无锡雷曼换热设备有限公司

Wuxi Lehman Heat Exchanger Equipment Co.,Ltd

板式换热器使用说明手册

OPERATION MANUAL FOR PHE

（2016 年版本）

目 录

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第一章　致用户

尊敬的用户

当您需要使用您的雷曼板式换热器时，这本指导说明手册就是您直接的向导，雷曼公司提醒您仔细阅读这本指导说明手册，尤其是直接对此设备进行安装、维修以及操作的人员。 对于用户不按手册的指导操作而造成任何设备损坏，雷曼公司概不负责。

如果您的板式换热器出现了本手册范围以外的特殊故障，请您及时与雷曼公司联系，雷曼公司将会给您一个满意的答复。

The Section 1 To user's Attention

Dear user:

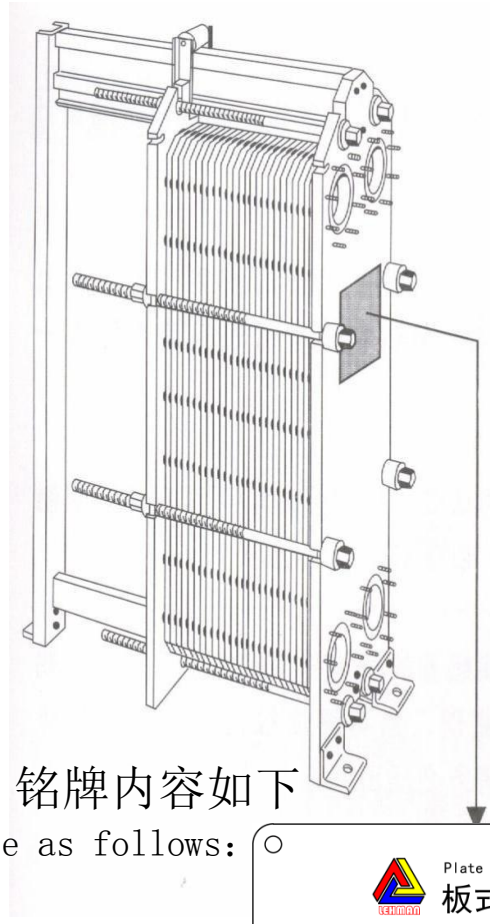
This operation manual for plate heat exchanger should be looked upon as your indispensable guide when adopting plate heat exchangers made in Lehman。You are advised that this manual should be red carefully. It is suitable for installation, maintenance of equipment and operators of equipment. It should be well preserved during the early days of ordering.

Lehman Company will not held responsible for any damage occurred without act in comply with the instruction of this operation manual.

If unexpected failure of PHE happened beyond the scope of this manual, please contact with Lehman's service official, satisfied reply will be certainly offered to you.

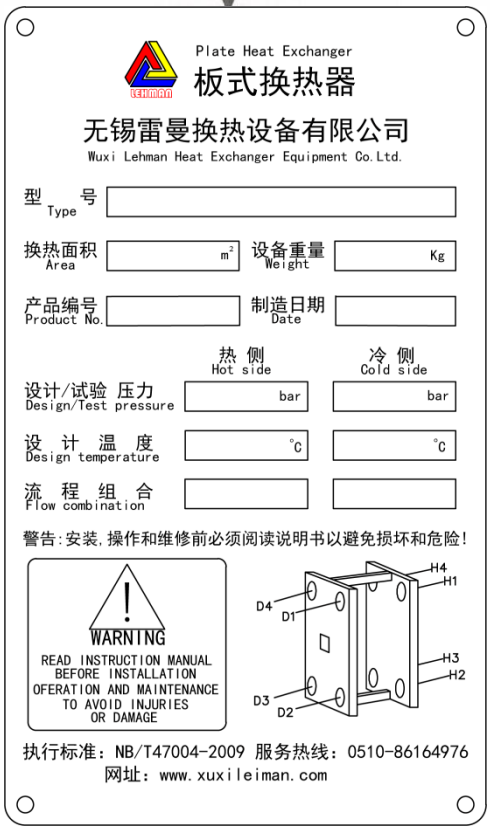
第二章 铭牌与设备的标志

The Section 2 Nameplate and Marking of Equipment



设备上带有铭牌，铭牌内容如下

Contents of Nameplate as follows：



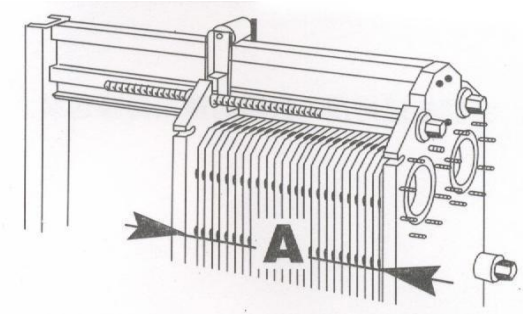
第三章 总则

Section 3 General Requirement

存放

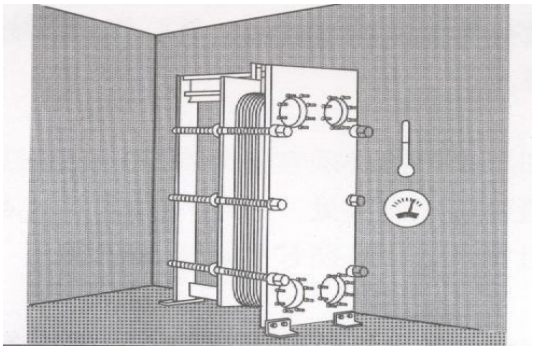
Storage

在本章中，首次提到换热器各零部件的名称，具体参见第四章第一部分
For this section, each part of PHE which first mentioned, See the first part of section 4 for details.



1. 除另有协议外，雷曼公司供货的板式换热器到货后即可投入使用。设备的夹紧尺寸为图中A尺寸。

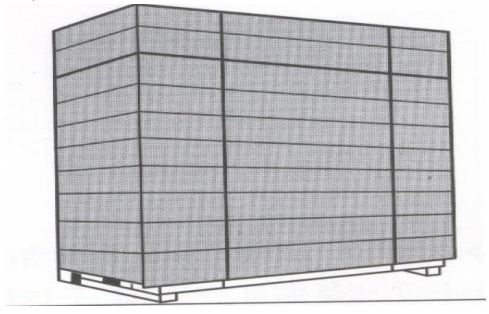
1、May be immediately put into ope -ration Unless agreement in stipulated fastening dimension shown as A size of figure.

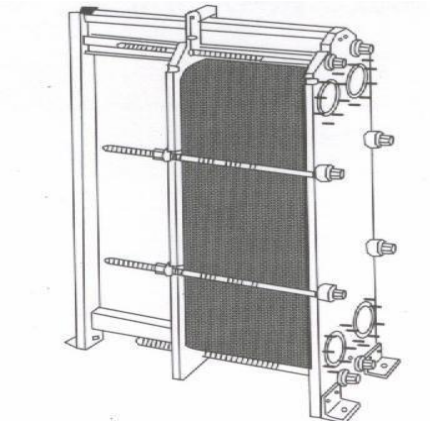


2. 换热器最好存放在室内，温度保持在 15－20℃，湿度约70%。
请注意： 在室内放置换热器时，室内绝对不能存放可 以产生臭氧的设备，因臭氧对许多橡胶材料
有破坏作用(裂纹) 。

2.PHES should best be stored in indoor store house, maintaining the temperature of 15~20℃ ,humidity appr.70%.
Please be attention:
When dopting indoor storage, it can not be allowed to store any equipment which releases Ozone, because, it arises aged deterioration to rubber materials (fis sures)。

3. 换热器安装前最好放置包装箱内。
3. Before installation, PHES should be best packed in wooden case.

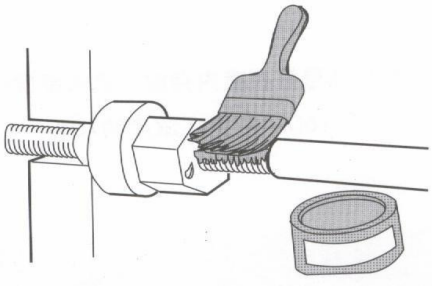




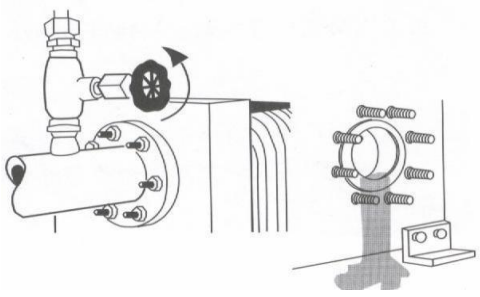
4. 换热板最好用不透明的塑料薄膜包装。

4. PHES should best be packed with non_transparency plastic film.

5. 锁紧螺栓表面应涂刷质量较好的防锈油。如不与管道系统联接，其联接螺栓处应刷防锈油。 如果换热器必需在室外存放，上述注意事项更应严格执行。



5、Surface of fastening bolts should be coated with high quality of antirust coat. If PHES is not coupled with piping line system, location of connecting bolts should be coated with antirust coat If PHES have to store in outdoor, the above regulations must be followed strictly。



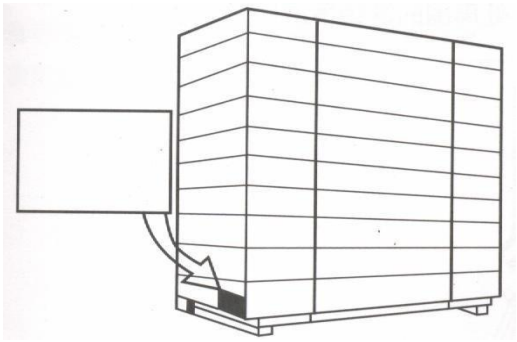
6. 同样，如果换热器因某种原因而停车或停止运转时间较长，即使设备没有移动，也应按上述建议对设备进行保护。 换热器应排空，并且根据所处理的介质不同， 建议在设备存放之前，对其进行清洗干燥。

6. Long time of running, even though they are not removed, the suggestions must be carried out。
PHES should be discharged out。
According to properties of circulating media, before storage, cleaning and drying should be done.

装箱单与开箱
Packing List and Open case

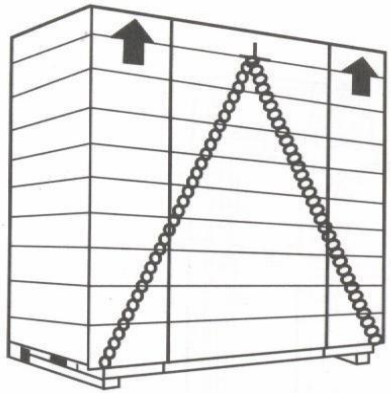
货物附有装箱单。 请根据装箱单对所有零件进行核对，对易损件 搬运时应注意防护。

Enclosed with packing list。
All parts should be checked with packing list。
All delicate parts should be well reserved when handling.



