



# COMPACT HEAT EXCHANGER **LHE**

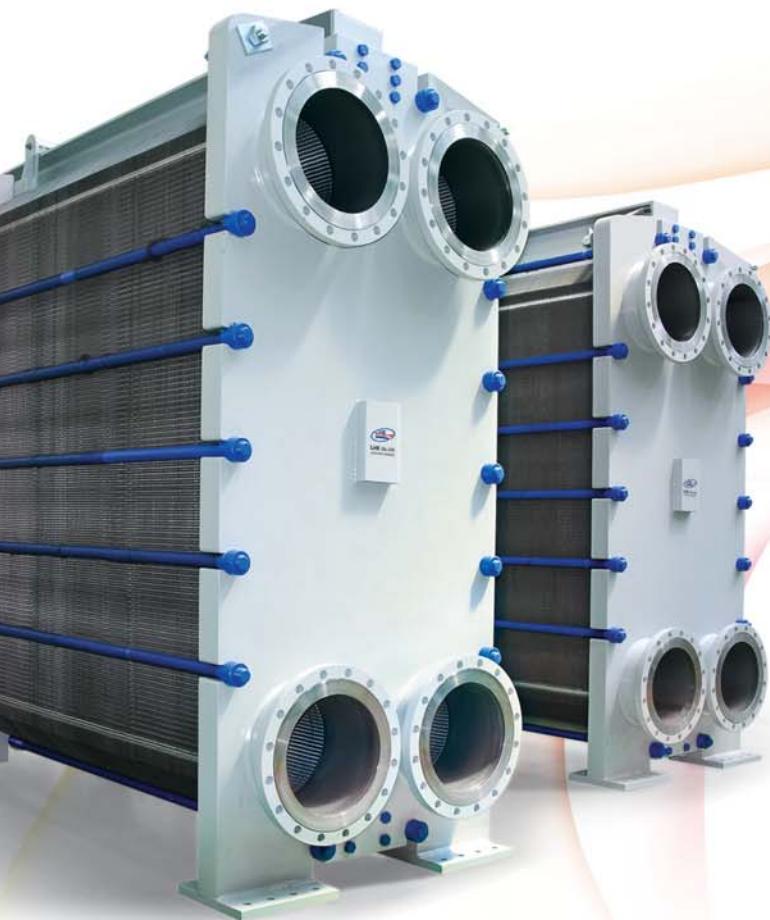


Spiral heat exchanger

Oblong plate & shell heat exchanger

Plate Coil

CHU



- Plate and Frame heat exchanger
- Spiral heat exchanger
- Oblong plate & shell heat exchanger
- Plate coil / Gas cooler
- Pressure Vessel (Mist & Dust collector, etc.)
- CHU(Compact heat exchanger unit)
- PHE gaskets



**[주] 엘에치이**  
LEADER HEAT EXCHANGER



# **LHE** Leader of Heat Exchanger !

Owing to supports from a lot of people, who has trusted us, LHE could make our position firm in this industry and always tried to share the fruits with all of you.

Now we are pleased to inform you that our company name has been changed from DHT to LHE (Leader Heat Exchanger) and we will jump to the center of the world industry with the new name.



# World Best !!

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## Greeting Message

**LHE**는 2001년 7월 DHT(디에이치티)로 창립한 후, 2006년 5월 최신시설을 갖춘 신사옥 및 공장을 준공하여 회사 명을 LHE로 변경하면서 열교환기 부문에서 세계속의 선두기업으로 도약하고자 합니다.



LHE는 축적된 기술을 바탕으로 기존 판형 열교환기의 사용상 제약(고온, 고압에서 사용상의 어려움)을 극복하고 보다 효율이 좋은 열교환기를 개발하기 위해 창립 이래로 계속 산학연 공동 사업을 진행하는 등의 구체적인 노력을 기울여 왔습니다. 이러한 지속적인이고 다양한 노력들이 결실을 맺어 최근에는 50,000톤급 및 25,000톤급 유압프레스라는 세계 최정상급의 설비를 확보하게 되었습니다.

그러나 LHE는 이에 안주하지 않고 더더욱 기술개발을 위해 박차를 가할 것을 다짐합니다.

창립초기에는 고객의 신뢰와 우수한 기술력만으로 미약한 생산설비를 극복하면서 어려운 사업들(크리스탈라이저 반응기, Heating & Cooling)을 수주 소화해냈던 조그마한 벤처기업에서 세계 최정상급 유압프레스를 자체 기술로 설계 제작할 정도의 규모가 되기까지는 참으로 많은 시행착오와 함께 끊임없는 노력을 했습니다.

