

Rainbow Containers GmbH

# TECHNICAL SPECIFICATION

FOR

20' x 8' x 8'6" TYPE  
STEEL DRY CARGO CONTAINER

**- RIGHT SIDE OPEN DOOR -**

FOR

**Rainbow Containers GmbH - Hamburg**

DATE OF ISSUE : February 2003

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## **1. GENERAL**

### 1.1 Scope

This specification will cover the design, construction, materials, testing and inspection performances of 20'x8'x8'6" type right side open door steel dry cargo containers.

### 1.2 Operational environment

The container will be designed and constructed for carriage of general cargo by marine (on or below deck), road and rail throughout the world.

All materials used in the construction will be to withstand extremes of temperature range from -40°C(-40°F) to +70°C(+158°F) without effect on the strength of the basic structure and watertightness.

### 1.3 Standards and Regulations

The container will satisfy the following requirements and regulations, unless otherwise mentioned in this specification.

#### 1.3.1 ISO Container Standards

ISO 668 - Series 1 freight containers - Classification external dimensions and ratings  
(4th edition - 1988/Amendment.1 - 1993) (Except length and internal length & internal width)

ISO 830 - Terminology in relation to freight container (1st edition - 1981)

ISO 1161 - Series 1 freight containers - Corner fittings Specification (4th edition - 1984)

ISO 1496-1 - Series 1 freight containers - Specification and testing.  
part 1 : General cargo containers for general purposes (5th edition - 1990 / Amendment 1 - 1993 and Amendment 2 - 1998)

ISO 6346 - Freight containers - coding, identification and marking (3rd edition-1995)

### 1.3.2 T.I.R. Certification

All the containers will be certified and complied with "The Customs Convention on the International Transport of Goods under the cover of T.I.R. Carnets." or "The Customs Convention on Containers."

### 1.3.3 C.S.C. Certification

All the containers will be certified and complied with the requirements of the "International Convention for the Safe Containers."

### 1.3.4 T.C.T. Certification

All exposed wooden components used for container will be treated to comply with the requirements of "Cargo Containers-Quarantine Aspects and Procedures" of the Commonwealth Department of Health, Australia.

### 1.3.5 Classification society

All the containers will be certified for design type and individually inspected by classification society, BV, ABS, LR, GL or CCS.

\* Note: BV: Bureau Veritas (France)

ABS: American Bureau of Shipping (USA)

LR: Lloyd's Register of Shipping (UK)

GL: Germanischer Lloyd (Germany)

CCS: China Classification Society (P.R.C)

## 1.4 Handling

The container will be constructed to be capable of being handled without any permanent deformation under the following conditions:

- a) Lifting, full or empty, at top corner fittings vertically by means of spreaders fitted with hooks, shackles or twistlocks.
- b) Lifting, full or empty, at bottom corner fittings using slings with terminal fittings at any angles between vertical and 45 degrees to the horizontal.
- c) Lifting, full or empty, at forklift pockets using forklift truck.

### 1.5 Transportation

The container will be constructed to be suitable for transportation in the following modes:

a) Marine: In the ship cell guides of vessels, nine (9) high stacked.

On the deck of vessels, four (4) high stacked and secured by vertical and diagonal wire lashings.

b) Road: On flat bed or skeletal chassis, secured by twistlocks or equivalent at the bottom corner fittings.

c) Rail: On flat cars or special container cars secured by twistlocks or equivalent at the bottom corner fittings.