起吊与提升
Hoisting and lifting

板式换热器的起吊
PHE Hoisting



吊运不开箱的包装箱时，请注意箱上吊钩位置的指示记号。货箱的重心十分重要，通常在箱顶面有标记，真正的重心在此标记下面的垂直线上。

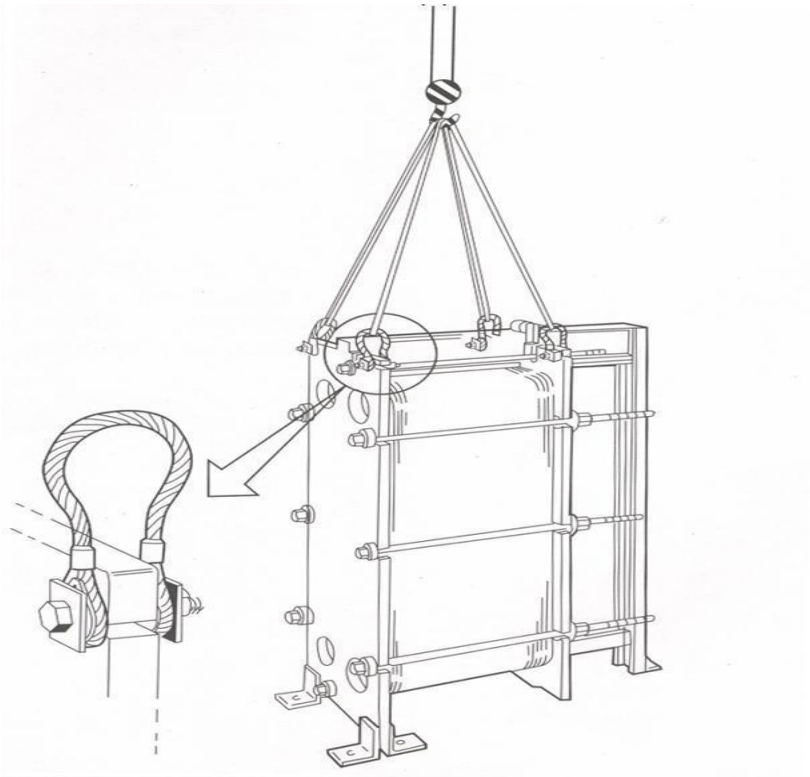
When hoisting the wooden case, please be attention to the sign of hook. It’s very important for center gravity of wooden case. Generally, the mark on the top of case。

雷曼板式换热器型号（PHE TOPE)： M032-D,M050-A,M050-C,M050-D,M065-D,M100-A,M100-C,M100-D,M150-B,M150-C,M150-D,M200-B,M200-C,M200-D,M250-B,M250-C,M250-D,M300-D

LEHMAN PHE-Type： M032-D,M050-A,M050-C,M050-D,M065-D,M100-A,M100-C,M100-D,M150-B,M150-C,M150-D,M200-B,M200-C,M200-D,M250-B,M250-C,M250-D,M300-D

如果只是吊运换热器，应使用用吊索，其吊索应套在吊眼上，如图所示。

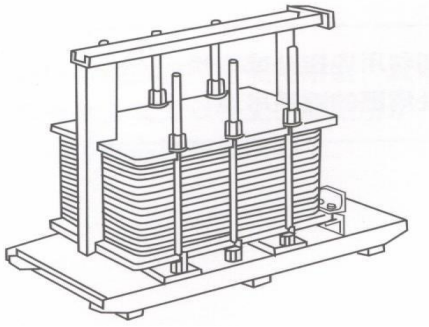
When PHE lifting, applicable sling should be used, shown as the figure。

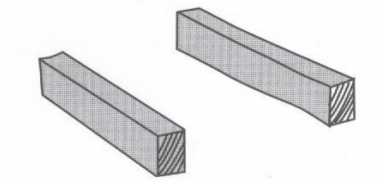


板式换热器的提升
PHE Lifting

1. 移开外包装及支承脚。

1. Unload the wooden case and supporting。



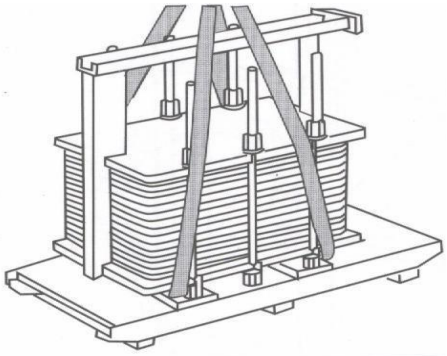


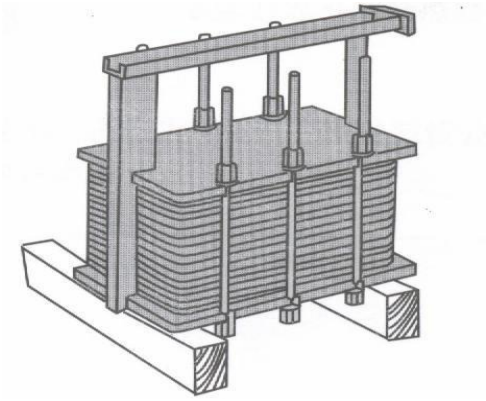
2. 在地上放两根木方条。

2. Put two pieces of wood on the floor.

3. 用吊索将换热器吊离托板。

3. Lifting PHE from pallet with sling.



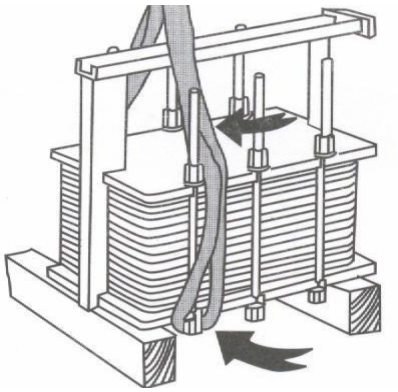


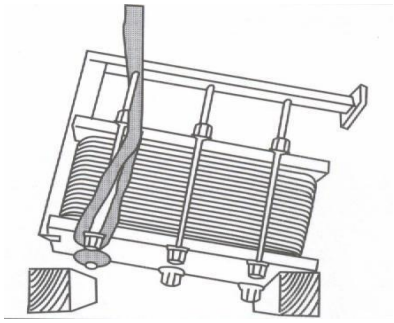
4. 将换热器放在两根木方条上。

4. Put PHE on the two pieces of wood.

5.将吊索绕在两边各一根锁紧螺栓上。

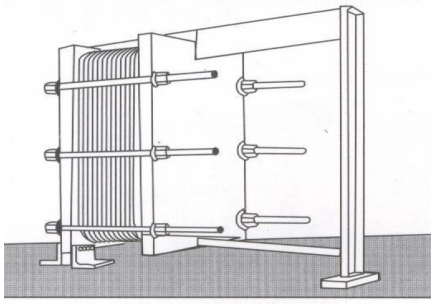
5. Sling locks with locking bolt.





6. 将换热器从木方条上吊起。

6. Lifting PHE from two of pieces wood。



7. 将换热器水平放在地面上。

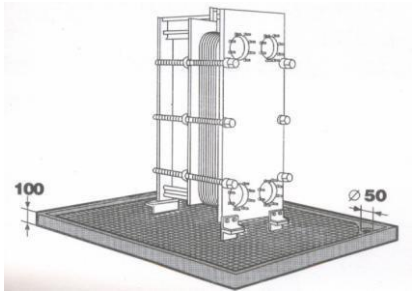
7. Put PHE on the horizontal floor

基础与安装

Foundation and Installation

基础

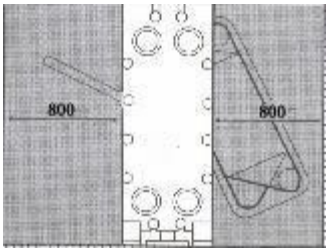
设备基础所需所有资料在雷曼公司的随机文件中提供。 有时，将换热器安置在一个排水箱上更为适用，排水箱的容积与换热器的容积相同，排水箱的进水口的直径不应小于 50mm。



Foundation

Foundation requirements see the enclosed document Sometimes, PHE may be installed on the drainage water tank. The water capacity of it should be equal to PHE volume. Water inlet D.Can not be less than 50mm.

安装
Installation



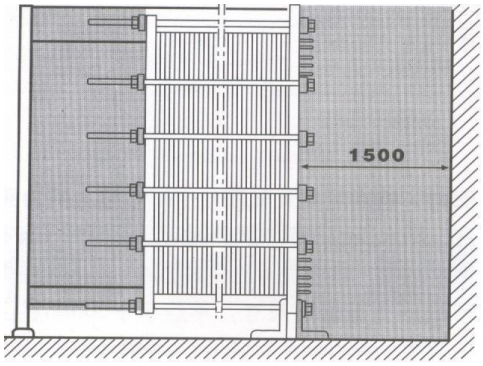
图为换热器拆卸所推荐的间距
Recommended PHE disassembly space shown as the figure

在进行换热器与管道联接之前，务必将管道中的所有杂物清洗出去！ 从雷曼公司提供的尺寸图与图中可以看出， 在设备周围留有足够的空间作为通道和将来 设备检修之用。除了换热器拆卸换热板时需要放置换热板的空间外，设备维护不需要更 多的空间。

Before PHE and pipe line connecting, foreign mathers in piping must be cleaned out ! PHE surroundings should be maintained enough space used for passageway and maintenance in the days to come。

请注意 图中给出的尺寸为雷曼公司推荐尺寸，以保证 设备安装及维护时，有合理的空间。如果地方 受限制，推荐尺寸可以减少，具体留出多大通 道用户自己决定。

Please be attention:
The size in figure should be looked as the recommended dimension used for installation and maintenance in a reasonable space. If the area is limited, the recommended dimension may be reduced by user。



图为固定安装应留出的距离
Maintaining space for fixed installation shown as figure

管道
Pipe line

进行换热器与管道联接时，切勿使换热器与管道系统之间产生应力。

When PHE and pipe line connecting, it can not be allowed to arise stress between PHE and piping system。

切断阀
Stop valve

为了能在必要时打开换热器，换热器上所有连接处都应装上切断阀。

In order to open the PHE at urgent situation, all connecting location of PHE should be equipped with stop valves。

第四章　板式换热器主要组成及功能

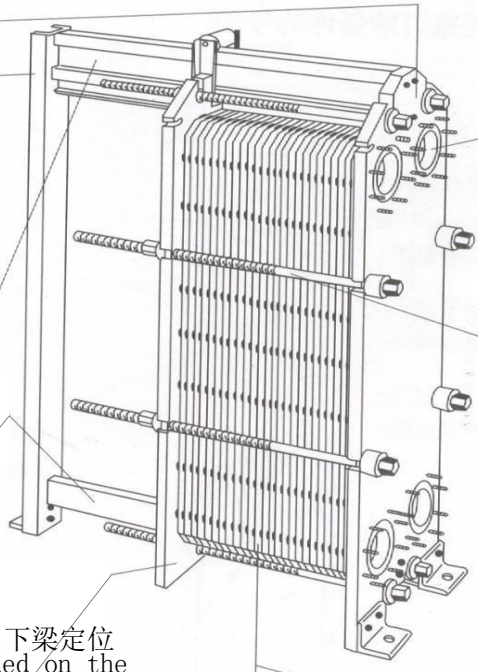
Section4　PHE Main structure and Function

功能

Function

雷曼公司的板式换热器中，热能通过一种压制成特殊波纹的薄金属换热板组，从一侧介质传递到另一侧介质中。

PHE built up by Lehman Company，heat energy can be transfered by combined plates that pressed by special metal, from one side of medium to another。



1. 固定板
1. Framplate
2. 支柱
2. Guide Support

上梁、下梁悬挂在固定板与支柱上，多数情况下，管道是连接在固定板上的。
Top bar and bottom bar are suspended on the frame plate and guide support. Generally, Pipe lines may be connected with the frame plate.

3. 上梁
3. Top Bar

4. 下梁
4. Bottom Bar

悬挂在上梁上的换热板片下端由下梁定位
Heat transfer plates suspended on the top bar may be fixed according to the end of plates。

5. 活动板
5. Pressure plate

活动板同换热板片一样，也悬挂在上梁，并且是可移动的，有时管道可连接在活动板上。
Pressure plate as the same as the heat transfer plates may be suspended on the top bar and may be removed. Sometimes, it may be connected with pipe lines.

6. 接口
6. Nozzle

介质通过固定板上与管道区配的开孔进入换热器。开孔周围的螺栓将管道固定与换热器上。根据应用情况，孔口周边可用金属的或橡胶的衬套加以防腐保护。
Media can be flowed into PHE from entrance of the frame plate; pipe lines may be connected with PHE by bolts around the entrances.

