

# Technical Specification of LNG Tank Container

## LNG 罐式集装箱技术规范

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### LNG 罐式集装箱技术规范

This technical specification specifies the purpose, design standard, main technical parameters, basic dimensions, main structure, materials, test and inspection of LNG tank container.

本技术规范规定了LNG罐式集装箱的用途、设计标准、主要技术参数及基本尺寸、主要结构及材料、试验及检验等。

#### 1. Purpose of application 用途

LNG tank container is applicable to the highway, waterway transportation and its multimodal transportation of liquefied natural gas.

LNG罐式集装箱用于装运LNG，适用于公路、水路及其联运。

#### 2. Design criteria 设计标准

TSG R0005 Supervision Regulation on Safety Technology for Transportable Pressure Vessel 《移动式压力容器安全技术监察规程》

GB/T 150.1~150.4-2011 Pressure Vessels 《压力容器》

NB/T 47059-2017 Tank Containers for Refrigerated Liquefied Gas 《冷冻液化气体罐式集装箱》

International Maritime Dangerous Goods (IMDG) Code 《国际海运危险货物规则》

ISO 1496-3 Series 1 Freight Containers-Specification and Testing-Part 3: Tank Containers for Liquids, Gases and Pressurized Dry Bulk 《系列1：液体、气体及加压干散货罐式集装箱技术要求和试验方法》

Container Inspection Criteria 2021 《集装箱检验规范》2021

International Convention for Safe Containers, 1972 CSC国际集装箱安全公约

#### 3. Main technical parameters and basic dimensions 主要技术参数及基本尺寸

Container type 集装箱类型	1AA
Medium 介质	LNG 液化天然气, UN1972
Geometric volume 几何容积	45m <sup>3</sup>
Effective volume 有效容积	40.5m <sup>3</sup>
Filling rate 充满率	90%
Tare weight 自重	13.0 t
Allowable filling weight 最大允许充装量	22 t

Rated mass 额定质量	35 t
Max. allowable work pressure 最大允许工作压力	0.60MPa
Set-pressure of safety valve 安全阀整定压力	0.64MPa
Min. design metal temperature of inner vessel 内容器最低设计金属温度	-196°C
Service ambient temperature 使用环境温度	- 40 °C ~ 50°C
Design service life of vacuum interlayer 夹层真空设计使用年限	5 years
Design service life 设计使用年限	20 years
Inspection and supervision authority 监检机构	China Classification Society 中国船级社
Valve box position 阀门箱位置	Rear side 后端侧面
Goose neck tunnel setting 鹅颈槽设置	None 无

## 4. Main structures and materials 主要结构及材料

The LNG tank container is mainly composed of tank body, frame, loading and discharging system, valve box , marking and safety monitoring device.

LNG罐式集装箱主要由罐体装配、框架装配、加排系统装配、阀门箱、标记和安全监测装置等组成。

### 4.1 Tank body assembly 罐体装配

Tank body assembly is mainly composed of shell, insulation layer, inner vessel, inner and outer tank support and interlayer pipeline. The connection between the tank body and the container frame adopts the bottom longitudinal sill welding structure and the end skirt type connecting plate welding structure. Inner vessel barrel, tank head, inner reinforcing ring, adsorbent barrel and supporting reinforcing ring adopt stainless steel plates or steel strips. The outer shell and tank head adopt carbon steel plates. Inner and outer tank support: 8-point support structure.

罐体装配主要是由外壳组成、绝热层、内容器组成、内外罐支撑和夹层管路等组成。罐体与集装箱框架的连接采用底部纵梁焊接结构、端部裙座式连接板焊接结构。内容器筒体、封头、内加强圈、吸附剂筒体、支撑补强圈采用不锈钢板或钢带；外壳筒体和封头选用碳钢板材。内外罐支撑：采用8点支撑结构。

### 4.2 Frame assembly 框架装配

The frame assembly is composed of end frame, longitudinal sill and load transfer area.

框架装配由端框组成、纵梁组成、载荷传递区等零部件组焊而成。

The corner pieces shall adopt the materials conforming to the requirements of Container Inspection Criteria, Table 3.7.4.4. Steel plate, end frame and diagonal bracing shall adopt Q450NQR1 high strength weathering resistant steels which comply with High Strength and Atmospheric Corrosion Resistant Steel Hot Rolled Plate For Railway Freight Cars, which are featured by high strength and good atmosphere corrosion resistance, and have been tested by 10 years of application on 30 thousand 70t freight cars.