LHE 임직원 일동은 고객이 믿어주시는 대로 지속적인 연구개발을 통하여 앞서가는 기술과 최고의 품질로 보답하겠습니다. 처음부터 LHE를 믿어주시고 지원해주시는 많은 분들께 거듭 감사의 말씀을 전하며, 지금까지와 같이 앞으로도 아낌없는 지원과 격려 부탁드립니다.

Since foundation of LHE, we have made tangible effort, such as Business-University Joint Research to overcome restrictions in using the existing plate heat exchangers, such as use at high temperatures and pressures, and to develop more efficient heat exchangers based on the accumulated technologies. As a result of these ceaseless and various efforts, we could secure the 25,000ton and 50,000 ton hydraulic presses, a world top class production facility, by our own technology. Not satisfied with current achievements, however, we still push ourselves everyday to develop more advanced technologies to repay for the customer's supports.

On the way from a small venture business, which won an hard-to-get order (Crystallizer Reactor and Heating & Cooling Device) without an appropriate production facility but only with our pure technology and customers' trust, to a company of the current scale, which can design and develop the world class hydraulic press by its own technology, we have made ceaseless efforts with so many trials-and-errors. With those efforts and experiences, we will challenge the world top position in the industry. We are confident of our top class technologies and will bend our efforts to prove it.

Based on customers' trust, all of our employees and managerial staff will not forget our original spirit and provide the industry's leading technology and the best quality in return for the customer's support. We'd like to thank all of the people who have trusted and supported us from the beginning, and ask for your continuous support and encouragement.





## History

- |          |   |          |  |
|----------|---|----------|--|
| 2001. 07 | (주)디에이치티 법인 설립                              | Jul 2001 | Founded DHT Co., Ltd.  |
| 2001. 07 | 무역업 등록                                      | Jul 2001 | International Trading License registered.  |
| 2001. 09 | 벤처기업 등록                                     | Sep 2001 | Designated as a Venture Business.  |
| 2002. 01 | ASME "U" STAMP 인증획득                         | Jan 2002 | Obtained "U" stamp from ASME (No.33038).   |
| 2002. 01 | 유망중소기업선정                                    | Jan 2002 | Selected as a Promising Small & Medium Sized Enterprise (Technology Evaluation by Korea Institute of Industrial Technology). |
| 2002. 03 | 10,000 ton 유압 프레스 설치(자체 설계 제작)              | Mar 2002 | Completed installation of 10,000 ton hydraulic press (designed and manufactured by own technology).                          |
| 2002. 04 | 입력용기에 대한 "특정설비저조허가" 인증                      | Apr 2002 | Approved of "Manufacturing License for Specific Facilities" for Pressure Vessel.   |
| 2002. 05 | "(주)디에이치티 기술연구소" 인증서 발급                     | May 2002 | Obtained approval for "DHT Technology Research Center".  |
| 2002. 08 | ISO9001 인증 : 한국가스안전공사                       | Aug 2002 | Obtained certificate of ISO 9001: Korea Gas Safety Corporation.  |
| 2003. 01 | 서울사무소 설립                                    | Jan 2003 | Established Seoul Branch Office.   |
| 2003. 03 | 한국수력원자력(주) "원자력품질등급 인증"                     | Mar 2003 | Approved for "Certified Nuclear Power Quality Grade" by Korea Hydro & Nuclear Power.   |
| 2003. 08 | 우량기술기업 선정 (기술신용보증기금)                        | Aug 2003 | Designated as an enterprise with excellent technology by Korea Technology Credit Guarantee Fund.                             |
| 2003. 08 | 부품소재 전문기업 확인서 발급                            | Aug 2003 | Acquired certificate of "Component & Material Technology Specialized Enterprise".  |
| 2003. 09 | 특허등록 제0399169호<br>(이중굴곡 열교환판 및 이를 이용한 열교환기) | Sep 2003 | Patent (#0399169) registered for "Double Wave Heat Plate and Heat Exchanger with using Double Wave Heat Plate".              |
| 2004. 06 | "LRQA CE MARK" 획득                           | Jun 2004 | Obtained the "CE MARK" by Lloyd's Register.  |
| 2004. 06 | ISO9001 LRQA 인증                             | Jun 2004 | Obtained the Certificate of "ISO9001" by Lloyd's Register.   |
| 2006. 05 | (주)엘에이치 법인명 변경 (LHE Co., Ltd.)              | May 2006 | Changed company name to LHE Co., Ltd.  |
| 2006. 09 | 세계최고의 50,000ton 유압 프레스 설치                   | Sep 2006 | Installed the World's biggest 50,000ton Hydraulic Press (designed and manufactured by own technology).                       |
| 2007. 04 | 기술신용보증기금 A+기업 선정                            | Apr 2007 | Accredited A+ by Korea Technology Credit Guarantee Fund.   |
| 2007. 11 | 무역협회 "1000만불 수출의 탑"                         | Nov 2007 | Awarded the \$10 Million Export Tower by Korea International Trade Association.  |
| 2008. 02 | 25,000ton 유압프레스 준공                          | Feb 2008 | Installed 25,000 ton Hydraulic Press.  |
| 2008. 05 | 인천 공장 준공                                    | May 2008 | Acquired New Factory in Incheon.   |
| 2008. 06 | Mann Diesel Certification 획득                | Jun 2008 | Certificated "Quality Assurance for Marine and Power plant" by Mann Diesel.  |
| 2008. 08 | OHSAS18001 LRQA 인증                          | Aug 2008 | Obtained the Certificate of "OHSAS18001" by Lloyd's Register.  |
| 2008. 08 | ISO14001 LRQA 인증                            | Aug 2008 | Obtained the Certificate of "ISO1400" by Lloyd's Register.   |

