

# *Flexcold Evaporator HANDBOOK*

For Units up to 20 kW

## *Flexcold 系列小型冷风机操作手册*

单台制冷量最大到 20 kW



**THANK YOU** for purchasing refrigeration products from Beijer Ref Wuxi. Please read and apply the following procedures carefully in order to fully utilize the equipment you purchased. This instruction booklet is only applicable to the Flexcold series of Low Profile Evaporators marketed as the Flexcold LOPM/LOPL range.

非常感谢您购买百尔制冷（无锡）产品，为了更好的使用您所购买的产品，请仔细阅读并按照下面的步骤操作，该手册仅适用于百尔Flexcold 系列小型冷风机 LOPM/LOPL。

### IMPORTANT INFORMATION 重要信息

**REFER TO THE SECTIONS ON “WARNINGS AND SAFEGUARDS”, AND “INSTALLATION INSTRUCTIONS” BEFORE ATTEMPTING TO COMMISSION THIS EVAPORATOR.**  
调试蒸发器前请先参看“警告及安全防护”和“安装说明”这两部分

### **CONTENTS** 内容

**Warnings and Safeguards**

警告及安全防护

**pg 3****Purpose**

目的

**pg 4****Standard Design Conditions**

标准设计工况

**pg 4****Recommended Placement and Clearance**

推荐的安装位置及间距

**pg 4****Installation Instructions**

安装说明

**pg 6****a) Lifting of Unit**

设备吊装

**pg 6****b) Unpacking of Unit**

包装拆除

**pg 6****c) Mounting the Unit**

设备安装

**pg 6****d) Drain Spout and Drain Line**

排水口及排水管

**pg 7****e) Refrigerant Distributor and Nozzle**

制冷剂分液器及节流环

**pg 7****f) TX Valve, Sensor Bulb and External Equalisation Line**

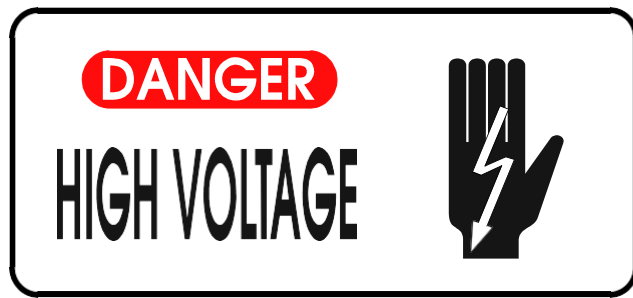
热力膨胀阀，感温包及外平衡管

**pg 8**

|  |                             |              |
|--|-----------------------------|--------------|
| <b>g) Refrigerant Piping</b>   | 制冷剂管道                       | <b>pg 8</b>  |
| <b>Electrical Connection</b>   | 电气连接                        | <b>pg 10</b> |
| <b>General Commissioning Guide</b>   | 调试指南                        | <b>pg 10</b> |
| <b>Advisory Defrost Guidelines</b>   | 除霜指南                        | <b>pg 11</b> |
| <b>a) Defrost Termination Requirements</b>   | 除霜终止要求                      | <b>pg 12</b> |
| <b>b) Control Setting Guidelines</b>   | 控制设置指南                      | <b>pg 13</b> |
| <b>Routine Maintenance of Unit</b>   | 设备日常维护                      | <b>pg 14</b> |
| <b>General Decommissioning Guide</b>   | 关机指南                        | <b>pg 15</b> |
| <b>Material Safety Data Sheets – M.S.D.S.</b>  | 制冷剂安全数据表 ( <b>M.S.D.S</b> ) | <b>pg 16</b> |
| <b>Important Note</b>  | 特别提示                        | <b>pg 16</b> |
|  <b>General Arrangement Drawing</b> | 安装布置图                       | <b>pg 17</b> |



## ***Warnings and Safeguards*** 警告及防护



**Under no circumstances should anyone other than a qualified person attempt to gain access to the interior of the unit without first ensuring electric power is**

**在没有保证切断电源前，除了具备资质的技工其他任何人决不允许接触设备内部。**

- Personal Protective Equipment such as gloves, eyewear and footwear should be used during any work carried out on this product.
- Installation, commissioning, testing, decommissioning and service maintenance should be performed only by qualified personnel (refrigeration mechanics and/or electricians) who have sufficient knowledge in this type of equipment. It is the purchaser's responsibility to co- ordinate with qualified personnel as required.
- All units are pressurized with dry air or Nitrogen gas. Care must be taken to discharge the pressurized gas carefully prior to installing or commissioning the equipment.
- Avoid contact with sheet-metal edges and the coil fins. They can be sharp and are a potential personal injury hazard.

- 在操作该设备时应该配备个人防护用品，例如：手套、眼镜、鞋。
- 安装、调试、测试、关机和维修服务等应该由对该类设备具有足够知识经验的有资质的人员（制冷机械工和/或电工）来操作。客户有职责配备操作的人员进行作业。
- 所有的设备都充有高压的干燥空气或者氮气。在设备安装或者调试前一定要小心的排放压缩气体。
- 避免接触钣金的边缘和盘管的翅片，锋利的边缘可能会引起人员受伤。

• Refrigerant can be harmful if it is inhaled and/or makes contact with exposed skin. Refrigerants used in this equipment are controlled substances, and must be used and recovered responsibly. It is against the law to deliberately discharge controlled substances into the environment. Extreme care must be taken when handling refrigerant, as personal injury or death may occur.

• 如果吸入和/或皮肤直接接触制冷剂都会造成伤害。该设备所用的制冷剂对人和环境都会造成危害，在使用和回收中必须要负责任。制冷剂排放到周围环境中是违法的。要非常小心的处理制冷剂，否则，可能发生人身伤害或死亡。

- All field wiring must conform to the requirements of the equipment and all applicable National and Local Codes. All power sources must be disconnected before the commencement of any service, maintenance or electrical work.
- Avoid contact refrigerant pipes and heat transfer surfaces when the equipment is operating. Their extreme hot or cold surfaces may result in skin burns.
- **WARNING:** Do not insert any object into operating fans. Ignoring this warning may result in personal injury and/or severe equipment damage and consequences.
- Fans operate continuously even when the refrigeration system has 'cycled off'. The exception is on freezer models where the fans will cycle off during defrost.
- Keep the floor of refrigerated rooms dry. Slippage due to ice formation on the floor is a potential personal injury hazard.

