

# ISO Shipping Container Specifications/Materials

**Accurate digest of specifications, requirements, and certifications for all ISBU modules and ISO steel dry cargo Shipping Containers sizes 10', 20', 40', 45' and 53', both GP and HC types.**

**Prepared in accordance with:**

International Organization for Standardization (ISO)  
ISO- 1CC type steel dry containers  
International Maritime Organization (IMO)  
International Convention for Safe Containers (CSC) 1972-2007  
and in accordance with CSC Article IV(2)

**BASIC VERSION (excerpts)**

These specifications and commentary cover design, construction, materials, testing, inspections of ISO standard shipping containers and ISBU modules. All information is in accordance with the requirements of ISO- 1CC type steel dry freight containers by all certified global manufacturers.

These Specifications are for information purposes and for use only by ISBU Association members and their associates for the development and construction of their projects.

Any structural modifications of these containers should be certified by a structural engineer to meet appropriate safety standards and building codes.

All information is certified to be accurate according to ISO/IMO/CSC requirements, articles and revisions current to March 2009.

## **6. Construction**

### **6.1 General**

The container will be constructed with steel frames, fully vertically corrugated steel side and end walls, die-stamped corrugated steel roof, wooden flooring, corrugated double hinged doors and ISO corner fittings at eight corners. All steelworks will be built up by means of automatic and semi-automatic CO2 gas arc welding. All exterior welding including that on base structure will be continuous to give perfect watertight properties, Interior welds will be intermittent with a minimum bead length of 25 mm for every 200 mm. All the welds, even spots, will have penetration without undercutting or porosity.

### **6.2 Corner Fittings**

Corner fittings will be designed in accordance with ISO/1161 standard, and manufactured at the workshops approved by the classification society.

### **6.3 Base Frame**

The base frame will be composed of two (2) bottom side rails, a number of cross members and a pair of fork pockets, which are welded together as a sub-assembly.

#### **6.3.1 Bottom Side Rail**

Each bottom side rail is built of a steel pressing made in one piece. The bottom flange face outwards so as to be easily repaired and hard to corrode.

**Note:** See specific ISO shipping container specifications & dimensions.

#### **6.3.2 Crossmember**

The crossmembers are composed of a number of small pressed channel section and some large one with three 4.0 mm thick webs located beneath each board joint of the plywood, which are placed at certain center distance.

Shape: " C " section

Small: 122 x 45 x 45 x 4.0 mm,

Quantity: - -

Large: 122 x 75 x 45 x 4.0 mm,

Quantity: - -

#### **6.3.3 Fork Pocket**

One pair of fork pockets will be provided in accordance with ISO requirements for loaded handling. Each fork pocket is constructed with two adjacent crossmembers, a top plate and two bottom end plates. A angle stiffener plate will be welded to each opening of fork pocket.

Top plate: 3.0 mm Thick

Bottom plate: 6.0 mm Thick

#### **6.3.4 Reinforcement**

Reinforcement plates will be welded at two ends of bottom side rail.

Dimension: 200 x 153 x 4.0 mm

## 6.4 Front End

The front end will be composed of corrugated end wall and front end frame, which are welded together as a sub-assembly.

### 6.4.1 Front End Wall

The front end wall is composed of steel sheet fully vertically corrugated into trapezium section, butt joint together to form one panel by means of automatic welding.

Thickness: 2.0 mm  
Corrugation dimension- Outer face: 110 mm                      Depth: 45.6 mm  
Interface : 104 mm                      Slope: 18 mm

### 6.4.2 Front End Frame

The front end frame will be composed of one front sill, two corner posts, one front header and four corner castings.

#### 6.4.2.1 Front Sill

The front sill is made of a special "C" section steel pressed with vertical webs as the stiffener.

Front sill: 4.0 mm thick  
Web: 4.0 mm thick                      Quantity: - -

#### 6.4.2.2 Corner Post

Each corner post is made of a 6 mm thick section steel pressing to ensure the suitable strength, light-weight and easy maintenance.

#### 6.4.2.3 Front Header

The front header is constructed with steel square tube lower part and steel plate upper part. The upper part is extended inwards of the container certain distance with full width from front part of top corner fittings.

Lower rail:            60 x 60 x 3.0 mm RHS  
Upper part:           3.0 mm thick

## 6.5 Rear End

Rear end is composed of Rear End Frame which consists of one door sill, two corner posts, one rear header with header plate and four corner fittings, which are welded together as a sub-assembly, and Door Systems with locking devices.