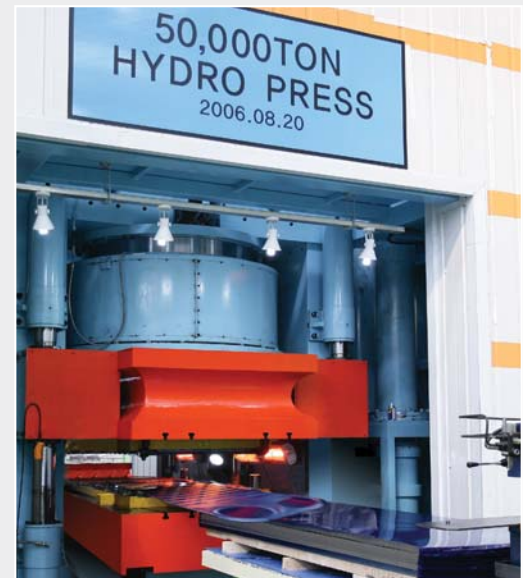




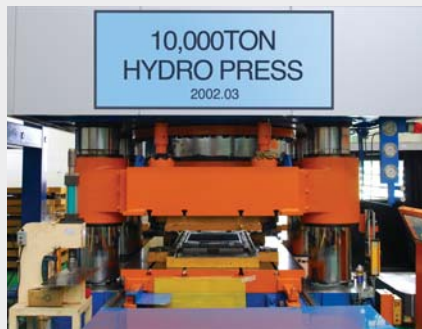
## Production Facilities

LHE는 열교환기 제작에 적합한 현대화된 설비를 보유하고 있습니다. 전열판의 품질은 Plate Heat Exchanger의 성능을 직접적으로 좌우합니다. 그래서 LHE는 세계최고설비인 50,000ton, 25,000ton, 10,000ton 유압프레스를 사용하여 초대형, 중형, 소형, 초소형등 다양한 제품을 생산하여 고객의 요구에 부응하고 있습니다.

LHE's production facilities are equipped with modernized and optimized system for manufacturing heat exchangers. The quality of heat plate is directly related to the performance of Plate Heat Exchanger. We, therefore, try our best to live up to customer's expectation by providing with a various range of heat exchangers with large, medium, small and mini-sized plates fabricated by 50,000, 25,000, 10,000ton hydraulic presses.