- 所有现场接线必须符合设备的要求和通用的国家和地方编码。在任何维修服务或者电气操作之前必须先切断电源。
- 当设备在运行过程中避免接触制冷剂管道和热交换表面。高温或低温的表面会导致您的皮肤受到伤害。
- 警告：不要把任何物体插入运行的风扇中，否则会导致人员的损伤和/或机械的损害。
- 当制冷系统循环停止时，风扇会继续运转，除了在制冷模式下的除霜期间风扇会停止运行。
- 保持库房地面的干燥。潮湿的地面因为结冰而较滑，可能会造成人身伤害。

## Purpose

These low profile evaporator ranges are standard OEM products of Beijer Ref China; they comprise both 'medium' and 'low' temperature ranges. They are intended for typical commercial sized cool room and freezer applications for the storage of vegetables, fresh meat, general foodstuffs, beverages, etc. They are not intended for environments that may have harmful, corrosive or flammable atmospheres or for the storage of corrosive or flammable chemicals. 'Marine' environments are considered corrosive; please consult Beijer Ref before installing in this environment.

## Standard Design Conditions

Medium temperature range evaporators (Flexcold LOPM series) are designed at  $-4^{\circ}\text{C}$  saturation suction temperature (SST) and 6 KTD to suit room temperature from  $-6^{\circ}\text{C}$  to  $+20^{\circ}\text{C}$  (refer to technical data for maximum and minimum allowed KTD for specific SST), for use in 'heavy duty' commercial cool room applications. For rooms below  $2^{\circ}\text{C}$ , additional defrosting means may be required. R507/R404A and R22 are recommended refrigerants. For other refrigerants, please refer to sales data sheet for capacity variations.

Low temperature range evaporators (Flexcold LOPL series) are designed at  $-24^{\circ}\text{C}$  SST and 6 KTD to suit room temperatures from  $-1^{\circ}\text{C}$  to  $-38^{\circ}\text{C}$  (refer to technical data for maximum and minimum allowed KTD for specific SST), for use in 'heavy duty' commercial freezer room applications. R507 or R404A are the recommended refrigerants. For other refrigerants, please refer to sales data sheet for capacity variations. For lower temperatures design variations may be required.

These standard evaporators cannot use Ammonia ( $\text{NH}_3$ ) as refrigerant.

For special design requirements (non-standard conditions and/or refrigerants such as Glycol, Hydrocarbons, etc.), please inquire with your local representatives and/or Beijer Ref local branches, or call our national telephone number 0510-85282020 for your nearest available information resources

## Recommended Placement and Clearance

Some general rules for evaporator placement shall be followed: 冷风机得布置规则如下:

- The air pattern shall cover the entire room or effective area.
- Do **NOT** locate evaporators over doors.
- Locate aisles, racks, etc. so as not to hinder the discharge or return airflow of the evaporator.
- Locate relative to compressors for minimum pipe runs.
- Locate condensate drains for minimum pipe runs.

## 目的

这些中小型冷风机是百尔标准的 OEM 产品；包括中温和低温两个应用范围。专为保存蔬菜，鲜肉，常规食品和饮料等典型的商业冷藏及冷冻库而设计。不能用于储藏有害，腐蚀，易燃物的冷库，也不能用于储藏腐蚀，易燃化学品的冷库。海洋环境是有腐蚀的；如果要安装在这样的环境中请在安装前咨询百尔。

## 标准设计工况

中温冷风机(Flexcold LOPM 系列)其设计的饱和吸气温度为 $-4^{\circ}\text{C}$ ，温差为 6K，适用于室温从 $-6^{\circ}\text{C}$ 到 $20^{\circ}\text{C}$ 商用冷库（特定的饱和吸气温度下允许的最大和最小温差请参照技术资料）。室温低于 $2^{\circ}\text{C}$ 时需额外的除霜方法。该蒸发器推荐使用的制冷剂有 R507/R404A 和 R22。对于其他制冷剂，请参照数据表查不同的制冷量。

低温冷风机(Flexcold LOPL 系列)其设计的饱和吸气温度为 $-24^{\circ}\text{C}$ ，温差为 6K，适用于室温从 $-1^{\circ}\text{C}$ 到 $-38^{\circ}\text{C}$ 商用冷库（特殊饱和吸气温度允许的最大和最小温差请参照技术资料）。该蒸发器推荐使用的制冷剂有 R507/R404A 和 R22。对于其他制冷剂，请参照数据表查的不同的制冷量。更低的库温必须重新设计。

这些标准的蒸发器不能用氨( $\text{NH}_3$ )作为冷媒。

对于非标设计（非标准工况和/或乙二醇、碳氢化合物等作为冷媒）请咨询百尔当地代表和/或百尔无锡，或者拨 0510-85282020 为您提供最新的信息。

## 建议安装位置和间距

- 气流组织应覆盖整个房间或者有效面积。
- **禁止**将蒸发器安装在门的上面。
- 过道和货架的布置不能阻碍蒸发器的送风和回风的流道。
- 蒸发器到压缩机的管道距离尽量短。
- 排水管的走管距离尽量短。

Minimum clearance shall be guaranteed:

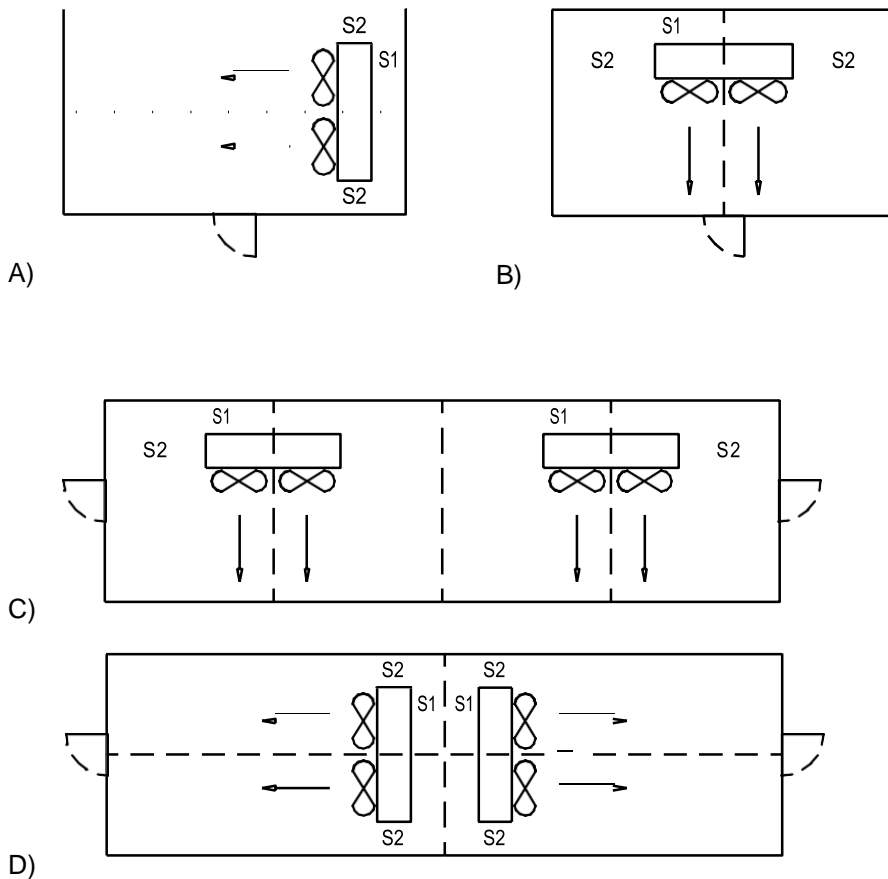
- S1 - Allow 300mm or more between the wall and air on side of the coil, for airflow.
- S2 - Allow 350mm or more between the wall and the access panel for service convenience.