## 2. DIMENSIONS AND RATINGS

### 2.1 External Dimensions

Length	6,058 + 0mm - 6mm	19' 10 1/2" + 0 - 1/4"
Width	2,438 + 0mm -5mm	8' + 0 - 3/16"
Height	2,591 + 0mm -5mm	8' 6" + 0 - 3/16"

- 1) No part of the container will protrude beyond the external dimensions mentioned above.
- 2) Maximum allowable differences between two diagonals on anyone of the following surfaces will be as follows:  
Roof, bottom and side diagonals: 13 mm  
Front and rear diagonals: 10 mm

### 2.2 Internal Dimensions (nominal)

Length	5,898 mm
Width	2,287 mm
Height	2,299 mm

### 2.3 Door opening Dimensions

Rear: Width	2,114 + 0mm -5mm
Height	2,169 + 0mm -5mm
Side: Width	5,702 + 0mm -6mm
Height	2,154 + 0mm -5mm

### 2.4 Internal cubic capacity (Nominal)

31.0 cu.m

1,093 cu.ft

### 2.5 Forklift pockets

	OUTER	INNER
Width	360 mm	310 mm
Height (min.)	115 mm	115 mm
Center to center	2,050 mm +/- 50 mm	860 mm +/-50 mm

### 2.6 Ratings

Max. Gross Weight(R)	24,000 kgs	52,910 lbs
Tare Weight(design)(T) +/-2%	3,200 kgs	7,055 lbs
Max. Payload(P)	20,800 kgs	45,855 lbs

### 3. MATERIAL

#### 3.1 General

The following materials will be used in the construction of containers.

#### 3.2 Part specification

Parts	Materials by JIS
1) Door panels	Anti-corrosive steel. SPA-H or equivalent
Roof panels	Y.P.: 343 N/mm <sup>2</sup>
Side panels	T.S.: 481 N/mm <sup>2</sup>
Front panels	
2) Door header (upper & lower)	Structural steel. SS41
Front top end rail	Y.P.: 25kg/mm <sup>2</sup>
Front bottom end rail	T.S.: 41kg/mm <sup>2</sup>
Door horizontal frames	
Floor center rail	
Bottom side rails (right)	
Gussets	
Upper plates of forklift pocket	
Lower plates of forklift pocket	
3) Cross members	Rolled high tensile steel. SM50A
Rear corner posts (outer & inner)	Y.P.: 33 kg/mm <sup>2</sup>
Front corner posts (outer & inner)	T.S.: 50 kg/mm <sup>2</sup>
Door sill	
Bottom side rails (left)	
Top side rails (right)	
4) Top side rails (left)	Structural steel rectangular pipe. STKR41
Door vertical frames	Y.P.: 25 kg/mm <sup>2</sup>
Front top end rail	T.S.: 41 kg/mm <sup>2</sup>
5) Door locking bars	Structural steel round pipe. STK41
	Y.P.: 24 kg/mm <sup>2</sup>
	T.S.: 41 kg/mm <sup>2</sup>



- |  |  |
|--|--|
| 6) Corner fittings                         | Casted weldable steel. SCW49<br>Y.P.: 28 kg/mm <sup>2</sup><br>T.S.: 49 kg/mm <sup>2</sup> |
| 7) Locking gear cams and keepers           | Forged weldable steel. S20C<br>Y.P.: 25 kg/mm <sup>2</sup><br>T.S.: 41 kg/mm <sup>2</sup>  |
| 8) Door hinges                             | Structural steel S25C<br>Y.P.: 27 kg/mm <sup>2</sup><br>T.S.: 45 kg/mm <sup>2</sup>        |
| 9) Door hinge pins<br>Door gasket retainer | Stainless steel.   |
| 10) Door gasket                            | EPDM   |

\* Note :

Y.P. - Yielding Point

T.S. - Tensile Strength

## **4. CONSTRUCTION**

### 4.1 General

4.1.1 The container will be constructed with steel frames, fully vertical-corrugated steel sides and front wall, horizontal-corrugated steel double doors at rear end and four folding door of the right side wall, die-stamped steel roof and corner fittings.

Side doors locate at right hand side for entering the container.

4.1.2 All welds of exterior including the base frames will be continuous welding using CO<sub>2</sub> gas.

4.1.3 Interior welds - when needed - will be stitched with a minimum length of 15 mm.

4.1.4 Gaps between adjacent components to be welded will not exceed 3 mm or the thickness of the parts being welded.

4.1.5 Chloroprene sealant is to be applied at periphery of floor surface and inside unwelded seams, butyl sealant is used to caulk at invisible seam of floor joint area and between door gasket and frame.