50,000ton hydraulic press



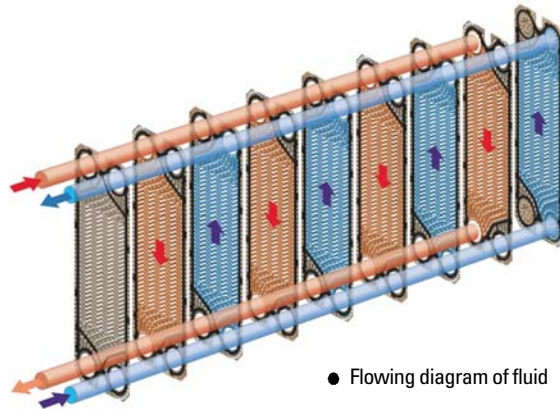
10,000ton hydraulic press



25,000ton hydraulic press

# Plate and Frame heat exchanger

**원리 및 구조**  
Principle and Structure



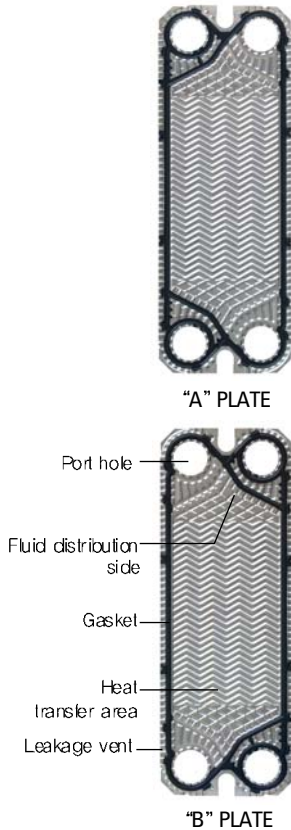
● Flowing diagram of fluid

**원리 | Principle**

전열판에는 Gasket이 부착되어 있으며 Gasket은 유로의 형성과 액이 외부로 누출되지 않도록 밀봉해 주는 역할을 하며, 열교환기 전열판의 숫자와 크기는 유량과 유체의 물리적 특성, 입력 손실 및 온도조건에 따라 결정된다. Cover는 두 유체의 압력 차이로 생길 수 있는 판이 휘는 것을 방지하여 준다.

Plate의 조립은 Plate표면(Gasket이 부착된 곳)이 Fixed cover쪽으로 향하여 1매마다 상하 역으로 걸어주어 "A" Plate의 표면을 흐르는 유체는 항상 "A" Plate만을 흐르고 "B" Plate를 흐르는 유체는 항상 "B" Plate만을 흐른다.

Gasket is attached to the heat plate which forms flow channel and acts seal up the fluid not to leak to the outside. The number of the heat plate is determined according to the amount of fluid, physical properties of fluid, the pressure drop and thermal condition. The covers prevent the plates bended from the difference of pressure. In the assembly of plate, the surface with gasket is directed to the fixed cover and each plate is hung in opposite direction alternately. And two fluids cannot be mixed and separated by a thin plate. One fluid always flows in "A" channel and the other fluid always flow in "B" channel.



**구조 | Structure**

판형 열교환기는 상부의 Carrying bar와 하부의 Guide bar 사이에 장착된 얇고 주름진 여러 장의 전열판으로 구성되어 있다. 이 전열판은 두 종류의 유체가 통과하는 유로를 형성해 주며, 전열판에 형성된 주름은 유체의 흐름을 난류로 만들어 주고 두 유체간의 압력차에 대해 판을 지지해 주는 역할을 한다. Plate pack은 Fixed cover와 Movable cover 사이에 들어가게 되며 Tie bolts로 조여 준다.

The plate heat exchanger is fixed by numbers of thin and corrugated heat plates, hanged between the carrying bar on the above and the guide bar on the below. These heat plates provide flow channels for two kinds of fluid, and the chevrons on the heat plates make the turbulent flow and play a role to support the plate against the pressure difference between the two fluids. The plate pack is to be placed between the fixed cover and the movable cover, and fixed with tie bolts.





**열판의 종류 및 채널 구성**  
Type of heat plate and Channel

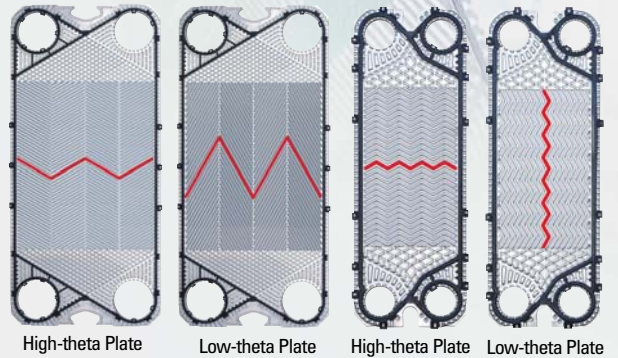
■ 열판의 종류 | Type of Heat Plate

**HIGH -THETA PLATE**

- 높은 난류 유동 (High turbulent flow)
- 높은 열전달율 (high heat transfer coefficient)
- 완벽한 온도 근접 (Perfect temperature approach)
- 높은 압력 손실 (High pressure drop)

**LOW -THETA PLATE**

- 낮은 난류 유동 (Low turbulent flow)
- 낮은 열전달율 (Low heat transfer coefficient)
- 큰 온도 근접 (High temperature approach)
- 낮은 압력 손실 (Low pressure drop)



■ 채널 구성 종류 | Channel Combination

2개의 열판을 사용하여 3가지 종류의 채널을 구성할 수 있습니다.