所允许的最小安装间距

- S1-墙壁到盘管空气侧之间的距离至少 300mm。
- S2-为了方便维修，墙壁到端板之间的距离为至少 350mm。

**Where one side of wall mounting is satisfactory.**

满足所有蒸发器安装在同一侧墙上的情况



A) is preferred placement.

A) 优先推荐的布置方位。

B) is an alternative, because it discharges air at the door. (However, it is still better than mounting over the door)

B) 次之的选择，因为送风正对门（但比直接安装在门上面要理想）

C) is preferred placement.

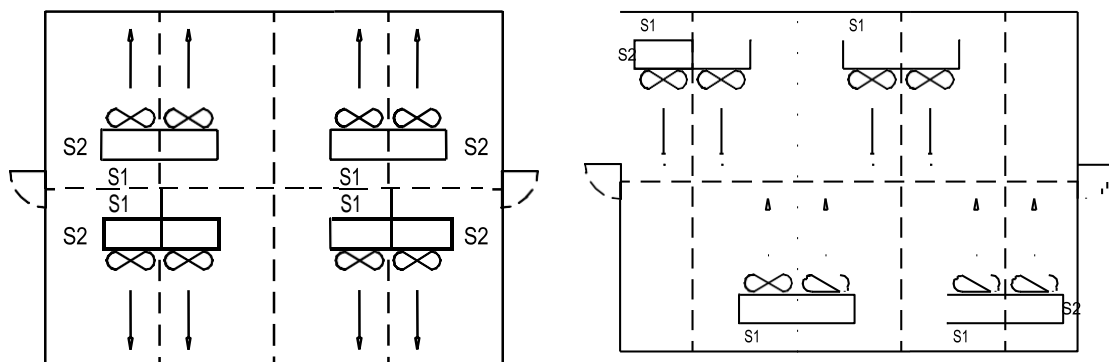
C) 优先推荐的安装方位。

D) is an alternative for the same reason as B).

D) 次之的选择，等同于B)。

**Where one side of wall mounting will not accommodate all required units or air throw distance must be considered.**

所有蒸发器不能容纳在同一侧墙上，或者必须考虑冷风射程的情况



Preferred Placement  
优先推荐的布置方位

Second Choice due to possible airflow collision and defrost difficulties

第二种选择，因为可能发生扰流或除霜困难



## Installation Instructions

## 安装说明



### a) Lifting of Unit

As a guide for lifting the weight of the unit is noted on the packaging label next to the model and serial number. Use the appropriate mechanical handling equipment to lift the unit into place.

### b) Unpacking of Unit

When unpacking, check for any damage to packing material or the unit itself, which may affect the unit's performance. **If any such damage is evident, please contact your Beijer Ref branch.**

### c) Mounting the Unit

These evaporators can be mounted with threaded rods and bolts. As a general rule, the single 5/16" rod, and bolts and washers can lift the weight up to 110kg (250 lb.), 3/8" for up to 270kg (600 lb.). However it is the installer's responsibility to ensure the evaporators mounted securely and professionally.

To comply with HACCP and/or relevant regulations for food safety, the area above the evaporator must be sealed or exposed in such a way to facilitate hand cleaning without the use of tools. So depending on the end user's preference, the evaporators can be installed either,

- Using threaded rod and allow sufficient space between the top of the evaporator and the ceiling for cleaning, or
- Flush mount the evaporator to the ceiling, seal the gap between the top and the ceiling with food benign sealant to prevent accumulation of any foreign matter.

All evaporators shall be mounted professionally and levelled properly so that condensate drains from the evaporator efficiently. Adequate support must be provided to hold the weight of the evaporator plus the weight of the refrigerant and any frost that may accumulate on the coil surface. The use of weight lifting equipment is highly recommended whenever possible.

### a) 设备的吊装

设备的搬运指南在型号及序列号边上的包装指南上。请使用合适的设备将设备运到指定地点。

### b) 包装的拆除

拆包装的时候，检查设备和包装材料是否受损，任何受损可能会影响运行效果。**如果发现明显的受损部位，请您联系百尔各地办事处。**

### c) 设备的安装

冷风机可以用螺栓和螺母固定。一般来说，单个 M8 的螺栓和螺母能承受重达 110Kg(250lb) 的重量，M10 的能承受重达 270Kg(600lb) 的重量。尽管是这样，但安装人员有责任确保蒸发器安全的、专业的安装在指定位置。

为了遵守 HACCP 和/或有关的食物安全标准，蒸发器的上面必须密封，或者不密封的话请留出一定的空间方便手工清洗。以上两种方式根据终端用户的实际需要而定。

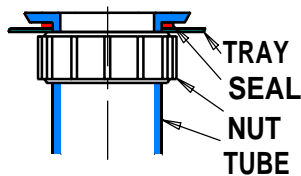
- 用螺栓固定蒸发器，并在顶板到天花板之间留有足够的空间以便于清洗。
- 将冷风机对齐安装在天花板上，采用亲食品的密封材料密封天花板和冷风机顶部间的空隙。

冷风机安装要得当，位置要适中，以保证凝结水能有效地排出冷风机。支撑必须有足够的承受能力承受冷风机自身的重量，冲注的制冷剂重量及盘管表面寄居的霜的重量。可能的话推荐使用起重设备来吊装。

**d) Drain Spout and Drain Line**

Loosely shipped with the purchased unit, there is a 32mm BSP O.D. drain spout (*the spout assembly is cable tied to a fan guard. If it is not present please notify your local Beijer Ref branch.*) It comprises of a tube, a seal and a nut (three parts). Reassemble these 3 parts in the hexagon drain hole in the tray in such a way to have the tube and the seal at the inside of the tray, and the nut at the outside of the tray (shown as below). The seal is seated in-between the tray and the tube.

