模块化冷库性能

检测报告

Performance Test Report of Modular Cold Store

委托方：制冷空调设备有限公司受托方：中粮工科检测认证有限公司

（国家商用制冷设备质量检验检测中心）

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Client: Refrigeration and Air-conditioning Equipment Co., Ltd.

Trustee: COFCO Engineering Testing and Certification Co.Ltd.

（National Commercial Refrigeration Equipment Quality Inspection and Testing Center）

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模块化冷库性能检测报告

Performance Test Report of Modular Cold Store

受制冷空调设备有限公司的委托，根据相关的标准和依据，本着客观、独立、公正、科学的原则，按照科学的评价方法，对模块化冷库性能进行检测。本单位检测人员按照必要的检测程序对委托的系统及设备开展实地查勘、现场检测等工作。模块化冷库性能检测结果如下，

At the request of Refrigeration and Air-conditioning Equipment Co., Ltd., and in accordance with the relevant standards and norms, this unit conducted performance testing on the Modular Cold Store. The testing adhered to the principles of objectivity, independence, impartiality, and scientific rigor, following established scientific evaluation methods. The unit's personnel carried out necessary testing procedures, including on-site inspection and field testing of the commissioned system and equipment. The performance test results for the Modular Cold Store are as follows:

1 基本概况

1 General Information

1.1 检测范围

1.1 Scope of Testing

本次委托检测的对象为模块化冷库，具体检测项目及设备以合同约定为准。

The object of this commissioned testing is the Modular Cold Store . The specific testing items and equipment shall be in accordance with the contract agreement.

1.2 检测对象概况描述

1.2 Description of Test Object

该项目产品为制冷空调设备有限公司生产的模块化冷库（外形尺寸：长14400mm×宽7450mm×高5500mm；内部尺寸：长14200mm×宽7250mm×高5270mm），设定冷藏温度0～4℃。该模块化冷库包含制冷系统和冷藏库体两个部分。

The product is a Modular Cold Store (External dimensions is 14400mm (L) ×7450mm (W)×5500mm (H), Internal dimensions is 14200mm (L) ×7250mm (W) ×5270mm (H)) manufactured by Refrigeration and Air-conditioning Equipment Co.,Ltd., with designed refrigeration temperature is 0-4°C. The container consists of two main systems: a refrigeration system and the cold store enclosure.

1.3 检测目的及检测基准日

1.3 Testing Objectives and Baseline Date

本项目对模块化冷库的实际性能进行检测，本次检测所有项目在空库状态下进行，主要包含对该模块化冷库温度场检测、冷库空库降温时间检测、冷库库体传热系数检测。

检测基准日为 2026 年 04 月 21 日，

This project involves testing the actual performance of the Modular Cold Store. All tests in this project were conducted under empty storage conditions. The testing includes air temperature testing inside the Modular Cold Store, the empty-cooling time testing of Modular Cold Store, and the thermal ransmittance (K-value) testing of Modular Cold Store .

The baseline date for this testing is April 21, 2026.

1.4 评估方法

1.4 Evaluation Methods

（1）依据相关标准规范要求，对模块化冷库内空气温度场进行 24 小时不间断检测，并计算空库状态下冷库内温度平均值、温度不均匀性。

（2）依据相关标准规范要求，对模块化冷库降温能力检测，并计算在空库状态下库内平均温度由 32℃±1℃降至设计温度所用的时间，

（3）根据现场实际运行情况，对模块化冷库库体保温性能进行检测，并计算该模块化冷库保温板传热系数是否满足规范要求，

(1) In accordance with the requirements of the relevant standards and specifications, the air temperature inside the Modular Cold Store were monitored continuously for 24 hours. The average temperature inside the empty storage were calculated.

(2) In accordance with the requirements of the relevant standards and specifications, the cool-down performance of the Modular Cold Store were testing, and calculate the cool-down time required for the average temperature in the cold store to decrease from 32°C±1°C to the design temperature under empty-store conditions.

(3) Based on the actual operating conditions, the thermal insulation performance of the Modular Cold Store was tested. It was evaluated whether the thermal transmittance (K-value) of this cold store meets the requirements of the relevant specifications.

