openings of the corner castings of the container.

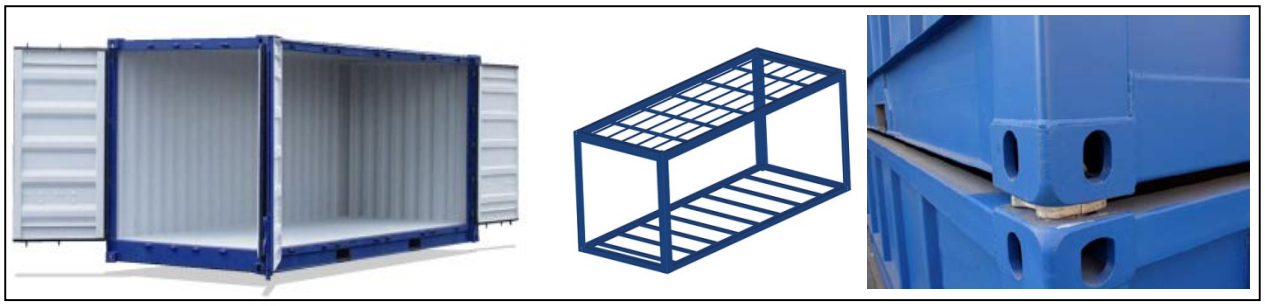


Figure 2.52; *Container frame and corner castings.*

A container has two doors. Each container door is locked with two rotating locking bars which have locking cams at the top and bottom to secure the doors tightly. Weatherproofing is obtained through PVC gaskets at the door's edges and a security seal for custom purposes can be applied to the levers.