Position the tube to match the hexagon drain hole properly. Handing tighten the nut to ensure no condensate water leaks. Over tightening or use of tools to tighten the nut may result in damage of the nut thus causing condensate water leakage.



Ensure that the installation complies with HACCP and/or relevant regulations for food safety, and the end user's preferences when choosing copper, stainless steel or PVC material for condensate drain lines. For low temperature applications, proper insulation and heating cable shall be provided to prevent the drainpipe from freezing. Provide a minimum 300mm per meter pitch to condensate drain lines for proper drainage. Drain lines should be at least as large as the evaporator drain connection. All condensate drain lines must be trapped to prevent outdoor air and odors entering the refrigerated room, and must never be connected directly to the sewer system. All traps must be located in a warm ambient to prevent water from freezing. It is recommended that the drain line be kept to a minimum length within the refrigerated room.

**e) Refrigerant Distributor and Nozzle**

To obtain the best performance of the evaporator, the distributor body shall be mounted vertically to ensure refrigerant liquid being distributed evenly to all the circuits.

For each unit through the whole range of Flexcold low profile evaporators, a carefully selected Sporlan-type orifice will be factory-fitted in the distributor based on your request of refrigerant type before delivering the completed unit to your preferred site.

**d) 排水口排水管**

32mm 直径的排水管接口运输时未装好，而是捆绑在风扇的网罩上。如果找不到的话，请和百尔当地办事处联系。该接头有一根管子，一个密封圈及螺帽组成。安装这三个部件请参照下面的方法，将管和密封圈装在接水盘里面，将螺帽安装在接水盘外侧（参看下面的图）。密封圈垫在接水盘和管子之间。改变排水管的位置使其和六角排水孔位正好符合。用手拧紧螺帽防止冷凝水泄漏。不要拧的太紧或者用工具拧紧都有可能导致螺帽损坏，使得冷凝水泄漏。

用手拧紧螺帽，并用水检验是否泄漏。

请确认排水管的安装符合食品的安全规范，材料可选择铜管，不锈钢管或 PVC 管，根据客户而定。对低温应用工况，需提供保温及加热丝以防止排水管结冰。推荐每 1 米 300mm 的坡度正确安装排水管。排水管的尺寸至少和冷风机的积水盘接头一样。所有的凝结水排水管必须要安装 U 型弯以防止外界空气及异味进入冷库，绝对禁止直接和排污系统相连。所有 U 型弯置于温暖的环境以防止结冰。建议排水管在冷库内的长度要尽可能短。

**e) 制冷剂分液器及节流环**

为保证冷风机达到最佳的制冷效果，分液器必须竖直安装，确保制冷剂均匀地分配到各个制冷回路中。

对于 Flexcold 小型冷风机中每一个型号，在发往客户指定的地点前，根据客户所采用的制冷剂，我司已在工厂安装了和分液器配套的 Sporlan 孔板。

**f) TX Valve, Sensor Bulb and External Equaliser**

For best performance, the TX valve should be installed as close to the distributor as possible.

Locate the TX valve sensor bulb on the horizontal section of suction line and close to the suction header. For a satisfactory TX valve operation, good thermal contact between the sensor bulb and the suction line is essential. Follow TX valve manufacturer's recommendations when positioning TX valve and sensor bulb. Incorrect installation may result in poor evaporator performance.

The external equalization line should be used to link the TX valve external equalization port and the suction line, near the suction header. A 1/4" tube brazed to the suction line is supplied for that purpose.

Note: With modern high quality TX valves, refrigerant leakage through the equalization line is at a minimum and the TX valve operation is not affected. Thus the external equalization connection could be made either upstream or downstream of the sensor bulb

**f) 热力膨胀阀, 感温包及外平衡管**

为了达到最佳的制冷效果, 热力膨胀阀应尽可能安装在离分液器近的位置。

将热力膨胀阀的感温包放置在吸气管的水平位置, 并且离吸气集管比较近的位置。为了达到良好的运行效果, 必须保证感温包和吸气管之间达到良好的热接触。热力膨胀阀及感温包的放置请遵循生产厂家的指示。不正确的安装会导致制冷效果变差。

外平衡管用于连接热力膨胀阀的外平衡口和吸气集管附近的吸气管。连接到吸气管的 1/4 英寸铜管就是所说的外平衡管。

注意: 目前热力膨胀阀的质量比较好, 外平衡管上很少会出现制冷剂泄漏, 热力膨胀阀的运行不受影响。因此, 外平衡管连接位置既可以在感温包前, 也可以在感温包后。

**g) Refrigeration Piping**

Refrigeration piping work shall be carried out professionally by qualified refrigeration mechanics in accordance with applicable national and local regulations and in conformance with good engineering practices required for the proper operation of the refrigeration system

**g) 制冷管路**

制冷管路的设计, 安装必须由专业的制冷技工依照国家和当地的规范, 同时符合良好的制冷工程运行实际。



All the evaporators supplied by Beijer Ref are supplied clean and internally charged with dry nitrogen to prevent oxidation and ingress of moisture or foreign matter. Care shall be taken during installation of the piping to prevent entrance of foreign matter or moisture by minimizing the time that the piping is uncapped.

The interconnecting refrigeration pipe size is not necessarily the same size as the outlet on the unit. The pipe sizes shall be selected and calculated based on the best compromise of minimizing refrigerant pressure drop and refrigerant velocity to ensure efficient oil return. Beijer Ref can provide a software program to assist in the calculation of pipe sizes.

Always consider the proper location for the TX valve sensor bulb when connecting the suction line to the suction fitting of the unit. Horizontal suction lines shall slope away from the evaporators to allow the oil return freely to the compressor by gravity. A 1:100 slope is considered sufficient. It is a good engineering practice to fit an oil trap when the suction line rises above the evaporator.

If in doubt during the installation, please consult with your local sales representatives and/or application engineers from Beijer Ref for technical support.