1.5 检测依据

1.5 Testing Standards

（1）本次检测的依据主要有：

1）《冷库设计标准》GB 50072-2021

2）《组合冷库》JB/T 9061-2018

3）《模块化组合冷箱》T/CAS340-2019

4）《冷库热工性能试验方法第三部分：围护结构热流量检测》GB/T 30103.3-2013

5）其他适用的标准。

（2）经济行为文件

制冷空调设备有限公司与我单位签订的检测合同。

（3）企业相关方提供的重大合同协议

1）企业相关方提供的图片及影像资料。

2）企业相关方提供的检测期间模块化冷库运行的相关数据，

(1) The primary standards and specifications referenced for this testing are:

1) Standard for Design of Cold Store GB 50072-2021

2) Pre-fab Cold Store JB/T 9061-2018

3) Modular reefer container T/CAS340-2019

4) Methods of Testing for Thermal Performance on Cold Store—Part 3: Heat flux testing for envelop enclosure GB/T 30103.3-2013

5) Other applicable standards.

(2) Economic Action Document

The testing contract signed between Refrigeration and Air-conditioning Equipment Co., Ltd. and our organization

(3) Major Contractual Agreements Provided by the Relevant Enterprise Party

1) Images and video materials provided by the relevant enterprise party

2) Operational data of the Modular Cold Store during the testing period, provided by the relevant enterprise party.

2. 现场检测

2. On-site Testing

2.1 模块化冷库内空气温度场检测

2.1 Air Temperature Field Testing Inside the Modular Cold Store

模块化冷库内温度场检测布点如图 1 所示：

The sensors layout for temperature field testing inside the Modular Cold Store is shown in Figure 1.

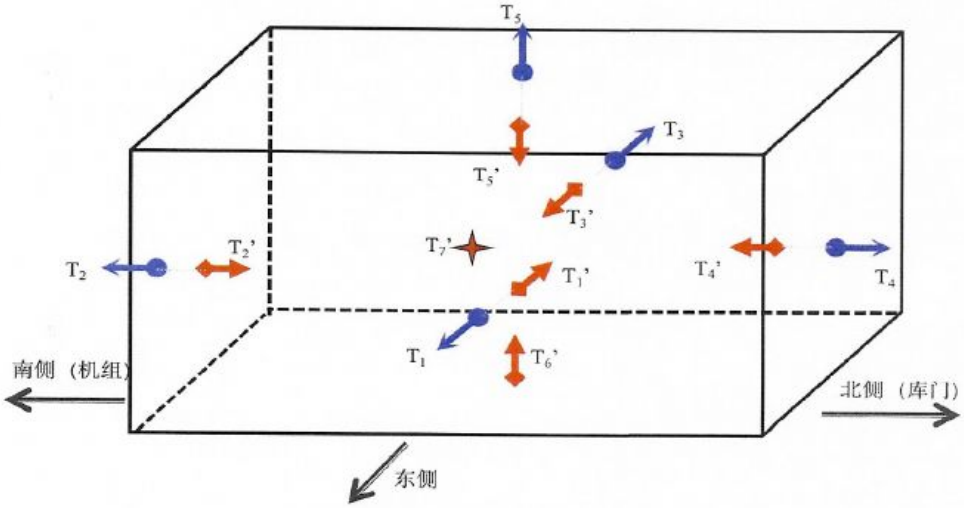


图 1. 冷库内温度场检测布点示意图

Figure 1. Schematic diagram of sensors layout for temperature field testing inside the Cold Store.

注：1. 图中 T_7'温度测点为冷库内几何中心点。

2. 其中 T_1'、T_2'、T_3'、T_4'、T_5'、T_6'、T_7'为冷库内温度测点，T_1、T_2、T_3、T_4、T_5 为冷库外温度测点。

Note: 1.The T_7' located at the geometric center point of the cold store.

2.Among these, points T_1', T_2', T_3', T_4', T_5', T_6' and T_7' located inside the cold store, while the points T_1, T_2, T_3, T_4 and T_5 located outside the cold store .

模块化冷库内温度检测结果如表 1、图 2 所示，数据截取时间段 2026 年 04 月 21 日 17:10—04 月 22 日 17:10。

The test results for temperature inside the Modular Cold Store are shown in Tables 1 . The data covers the period from 17:10 on April 21, 2026, to 17:10 on April 22, 2026.