7. 夹紧螺栓
7. Fastening Bole

8. 换热板
8. Heat Transfer plate

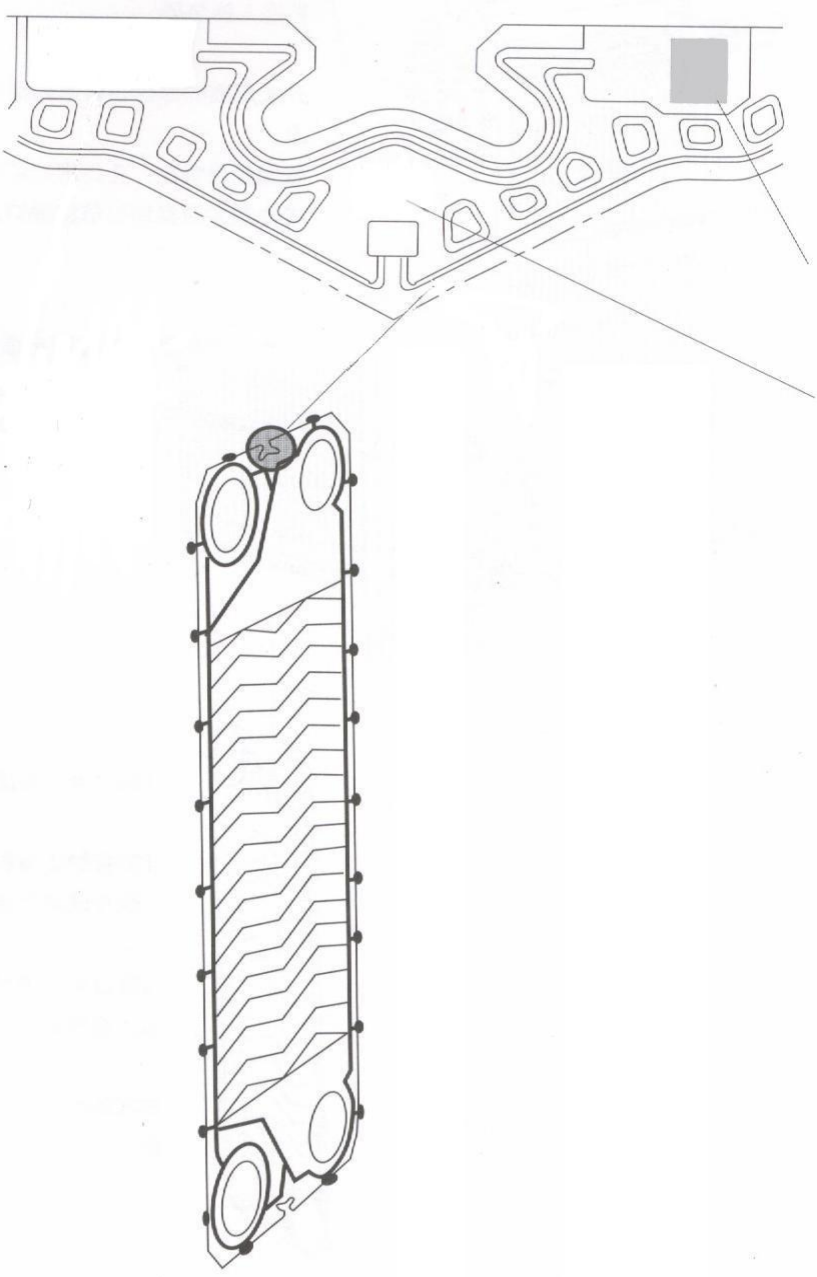
换热板也称为“通道板”。
Heat transfer plates also named as “passage channel plate”。

9. 垫片
9. Sealing Gasket 垫片沿着换热板的边沿和孔口的沟槽卡住，垫片通 常为橡胶材质。除了一些角落以外，热传递是在垫 片内的表面上时行的。换热器上的换热板的板片数 由所需要的换热面积确定。
Sealing gasket may be clutched along slot of heat transfer plate. Commonly, it adopted with the material of rubber. Heat transfer conduction is generated on the surface of sealing gasket except for corner area Numbers of heat transfer should be determined in accordance with the requirement of heat transfer area.

换热板
Heat transfer plate

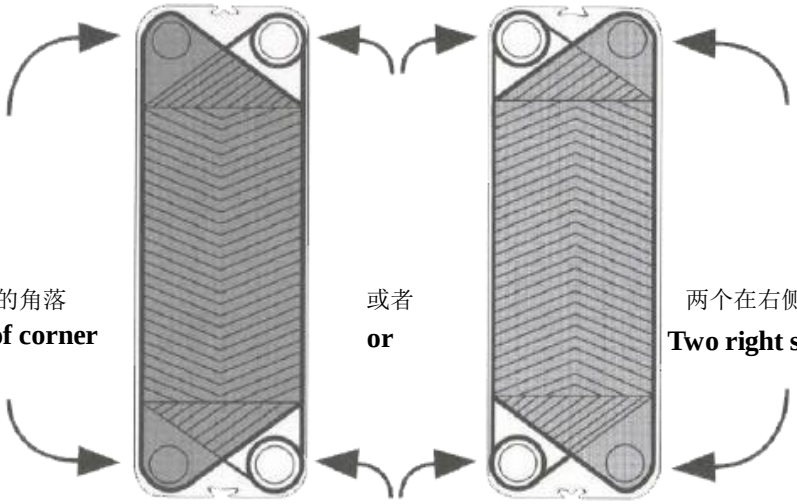
换热板和垫片是板式换热器的特殊部件，需要进行详细介绍。

Heat transfer plate and sealing gaskets are belong to special components of PHE. It is necessary to indicate them in greater details.



如图所示：在竖直悬挂的换热板上，垫片放置在沟槽里，沟槽所包含的区域即为传热面。

As the figure: For the shape of vertical suspension of plate, sealing gasket is placed into slot of plate to form the area of heat transfer.



两个在左侧的角落
Two left sides of corner

或者
or

两个在右侧的角落
Two right sides of corner

围绕另外两个角的小圆环

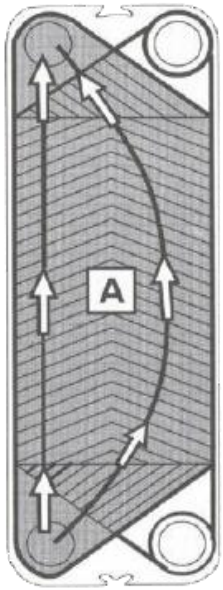
Small Ring around other two corners

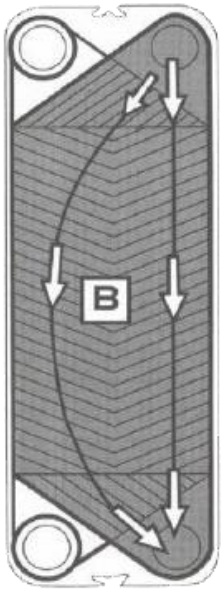
我们决定根据这两种情况来命名金属板

The metal plate is named as these circumstances

悬挂的金属板带有向上的“人字形”波纹时，称为 A 型金属板

The metal plate with the upward herring bone waviness is named as metal plate A



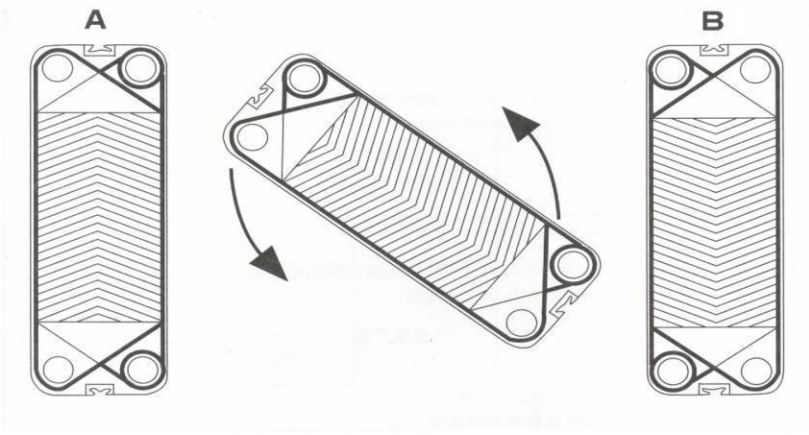


悬挂的金属板带有向下的“人字形”波纹时，称为 B 型金属板

The metal plate with the down ward herring bone waviness is named as metal plate B

如果将 **A** 型换热板颠倒过来，所得到的将是 **B** 型换热板

If reverses the order of plate A, can form the plate B.

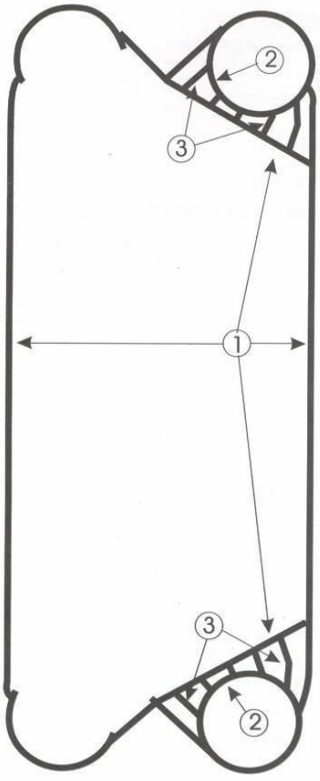


垫片

Sealing gasket

垫片是一个整体成型的，其材料一般为合成橡胶，是根据温度、化学环境以及其它条件综合考虑确定的。

Sealing gasket should be formed as per the forming procedure of integral construction. Generally, Synthetic rubber should be adopted as the material of sealing gasket. It is necessary to conside its temperature, chemical environment and other conditions to determine material selection.

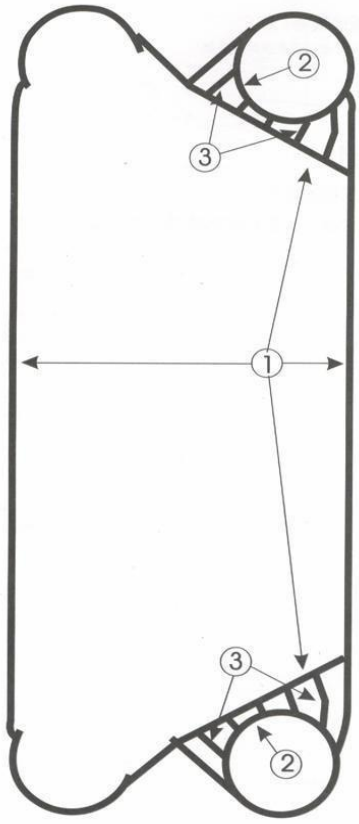


一体化的垫片，可分成下列三部：
1、一个大垫片
2、二个环形垫片
3、连接条

Integral sealing gasket can be divided into three parts:
1、One larger gasket 2
、Two ring type gasket
3、Connecting gasket

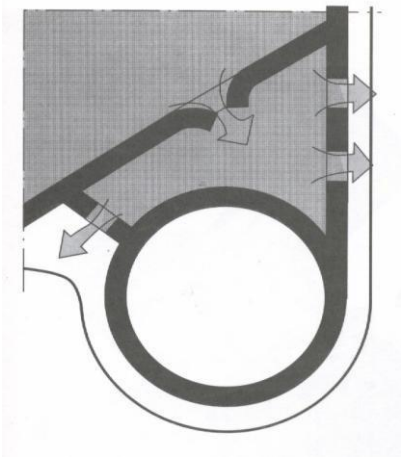
大垫片较大，它包括了整个传热面积和两个与之连接的圆角，而环形垫片则对其余两个圆角密封。

Larger gasket includes the total area of heat transfer and two connected round corners but ring type gasket seals the other two round corners only.



这三部份由一些短条连接为一体，这些短条不起密封作用，只是为了连接的目的，并且在一些地方增加一些支撑作用。对于多数板式换热器，其垫片都是用适当的粘结剂固定在换热板上。

These three parts are composed of shorter strips as the aim of connection some area need to increase the application of support. For the most plate heat exchanger, the sealing gasket may be glued on the surface of plate by applicable adhesive glue.



如图所示：环形垫片和大垫片将两种介质有效地隔离开。为防止在垫片和环形垫片相距较近的角落区两种介质互相混合，在连接条上留有一些槽也，使大垫片与环形垫片之间的角落区与大气接通。

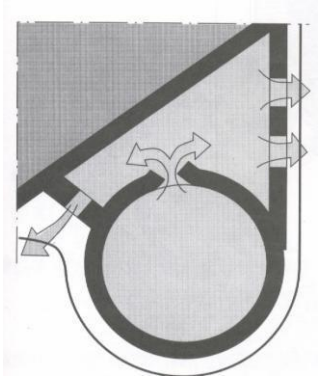
As the figure, ring type gasket and larger type gasket can effectively isolate the two kinds of media to prevent from mixture of two kinds of media adjacent corner area of ring type and larger type gasket. Slot hole of connecting strip can make air through the corner area between larger type gasket and ring type gasket.

这些槽孔决不允许堵塞，这是非常重要的。如果堵塞了，当遇到该金属板发生泄漏时，就有可能出现局部的压力升高，会使一种介质渗透到另一介质中并与之混合。

It is very important not to be allowed to blank off the slot holes. If the blockage happened, partial pressure may be increased when sign of leakage of metal plate and one kind of medium will be flowed to another medium side, generating the mixture of two kinds of media.