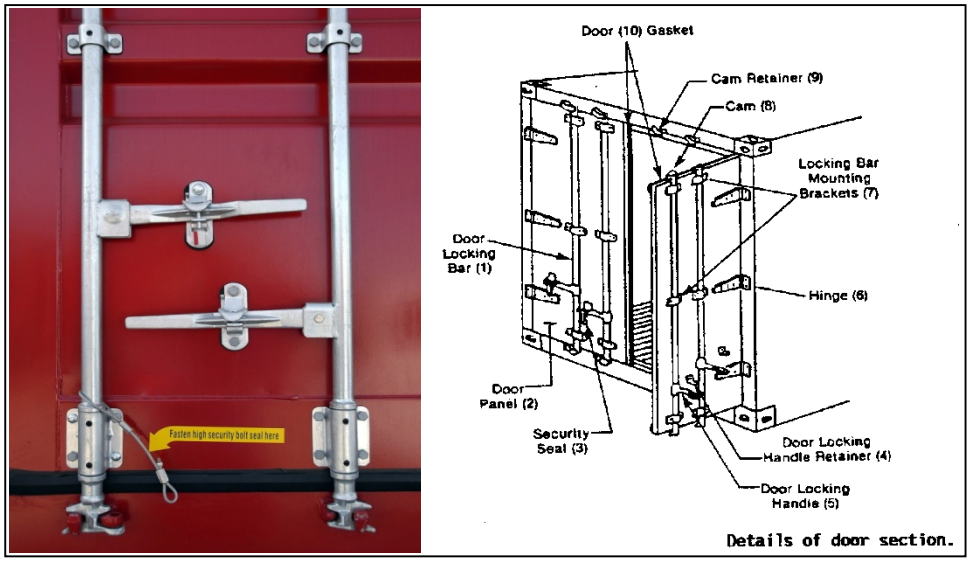


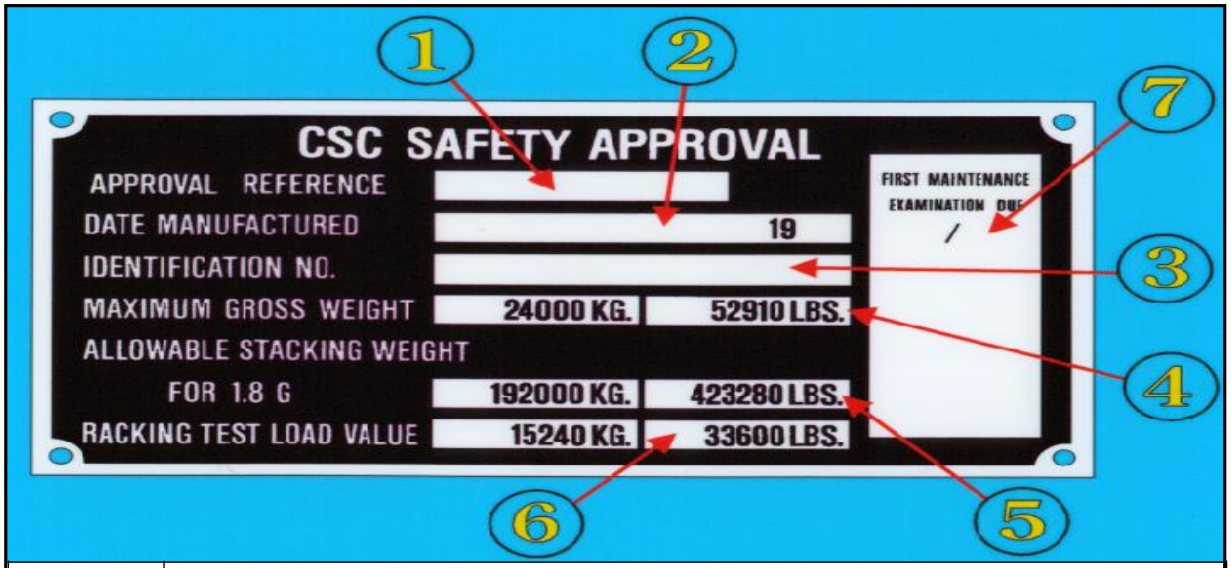
Figure 2.53; *Container doors.*

The ISO does not only standardise dimension of a container, but also the **Maximum Gross Weight (R)**. The maximum weight of a fully loaded container and the stacking capability of containers are illustrated in table 4.

Table 4; *Maximum gross weight per container size.*

Length (feet)	R	Save stacking height; fully loaded
10	10,160 Kg	-
20	24,000 Kg	8 containers
30	25,400 Kg	-
40	30,480 Kg	6 containers

Further, every container needs to have a **Safety Approval Plate (CSC plate).** This plate indicates that the container has been constructed according to standards defined by the International Convention for Safe Containers (CSC) Regulations. The container has to be type tested (sample container of a particular type or batch from a manufacturer), approved and certified by competent authorities according to the structural safety requirements set out in the CSC regulations.



Number	Description
1	Code of country of approval – approval number and year of approval
2	Date of manufacture
3	Manufacturer's container identification number
4	Maximum Gross Weight
5	Allowable stacking weight = total maximum gross weight of containers that can safely be stacked on it
6	Racking test load value and other test values indicating the load and stacking strength of the container walls
7	Date (year and month) of re-examination of the container: within five years of manufacture and thereafter at intervals of not more than 30 months or a so called ACEP sticker (Approved Container Examination Program

Figure 2.54; *Container CSC plate.*

A number of classification/inspection societies have been approved by countries signing the CSC convention as 'competent authorities'. Their relevant seals are attached to the tested containers. Examples of: Lloyds Register of Shipping, American Bureau of Shipping, Bureau Veritas, Germanischer Lloyd, Nippon Kaiji Kyokai.

Inspection of the CSC plate must be carried out on arrival of the container at the terminal. In case of no (valid) CSC plate the container should not be accepted and handled and the contents repacked in a sound container (after informing the principal via the Ship's agent).

Next to the different ISO sizes as discussed previously, do exist different types of containers for different purposes. A **tank container is** used for transporting liquid goods, mainly used for chemicals, and a refrigerated container for transporting goods that require remaining chilled or frozen. This reefer **container** has a cooling installation build in.

There are containers without a roof, covered with a tarpaulin and flat racks being open with only sides at each end which enables container terminals to lift the flat rack with the available lifting devices. These containers make it possible to load heavy and awkward sized cargo that cannot be entered into a normal container through the doors. These containers are often used for project cargoes, machine parts, etc, and make it possible to ship these through the more efficient and regular container routes.

Figure 2.55; *Container spreader; lifting device that hooks into the corner castings of a container.*