4.1.6 The internal bend radii of pressed sections of steel will be not less than 1.5 time the thickness of the materials being pressed.

4.1.7 The wooden floor will be fixed to the base frames by zinc plated self-tapping screws.

### 4.2 Protrusion

4.2.1 The plane formed by the lower faces of the transverse members shall be positioned by 12.5 mm +5/-1.5 mm above the plane formed by the lower faces of the bottom corner fittings.

4.2.2 The top face of top corner fittings are to protrude a minimum of 6 mm above the highest point of the roof.

4.2.3 The outside faces of the corner fittings will protrude from the outside faces of the corner posts by nominal 4 mm.

4.2.4 The outside faces of the corner fittings will protrude from the outside faces of the sides and front wall by nominal 8 mm.

4.2.5 Under maximum payload, no part of the container will protrude below the plane formed by the lower faces of the bottom corner fittings at the time of maximum deflection.

4.2.6 Under 1.8 x maximum gross weight, no part of the container will protrude more than 6.0 mm below the plane formed by the lower faces of the bottom corner fittings at the time of maximum deflection.

#### 4.3 Corner fittings

The corner fittings will be designed in accordance with ISO 1161 (1984 edition) and manufactured at the works approved by classification society.

#### 4.4 Base frame structure

Base frame will be composed of two bottom side rails, ten cross members, and two set of forklift pockets.

##### 4.4.1 Bottom side rail

The right bottom side rail is built of two 140x28 mm thick flat steel located up and down separately and a 190x16 mm thick flat steel in the middle, welding together to make it in the shape of "I" section.

The left bottom side rail is built of a 50x246x30x4.5 mm thick cold formed "C" section steel made in some pieces by welding.

Reinforcement plates to be made of 6.0 and 4.5 mm thick flat steel is welded to bottom corner fitting.

##### 4.4.2 Cross member

The cross members are made of pressed channel section steel with a dimension of 45x122x45x4.0 mm for the normal areas and 75x122/213x45x4.5 mm for the floor butt joints, and another 45x213x45x4.0 mm channel section steel as side rails of forklift pockets.

The cross members are placed fully to withstand floor strength and welded to each bottom side rail.

##### 4.4.3 Forklift pockets

Each forklift pocket is built of 3.0 mm thick full depth flat steel top plate and five 4.5 mm thick inner bows top reinforcement plate and two 170 mm deep x 6.0 mm thick flat lower end plate between two channel section cross members.

The one set of forklift pockets is designed in accordance with ISO requirements.

#### 4.5 Flooring

The floor will consist of six pieces plywood boards, floor center rail, and self-tapping screws.

#### 4.5.1 Floor

The wooden floor to be constructed with 28 mm thick hardwood plywood boards are laid longitudinally on the transverse members between the 4.0 mm thick flat bar steel floor center rail and the 3.0 mm thick pressed angle section steel floor guide rails stitched welded to the bottom side rails.

The floor boards are tightly secured to each transverse member by self-tapping screws, and all butt joint areas and peripheries of the floor boards are caulked with sealant.

- 1) Wood species: Apitong or Keruing.
- 2) Glue: Phenol-formaldehyde resin.
- 3) Treatment:

- a) Preservative: Basileum or equivalent.

In accordance with Australian Health Department Regulations.

- b) Average moisture content will be 14% before installation.

#### 4.5.2 Self-tapping screw

Each floor board is fixed to the transverse members by zinc plated self-tapping screws that are 8.0 mm dia. shank x 16 mm dia. head x 45 mm length, and fastened by four screws per cross member but five screws at joint areas.

Screw heads are to be countersunk with about 2 mm below the floor top surface.

#### 4.6 Rear frame structure

The rear frame will be composed of one door sill, two corner posts, one door header and four corner fittings, which will be welded together to make the door-way.