在搬运换热板时应注意不要把垫片弄断或划破。

Sealing gasket can not be allowed to fracture or scratch during PHE handing

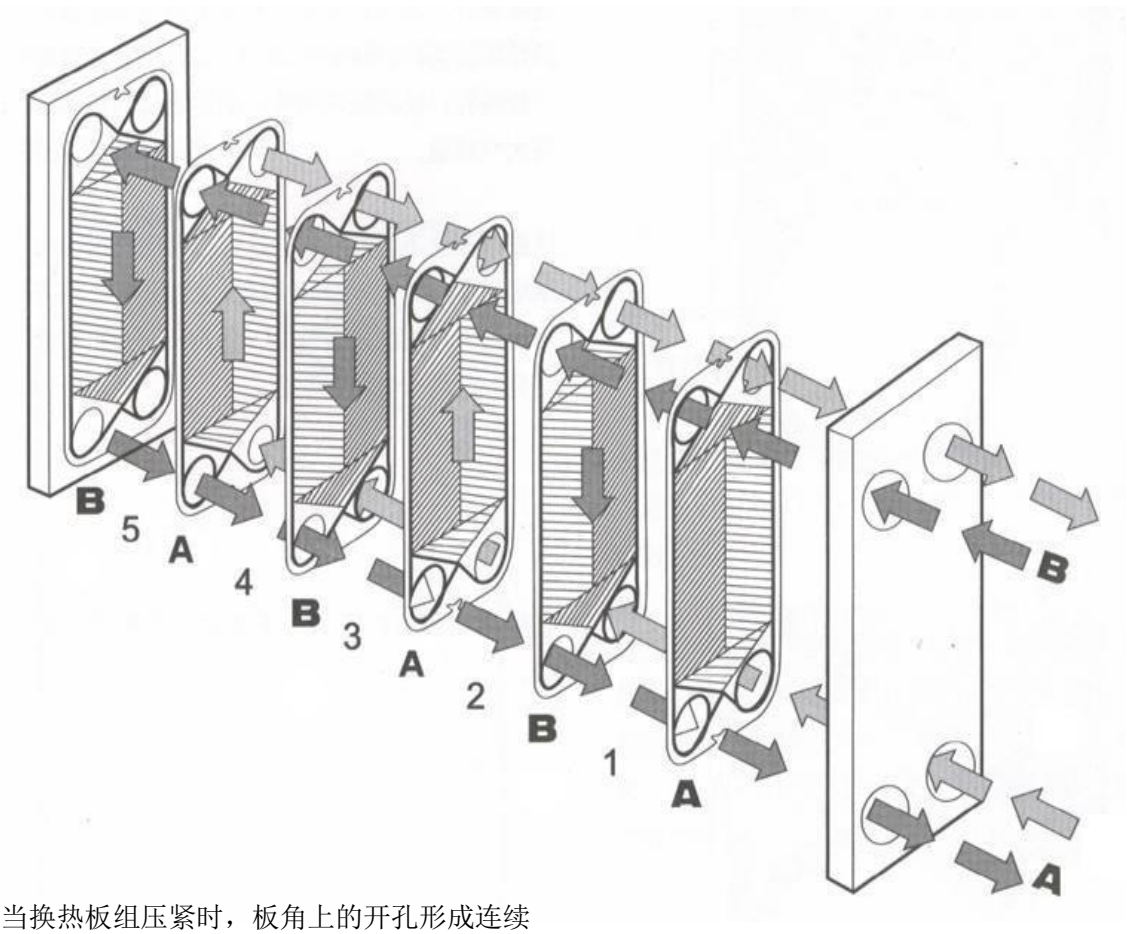


工作原理及热传递

Working Principles and Heat Transfer

工作原理

Working Principles



当换热板组压紧时，板角上的开孔形成连续的通道，将介质（参与热交换过程的介质）从进口处引流到换热板组中，并分配到换热板间的狭窄槽道中。

When fastening combination of plates, passage channel generated to make the medium (heat transfer medium) flow to combination of plates from the inlet of medium; distribute it to the narrow channel of plates.

由于换热板上配了垫片以及换热板“**A**”和换热板“**B**”的交替安装，两种介质进入换热板内的槽道，即热介质进入奇数槽道，而冷介质进入偶数槽道。

这样两种介质被薄薄的金属壁隔开。多数情况下，两种介质的流动方向相反。

Owing to reverse order of assembly of “plate A” and “plate B” alternately, two kinds of media flows into passage channels, i. e. heat medium flows into odd number channel but cold medium flows into even number channel.

Generally, two kinds of media flows in opposite direction

介质通过换热器时，热介质将其部分热量传递到薄金属壁上，而薄金属壁又将这部分热量传递到另一侧的冷介质上。

When heat medium through PHE, partical heat capacity is transfered to wall of thin metal by heat medium and it is transfered to the other side of cold medium by wall of thin metal.

热介质的温度下降，而冷介质的温度则上升。

最后，两种介质流向换热板另一端的相似通道，并排出换热器。

While temperature of heat medium is falling and temperature of cold medium is rising.

Finally, the two kinds of media flows to another similar passage channels, drains off the heat exchanger.

热传递

Heat transfer

换热器的目的就是将热从一种介质转移到另一种介质，并且使热很容易地通过冷热介质隔开大的薄金属换热板壁。

The aim of PHE is to make medium of heat capacity to transfer to another medium and let is easily isolate the larger and thin metal wall by cold and heat capacity.

金属换热板压制成特殊波纹不仅使其强度和刚度增加，而且还大大地提高了冷热介质通过薄金属换热板壁的换热效率。

Metal plate pressed by special waveform is not only increment of strength but also increase the efficiency of heat transfer.

压降

Pressure drop

压降即能量损耗。

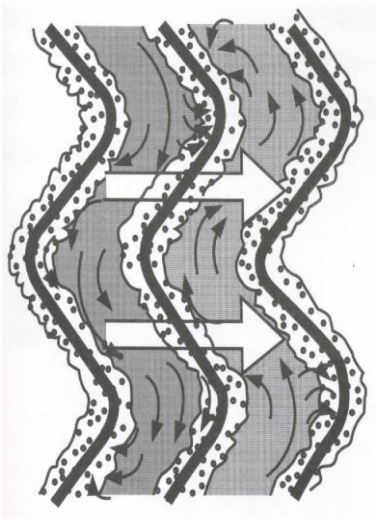
Pressure drop means loss of energy.

整个管道系统，包括其中的设备，对所通过的介质都产生阻力。

The whole system of piping line, including heat equipment win generate the resistance force due to media transfer.

有些压降是不可避免的，但对于一台给定的换热器，应尽可能按其设计操作。

Under the designated conditions, pressure drop can not be exempted from generation. For the designated heat exchanger, it should be operated as per design requirements.



换热面上沉淀物的形成会导致换热板之间自由空间的逐渐减少。这就意味着如果要使介质按要求通过换热器，就需要更多的能量。

Deposition formed on the surface of heat exchanger may decrease the free space between heat transfer plates. That means more energy need to be added to meet the requirements of media through.

板壁上各种沉淀物的形成会大大降低换热效率。

All kinds of deposit formed on the plate may decrease the efficient of heat transfer.

上面提到的雷曼公司的波纹形换热板可使液体形成高速紊流。紊流有力地阻止了沉淀物在板上形成，但不能永远削除污垢。

Waveform plate pressed by siping Lehman company mentioned above, can make the liquid to realize the turbulent flow, thus prevent from generating the fouling on the plate but can not eliminate it for ever.

沉淀物地形成使换热板的壁厚显著增加，而且沉淀物的导热性比换热板低的多。因此，沉淀物的形成严重地降低了总地传热效率。

Deposition will evidently increase the wall thickness of heat transfer plate and decrease the total efficiency of heat transfer since heat conductivity of deposition is lower than heat transfer plate.

有关沉淀物的清除在下面第七章“维护－清洗”中还要谈到。这里我们只是要说明污垢是有害的，并且由于沉淀物会产生腐蚀作用，在一定情况下，会对换热器构成危害。

Deposit cleaning see “Section 7” maintenance-cleaning. It is very clear that deposition is very harmful. It will generate corrosion due to deposition formed. Under this circumstance, PHE may be damaged.

显然，污垢是我们所不期望有的。如果没有设置过滤器或采用其它保护措施，大一点的颗粒和纤维可能会被吸入换热器，并堵塞设备。

Obviously, We don’t expect fouling generated, larger granulations and fibres may be imbibed into PHE, blanking off equipment, unless it equipped with filler of protective device.

如果设备不能保持所期望有的温度，并且同时任一介质的压降增大，这就表明有污垢产生或设备出现堵塞。要采取补偿措施，请阅第七章“维护-清洗”

If designated temperature can not be hold. And at same time, pressure drop of any medium is increasing, that means fouling generated and banking off happened for equipment. Method of compensation shall be carried out as per the stipulation of “ Section 7” Maintenance-cleaning.

第五章　操作

Section 5 Operation

设备的启动与停止运转

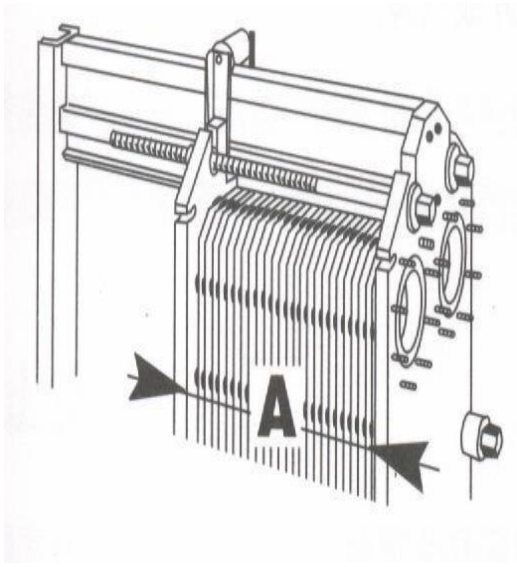
PHE startup and shutdown

设备的启动

PHE startup

1.首次启动或长期停运后再次启动换热器时，注意换热板组是否夹紧到A尺寸！

1.For first startup or once wore startup for long tine of stopping it should be taken to see whether fastening to the size A!



请注意：

换热器所连接的系统是否设置了对于温度和压力突然急剧变化的保护措施，这是非常重要的。这不仅关系到换热器本身，而且关系到管道系统以及系统中每一台设备。

进行任何操作时，包括启动系统中的各种泵时，应切记这一点。

Please attention:

It is very important to see whether PHE connecting system has been equipped withthe protective device for sudden changing of temperature and pressure. It not only concerns for itself of PHE but also for piping system and each equipment of system.

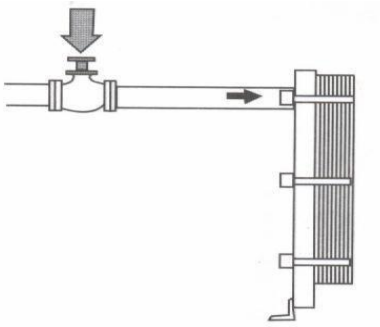
Whatever when do operation, including startup the system pumps must be pay attention.

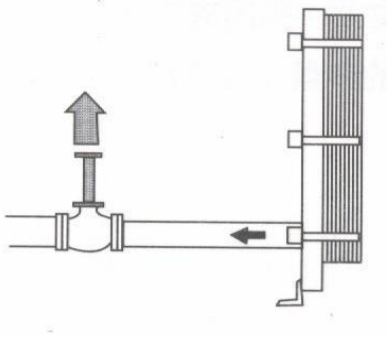
2.启动泵之前，先核实是否有操作规程，以便通知应先启动哪台泵。

2.Before open the pump, operating regulations should be checked to see which one shall be firstly opened。

3.检查所有启动的系统中位于泵与换热器之间的流量控制阀是否关闭。

3.Whole startup system should be checked to see whether flow rate control between valve pump and PHE opened or not。



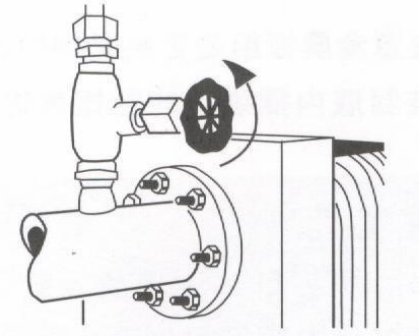


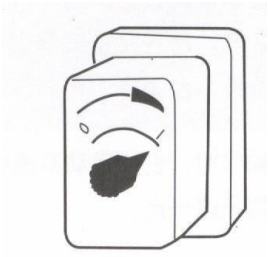
4.检查出口处阀门，如果有的话，是否全部打开。

4.All outlet valve, if it equipped with, should be checked to see whether it opened or not。

5.打开放气阀。

5.Open air discharge valve



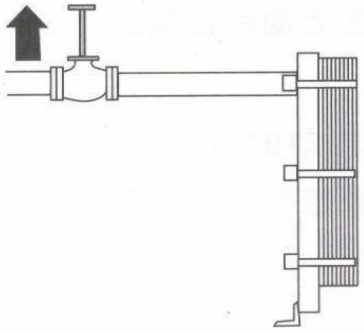


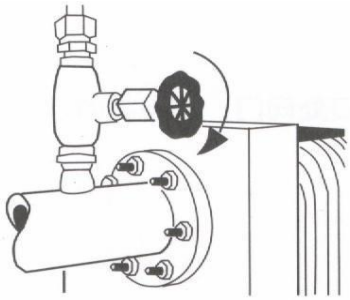
6.启动泵。

6.Startup Pump

7. 慢慢开启阀门。

7.Open valve slowly。





8. 空气放尽后，关闭放气阀。 按同样的步骤，启动另一侧的管路系统。

8. After air discharged out, air discharge valve should be closed。 As the same procedure, other side of piping system should be startup.