There classes of channel with high theta plate and low theta plate are possible.

- H** (High Channel) : 2개의 High-theta 열판으로 구성  
Combination of two high-theta heat plate)
- L** (Low Channel) : 2개의 Low-theta 열판으로 구성  
Combination of two low-theta heat plate)
- M** (Medium Channel) High-theta 열판과 Low-theta 열판의 조합으로 구성  
Combination of one high-theta plate & one low-theta plate)



**재질 | Material**

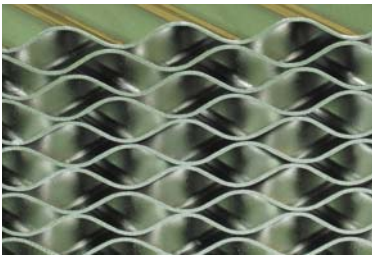
Plate : S.S 304, 304L, 316, S.S 316L, Titanium, Ti-Pd, Nickel, Hastelloy, Avesta 254 SMO

Gasket : NBR, EPDM, FPM, Neoprene, IIR, Butyle, Silicone

# Plate and Frame heat exchanger



**특징 및 용도**  
**Characteristics and Usage**

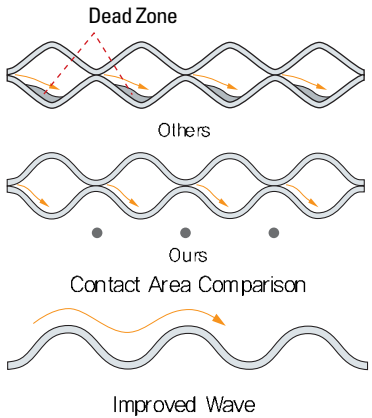


## ■ 특징 | Characteristics

### — 최고의 열교환 효율 | High efficiency

전열판(Plate)은 최대의 열전달 효과를 얻기 위해 주름(Corrugated, 파형)모양의 패턴을 형성하였으며 유체의 흐름을 난류(Turbulence)로 만들기 위해 유로를 경사지게 배열하고, 또한 이들의 흐름방향을 대항류(Countercurrent Flow)로 하였으며 열교환기내에 체류하는 유체의 체적을 작게하고, 정체되는 곳(Dead Space)이 없으므로 최고의 열교환 효율을 발휘한다. 다관식(Shell & Tube)열교환기에 비해 5배 이상의 열교환계수를 얻을 수 있다. (K값 : 3,000~6,500kcal/m<sup>2</sup>h °C, Water/water)

The heat plate forms corrugation to maximize the heat transfer efficiency and chevrons to create turbulence flow also designed to make countercurrent flow which enables to diminish the quantity of fluid remaining in the heat exchanger and eliminate the dead-zone. The plate heat exchanger can obtain five(5) times heat transfer efficiency compared with shell and tube heat exchanger.



### — 넓은 접촉면적 | Wide contact area

열교환기 조립 시 금속접점이 약간의 면접촉이 되도록하여 점접촉으로 되어있는 타사제품에 비해 강도가 우수하며 이에따른 변형 및 응력집중을 최소화함으로써 내구성(내식성)및 수명을 크게 향상시켰다. Gasket의 단면은 유체와의 접촉 면적이 가장 적게 나오면서 탄성을 유지할 수 있는 구조로 설계 되었다 이는 Plate 와 Gasket의 내구 수명에 가장 큰 영향을 미치며 내압을 증가시키는 가장 큰 요인이 된다

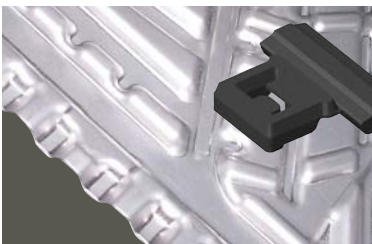
The strength of the plate is excellent, compared with other companies' products with the point contact type, as the metal contact point has the surface contact feature when the plates are assembled. And the durability and corrosion resistance are greatly improved by minimizing deformation and stress concentration.