##### 4.6.1 Door sill

The door sill to be made of a 4.0 mm thick pressed open section steel is reinforced by four internal gussets at the back of each locking cam keeper location.

The upper face of the door sill has a 10 mm slope for better drainage.

There is a gusset at each end of the door sill and reinforced by a 200x80x10 mm thick flat steel as a protection against handling equipment damages.

##### 4.6.2 Rear corner post

Each corner post is made of 6.0 mm thick pressed open section steel and a single piece reinforced by 6.0 mm thick steel plate, and designed to give a sufficient strength against stacking and racking forces.

Four (4) sets of hinge pin lugs are welded to each rear corner post.

#### 4.6.3 Door header

The door header is constructed with a 4.0mm thick pressed "U" section steel lower part having four internal gussets at the back of each locking cam keeper location and a 3.0mm thick pressed steel upper part, which are formed into box section by continuous welding.

#### 4.7 Rear Door

4.7.1 Each container will have double wing doors at rear end frame, and each door will be capable of swinging approximately 180 degrees.

4.7.2 Each door is constructed with two 3.0 mm thick pressed channel section steel horizontal frames for the top and bottom, 100x50x3.2 mm thick rectangular hollow section vertical frames and 2.0 mm thick horizontally corrugated steel door panel, which are continuously welded within frames.

4.7.3 Two sets of galvanized "BE-2566 MN" model locking assemblies with pressed steel handles are fitted to each door using high tensile zinc plated steel bolts and Huck bolts according to TIR requirements. Locking bar retainers are fitted with nylon bushings at the top, bottom and intermediate bracket.

Locking gears should be assembled after painting of the container.

4.7.4 The left hand door can not be opened without opening the right hand door when the container is sealed in accordance with TIR requirements.

4.7.5 Each door is suspended by four hinges being provided with stainless steel pins, self-lubricating nylon bushings and brass washers, which are placed at the hinge lugs of the rear corner posts.

4.7.6 The door gasket to be made of an extruded J-type EPDM rubber is installed to the door peripheral frames with stainless steel gasket retainers which must be caulked with butyl sealant before installation of gasket, and fastened by stainless rivet at a pitch of 150 mm.

#### 4.8 Roof structure

The roof will be constructed with five five-corrugated (die-stamped) steel panels and four corner protection plates.

##### 4.8.1 Roof panel

The roof panel is constructed with 2.0 mm thick die-stamped steel sheets having about 6.0 mm upward smooth camber, which are welded together to form one panel and continuously welded to the top side rails and top end rails.

All overlapped joints of inside unwelded seams are caulked with sealant.

#### 4.8.2 Protection plate

Each corner of the roof in the vicinity of top corner fitting is reinforced by 3 mm thick rectangular steel plate to prevent the damage caused by the mishandling of lifting equipment.

#### 4.9 Top side rail

Top side rail at left is made of a 60x60x3.0 mm thick rectangular hollow section steel.

Top side rail at right is made of a 4.5mm thick “U” section pressed steel and a 4.5mm angle section pressed steel which are continuously welded together.

#### 4.10 Side wall

##### 4.10.1 Left side wall

The trapezium section side wall is constructed with 2.0 mm thick fully vertically continuous-corrugated steel outer panels near the each post and 1.6 mm thick intermediate inner panels, which are butt welded together to form one panel and continuously welded to the side rails and corner posts.

##### 4.10.2 Right side door

Side doors locate at right hand side when entering the container.

Each side door will be equipped with two sets of locking gear system (as same end door locking gear).

The hinges pins, gaskets and door holder will be installed on each door.

By six hinge pins, the outer door will be fitted at the hinge post which is be welded with intermediate post and inner door will be connected with outer door by five hinge pins.

The outer door will be capable of swinging approximately 180 degrees.

##### 4.10.3 side door

Each door is constructed of door frames and door panel

Door panel: 2.0 mm thick

Door horizontal frame: 3.0 mm thick

Door vertical frames: 50x100x3.2 mm thick rectangular hollow section steel and 3.0 mm thick pressed channel section steel.