设备运转
PHE Running

为保证正常的温度或压降，对流速的任何调整都应缓慢进行，以免对系统产生冲击。温度的某些变化，热负荷的变化或污垢的产生都会给换热器的运行带来影响。 要使换热器正常运行，就应当避免任何突然冲击。

In order to maintain normal temperature and pressure drop, any adjustment for flow rate should be slowly carried out to refrain from system shock.

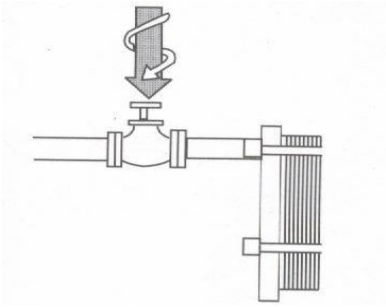
停止运转
PHE Shutdown

如果要使换热器停止运行，或完全是因为泵要停止运行，应按下列程序操作。

The shutdown of PHE or pump should be operated as follows

1.首先确认是否有操作规程，即哪一侧先停止运行。

1. First confirm whether it has operating procedure, which side shall be firstly stopped



2. 缓慢地关闭控制泵流速的阀门。

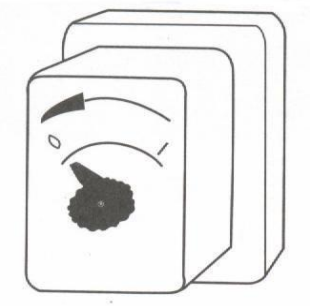
2.Flow velocity valve should be slowly closed。

3. 阀门关闭后，停止泵运行。

3.After valve closed ， pomp should be stopped。

4. 按同样的程序进行另一侧的操作。

4.Do it as the same procedure for other side。



5. 质量低劣的冷却水对金属材料是有害的。典型的例子就是对不锈钢和镍合金有腐蚀作用。 如果因某种原因，换热器需要停止运行很 长一段时间，则应进行放空，根据热交换 介质的性质，建议进行冲洗及干燥。

5.Inferior quality of cooling water may arises damage to metal For example; it etches stainless steel and nickel alloy steel. If PHE has to be stopped for along time as the reasons, it should be discharged out .According to the characteristic of media, water cleaning and drying are recommended。

第六章 换热板组件的拆开及组装

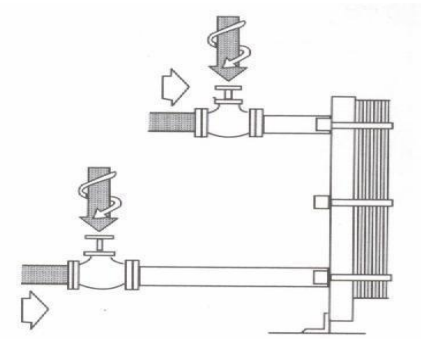
Section6 Disassembly and assembly of Combined Parts

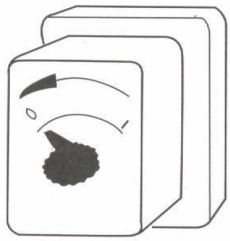
拆 开

Disassembly

1.慢慢关闭进口阀门。先切断进口侧以降低最高压力。

1. Inlet of valve should be closed slowly; inset side should be firstly closed to reduce the max. pressure。



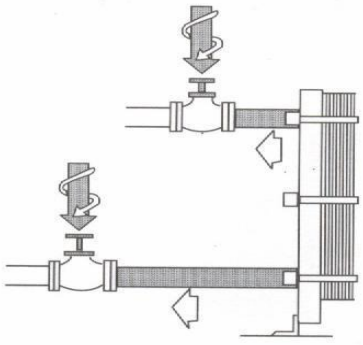


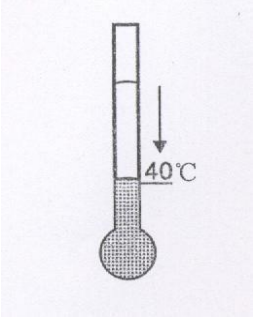
2.停泵。

2.Pump should be stopped。

3.关闭两个出口端阀门。

3.Two outlet of valve should be closed。



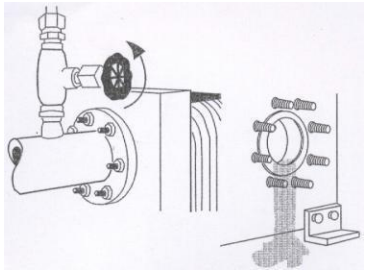


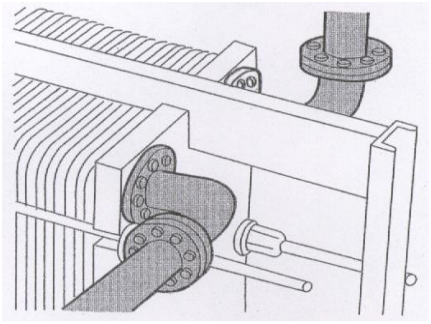
4.如果换热器温度太高，等温度降至40℃左右再进行操作。

4.If the temperature of PHE is too high, does not operate it until temperature decrease to about 40℃。

5. 放空。

5. Discharge out。



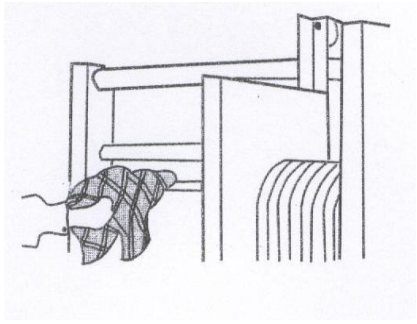


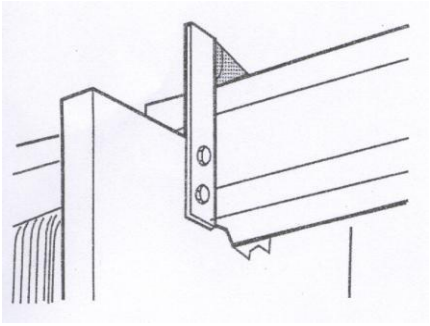
6. 卸下与活动板连接的所有弯管，使活动板可以在上梁上自由移动。

6. All bending pipes connected with pressure plate should be disassembled to make it move from top bar freely 。

7. 检查上梁的滑动面，并擦拭其表面。

7. Slipper surface of top bar should be examined and cleaned。



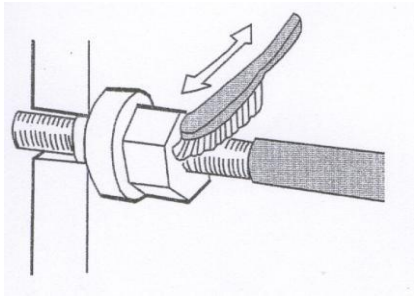


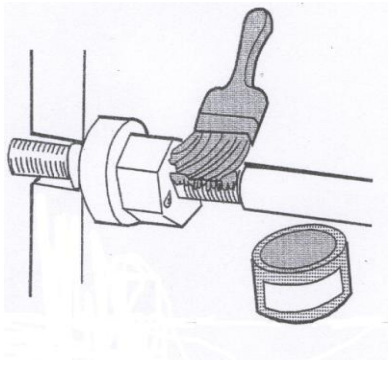
8. 检查活动板的滑动辊。

8. Sliding roller should be examined

9. 移开夹紧螺栓上的塑料罩，用铁刷刷螺纹处。

9. After removing the plastic cover of fastening bolt, thread may be cleaned with iron brush。



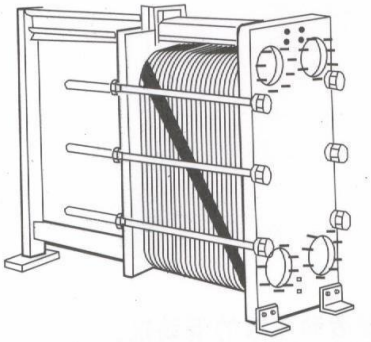


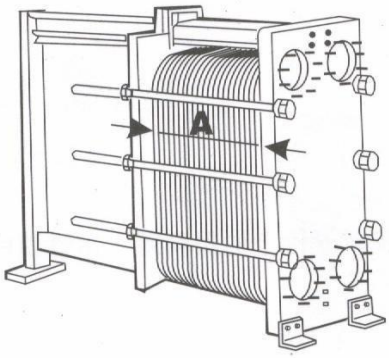
10. 在螺纹处刷一薄层润滑油。

10. Lubricant should be lubricated on the area of thread。

11. 在换热板组件外面做一对角线记号，或按顺序将换热板编号。

11. Outside of combined parts may be marked a diagonal line sign or accordance with the sequence number of PHE plate。

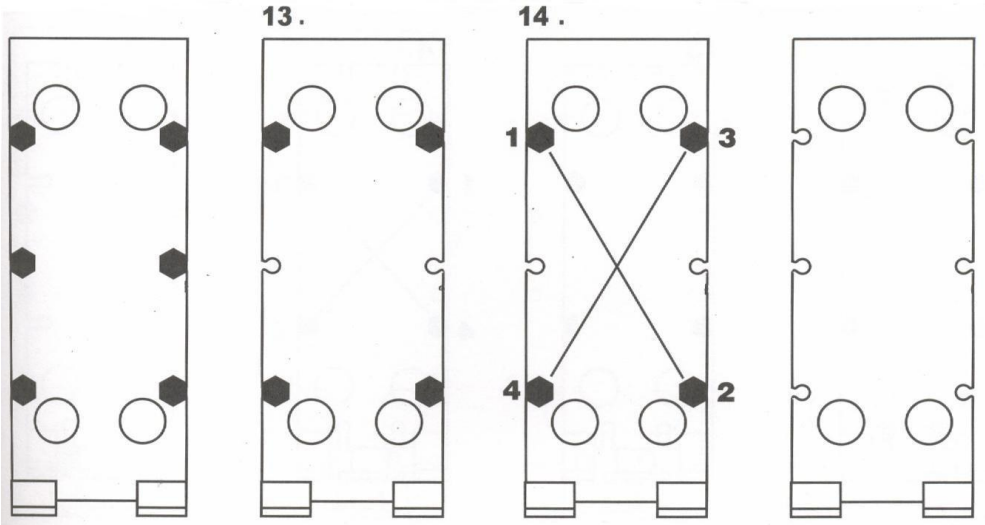




12. 测量并记录换热板组件组装尺寸 A。

12. Assembly size A of combined parts should be measured and recorded。

板式换热器型号(PHE TOPE)： M032-D,M050-A,M050-C,M050-D,M065-D,M100-A,M100-C,M100-D,M150-B,M150-C,M150-D,M200-B,M200-C,M200-D,M250-B,M250-C,M250-D,M300-D



顺序	螺栓号	尺寸
1	1-2-3-4	1.05A
2	1-2或3-4	拆开

NO.	Bolt NO.	Size
1	1-2-3-4	1.05A
2	1-2 or 3-4	disassembly

13．拧下不带轴承的螺栓。

13．The bolt that is not equipped with bearing box shall be disassembled.

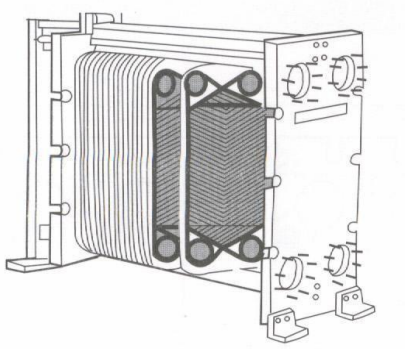
14．带轴承盒的螺栓应交替地，成对角线地成对打开，如图所示。 拆开活动板时，板的歪斜在宽度方向不可超过 **10mm**（每个螺栓 **2** 圈),长度方向 不可超过 **25mm**（每个螺栓 **2** 圈)。

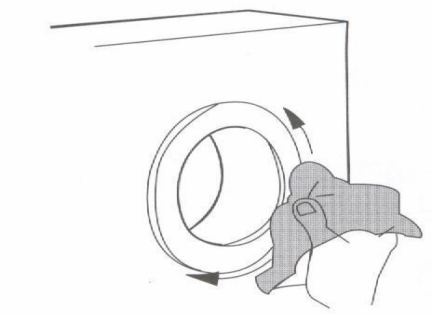
14．The bolt that is equipped with bearing box shall be alternately and diagonally loosed as the figure. When disassembling of pressure plate, width direction of inclination shall not be over than 100mm; (Two circles of each bolt) length direction shall not be over than 25mm. (Two circles of each bolt).