### 6.5.1 Door Sill

The door sill is built of special channel section steel pressing with internal ribs as stiffeners at the back of each cam keeper. The upper face has a slope for better drainage and the highest part is on the same level to the upper face of the wooden floor.

Door sill:            4.5 mm thick      Slope  
Stiffener ribs:      4.0 mm thick      1:10 approx.      Quantity: - -

### 6.5.2 Corner Post

Each corner post is constructed from an inner part of channel shaped hot-rolled section steel and an outer part of steel pressing, welded together to form a hollow section to ensure the door opening and suitable strength against the stacking and racking force. Four (4) sets of hinge pin lugs are welded to each outer part of the corner post.

Inner part: 113 x 40 x 12 mm  
Outer part: 4.5 mm thick

### 6.5.3 Door Header

The door header is constructed from a lower part of a " U " shaped steel pressing with internal stiffener ribs at the location of the back of cam keeper and an upper part of steel pressing rear header plate, they are welded together to form a box section to provide a high rigidity.

Rear header: 4.0 mm thick  
Header plate: 3.0 mm thick  
Rib: 4.0 mm thick  
Quantity: - -

### 6.5.4 Door Systems

Doors will consist of two door leaves, each leaf with two locking devices, four hinges and pins, seal gaskets and the door holders. The doors will be installed by hinge pins to the rear end frame and capable of swinging about 270 degrees.

#### 6.5.4.1 Door Leaves

Each leaf consists of door panel, steel door frame which consists of horizontal ( upper & lower ) and vertical ( inner & outer ) members. They are welded together to form the rectangular door leaves. The door are so arranged that the left leaf can not be opened without displacement of the right leaf.

Door panel: With 3 corrugations

Depth: 40.0 mm  
Interface: 106.0 mm  
Slope: 22.0 mm  
Panel thickness: 2.0 mm

**Note:** See specific ISO shipping container specifications & dimensions.

#### 6.5.4.2 Hinges and Pins

Four forged hinges, providing with bushed hole, are welded to each door leaf. Each door is installed by hinge pins, washers and bushing.

Washer- Material: Stainless steel, Location: Under the bottom of hinge  
Bushing- Self-lubricating synthetic  
Pin- Material: Stainless steel



## 6.7 Roof

The roof will be constructed by several die-stamp corrugated steel sheets with a certain upwards camber at the center of each trough and corrugation, these sheets are butt jointed together to form one panel by automatic welding.

|                    |                               |        |                 |
|--------------------|-------------------------------|--------|-----------------|
| Corrugation Shape: | Depth:                        | 20 mm, | Pitch: 209.0 mm |
|                    | Inner face:                   | 91 mm, | Slope: 13.5 mm  |
|                    | Camber upwards:               | 5 mm   |                 |
| Panel thickness:   | 20 mm                         |        |                 |
| Sheet Quantity:    | (depends on container length) |        |                 |

### 6.7.1 Roof reinforcement plate

Four 3.0 mm thick. reinforcement plates shall be mounted around the four corner fittings.

## 6.8 Floor

### 6.8.1 The Floor Boards

The floor consists of plywood. The plywood is treated with wood preservative containing "Phoxim" or equivalent according to the Commonwealth Department of Health, Australia (International standard).

|                           |                  |
|---------------------------|------------------|
| Plywood thickness:        | 28 mm            |
| Plywood moisture content: | Less than 14%    |
| Plywood ply number:       | 19 plies         |
| Plywood material:         | Apitong/Hardwood |

### 6.8.2 Arrangement and Fixing

The plywood boards are longitudinally laid on the Crossmember with a pre-blasted painted and free floating flat steel at the center, and two angle steel along both side rails. The plywood boards are tightly secured to each crossmember with countersunk self-tapping electro-zinc plated steel screws. These heads of the floor screws are countersunk below the level of the upper surface of the floor by 1.5 mm to 2.5 mm.

|                   |   |
|-------------------|---|
| Screws:           | M8 x 45 x $\Phi$ 16 (head), Electro zinc plated |
| Screws, quantity: | 6 Pcs/end row, 4 Pcs/other                      |
| Flat bar:         | 50 x 4.0 mm, primed and painted                 |
| "L" section:      | 3.0 mm Thick.                                   |

## **6.9 Special Features**

### **6.9.1 Customs Seal Provision**

Customs seal provisions are made on each locking handle and retainer in accordance with TIR requirements.

### **6.9.2 Lashing rings**

- 1) Lashing rings are welded to each bottom and top side rail at corresponding recessed area of side wall.

Lashing ring Qty./ Each bottom or top side rail: (depending on container length)

- 2) Lashing rods are welded on each rear & front corner post slot.