百尔提供的所有冷风机都是干净的，并且内部预先充注有干燥氮气以防止氧化及湿气和外界杂质进入。在安装时，尽量减小接管暴露在空气中的时间，以防止外界杂质和湿气的进入。

制冷连接管路不一定要和冷风机的出口管路一致，管路尺寸的选择和计算应基于最小压降和流速衰减的原则。百尔可提供管路计算软件。

在连接吸气管与弯头时，事先考虑感温包放置的位置。水平吸气管需以一定的倾斜度离开冷风机，确保冷冻油由重力作用回到压缩机。1:100 的斜率是足够的。当吸气管高于冷风机时，最好安装回油弯。

如果在安装过程中有疑问，请咨询我们当地的销售代表或应用工程师。

## Electrical Connection

## 电气连接



**All electrical connections must be carried out by a licensed electrical technician and in accordance with the relevant regulations. Without prior permission from Beijer Ref, all the provided electrical wiring shall NOT be modified. Failure to follow this procedure may cause death and void warranty.**

所有电器连接必须遵循相应的规范，并由专业的电气技工来实施。未得到百尔认同的情况下，不允许修改电气连接。若不遵循该要求，将会导致人身伤害，并且我司也将因此不提供任何质保。

The LOPM-H series, the medium temperature evaporators fitted with heater elements, and the LOPL series, the low temperature evaporators, are supplied pre-wired to terminal block located in the external electrical box of the evaporator (Note: the LOPM series, the medium temperature evaporators, is not pre-wired). The wiring diagram for each pre-wired evaporator is located on the inside of the electrical box cover. Refer to the sales data sheets for all the information regarding voltage and current for fan motors and element heaters.

LOPM-H 系列中温冷风机安装有加热丝，LOPL 系列低温冷风机在外置电器接线盒上的接线端子上预先接线（注：LOPM 系列中温冷风机无预留接线）。每个预先接好线的冷风机的电气接线图放在接线盒的盖子内。对于风扇马达和电热丝的详细请参看样本。

During field wiring, fan motors shall be wired up in star connection. After electrical installation, units should be tested for correct current draw and rotation of fan motors.

在现场接线时，风扇马达采用星型连接。电气接线完毕后，请检查电流及风扇马达的运转方向是否正确。

## General Commissioning Guide

## 调试指南

**Refrigeration system commissioning shall be carried out professionally by qualified refrigeration technicians in conformance with good engineering practices required for the proper operation of the refrigeration system.**

制冷系统的开机调试需符合正确的制冷运行实际，由资质的制冷技工操作。

After all installation and electrical work is completed, the entire refrigeration system must be leak tested. After satisfactory testing the refrigeration system, then necessary refrigeration lines shall be insulated. The insulation located in outdoor environments shall be protected from UV exposure.

在所有的安装和电气连接完毕后，整个制冷系统需先检漏，确认系统无泄漏后，所有的制冷管路需保温，室外的保温同时需满足防止UV暴晒。

Before charging the refrigerant, the entire refrigeration system shall be evacuated by connecting a good, high vacuum pump to both the high-pressure side and low-pressure side service valves or ports.

在充注制冷剂前，必须在高压侧和低压侧的维修阀件处连接高性能的真空泵对整个系统抽真空。

Vacuum must be maintained sufficiently so as to minimize the occurrence of leaks when the system is charged. Refrigerant must not be charged into a system with known leaks. Should vacuum not be maintained, check for leaks with Nitrogen gas at a suitable pressure prior to charging.

系统必须维持足够的真空度，这样在充注制冷剂时不会出现泄漏现象。如果系统已有泄漏，决不允许再充注制冷剂。如果系统不能保持真空状态，那么在充注制冷剂前，用氮气在一定压力下检漏。

Installing a liquid line drier and a sight glass in a refrigeration system is sound engineering practice. The liquid line drier will ensure all refrigerant supplied to the refrigeration system is clean and dry. The sight glass is a useful device to ensure sufficient refrigerant is supplied to the refrigeration system.

制冷系统中安装液路干燥器和视液镜是比较好的工程应用。液路干燥器可以确保系统中的制冷剂是干净及干燥的。视液镜用来检查系统中是否有足够的制冷剂。

Refrigerant charging shall be in liquid form at the high-pressure side of the system such as condenser or liquid receiver. If the refrigerant charging must be carried out through the suction side of the compressor, charge in vapour form only.

采用液态制冷剂进行充注，一般在系统的高压侧，比如在冷凝器或储液器。如果必须在压缩机的吸气侧进行充注，必须以气态的方式充注。

Double-check all field wiring connections and factory terminals. Factory connections can vibrate loose during shipment. Ensure correct fan motor rotation, airflow is induced from coil side and forced out of fan motor side. Fan motor with thermal protection, the reset time is about 1 hour. If motor abnormal stalled, please check whether it is a thermal protection action.

由于运输可能导致工厂接线松动，请再次确认出厂前的接线及现场的接线。检查风扇马达的运转方向是否正确，气流是否是从盘管处吸入，从风机侧排出。风扇电机自带热保护功能，热保护后的复位时间约为1小时。如风扇电机非正常停转，请在报修前先检查是否为热保护动作。

Check the room thermostat for normal operation and adjust if necessary.

检查库房的温控器是否运行正常，有必要时可对参数进行调整。

### Advisory Defrost Guidelines

### 除霜指南

In order to maximize efficiency and airflow, the following advisory defrost data has been compiled. Defrost data is minimum number of defrosts required per 24 hrs for average room loads.

为了能使客户在使用我公司蒸发器时得到最高的效率和最大的风量，建议根据以下除霜参数进行除霜。

|                                 |     |     |     |     |     |     |
|---------------------------------|-----|-----|-----|-----|-----|-----|
| SST 饱和吸气温度                      | -42 | -36 | -30 | -24 | -18 | -12 |
| DEFROSTS AT MAX. KTD 最大温差下的除霜次数 | 9   | 8   | 7   | 7   | 6   | 6   |
| DEFROSTS AT 6KTD 6K 温差下的除霜次数    | 6   | 5   | 5   | 4   | 4   | 4   |
| DEFROSTS AT MIN. KTD 最小温差下的除霜次数 | 6   | 5   | 4   | 3   | 3   | 4   |

Advisory defrost timing for -18°C room

建议的除霜时间 (-18°C 冷库)

| KTD<br>温差 | LIGHT LOAD<br>轻负荷 |   | HEAVY LOAD<br>重负荷 |   |   | LIGHT LOAD<br>轻负荷 |   |   |
|-----------|-------------------|---|-------------------|---|---|-------------------|---|---|
|           | 1                 | 2 | 3                 | 4 | 5 | 6                 | 7 | 8 |
| 10        | X                 | X | X                 | X | X | X                 |   | X |
| 8         |                   | X | X                 | X | X | X                 |   | X |
| 6         |                   | X |                   | X |   | X                 |   | X |
| 4         |                   |   | X                 |   | X |                   |   | X |

Each column represents a 3-hour period during the day. An X indicates the hour that a defrost should commence. "Heavy Load" represents the nominal 'working period' of each day.