组　装
Assembly

1.检查所有的密封面（即与换热介质接触的表面）是否清洁。

1.All seal surface (media contact surface) should be examined to see whether cleaning or not.



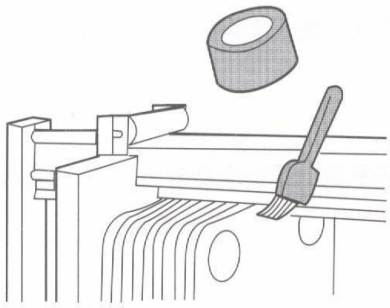


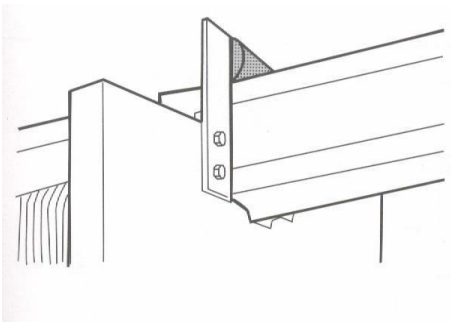
2. 还检查安装在接口处的环形垫圈是否。

2.Ring shape of washer equipped with locati of nozzle should be examined once more。

3. 擦净并润滑上梁的滑动面。

3.Slipper surface of top bar should be cleaned and lubricated。





4. 检查活动板的滑动辊。

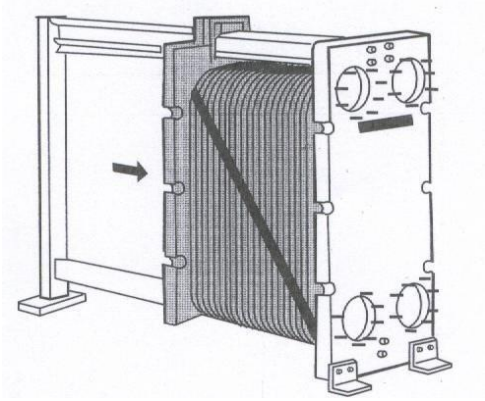
4.Sliding roller should be examined。

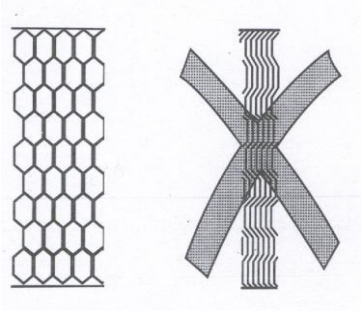
5. 对照板片流程图检查换热板是否按正确的顺序悬挂。

5.Sequence number of PHE plate should be examined as per flow chart of plates。

6. 将换热板组件压紧。

6.Combined parts should be pressed and fastened。





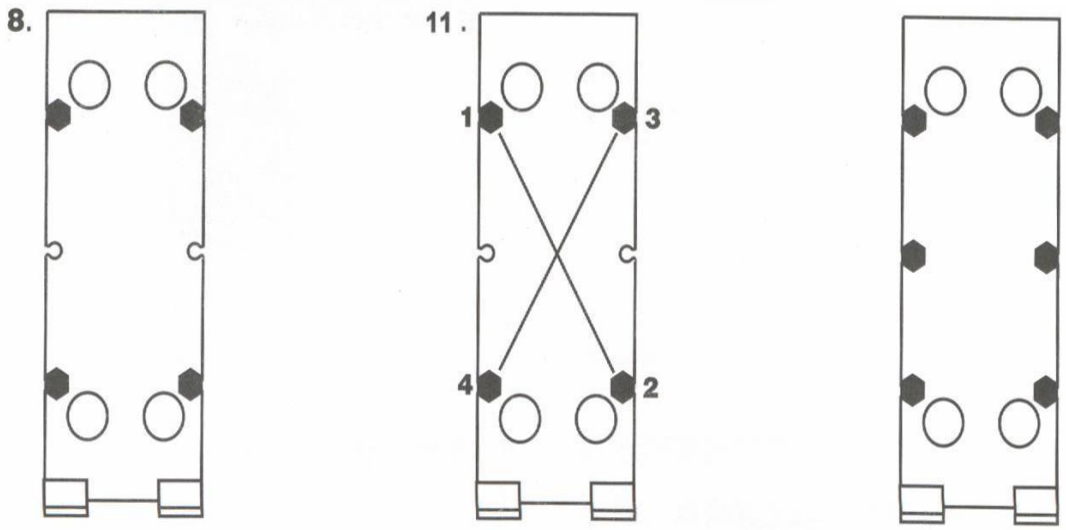
7．若换热板组装正确的话，其边缘应形成蜂窝图案。

如果换热板组装件外边做有对角线记号，检查是否组装正确。

7.Outside of combined parts with a diagonal line sign should be examined to see whether it correct or not。

if correct, its edge must be shaped like pattern of honey comb。

板式换热器型号(PHE TOPE)： M032-D,M050-A,M050-C,M050-D,M065-D,M100-A,M100-C,M100-D,M150-B,M150-C,M150-D,M200-B,M200-C,M200-D,M250-B,M250-C,M250-D,M300-D

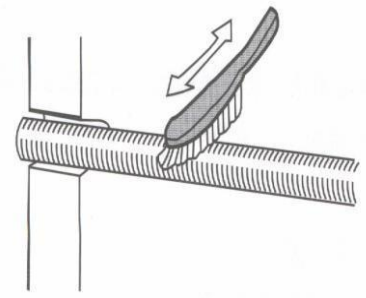


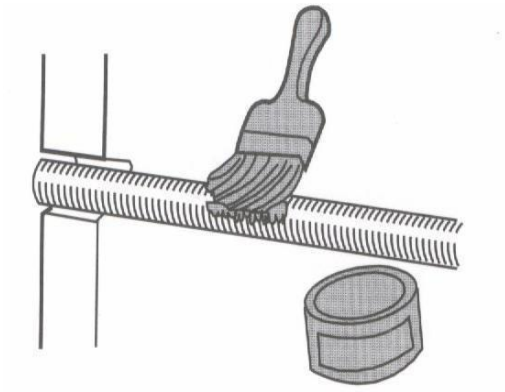
顺序	螺栓号	尺寸
1	1-2-3-4	1.05A
2	1-2或3-4	A

NO.	BoIt NO.	Size
1	1-2-3-4	1.05A
2	1-2 or 3-4	A

8. 将带轴承盒的螺栓就位。
8.The bolt equipped with bearing box should be assembled。

9. 用铁刷刷净螺栓杆螺纹部分。
9.thread of bolt should be cleaned with iron brush。





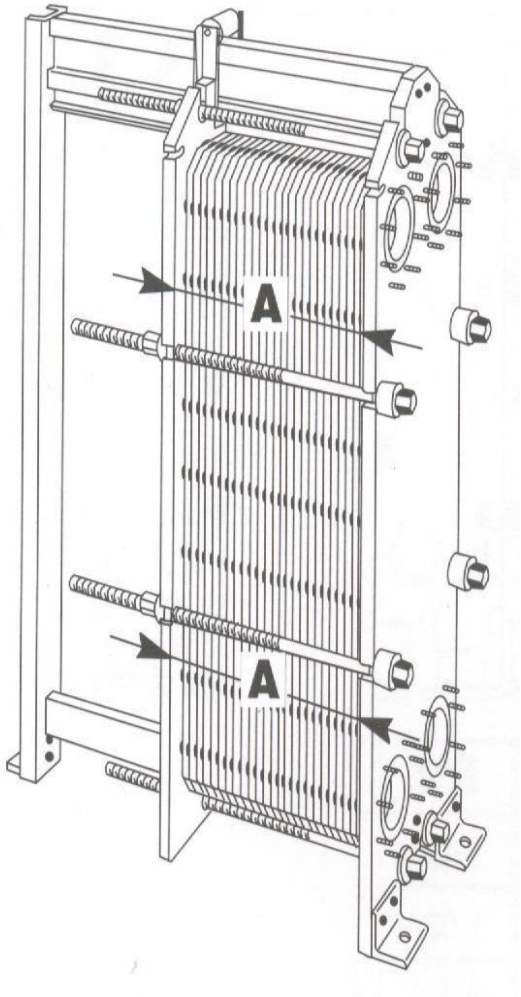
10. 在螺纹处刷一薄层润滑油。
10. luricant should be lubricated on the eara of thread。

11. 拧紧螺栓时应按上图所示交替并对角进行。
11. Fastening bolt should be carried out alternation and diagonal, shown as the figure。

12. 拧螺栓时，活动板的歪斜程度，宽度方向不可超过 10mm（每个螺栓两圈），长度方向不可超过 25mm（每个螺栓五圈）。
12. When fastening, size A should be examined. The slope of pressure plate, direction of width can not be over than 10mm(two circles for each bolt) direction of length can not be over than 25mm (five circles for each bolt).

换热板组的安装长度特殊情况下可以超出正常值 A。具体可按下列尺寸：
Assembly for length of combined parts, under the special requirement, may be over the limit of normal value A. following size may be followed:

金属板组紧厚度/度 **Fastening Value of metal combined parts/thickness**	金属板组夹紧长度 **Fastening Value of metal combined parts/length**
>4mm	**A+1%**
>3mm,<4mm	**A+1.5%**
<3mm	**A+2%**



13. 将其它螺栓就位。

- 检查垫圈。
- 完全拧紧后，所有螺栓应受力均等。
- 相邻螺栓测得的换热板组夹紧长度的差值不应超过下列规定值：
  尺寸 A <1000mm 时不超过 2mm
  尺寸 A>1000mm 时不超过 4mm
- 所有螺栓测得的换热板组夹紧长度相差不得超过 1%。
- 如果换热器没有完全密封，可以再拧紧螺栓，使换热板组件夹紧尺寸达到 A-1%。但不得超过最大拧紧扭矩。

13. Put other bolts to their post location。

- Washer should be examined。
- Fastened completely， all bolts should be uniformly stressed。
- Fastening length of tolerance for adjacent bolts can not be over than the following value stipulated:
  When size A <1000mm, can not be over than 2mm
  When size A >1000mm, can not be over than 4mm
- All fastening length of tolerance for bolts can not be over than 1%。
- if PHE has not well been tightened, fastening bolts shall be tightened once more to reach fastening size A-1%, but it can not be over than the max. fastening moment of force。

如果使用最大扭矩仍达不到尺寸 A，则：
If it can not be reached to the size A, with the max. torque, it should be done as follows:

- 检查换热板的片数和尺寸 A。
- 检查所有的螺母及轴承是否转动自如，如果不是，擦净并润滑或更换之。
- 装上所有的螺栓，交替地拧紧各螺栓
- Quantities of plates and size A should be examined。
- All nuts and bearings should be examined to see whether running or not, if not , cleaned and lubricated or replaced。
- All bolts should be assembled and tightened alternately。

请注意:
Please be attention:

当使用气动夹紧装置时，应按下表设定最大扭矩，并且仍然要测量尺寸 A .

When adopting air-powered fastening device, the max. Moment of force should be set as the following table, and size A should be examined.