Other structures are the same as rear door.

#### 4.11 Front structure

Front end structure will be composed of one bottom end rail, two corner posts, one top end rail, four corner fittings and an end wall, which are welded together.

#### 4.11.1 Bottom end rail

The bottom end rail to be made of a 4.0 mm thick pressed open section steel is reinforced by three internal gussets.

There is a gusset at each end of the rail and is reinforced by a 200x80x10 mm flat steel, as the protection against handling damages.

#### 4.11.2 Front corner post

Each corner post is made of 6.0 mm thick pressed open section steel and a single piece reinforced by 4.5 mm thick steel plate, and designed to give a sufficient strength against stacking and racking forces.

#### 4.11.3 Top end rail

The top end rail is constructed with 60x60x3.0 mm thick square hollow section steel at lower part and 3.0 mm thick press steel plate at upper part.

#### 4.11.4 Front wall

The trapezium section front wall is constructed with 2.0 mm thick vertically corrugated steel panels, butt welded together to form one panel, and continuously welded to front end rails and corner posts.

### 4.12 Special feature

#### 4.12.1 Customs seal provisions

Customs seal and padlock provisions are made on each locking handle retainer to cover the sealed area in accordance with TIR requirements.

#### 4.12.2 Lashing fittings

Five (5) lashing hoop rings are welded to left top and bottom side rail at recessed corrugations of side panels (total 10 rings).

#### 4.12.3 Ventilator

Each container will have two labyrinth type small plastic ventilators.

Each ventilator is fixed to the right and left hand upper part of left side wall by three 5.0 mm dia. steel Huck bolts in accordance with TIR requirements after drying of top coating, and caulked with sealant around the entire periphery except underside to prevent the leakage of water.

## **5. SURFACE PRESERVATION**

### 5.1 Surface preparation

1) All steel surfaces - prior to forming or after - will be fully abrasive shot blasted conforming to Swedish Standard SA 2 1/2 with near white metal surfaces and RUGOTEST #3 BN9a to BN10 to remove all rust, dirt, mill scale and all other foreign materials.

2) All door hardware will be hot-dipping zinc galvanized with approximately 75 microns thickness and gasket retainers will be hot-dipping zinc galvanized with approximately 30 microns thickness.

3) All fasteners such as self-tapping screws and bolts, nuts, hinges, cam keepers and lashing fittings will be electro-galvanized with approximately 13 microns thickness.

### 5.2 Coating

#### 5.2.1 Prior to assembly

All steel surfaces will be coated with 10 microns thick two-pack polyamide cured zinc rich epoxy primer immediately after shot blasting, and then dried up in drying room.

#### 5.2.2 After assembly

All weldments will be shot blasted to remove all welding fluxes, splatters, burnt primer coatings caused by welding heat, and other foreign materials.

Then all blasted weldments will be coated with 10 microns zinc rich epoxy primer.



5.2.3 The total dry film will be (microns):

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

<i>Where</i>	<i>Paint name</i>	<i>DFT</i>
Exterior surface	Epoxy zinc rich primer	30
	Epoxy primer	40
	Chlorinated rubber coating	40
	Total:	110
Interior surface	Epoxy zinc rich primer	20
	Epoxy high build coating	50
	Total:	70
Under structure	Epoxy zinc rich primer	20
	Bituem	200(include wooden)
	Total:	220

\* Epoxy zinc rich primer and epoxy high build coating are not applied to the wooden.

\* Paint supplier: confirmed by customer

## **6. MARKING**

### 6.1 Arrangements

The containers will be marked in accordance with ISO, TCT, CSC and TIR requirements, owner's marking specifications and other required regulations.

### 6.2 Materials

- 1) Decal: - Self-adhesive, hightensile PVC film for seven (7) years guarantee without peeling off, tenting or color fading.
  
- 2) Certification plate: Stainless steel plates to be chemically etched by acid.

