



# Design of Shipping Containers

An Online Continuing Education Course for Engineers

**Course Number: T-2027**

**Credit: 2 Hours / 2 PDH / 2 CPD**

# Design of Shipping Containers

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## 1. Introduction:

International trading is the main stimulator of the world economy. Millions of goods are transported daily between the countries between the east and the west of the world.

Due to the Covid-19 pandemic, the supply chain of goods around the world is impacted due to the closed economics. After the spreading of vaccines, the demand for goods returns to higher levels than before, causing massive pressure on the existing supply chain.

The demand for shipping containers increases nowadays to accommodate the great demand for transportation of goods.

To transport these goods easily and reliably, a perfect supply chain from the country of export to the country of import. This supply chain mainly depends on the means of transportation and the units of handling.

There are several means of transportation, such as road transportation, railway transportation, river transportation, naval transportation, and air transportation.

Standard units of transportation are used to ease the process of transportation.

The common standard unit is the shipping container, which can be used in all means of transportation. This standardization unifies many factors of shipping containers, such as the rated capacity of the container, the volume of the container, the way of fixation of the shipping container to decks of the transportation means, stacking of shipping containers, and other factors.

Some goods are packed in packs, which are assembled on wooden pallets with standard dimensions; these pallets are put in a standard shipping container.

Some goods are transported directly in a standard container, such as cement, grains, steel, cars, and many other goods.

In this course, the structural design of the shipping containers is explained based on the **CSC-1996 standard (Convention for Safe Containers)**, published by IMO (International Maritime Organization) and United Nations. Also, the standard (**ISO 1496-1-Fifth Edition**) is used to cover this topic.

By the end of the course, a solved comprehensive example is introduced to apply all of the concepts and knowledge of the course to a real shipping container.

This course covers the following topics:

1. Definitions.
2. Classifications and designations of shipping containers.
3. Dimensions and ratings of shipping containers.
4. Loading cases of shipping containers (lifting from pad eyes, lifting from forklift pockets, vertical stacking, longitudinal stacking, transversal stacking, roof loading, floor loading, etc.)
5. Design and detailing requirements of members of shipping containers.
6. Design and detailing of load transfer areas.
7. Optional features of shipping containers (gooseneck tunnels, cargo securing devices, forklift pockets).



**3D VIEW**

**Figure (01). 3D Model of Shipping Container**

## **2. Definitions:**

- i. Shipping Container (Freight Container):

Based on the definition of **ISO-668:2013**, shipping containers (also called shipping containers) it is a type of transport equipment of a permanent character that is strong enough and suitable for repeated use to carry goods by one or more means of transport without intermediate reloading. It shall be designed to ease the process of emptying and filling.

It shall be provided by devices that facilitate the transfer from mean to mean, such as bottom corner fittings or top corner fittings.

The internal volume shall be at least equal to 1 m<sup>3</sup> (35.3 ft<sup>3</sup>).

For containers with four outer bottom corners, the total area enclosed shall be at least 14 m<sup>2</sup> (150 ft<sup>2</sup>).

For containers with four outer top corners, the total area enclosed shall be at least 7 m<sup>2</sup> (75 ft<sup>2</sup>).

ii. Corner fittings:

They are apertures and faces at the top and/or the bottom of the container for handling, stacking, and/or securing.

iii. Tare Mass (T):

Tare mass is the own mass of the container, including corner fittings and doors.

iv. Payload (P):

Payload mass is the mass of the cargo carried by the container

v. Rating (R):

Rating is the gross mass of the container, including both the own weight of the container (Tare Mass) (T) plus the payload mass (P) carried by the container.

The rating shall be the maximum mass for operations performed by the container and the minimum testing mass.

$$R = T + P$$

vi. Allowable stacking weight:

It is the maximum weight of the containers above the lowest container in a series of vertically stacked containers.

vii. Nominal dimensions:

Dimensions disregarding tolerances and rounded to the nearest convenient whole number by which a container may be identified.

viii. Inter

Dimension  
inscribed

which could be  
disregarded.

### 3. Classification

According to

Type	Designation
	g roof

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The above designation is based on the opening condition of the container and the ventilation condition.

Another designation is presented in the next section, which is based on the nominal dimensions of the shipping container.

i. Nominal Length of Shipping Containers:

Containers have designations based on their nominal lengths. Table (02) lists the nominal dimensions for each designation of a container.