螺 栓 规 格 Bolt spec.	带轴承盒的螺栓 Bolt equipped with bearing box (Nm Kpm)	带垫圈的螺栓 Bolt equipped with washer (Nm Kpm)
M24	1300 130	450 45
M30		900 90
M39		2000 200
M48	2100 210	3300 330

如果使用扳手拧紧螺栓，其力矩可估算

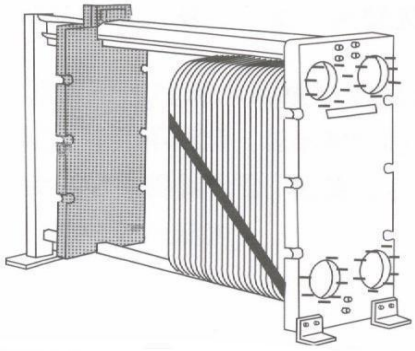
If adopting spanner for fastening, its moment of force should be calculated

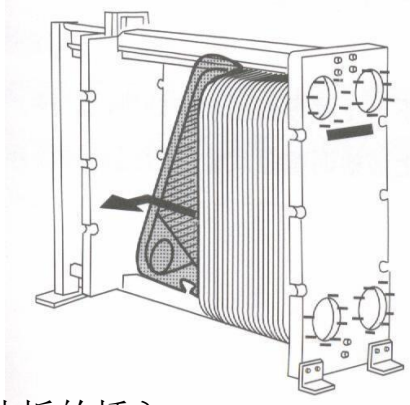
换热板的移出与插入
Removal of PHE plate and Insert

换热板的拆卸
Disassembly of PHE plates

将活动板推向支柱。

Pressure plate should be pushed to support。





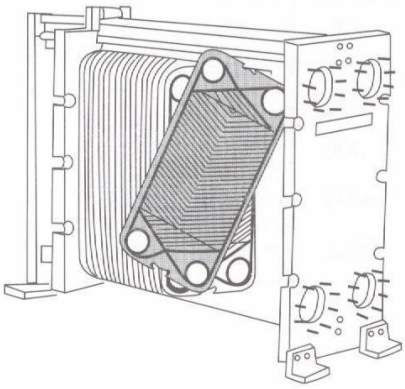
拆卸换热板。

PHE plates should be disassembled。

换热板的插入
Insert of PHE plate

将换热板悬挂在上梁上，换热板地背面(即无垫片一面)，朝向活动板。

PHE plate has to be suspended to top bar, The back side (the side without seal gasket) should be turned towards to pressure plate。



请注意

按流程排版的顺序，因事实上装板时都是从换热板组的后面开始装起。
为避免碰伤手，安运换热板时一定要戴防护手套。

Please be attention

When assembly of PHE plate, in fact, the work should be started from back of combined plates in accordance with the sequence of flow chart。

In order not to be injured, protective gloves should be put on when assembling.。

第七章 维护

The section 7 Maintenance

警告

Warning

氯气做为生长抑制剂

氯气通常作冷却水系统中的生长抑制剂，它会降低不锈钢（包括耐蚀耐高温镍基合金、耐热镍铬合金、SMO）的抗腐蚀能力。

氯气能削弱这些钢种的保护层作用，使其变得更易于腐蚀。这只是个时间和浓度的问题。

如果无法避免在非钛材设备中使用氯气，您一定要与雷曼换热设备有限公司确认。

请注意

钛材不受氯腐蚀

Chlorine as the growth inhibitor

Generally, chlorine as the growth inhibitor for system of cooling water, may decrease the capability of corrosion resist an for stainless steel. Including (high temperature resistant and corrosion resistant of nickel base alloy, high temperature resistant of nickel chromic alloy and SMO)

It may weaken the protective layers of these brand of steel to make them corrosion easily, if you have no choice to adopt chlorine for the material of non-titanic steel, please contact with Lehman company to confirm。

Please be attention:

Titanic steel can not be etched.

清洗
Cleaning

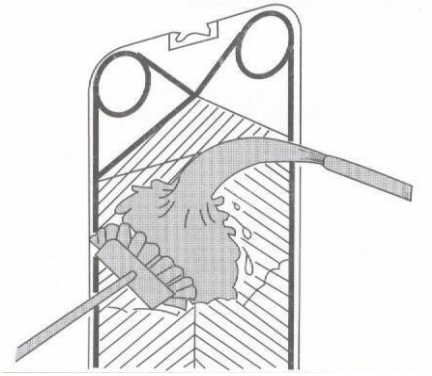
油类残留物/沥清和脂肪

Oil Residuum/Asphalt and Fat

- 油类残留物 **Oil Residuum**
- 沥青 **Asphalt**
- 脂肪 **Fat**

打开装置进行机械清洗

Open PHE to clean with the mechanical method



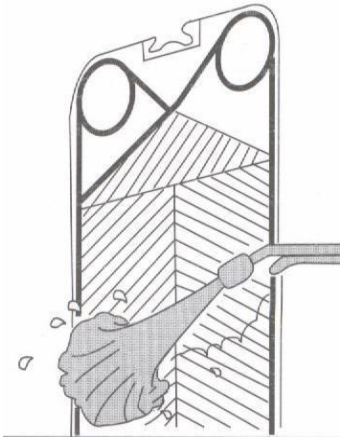
1、碳氢类沉淀物可用烷族或石脑油溶液（例如 **KEROSINE**）和软刷洗掉。

请注意 天然橡胶，丁基橡胶以及三元乙丙橡胶制成的垫片与上述溶液接触会膨胀。接触时间应限制在 **0.5** 小时以内

1、Deposition of hydride and carbide maybe cleaned out by solution of alkane and naphtha （ such as KEROSZINE） or soft brush.

Please be attention:

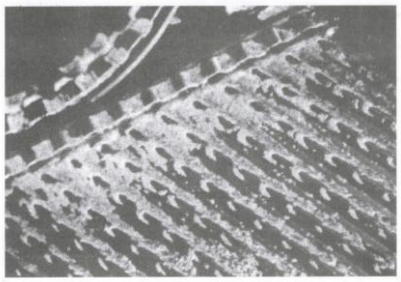
The solution mentioned above, touched with stall gasket material of natural rubber, butyl rubber and EPDM may generate the phenomenon of expansion. In that case, time of touch must be completed within the of 30 minutes.



2、用干布擦干或用清水漂洗。

2、Cleaned by dry cloth of cleaned by fresh water.

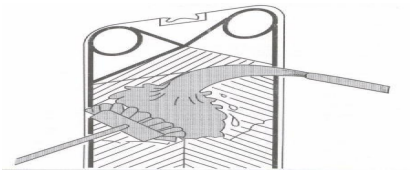
大污垢
Severe fouling Deposit



- 海藻 **Marine alga**
- 贻贝 **Mussel**
- 藤 **Rattan**
- 木屑/纤维 **Wood chips/fibre**

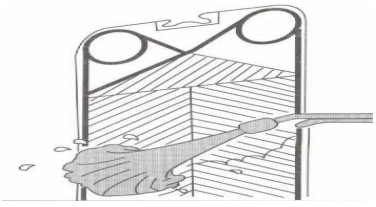
打开装置进行机械清洗

Open PHE to clean with the mechanical method



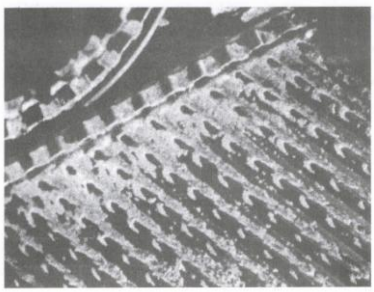
1. 用流动水轻轻刷洗。
   请注意
   避免损坏垫片。

2. 高压软管冲洗。
3. 对未打开的换热器进行反冲洗有时会更为有效



1. Clesned by flowing water。
   Please be attention:
   Refraining from damage of sealing gaskets。
2. Cleaned by high pressure of water。
3. It is very effective to clean with reverse side of cleaning for unopened PHE

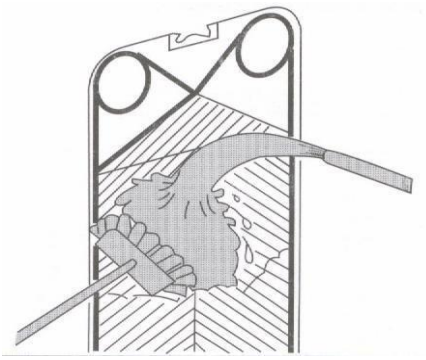
水垢－水
Water scale -Water



- 碳酸钙 **calcium carbonate**
- 硫酸钙 **calcium sulphuric acid**
- 硅酸盐 **sulphate**

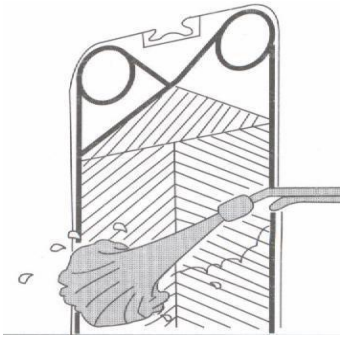
打开装置进行机械清洗

Open PHE to clean with the mechanical method



1. 用流动水轻轻刷洗。
   请注意 避免损坏垫片。
2. 高压软管冲洗。
3. 用下列清洗剂进行化学清洗
   - 硝酸
   - 氨基酸
   - 柠檬酸
   - 磷酸
   - 复合药剂（NDTA,NTA）
   - 聚磷酸钠

- 最高浓度 4%/最高温度 60℃



1. Cleaned by flowing water。
   Please be attention:
   Refraining from damage of sealing gaskets。
2. Cleaned by high pressure of water。
3. Cleaned by the following chemical detergents
   - Nitric acid
   - Amino acid
   - Citric acid
   - Phosphoric acid
   - Compound medicament (NDTA,NTA)
   - sodium phosphate
   - The Max. Concentration 4%/the Max. Temperature 60℃

请注意：

任何情况下，不得使用盐酸清洗不锈金属板。制备清洗液时，水中氯含量超过 **300PPm** 时不能使用。

Please be attention:

Under any circumstances, metal of stainless steel can not be allowed to clean with hydrochloric acid. When cleaning, content of chlorine ion in water can not be over than 300ppm.

微生物—粘植物

Microorganism-Viscous flora

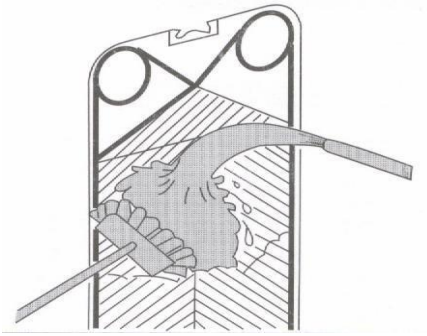
•细菌 **•Bacteria**

•绕虫 **•Maggot**

•原生植物 **•Protoplant**

打开装置进行机械清洗

Open PHE to clean with the mechanical method



1、用流动水轻轻刷洗。

请注意：

避免损坏垫片。

2、高压软管冲洗。

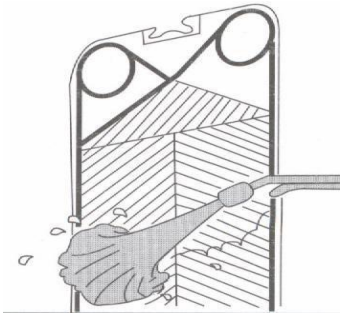
3、用下列清洗剂进行化学清洗

•氢氧化钠

•碳酸钠

•如果在清洗液中加入少量的次氯酸盐或能生成合成物和表面活性剂的药剂其清•洗效果会更好

•最高浓度 4%/最高温度 60℃



1、Cleaned by flowing water。

Please be attention:

Refraining from damage of sealing gaskets。

2、Cleaned by high pressure of water。

3、Cleaned by the following chemical detergents

•Sodium hydroxide

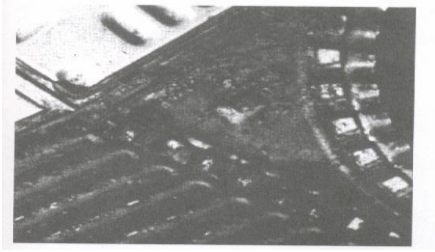
•Sodium carbonate

•Little hypochlorite or surface active reagent added in the solution of cleaning will be achieved a good result.

•The Max. Concentration 4%/ the Max. Temperature 60℃.

沉淀物

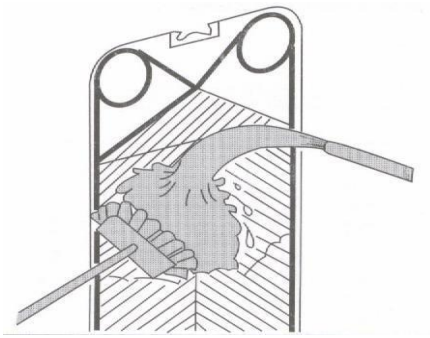
Deposition



•腐蚀产物	**•Rotted plant**
•氧化铁	**•Iron oxide**
•泥沙	**•Mud and Sand**
•氧化铝	**•Aluminum oxide**
•双原子有机物	**•Diatomic organism**

打开装置进行机械清洗

Open PHE to clean with the mechanical method



1、用流动水轻轻刷洗。

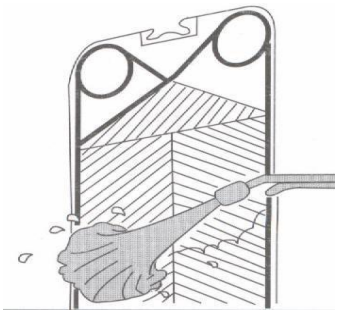
请注意：

避免损坏垫片。

2、高压软管冲洗。

3、用下列清洗剂进行化学清洗

- •销酸
- •氨基酸
- •柠檬酸
- •磷酸
- •复合药剂（NDTA，NTA）
- •聚磷酸钠
- •最高浓度 4%/最高温度 60℃



1、Cleaned by flowing water。

Please be attention:

Refraining from damage of sealing gaskets。

2、Cleaned by high pressure of water。

3、Cleaned by the following chemical detergents

- •Nitric acid
- •Amino acid
- •Citric acid
- •Phosphoric acid
- •Compound medicament(NDTA,NTA)
- •Sodium phosphate
- •The Max. Concentration 4%/ the Max. Temperature 60℃.