每列代表了每天时段中的 3 个小时。X 显示了除霜应该开始的时间。"重负荷"显示的是通常意义上每天的“工作时段”。

## a) Defrost Termination Requirements

Defrost time for average loads should be approx. 20 - 25 minutes including drainage. Time will vary with varying degrees of ice buildup.

Time Termination – should be set to ensure complete defrost at the heaviest load condition. Typically allow 25 - 30 minutes with safety reset at 35 minutes.

**Fan Delay Requirements** – may vary with application, conditions and control method, but should not be more than 5 minutes.

**Coils** – 4FPI (for Low Temp.) and 6FPI (for medium Temp.) coils (standard coils), should be operated to the above guidelines unless otherwise indicated on the installation concerned.

## a) 除霜终止要求

对于正常负荷的系统来说，平均的除霜时间大约为 20-25 分钟（包括滴水时间）。这个除霜时间将随着结霜的程度有所变化。

**时间终止**—时间终止是为了能够保证在最重负荷的情况下仍然能够除尽盘管上的霜。通常的时间设定为 25 - 30 分钟，安全关断时间为 35 分钟。

**温度终止**—温度终止的设定主要根据除霜的频率和结霜的状况，另外还取决于温度传感器/温度开关的位置。如果使用的是电子除霜控制器，对于每个安装环境下的冷风机，其温度终止的设定点必须单独确定，设定点应不低于 12°C 切断。温度传感器的位置应根据各个不同的安装环境进行优化摆放。将传感器放置于盘管上时通常需要更高的设置点，一般为 20 °C 或者更高。

**压力终止**—可采用多种方式用于除霜。不论采用何种方式，必须注意翅片表面的温度总是比制冷剂饱和压力对应的温度要低，应此，必须考虑在设定压力控制时，制冷剂的温度设定要高点。请参看下面的表。西克制冷不推荐通过压力来控制风机延时，因为在采用热力膨胀阀的系统中，当风机停止时，除霜结束后系统迅速进入低压状态。对风机延时控制上，建议对采用压力中止的除霜方式基础上采用时钟。

**电加热丝热保护**—百尔生产的冷风机标准产品中不带电加热丝热保护装置。客户负责安装合适的该保护装置以防止在控制器和传感器失灵的情况下，由于过高的温度和压力引起的冷风机及周围环境的过热。

**风机延时要求**—风扇延迟需要根据不同的应用场合而定，但一般来说不应超过 5 分钟。

**盘管**—4FPI(低温) 和 6FPI(中温)盘管(标准盘管) 除非有特殊安装指示，一律按上述的指导进行安装运行。

## b) Control Setting Guidelines

Each application should be treated on its merits, however the following is given as a guide. During the commissioning, this data should be used as a reference initially. It is then necessary to fine-tune the control settings to achieve the satisfactory defrost results.

| Termination Type<br>终止方式 | Sensor Location<br>传感器位置   | Setting<br>设置            | Fan Delay<br>风机延时        |
|--------------------------|--|--------------------------|--------------------------|
| Time<br>时间               | n/a<br>无   | 25 – 30 mins<br>25-30 分钟 | 5 mins (max)<br>5 分钟（最长） |
| Temperature<br>温度        | Position & temperature settings must be determined for individual case<br>根据不同的应用，设置不同的传感器位置和温度控制点 |                          |                          |
| Pressure (Gauge)<br>压力   | Header<br>集管   | 770-790kPa R404A         | n/a<br>无                 |
|                          |  | 800-820kPa R507          | n/a<br>无                 |
|                          |  | 630-650kPa R22           | n/a<br>无                 |
|                          |  | 690-710kPa R407C         | n/a<br>无                 |
|                          |  | 340-360kPa R134a         | n/a<br>无                 |

The above guidelines allow for relatively heavy defrost loads. Shorter times or lower settings must be verified on the installation. Pressure termination given for R407C and R404A corresponds to the mid-point at the required temperature. Refer to the applicable Beijer Ref Pressure / Temperature Chart.

All data given is for defrost without refrigerant pump down.

Pump-down is not recommended for electric defrost using pressure and/or temperature control. There is clear evidence in testing that positive defrosting of the distributor, leads, header and suction line cannot be achieved without refrigerant being present in the coil. Additional means, such as heater tape around these components, may be needed if using pump-down.

Longer defrosting time and / or more frequent defrosting may also be necessary to ensure long-term ice built up does not occur.

Pump-down may be used with time termination. The defrost time will be longer and requirements must be determined on individual systems.

Data above based on R507/R404A refrigerant. For other refrigerants, it may be necessary to vary the number of defrosts per day to maintain efficient performance.

## b) 控制设置

不同的应用需区别对待，请遵从下面的安装指南。在开机调试时，下面的参数应作为首选参考值，然后根据实际做相应的调整，达到最佳的除霜效果。

上面的设置参数同样适用于重除霜负荷的工况。在安装时必须修改时间及温度设定。对 R407C 和 R404A 压力设定点取要求温度对应的中间点。具体请参看百尔的压力温度对应表。

所有给定的除霜参数在无抽空循环的情况下的。百尔制冷不推荐在抽空情况下使用电加热化霜的方式。根据我们多年积累的经验，分液器、分液管、吸气集管上的霜如果在盘管内没有制冷剂存在的情况下是很难除掉的。可能还会需要其它诸如在这些零部件上加装发热管等辅助方式。

可能还必须采用延长加热时间，提高加热次数的方法以避免霜堵。

抽空最好和时间中止一起使用。除霜时间会相应变长。

上面的数据是基于R507/R404A 制冷剂的。对于其他制冷剂，百尔建议变化每天的除霜次数来最佳的除霜效果。



## Routine Maintenance of Unit

All Flexcold Low Profile Evaporators are designed to have low service maintenance requirements. Based on normal operation conditions and working environment, a service maintenance schedule shall be established after the successful completion of commissioning, to ensure the evaporators operate efficiently and running costs are kept at a minimum. The following items shall be checked and recorded during service maintenance