表 1. 冷库内温度检测结果

Table 1. Temperature Test Results Inside the Cold Store

测点 Measuring Point	最小值（℃） Minimum (°C)	最大值（℃） Maximum (°C)	平均值（℃） Average (°C)

T_1'	-0.2	5.3	3.0
T_2'	-0.6	5.1	2.9
T_3'	-0.4	5.4	3.1
T_4'	0.0	5.4	3.5
T_5'	0.7	5.0	4.1
T_6'	-0.1	5.1	3.5
T_7'	-0.5	5.6	3.2
库内温度平均值 Average Temperature		3.3℃	
库内温度不均匀性 Temperature non-uniformity		3.1℃ (≤ 6.0℃)	

注：表中“6.0℃”为标准 JB/T9061-2018 中规定值。

Note: the value of 6.0℃ is the specified value in the JB/T9061-2018.

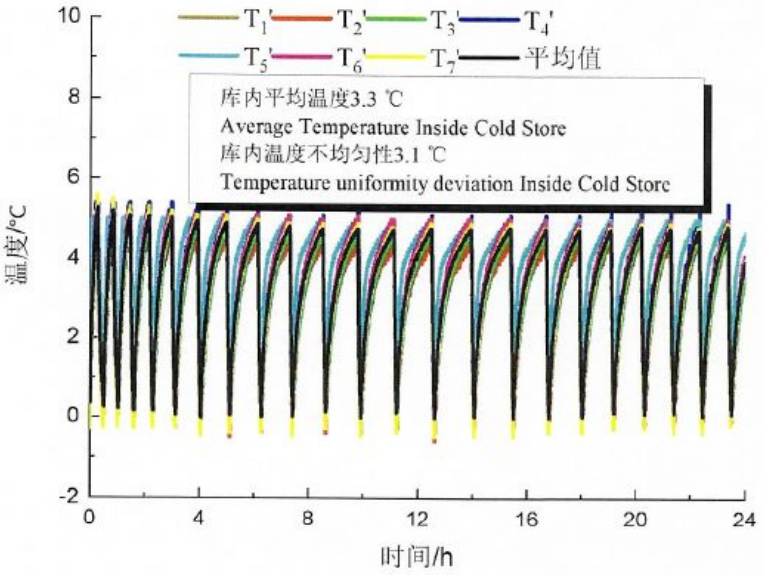


图 2. 冷库内测点 T_1'—测点 T_7'温度随时间变化情况

Figure 2. Temperature Variation Over Time for Points T_1' to T_7' Inside the Cold Store.

2.2 模块化冷库外表面凝露检测

模块化冷库库体外表面凝露检测结果如表 2 所示，检测时间 4 月 22 日 09:00—15:00。

Condensation test results on the exterior surface of the modular cold store are presented in Table 2. Test period: 09:00–15:00, April 22.

表 2. 冷库库体外表面凝露情况检测结果

Table 2. Condensation test results on the exterior surface of the modular cold store

	试验环境平均温度 Average Ambient Temperature	试验环境平均相对湿度 Average Ambient Relative Humidity	出现凝露时间 Condensation Occurrence Time	凝露状况 Condensation Status
结果	19.6℃	63.1%RH	无凝露 No condensation observed	无凝露 No condensation observed

2.3 模块化冷库空库降温时间检测（热流量补偿法）

2.3 Empty-Cooling Time Testing of Modular Cold Store (Heat Flux Compensation Method)

模块化冷库空库降温时间测试结果如表 3、图 3 所示。

The measured empty-cooling time results inside the Cold Store are shown in Table 3 and Figure 3.

表 3. 冷库空库降温时间测试结果

Table 3. Empty-cooling Time Test Results

库内温度 Temperature Inside Cold Store	温度测点 Temperature Points Inside the Cold Store.							平均值 Average Temperature（℃）
	T_1'	T_2'	T_3'	T_4'	T_5'	T_6'	T_7'	
初始值（℃）Initial Value	31.7	31.5	31.8	31.9	33.1	30.7	32.2	31.8
终止值（℃）Termination Value	0.1	0.2	0.1	0.7	1.5	0.2	-0.3	0.4
降温时间 Empty-cooling Time	**1h 55min (≤3h)**							

注：表中“3h”为标准 JB/T9061-2018 中规定值。

Note: the value of 3h is the specified value in the JB/T9061-2018.