请注意：

任何情况下，不得使用盐酸清洗不锈金属板。制备清洗液时，水中氯含量超过 **300PPm** 时不能使用。

Please be attention:

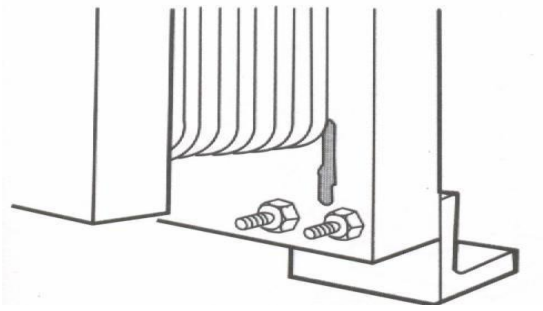
Under any circumstances, metal of stainless steel can not be allowed to clean with hydrochloric acid. When cleaning, content of chlorine ion in water can not be over than 300ppm.

第八章 故障检查

The section 8 Failure Examination of Failure

换热板片与固定板之间发生介质泄漏现象

Appearance of leakage between heat transfer plates and frame plate



操作： 在发生泄漏的地方上标记，然后打开换热器。 1. 检查最后一块换热板上的垫片及连接 处，看是否有错位、杂物、裂痕或其它损伤。 2. 检查活动板上是否受力不均或板上有杂 物附着，以至于有可能破坏垫片于邻近面的 连接。

3. 检查换热板本身是否出现裂纹或孔眼。

校正：

1. •重新安装垫片。
   •排出杂物。
   •更换损坏的垫片。
   •如果合适的话，更换连接处垫片。
2. 排出影响垫片于活动板连接处的杂物。
3. 带有裂纹或孔眼的换热板必须更换掉

Manipulation:

Area of leakage should be marked with a sign, then PHE opened。

1.The last piece of sealing gasket and point of connection should be examined to see whether it has dislocation, sundries, fracture or other damage。

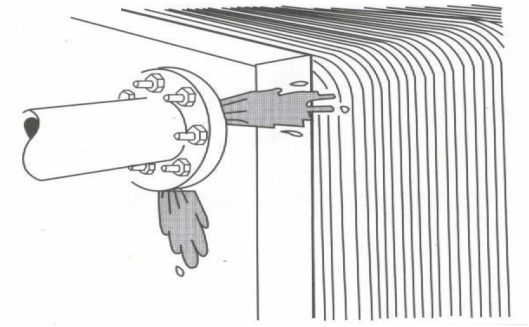
2.Pressure plate should be examined to see whether if has stress of ununiformity or impurities on plate, which may destroy the connection between sealing gasket and adjacent plate

3.PHE itself should be examined to see whether it has cracks or holes。

Adjustment:

1. •The sealing gasket should be reassembled。
   •Foreign matters should be removed out。
   •Damaged gasket should be replaced。
   •Gasket of connection area should be replaced, if required。
2. Impurities on the connection area of pressure plate should be removed out 。
3. The heat transfer plate with cracks or holes mast be replaced。

法兰与板框之间有介质泄漏现象
Appearance of leakage between flange and frame plate



操作：

拆下法兰，检查与接口是否对中，垫片是否错位或损坏，垫片或法兰表面是否有杂物。

Manipulation:

Flange should be disassembled to see whether it has been centered to nozzle, sealing gasket should be examined to see whether if has been dislocated or distorted, surface of sealing gasket or flange whether has foreign matters.

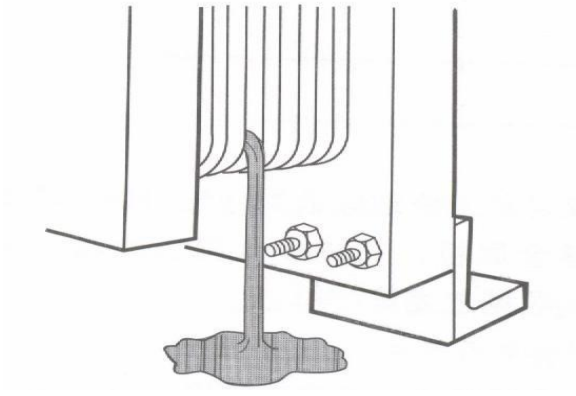
校正：

- 重新安装管道，以削除应力及校直。
- 重新安装垫片。
- 更换损坏垫片。
- 如果合适的话，更换连接处垫片。
- 清除法兰与垫片间的异物。
- 重新安装，注意法兰与接口对中。

Adjustment:

- Pipe line should be reassembled to remove the stress and alignment。
- Sealing gasket should be reassembled。
- Gasket of connection area should be replaced, if required。
- Impurities between flange and sealing gasket should be removed out。
- Flange should be centered to nozzle, after reassembly

换热板之间的介质外泄现象
Appearance of leakage among heat transfer plates



操作：

在发生泄漏的两块换热板上做记号，检查并记下固定板内侧与活动板内侧间的距离，然后拆开换热器。 1.检查垫片是否松脱、错位或损坏。

2.检查发生泄漏的换热板片，对照图纸校核换热板组装尺寸，看是否可能由于组装过紧而引起换热板或垫片损坏，或只是由于组装得不够紧而发生泄漏。

3.检查换热板两端的悬挂凹口是否变形，凹口处的变形会引起换热板间发生不对中。

4.注意换热板悬挂的正确与否，如 A-B-A-(见第四章)

5.检查换热板上是否有孔眼（腐蚀）。

Manipulation:

Area of leakage should be marked with a sign to examine and recorder the distance between internal side of frame plate and pressure plate, then PHE opened

1. Sealing gaskets should be examined to see whether they have been loosened, dislocated or damaged

2. Leaking plate should be examined in according go assembly size of drawing, to see whether it has damage of plate or deterioration gasket due to fastening or enlightening.

3. Hanging recess of heat transfer plate should be examined to see whether it has deformation or not.

4. Hanging of heat transfer plate should be examined to see whether it correct or not

5. Surface of heat transfer plate should be examined to see whether it has hole or not (corrosive wear).

校正：

1.•重新安装垫片。
•重新粘结松脱得垫片。
•更换损坏的垫片。

2．在多数情况下，破损的换热板必须卸下修理或更换，若是带有四个孔的普通换热板；将破损的换热板核其前面或后面一块四个孔换热板撤下来。只要换热器重新组装后的新尺寸比图纸上的尺寸小两块板的距离，换热器重新组装后便可以投入运行。换热面积的略微减小通常不太重要，至少是在短时间内换热器可以投入运行。

3．如果可能，修理破损的悬挂凹口。或更换该换热板。对减少换热板的临时组装，参见上述第 2 条。

4．纠正换热板组装顺序的错误（**A-B-A-B**）。重新组装换热板时，注意换热板是否完好无损！

5．有孔眼的换热板必须更换，做为临时措旋可参照上述第 **2** 条进行。

Adjustment:

1. •Sealing gasket should be reassembled。
•loosening gasket should be reglued。
•Damaged gasket should be replaced。

2. under the most circumstances, damaged plate must be disassembled to repair or replace, it is not important to decrease the area of heat transfer, at least, not for short period, after reassembly, can make PHE put into normal operation。

3. If possible, repairing of hanging recess, replacement of plate, temporary assembly of reduction of plates should be followed the above clause 2.

4. Reassembled plate should be examined to see whether its sequence of assembly correct or not, correct a mistake of sequence of assembly (A-B-A-B).

5. Heat transfer plate with holes must be replaced, temporally measure of use may be followed the above clause 2.

介质间发生混淆现象

操作：

1. 检查换热器上各管道接口位置是否正确。

2. 将一侧下部接口打开，提高另一侧的　压力，观察打开的接口，看是否有被加热侧介质渗入，如果有渗漏，位置在哪儿。如果没有渗漏，则可以从其它方面寻找发生介质间混淆的原因。

3. 如果查出有渗漏，注意渗漏发生在换热板组件的什么位置，然后拆开换热器换热板组件。

4. 在检查换热板之前，首先检查大垫片与环形垫片间的角落区是否清洁，其漏孔是否通畅。这可确保任何泄漏都可排至大气，故不会构成压力使介质从垫片密封处渗入另一介质中。

5. 如果不可能按上述第 **2** 条确定泄漏的位置，则可按下列任意一种方法对每块换热板进行检查看是否有孔眼。

在换热板后面用强光束照射，看是否有透光的孔眼或裂纹。

用放大镜检查可疑的地方。 将换热板清洗干净后，使用化

学渗透剂进行检查。

校正：

1. 将管道正确连接。

2. 必须清除角落区漏孔中的所有沉淀物。如果垫片上的漏孔已破损，则必须使用适当的工具重新开孔或更换。

3. 一般来说，有孔眼的换热板为破损板应更换。对于换热板减少的临时装配，见“换热板之间的介质外泄现象”一节

Appearance of leakage among media

Manipulation:

1. All location of nozzle should be examined to see whether they are correct or not.

2. Nozzle bottom of one side should be opened and pressure of other side be increased

to see whether the opening nozzle has heated medium got in? If has appearance of leakage, where is the location? If has no appearance, the reason of mixture of media should be found from other aspect.

3. If the area of leakage has been found, location of leakage should be pay attention, then parts of PHE be opened.

4. Before PHE examination, area of corner between seal gasket and ring shape of washer should be firstly examined to see its leak hole whether clean of clear.

5. If the area of leakage can not be found as the above clauses, each plate should be examined by the following method to see its holes of plate.

Adopting glare examination to test cracks and holes.

Adopting magnifier examination to test suspicious area.

Adjustment:

1. Pipe line should be correctly connected.

2. Fouling deposit of corner area should be thorough cleaned. If leak hole of gasket damaged, it should be holed once more or replaced it with a suitable tool.

3. Generally speaking, heat transfer plate with holes must be replaced. For temporary assembly due to reduction of heat transfer plates see “paragraph of appearance of leakage among media”.

压力降问题现象

压降增大

操作：

检查是否所有的阀门包括止回阀都已打开，测定换热器前后的压力和流量。对于粘性介质，应采用直径至少 **30mm** 的膜片压力计，如可能应测定或估算流速。当流量较少时，只用一个料斗和一只秒表就足够了，流量较大时，则要求使用任何一种型式的流量计进行测定。

将实际测定的压力降值与规定的压降值进行比较。

1.如果实际压降值高于规定的压降值，还需检查温度。

1.1 如果温度表读数与规定值一致，换热面可能是相当洁净，但换热器进口可能是被异物堵塞。

1.2 如果温度表读数与规定值不一致，很明显，热传递降低，且低于规定值,这是因为在换热面上有沉淀物产生,同时由于沉淀物使流道变窄,压降增大。

2.如果压降规定值一致,就不需要进行任何操作。
3.如果压降低于规定值,则泵的能力太低,或是测定有误。

校正：

1 打开换热器，排出堵塞物, 如有反冲洗装置，可采用反冲洗装置冲洗堵塞处。

2 如果有就地冲洗装置，按说明书进行冲洗。如果没有这种装置，打开换热器冲洗换热板片。

Problem of pressure drop

Increment of pressure drop

Manipulation:

All valves including non-return valve should be examined to see whether opened or not. Pressure and flow rate of PHE should be inspected. For conditions of viscous flow, it should be inspected with D. not less than 30mm and with diaphragm type of pressure gage to inspect the calculated or estimated flow velocity. When flow velocity is smaller, it can be inspected by hopper stopwatch. When flow velocity is larger, it should be inspected with any type of flow meter.
Actual inspected value of pressure drop should be compared with the value stipulated. (see accompanied document)

1. If the actual inspected value is higher than stipulated value, temperature should be examined.

1. If the reading value of temperature is the same as the stipulated value, surface of heat transfer may be clean but inlet of PHE may be blockage

2. If the reading value of temperature is not the same as the stipulated value, clearly, heat transfer conductivity may be lower than the stipulated value because the fouling sediment on the surface of plates may change the passage channels, become into narrow and increment of pressure drop.

2. If the value of pressure drop is the same as the stipulated value, manipulation should not be carried out.

3. If the value of pressure drop is lower than the stipulated value, capacity or pump may be lower or measurement is not correct.

Adjustment:

1. PHE opened to discharge the blockage. Area of blockage may be cleaned with the back washing device if equipped with.

2. If PHE equipped with washing device, it may be cleaned as per the operating procedure of operation manual. If PHE is not equipped with, heat transfer plates may be disassembled to clean.