- Visually inspect the evaporators looking for corrosion, unusual vibrations, oil stains and drain tray blockage. The drain tray should be cleaned regularly with warm soapy water.
- Clean the evaporator fins by using a soft brush, low pressurized water and/or commercially available evaporator coil cleaner. Never use an acid based cleaner. Follow label directions for appropriate use. Flush and rinse coil until no residue remains.
- Coils supplied with 'Koil Kote' need special care so as not to damage the coating. The coils should not be cleaned with strong Alkaline Cleaners and/or with stiff brushes. Mild soapy solutions that are well rinsed after cleaning should be satisfactory.
- Check that each fan rotates freely and quietly, fan guards are free of airflow obstructions and fan screws are tight.
- Inspect electrical wiring, connections and components looking for damaged wiring, loose connections and worn components.
- Check that all coil heaters are in their original positions and properly secured, and that drain tray heater is in proper contact with the tray and located by the brackets.
- Ensure even coil frost formation pattern on the air off (fan) side of the coil during operation. An uneven frost pattern may indicate a distributor blockage or incorrect refrigerant charge. The air on side tubes may contain superheated vapor and may not frost completely.
- Look for abnormal accumulation of ice patterns and adjust the defrost cycles accordingly.
- Check the superheat and adjust TX valve accordingly.

## 设备的日常维护

所有Flexcold冷风机都是基于维护较少的前提下设计的。根据正常的运行工况和环境，在调试成功后，应准备一份维护时间表，以确保冷风机在最佳效率下运行，同时保证运行成本最低。在做维护时，请检查并记录下列各项参数：

- 检查冷风机是否有腐蚀，不正常的振动，油堵及排水管脏堵。排水管需要经常用温肥皂水清洗。
- 用柔软的刷子清洗冷风机翅片，用低压清水冲洗盘管或者用市面上买得到的盘管清洗器。禁止使用酸性清洗剂。请遵循标识的使用指南。冲刷盘管直至无任何残留物。
- “Koil Kote”盘管需要特殊注意，不要破坏其涂层。不要用碱性清洁剂或坚硬的刷子来清洗这类盘管。清洗后最好用中性肥皂水进行冲淋。
- 检查每个电机风扇转动是否正确，风扇罩是否有堵塞，螺栓是否拧紧。
- 检查电线，接头及其他元件是否有电线损坏，接线是否松动，元件有无磨损。
- 检查所有的盘管加热丝是否在原始位置，是否安装牢固，检查积水盘管的电加热丝是否和托盘接触良好，位置是否在托架上。
- 在运行时检查在排风侧盘管上的结霜是否均匀。不均匀的结霜说明分液头有堵塞物或者制冷剂充注的不正确。在吸风处的盘管上可能因为有过热气体而无任何结霜现象。
- 寻找不正常的结霜状况，根据情况调整除霜循环。
- 检查过热度，相应的调整热力膨胀阀。

All power must be disconnected before cleaning and/or service maintenance. The condensate drain tray also serves as a cover of hazardous (hot, cold, electrical and moving) parts. Operation of evaporators without condensate drain tray constitutes a safety hazard.

在清洗和维修时必须断电。积水盘也是需要维修的部件（热，冷，电气及运动部件）。如果冷风机在不安装积水盘情况下运行是存在安全隐患的。

The service maintenance record as well as this "Flexcold Low Profile Evaporators Handbook" shall be kept together in a safe place as a future

维护记录和"Flexcold 小型冷风机的操作手册" 应好好保管以便将来做参考。

## General Decommissioning Guide

## 关机指南

In order to remove the evaporator from its mounting place, the following procedures need to be carried out professionally by qualified personnel. Failure to do so may result in personal injury or death, property damage by fire or explosion. Discharge of refrigerant to atmosphere is illegal and may result in heavy fines by relevant regulatory authorities.

将冷风机从原来的安装位置移走，必须由专业的制冷技工遵循下面的程序来进行拆卸。不遵循该程序将引起操作人员受伤或死亡，并且由于失火或爆炸引起财产损失。直接将制冷剂排放到大气中是不合法的，并且会受到监控部门的严厉罚款。

- Pump down the entire refrigerant charge into the liquid receiver or appropriate container such as reclaim cylinder, and shut related valves. All reclaimed refrigerant that is not re-used must be taken to an approved refrigerant recycling or destruction facility.
- Disconnect the power supply. Remove all necessary field electrical wiring and related components, leaving the earth wire to the last.
- Disconnect the drainpipe.
- Care must be taken when de-pressing the Schrader valve core in order to balance the pressure between the evaporator and ambient. There may be a small amount of refrigerant trapped in the oil, the pressure rise in the evaporator will boil and vaporize the refrigerant resulting in a potential personal injury hazard.
- Cut and solder seal the refrigeration liquid line and suction line pipe connections.
- Remove the evaporator from its mounting place. Adequate support must be provided to hold the weight of the evaporator. The use of weight lifting equipment is highly recommended whenever possible.

- 将全部充注的制冷剂抽到储液器或合适的储液罐，如回收钢瓶，同时关闭相应的阀件。所有回收的不能再用的制冷剂必须送往合格的制冷剂再利用或销毁处。
- 切断动力供电。移走所有不要的现场接线，相应的电气元件，最后切断地线。
- 断开排水管
- 为了平衡蒸发器和外界的压力，在打开针阀阀心时必须特别小心。在润滑油中溶有一定量的制冷剂，当冷风机的压力上升时制冷剂就会沸腾并挥发，这可能会导致人员受伤。
- 切断，并密封液管和气管的接头。
- 将冷风机从安装位置移走。当需要时，建议采用起重设备。

## Material Safety Data Sheets – M.S.D.S.

These are available from your nearest Beijer Ref Branch for all refrigerants that this range of evaporators are approved for.

### Important Note

- To ensure Flexcold Low profile Evaporators operate efficiently and for a long working life, always obtain genuine replacement parts from your local Beijer Ref Branch. Genuine replacement parts are covered by the warranty. Refer to the Standard Terms & Conditions of Sale in the Price Guide for warranty statements.
- Continuous product improvement is our company policy. Beijer Ref reserves the right to make changes in product specifications and/or this instruction manual without notice.