Lashing rods Qty. / Each front corner post : (depending on container length)

Lashing rods Qty. / Each rear corner post : (depending on container length)

- 3) Capabilities of pull load of every lashing point are as following:

Lashing rings on the side rails:

1,500 kg/each

Lashing rods on the corner posts:

1,500 kg/each

- 4) Treatment of lashing ring / bar: Electro zinc plated

### **6.9.3 Sill Cut-Outs**

200 x 75 x 9 mm channel section steel recesses are provided in each ends of rear and front sills adjacent to the bottom fitting to prevent damage due to any twistlock misalignment.

### **6.9.4 Ventilators**

One ventilator with E.P.D.M seal gasket is supplied on each side wall at the right-hand end when facing the outside of container, fixed by aluminum huck bolts, the seal is to be applied on the edges except the bottom side of the ventilator, after the completion of the painting process.

Quantity: 1 / each side panel

Material: ABS Labyrinth Type.

## 7. Preservation

### 7.1 Surface Preparation of the Steelwork

- 1) All the steel surface prior to forming or after will be de-greased and shot blasted to Swedish Standard SA 2.5 to obtain the surface roughness at 25 to 35 microns which can result in the removal of all the rust, dirt, mill scale and all other foreign materials.
- 2) Locking rod assemblies, which are welded with gear cams, bars holder and handle hinges, are hot dipping galvanized (Thickness: 75 microns).
- 3) All fasteners such as bolts/nuts, washers, self-tapping screws, which are not mentioned in this Spec. will be electro zinc plated to 13 Microns, unless specified otherwise.
- 4) Hinges and cam keepers will be electro zinc plated to 13 Microns.
- 5) Sealant  
Apply to each perimeter of the floor, all the overlapped joints of inside, all the holes for bolts and nuts and all the places where water may leak and be sealed to prevent against water entry.

#### Sealant Materials:

Chloroprene (Cargo contact areas)

Butyl (Hidden parts and other areas)

### 7.2 Coating

#### 7.2.1 Prior to Assembly

All the steel surfaces will be coated with primer paint immediately after shot-blasting .

#### 7.2.2 After Assembly

All the weld joints will be shot-blasted to remove all the welding fluxes, spatters, burnt primer coatings caused by welding heat, and other foreign materials, and followed with the secondary paint operation immediately.

**7.2.3** All the surface of the assembled container will have coating system as follows:

| Process                          | Paint Name                            | DFT ( $\mu$ ) |
|----------------------------------|---------------------------------------|---------------|
| Exterior Surface                 | Epoxy zinc rich primer                | 30            |
| Epoxy primer                     | Chlorinated rubber or Acrylic topcoat | 40            |
| Color: BS 445                    |                                       | 40            |
| <b>Total:</b>                    |                                       | <b>110</b>    |
| Interior Surface                 | Epoxy zinc rich primer                | 40            |
| Pure epoxy                       |                                       | 30            |
| <b>Total:</b>                    |                                       | <b>70</b>     |
| Underside Epoxy zinc rich primer |                                       | 30            |
| Bitumen                          |                                       | 200           |
| <b>Total:</b>                    |                                       | <b>230</b>    |

NOTE: Flooring is not generally coated with epoxy zinc primer or any epoxy topcoat.

**9.2.2** Each assembled corner post structure will have a tension test with 15,240 kgs. after the welding in the construction line.

**9.3 General Testing Criteria:**

| Test Number                            | Test Load  | Method  |
|--|--|---|
| a. Stacking                            | Internal Load: 1.8R-T<br>Testing load: 86,400kg/post | Hydraulic cylinder load to corner post through top corner fittings.<br>Time duration: 5 mins .                  |
| b. Lifting from Top Corner Fittings    | Internal Load: 2R-T                                  | Lifting vertically from top corner fittings.<br>Time duration: 5 mins .   |
| c. Lifting from Bottom Corner Fittings | Internal Load: 2R-T                                  | Lifting from bottom corner fitting 45° Deg. To horizontal.<br>Time duration: 5 mins .                           |
| d. Lifting from Fork Pocket            | Internal Load: 6R-T                                  | Lifted by horizontal bars.<br>Bar length : 1828 mm,<br>Bar width : 200 mm,<br>Time duration: 5 mins .           |
| e. Restraint (Longitudinal)            | Testing Load: 2R(R/side)<br>Internal Load: R-T       | Hydraulic cylinder load applied to bottom side rails in compression & then tension .<br>Time duration: 5 mins . |