角件材料选用符合《集装箱检验规范》表3.7.4.4的要求。钢板、端框及斜撑采用符合《铁道货车用高强度耐大气腐蚀钢热轧板（带）》的Q450NQR1高强度耐候钢，该材料具有高强度，耐大气腐蚀能力强的特点，在我国近30万辆70t级铁路货车经受了10余年的运用考验。

The structural dimensions of end frame and diagonal bracing shall meet the requirements of GB/T 6728 *Cold formed steel hollow sections for general structure - Dimensions, shapes, weight and permissible deviations*.

端框及斜撑结构尺寸符合GB/T 6728《结构用冷弯空心型钢尺寸、外形、重量及允许偏差》的要求。

### 4.3 Assembly of loading and discharging system 加排系统装配

Fully considering the operation of users and the subsequent maintenance of products, the layout of tank container loading and discharging system is arranged according to the functional area. The loading and discharging system is mainly concentrated in the valve box, including loading and unloading liquid pipeline, gas phase pipeline, PBU pipeline, differential pressure pipeline, overflow pipeline and emergency shut off valve pipeline, vacuum measuring valve, vacuum device, etc. According to different functions, pipelines are equipped with globe valve, emergency shut off valve, safety valve, overflow valve and combined pressure and liquid level gauge.

罐箱加排系统布置充分考虑用户操作使用及产品后续的维护保养，按功能区进行布置。加排系统主要集中于阀门箱内，包括装卸液管路、气相管路、增压管路、差压管路、溢流管路及紧急切断阀管路、测真空阀及抽真空装置等。根据功能不同，在相关管路设有截止阀、紧急切断阀、安全阀、溢流阀及组合式压力液位计等。

One main ESD and three branch switches are set in the middle of the tail end of the tank container and near the valve box respectively. All buttons are made of corrosion-resistant elements, and the operating circuits are fully protected.

在罐箱尾端的中间和阀门箱附近各设置一只总ESD和三只支路开关。所有按钮采用耐腐蚀元件，并且对操作线路充分进行防护。

### 4.4 Valve box 阀门箱

The valve box is arranged on the left side of the tank body end. The operation box adopts stainless steel materials, which is safe, reliable and beautiful.

阀门箱设置在罐体尾端左侧。操作箱整体采用不锈钢材料制作，安全、可靠、美观。

The box door is open upwards and equipped with compressed air spring brace rod. A mechanical brace rod can be set according to the needs of users to ensure that the operation box can still be opened normally when the spring brace rod fails.

箱门采用向上开启式并配备了压缩气弹簧撑杆，同时可根据用户需要设置机械撑杆，确保弹簧撑杆失效时，操作箱仍能正常开启。

Both the liquid level gauge display position and pressure gauge display position are provided with transparent visible windows. And brief operation and safety instructions are pasted in the operation box.

在液位计及压力表显示位置设置可视透明窗口，并且在操作箱内粘贴简要操作说明及安全须知等。

### 4.5 Marking and painting 标识及油漆

The application of markings and paintings comply with the related standards & specifications and specific requirements stipulated by competent authorities.

罐箱标识、油漆的涂刷符合相关标准规范及主管部门的具体要求。

The painting consists of 125 μ m low temperature resistant oily epoxy primer and 80 μ m high performance low temperature resistant polyurethane top-coat. The total dry film thickness is 205 μ m. This painting is suitable for C4 corrosive environment.

涂层配套是125μm的耐低温油性环氧底漆，80μm高性能耐低温聚氨酯面漆，干膜总厚度为205μm，适用于C4腐蚀环境。

PVC file barrel and fire extinguisher are set on the right side of the front end of the tank container. The file barrel is used for storing the documents and files, such as operation instruction of tank container. Spare parts are provided freely for the replacement of file barrel.

在罐箱前端右侧设置PVC文件筒及灭火器，文件筒内提供罐箱使用说明书等，文件筒可免费提供备品供更换。

#### 4.6 Safety monitoring device 安全监测装置

The tank container monitoring system is configured according to the customer's requirements, which monitors the liquid level, pressure, temperature, position and other information of the tank container in real time. The customer can monitor the tank container remotely through the mobile phone or computer.

罐箱远传监控系统根据客户要求配置，可实时对罐箱的液位、压力、温度、位置等信息进行监测，客户可远程通过手机或电脑客户端对罐箱进行监控。

#### 4.7 Other accessories 其它配件

The three-way ball valve, check valve and liquid level gauge are from imported brands. Other valves, such as globe valve, thermocouple tube valve, ultra high vacuum valve and monitoring system can be from domestic brands.