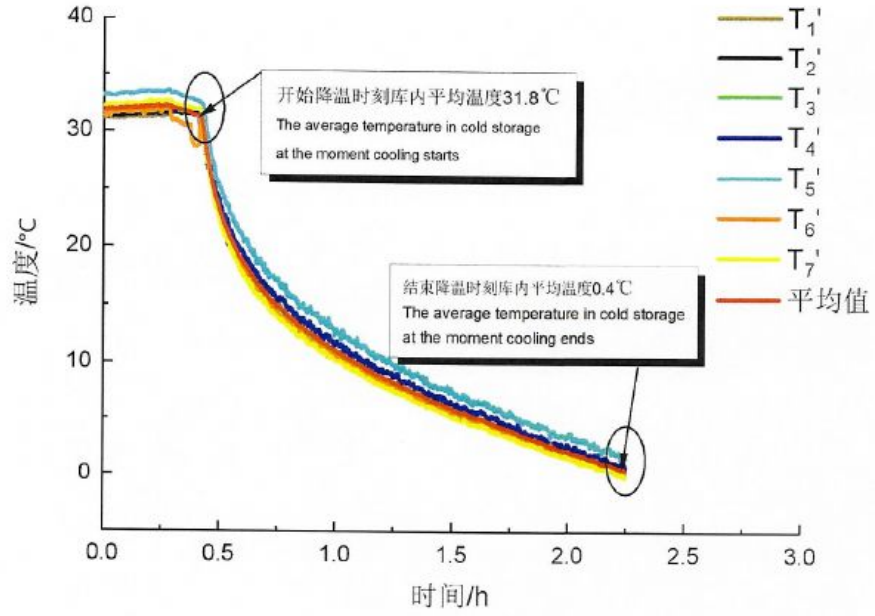


图 3. 冷库内各测点温度随时间变化情况

Figure 3. Temperature changes of each monitoring point in the cold store over time

2.4 模块化冷库库体传热系数 K 值测定（热平衡法）

2.4 Thermal Transmittance (K-value) Testing of Modular Cold Store

模块化冷库库体传热系数检测结果如表 4 所示，库内外温度变化情况如图 4 所示。热平衡时间阶段截取：4 月 24 日 10：30——16：30。

The K-value test results for the Modular Cold Store are shown in Table 4 . Test period: 10:30–16:30, April 24.

表 4. 冷库库体传热系数 k 值检测结果

Table 4. K-value Test Results for the Cold Store

参 数	库体传热面积 F Heat Transfer Area （m^2）	库内外平均温差 Δ T Average Temperature Difference（℃）	总功率平均值 Average Total Power （W）
	443.298	20.2	3747.6
传热系数K 平均值 Average K-value	0.42 W/(m^2 • ℃）（ **≤ 0.48**W/(m^2 • ℃））		

注：1. 表中“总功率平均值”包含电加热功率与电风扇功率之和。

3. 表中“0.48W/(m²·℃）”为标准 JB/T9061-2018 中规定值。

Note: 1. The total power average in the table includes the sum of electric heating power and electric fan power.

2.The value of 0.48W/(m²·℃) is the specified value in the JB/T9061-2018.