|                                 |                                   |   |
|---------------------------------|-----------------------------------|---|
| f. Floor Strength               | Truck Load: 7,260 kg              | Special truck is used.<br>Total contact area: 284 sq cm,<br>Wheel width: 180 mm,<br>Wheel center distance: 760 mm   |
| g. Wall Strength (Front & Door) | Test Load: 0.4 P                  | Compressed air bag is used.<br>Time duration: 5 mins.   |
| h. Side Wall Strength           | Test Load: 0.6 P                  | Compressed air bag is used.<br>Time duration: 5 mins.   |
| i. Roof Strength                | Test Load: 300 kg                 | Applied area will be the weakest place of 600 x 300 mm longitudinal & transverse.<br>Time duration: 5 mins .  |
| j. Rigidity (Transverse)        | Test Force: 15,240 kg<br>(150 kn) | Hydraulic cylinder will be applied to front top end rail & door header through top corner fittings, each time pulling & pushing.<br>Time duration: 5 mins . |
| k. Rigidity (Longitudinal)      | Test Force: 7,620 kg<br>(75 kn)   | Hydraulic cylinder load will applied to side top rail through top corner fittings.<br>Time duration: 5 mins .   |
| l. Weather Nozzle:              | 12.5 mm (inside dia.)             | Distance 1.5 m  |
| Proofing Pressure:              | 100 kpa (1 kg/sq.cm)              | Speed: 100 mm/Sec.  |

Note:

R - Maximum gross weight

T - Tare weight

P - Maximum payload

## 12. Materials

The main materials used in construction are as follows or approved equivalent:

| Location                   | Materials                     |
|----------------------------|-------------------------------|
| <b>Front End Assembly:</b> |                               |
| Front corner post          | Corten A                      |
| Front sill                 | Corten A                      |
| Front panel                | Corten A                      |
| Front header cap           | Corten A                      |
| Front rail                 | Corten A                      |
| <b>Base Assembly:</b>      |                               |
| Bottom side rail           | Corten A                      |
| Crossmember                | Corten A                      |
| Fork pocket assembly       | Corten A                      |
| Floor center rail          | Corten A                      |
| Floor support angle        | Corten A                      |
| Cover plate                | Corten A                      |
| <b>Rear End Assembly:</b>  |                               |
| Rear corner post (outer)   | Corten A                      |
| Rear corner post (inner)   | SM50YA (or SS50)              |
| Rear header cap            | Corten A                      |
| Door header lower          | Corten A                      |
| Door sill                  | Corten A                      |
| Door panel frame           | Corten A                      |
| Door panel                 | Corten A                      |
| Door hinge                 | S25C, Electro zinc plated     |
| Door hinge pin             | Stainless steel               |
| Locking device             | BE 2566MN Type, made in China |
| Locking cam keeper         | S20C, Electro zinc plated     |
| Locking cam                | S20C, HDG                     |
| Locking rod                | STKR41, HDG                   |
| Door gasket                | E.P.D.M                       |
| Gasket retainer            | Stainless steel               |
| Washer                     | Stainless steel               |
| Rivet                      | Stainless steel               |
| Shim                       | EPDM                          |
| Corner fitting             | SCW49                         |
| <b>Side Wall Assembly:</b> |                               |
| Side panel                 | Corten A                      |
| Top side rail              | Corten A                      |
| Lashing bar, lashing ring  | SS41, Electro zinc plated     |
| Ventilator                 | A.B.S                         |
| <b>Roof:</b>               |                               |
| Roof corner gusset         | Corten A                      |
| Roof panel                 | Corten A                      |
| <b>Floor:</b>              |                               |
| Floor board                | Apitong / Hardwood plywood    |
| Floor screws               | Electro zinc plated           |

## Material Strengths:

| Material  | Yield point (Kg/sq.mm) | Tensile strength (Kg/sq.mm) |
|-----------|------------------------|-----------------------------|
| SS41      | 25                     | 41                          |
| JIS SCW49 | 28                     | 49                          |
| SS50      | 29                     | 50                          |
| S20C      | 25                     | 42                          |
| S25C      | 28                     | 46                          |
| SM50YA    | 37                     | 50                          |
| Corten A  | 35                     | 49                          |
| SM50A     | 33                     | 50                          |

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References and documentations include:

International Maritime Organization (IMO)  
International Convention for Safe Containers (CSC) 1972-2007 and in accordance with CSC Article IV(2)  
U.S. Steel technical data sheet, 2002  
Universal Building Code  
Cronos Leasing Company  
China International Maritime Containers (Group) CIMC