### 6.3 Specifications

- 1) Identification plates such as consolidated data plate consisting of CSC, TIR and TCT will be riveted on the door permanently by stainless steel rivets. The entire periphery except underside will be caulked with sealant.
  
- 2) The owner's serial numbers and manufacturer's serial numbers will be stamped into the top rear bottom L/H and R/H corner fitting respectively.

## 7 TESTING

### 7.1 Prototype testing

The prototype container manufactured in accordance with this specification will be tested by manufacturer under the supervision of classification society.

Test items & loads	Test methods
A) Stacking Internal load: 1.8R-T 1)Test load: 86,400kg/post.	Hydraulic cylinder load will reapplied to each corner post through top corner fittings. Offset: 25.4 mm lateral 38.0 mm longitudinal Time duration: 5 minutes
B) Lifting (from top corner fitting) Internal load: 2R-T	Lifting vertically. Time duration: 5 minutes
C) Lifting (from bottom corner fitting) Internal load: 2R-T	Lifting 45 deg. to the horizontal. Time duration: 5 minutes
D) Lifting (for forklift pockets) Internal load: 1.6R-T	Lifting by horizontal bars. Bar length: 1,828 mm Bar width: 200 mm Time duration: 5 minutes
E) Restraint (longitudinal) Internal load: R-T Test load: 2R	Hydraulic cylinder load will be applied to the bottom side rails. Two times for pulling and pushing Time duration : 5 minutes
F) Floor strength. Test load: 7,260 kgs (16,000 lbs)	Use of a special truck. Total contact area: 284 cm <sup>2</sup> Wheel width: 180 mm Wheel center: 760 mm
G) Wall strength (front) Test load: 0.4(R-T)=0.4P	Compressed air bag will be used. Time duration: 5 minutes

H) Wall strength (side) Test load: $0.6(R-T)=0.6P$	Compressed air bag will be used on one side only. Time duration: 5 minutes
I) Wall strength (door) Test load: $0.4(R-T)=0.4P$	Same as front wall strength test.
J) Roof strength (weakest part) Test load: 300 kgs	Applied area will be 600x300 mm longitudinal and transverse. Time duration: 5 minutes
K) Racking (transverse) Test load: 15,240 kgs	Hydraulic cylinder load will be applied to the header rail through top corner fittings. Two times for pulling and pushing. Time duration: 5 minutes
L) Racking (longitudinal) Test load: 7,620 kgs only. Two times for pulling and pushing.	Hydraulic cylinder load will be applied to the top side rail through top corner fitting on one side only. Time duration: 5 minutes
M) Operation of door	After completion of test, the operation of doors, locks, hinges, etc. will be checked.
N) Dimensions and weight	After completion of test, the dimensions and weight will be checked.
O) Weatherproofness	Inside dia. of nozzle: 12.5mm Distance: 1.5 m Speed: 100 mm/sec Pressure: $1 \text{ kg/cm}^2$

\* Note: R - Maximum Gross Weight

T - Tare Weight

P - Maximum Payload

## **8. WARRANTY**

### **8.1 Structure**

All the containers shall be guaranteed by manufacturer to be free from defects in materials, workmanship and structure for a period of one (1) year from the date of acceptance of the container by the buyer.

### **8.2 Painting**

8.2.1 The paint system coated on the container surface shall be guaranteed to be free from corrosion and failure for a period of three (3) years from the date of acceptance of the container by the buyer.

8.2.2 Corrosion is defined as rusting which exceeds RE3 (European Scale of degree of Rusting) on at least ten (10) percent of the total container surface, excluding that resulting from impact or abrasion damage, contact with solvents or corrosive chemicals and abnormal use.

8.2.3 If the corrosion exceeds RE3 as defined above within the guarantee period, inspection of the corrosion shall be carried out by the buyer, Rainbow and paint manufacturer to detect the cause.

As the result of the inspection, if it is mutually agreed and accepted that the corrosion has been caused by the defective paint quality and/or poor workmanship, Rainbow and/or paint manufacturer shall correct the defect on their accounts.