三通球阀、止回阀和液位计均采用进口品牌，其它阀门，如截止阀、真空规管阀、超高真空阀、以及远程监控系统等可采用国产品牌。

The specific requirements for valves, instruments and monitoring system for the 40 ft LNG tank container applicable to railway-highway-waterway multimodal transportation are as follows:

40英尺铁公水联运LNG罐式集装箱装用的阀门、仪表和远程监控系统具体要求如下：

S/N 序号	Code name 代号	Name 名称	Manufacturer 厂商	Quantity 数量	Remark 备注
1	01321.4045.0014	DN40 globe valve DN40 截止阀	HEROSE	1	Import 进口
2	01353.2533.H004	DN25 low temperature emergency shut off valve DN25 低温紧急切断阀	HEROSE	1	Import 进口
3	01353.4048.H014	DN40 low temperature emergency shut off valve DN40 低温紧急切断阀	HEROSE	1	Import 进口
4	01353.5060.H014	DN50 low temperature emergency shut off valve DN50 低温紧急切断阀	HEROSE	1	Import 进口

5	05416.4045.0004	DN40 check valve DN40 止回阀	HEROSE	1	Import 进口
6	06388.1510.6000	Pressure-relief valve 内容器安全阀	HEROSE	4	Import 进口
7	06510.3210.6326	DN32 low temperature three-way ball valve assembly DN32 低温三通球阀组合	HEROSE	1	Import 进口
8	PRV9432TP215P	Composition of safety valve PRV9432 安全阀 PRV9432 组成	REGO	2	Import 进口
9	T325DA50	DN50 low temperature long shaft globe valve DN50 低温长轴截止阀	成都空分 Sichuan Air Separation Group	1	Made in China 国产
10	T325DA40	DN40 low temperature long shaft globe valve DN40 低温长轴截止阀	成都空分 Sichuan Air Separation Group	2	Made in China 国产
11	01321.4045.0014	DN40 globe valve DN40 截止阀	HEROSE	1	Import 进口
12	T308DA10	DN10 low temperature globe valve DN10 低温截止阀	成都空分 Sichuan Air Separation Group	1	Made in China 国产
13	T330DA25	DN25 low temperature short shaft globe valve DN25 低温短轴截止阀	成都空分 Sichuan Air Separation Group	1	Made in China 国产
14	T330DA10	DN10 low temperature short shaft globe valve DN10 低温短轴截止阀	成都空分 Sichuan Air Separation Group	6	Made in China 国产
15	GGCKZJ-II	Composition of thermocouple tube valve 真空规管阀组成	成都国光 Guoguang Electric	1	Made in China 国产
16	CD-750	Ultra high vacuum valve 超高真空阀	沈阳科仪 Sky Technology Development Co., Ltd.	1	Made in China 国产
17	712.15	Differential pressure level gauge 差压液位计	WIKA	1	Import 进口
18	AHDt-MLT	Monitoring system (differential pressure type) 远程监控系统 (差压式)		1	Made in China 国产

## 5. Inspection and test 检验与试验

The prototype of 40 ft LNG tank container is inspected and tested as per the relative standards and regulations to ensure the design type can be approved by monitoring and inspection organization and the structure and quality of the tank container are safe

and reliable.

40英尺铁公水联运LNG罐式集装箱样箱按标准规定进行检验和试验, 确保监管机构对定型设计进行批准, 确保罐相结构和质量安全可靠。

## 6. Documents and data 文件与资料

The tank container manufacturer shall provide the following technical documents and data:

罐箱制造厂应提供以下技术文件与资料:

- Classification Society Certificate; 船级社证书;
- Product inspection certificate; 产品监检证书;
- As-built drawing of equipment (including general assembly drawing. 中车长江运输设备集团有限公司

strength calculation instruction and safety accessory calculation sheet);设备竣工图(包含总装图、强度计算说明书、安全附件计算书);

- d) Equipment installation, use, and maintenance instructions;设备安装、使用、维护及保养说明书;
- e) Product quality certificate;产品质量证明书;
- f) Product certificate;产品合格证;
- g) Table of technical characteristics;产品技术特性表;
- h) List of materials used for main pressure parts;产品主要受压元件使用材料一览表;
- i) Inspection report on mechanical and impact performance of welding test plate;产品焊接试板力学和冲击性能检验报告;
- j) Inspection report of container appearance and geometric dimensions;容器外观及几何尺寸检验报告;
- k) Weld inspection report (including ray, ultrasonic, penetration and magnetic particle);焊缝检测报告(含射线、超声波、渗透和磁粉);
- l) Inspection reports of pressure test and air tightness test;压力试验及气密性试验检验报告;
- m) Ultrasonic inspection reports of steel plates and forge pieces.钢板、锻件超声波检测报告.