## 制冷剂安全数据表-M.S.D.S

从就近的百尔办事处获取冷风机所使用的所有制冷剂的数据表。

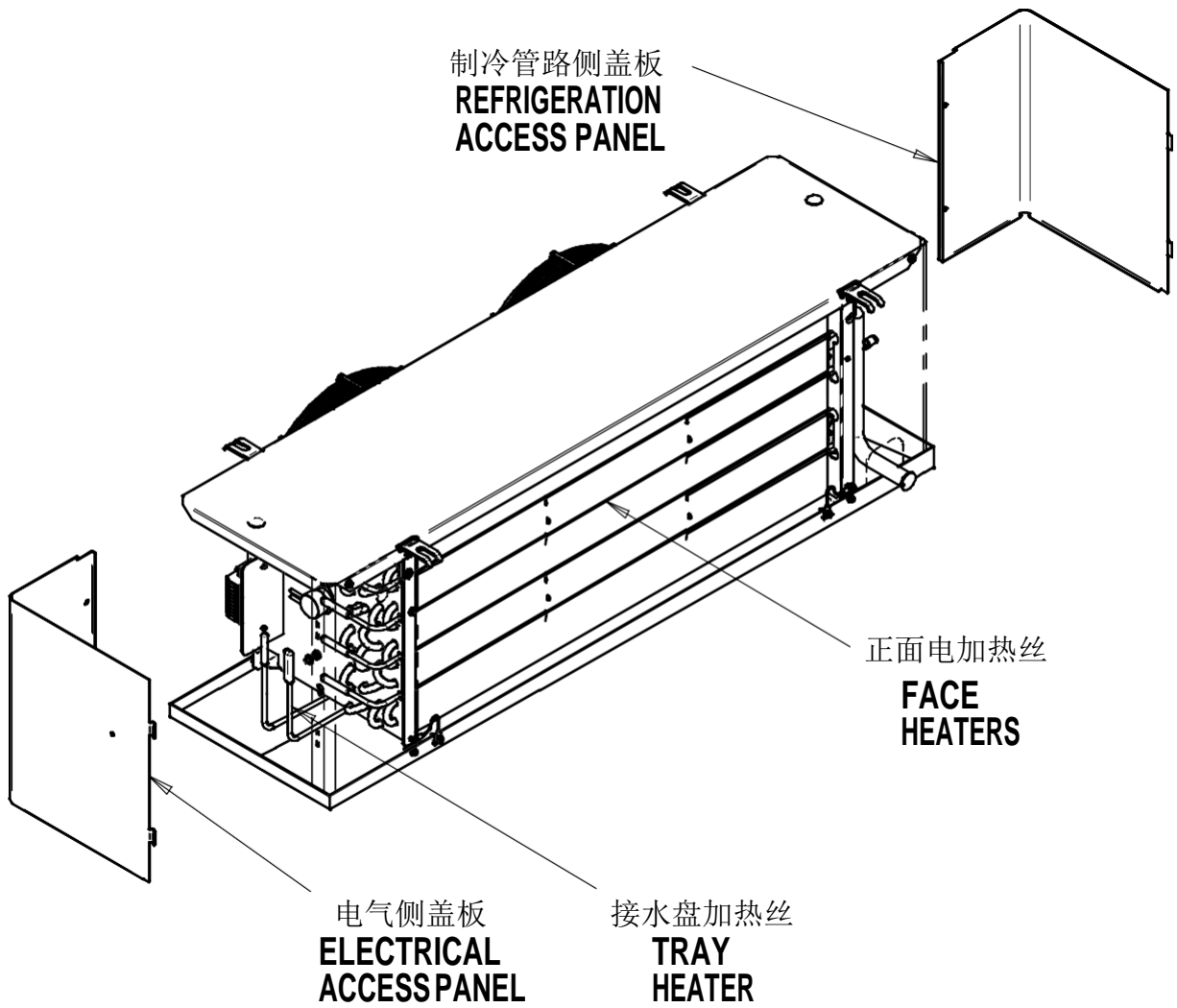
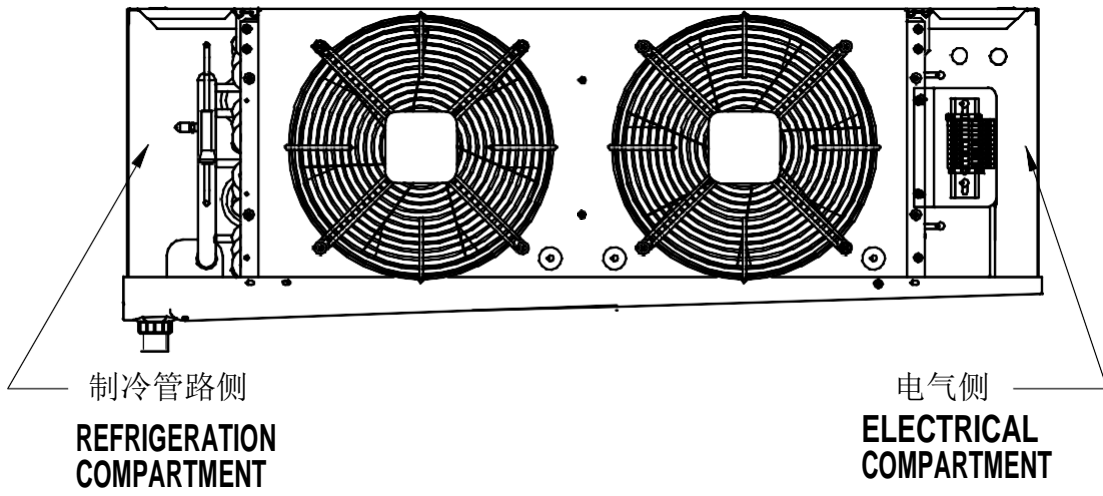
### 提示

- 为了确保Flexcold小型冷风机运行经济，使用寿命长，请向当地的百尔办事处采购原装的配件，并且这些配件也是有一定的质保期的。对质保期的详细描述请参看西克标准销售合同。
- 不断的改进产品是我们公司的宗旨。百尔保留对未经许可对我司产品及操作手册改动的最终解释权。

Beijer Ref is dedicated to providing safe products and protecting the environment by complying with all applicable national laws and regulations governing environmental protection. New and used refrigerants cannot be vented into atmosphere. Reclaim all used refrigerants.

百尔制冷致力于提供安全，并且符合国家法律及环境保护法规的制冷产品。新的或者使用过的制冷剂是不可以直接排放到大气中的，回收所有使用过的制冷剂。





Beijer Ref reserves the right to alter its products without notice, more information please contact with sales and visit Beijer Ref website.

百尔制冷（无锡）有限公司对手册中出现的各类技术参数保留自行更改而不事先通知的权利, 保留此手册的最终解释权, 更多信息, 请联系销售人员或百尔制冷网站

<http://www.beijerref.com.cn>

Beijer Ref (Wuxi) CO. LTD  
百尔制冷（无锡）有限公司

**BEIJER REF**

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