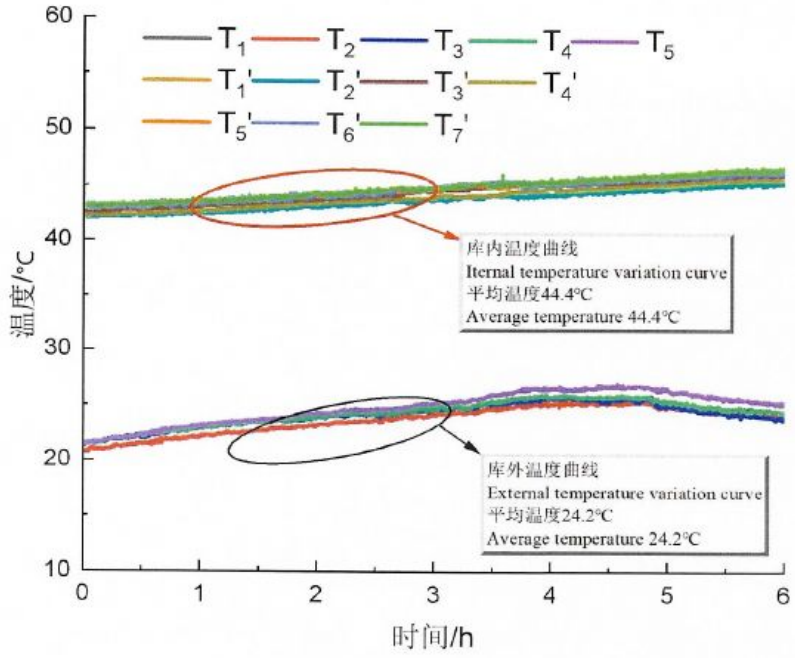


图 4. 库内外温度随时间变化情况

Figure 4. Temperature changes inside and outside the cold store over time

3. 检测结论

3. Testing Conclusions

（1）在检测期间，对模块化冷库内空气温度场检测。从检测结果看，在稳定运行的 24 小时期间，该冷库内空气平均温度为 3.3℃（机组设定起停温度区间为 0~4℃），库内温度不均匀性为 3.1℃，满足相关标准要求；在库外环境平均温度为 19.4℃、平均相对湿度为 47.8%RH 的条件下，模块化冷库库体表面未出现凝露现象。

（1）During the testing period, the air temperature field inside the Modular Cold Store was monitored. Based on the test results, during the 24-hour stable operation period, the average air temperature inside the cold store was 3.3 °C, and the temperature unevenness

within the cold store is 3.1°C , meeting the relevant standard requirements. Under conditions where the average ambient temperature outside the cold store is 19.4°C and the average relative humidity is 47.8%RH, no condensation has appeared on the surface of the modular cold store unit.

（2）在检测期间，利用热流量补偿法对模块化冷库空库状态下降温时间进行测定。从检测结果看，该冷库从库内平均温度 31.8°C 降至 0.4°C 所用时长为 1h 55min，满足相关标准要求。

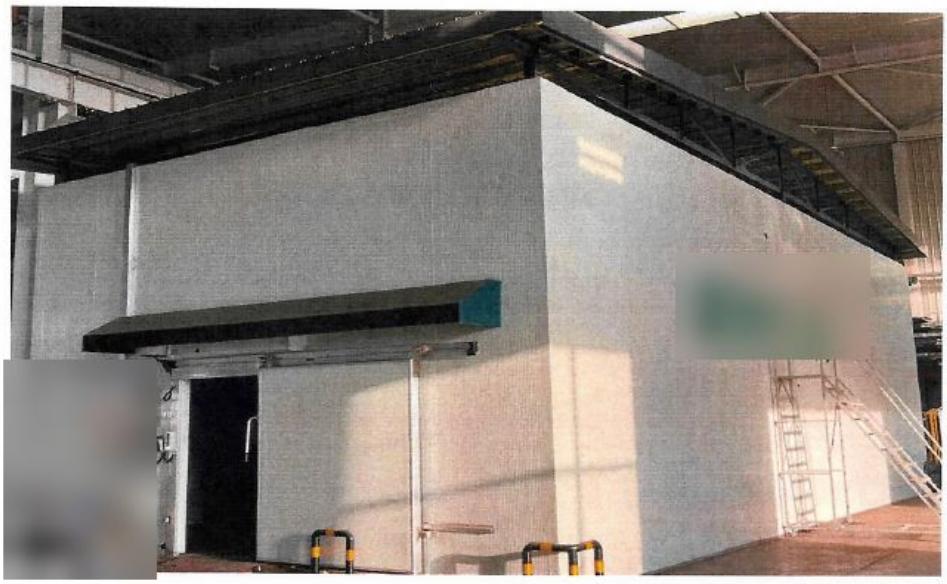
（2）During the testing period, the empty-cooling time of the modular cold store was measured using the heat flow compensation method. Based on the test results, The cold store facility took 1 hour and 55 minutes to reduce the average temperature inside from 31.8°C to 0.4°C, meeting the relevant standard requirements.

（3）在检测期间，利用热平衡法对模块化冷库库体传热系数进行测定。从检测结果看，该冷库库体传热系数 K 平均值为 0.42W/(m^2·°C），满足相关标准要求。

（3）During the testing period, the thermal transmittance (K-value) of the modular cold store was measured using the heat balance method. Based on the test results, the average K-value of the cold store is 0.42 W/(m^2·°C), meeting the relevant standard requirements.

4. 检测附图

4. Test Figures



附图 1. 模块化冷库外观

Figure 1. External View of the Modular Cold Store



附图 2. 制冷系统外观

Figure 2. External View of the Refrigeration System



附图 3. 模块化冷库温度场及热平衡试验

Figure 3. Temperature Field and Thermal Balance Test of the Modular Cold Store