Besides, the section of the gasket is designed and manufactured to have a pressure-resistant structure that enables the minimum contact area with the fluid, and thus to withstand a high pressure.

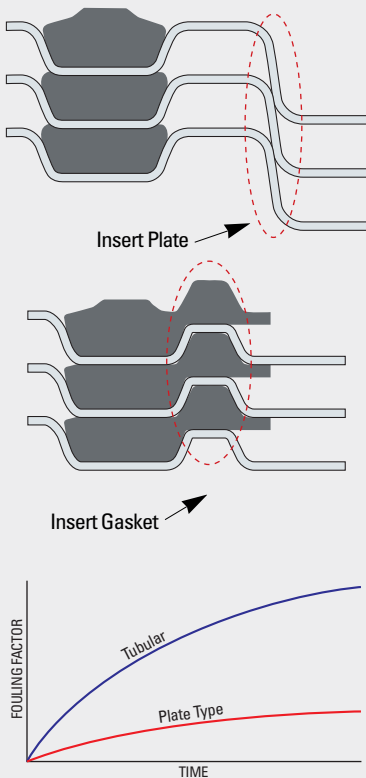
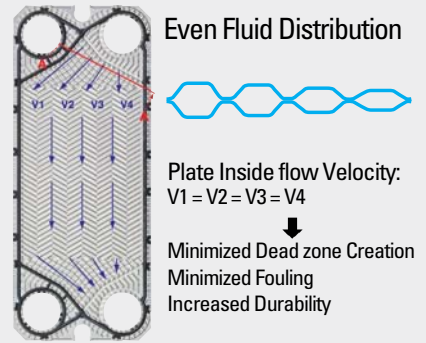
### — LHE-Clip Gasket

LHE의 판형열교환기에 사용되는 GASKET은 Clip Type 또는 Snap Type의 장치에 의해 최적의 상태로 빠르고 단단하게 열판에 고정시킬 수 있으며, Glue type과 None Glue type을 생산하여 용도에 맞게 사용할 수 있다.

The gasket can be fixed tightly and quickly on the heat plate in the optimum condition with the dual fixing device (snap on type), and is designed and manufactured to have the glue type and non-glue type so that it can be selected according to the usage.







### 진동 방지 설계 | Anti Vibration Design

연속적인 진동에도 Tie bolt/nut가 풀리지 않도록 설계를 하여 기계 수명의 증가 및 운전 중에 진동에 의한 누수를 미연에 방지하도록 하였다.

Designed to prevent loosening the tightening bolts and nuts during continuing operation which secure to prolong the equipment's operation lifetime and prevent leakages.

### 분해 조립 용이 | Easy disassembly and assembly

초대형 Model일 경우에도 1~2명이 분해 조립이 용이하다.

Insert형 Plate와 Insert형 Gasket 2중 고정 type으로 설계가 되어 미숙련된 초보자가 열교환기를 분해 조립하여도 Plate의 미끄러짐이나, 잘못 조립되는 경우가 없다.(고점도물질 or L.O cooler, Oil heater 등 Oil의 Maintenance가 탁월함)

Even the biggest model also can be assembled or disassembled by 1 or 2 persons.

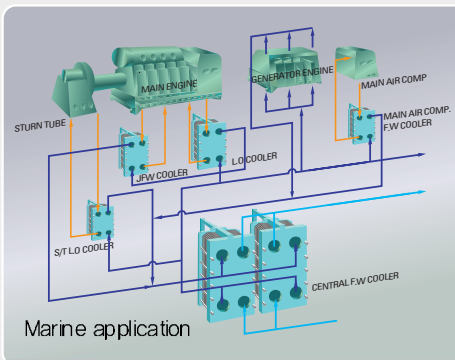
As it is designed to have a dual fixing method of the insert-typed plate and insert-typed gasket, there is no sliding on the plates. It prevents sliding and an assembling failure even when a non-skilled novice disassemble or assemble the device. (Excellent maintenance against materials with high viscosity such as oils for LO cooler or oil heater)

### 온도의 근접성 | Temperature Approach

열판의 파형패턴(Corrugated Pattern)에 의해 난류가 크게 촉진되므로 열전달 계수가 매우 높으며 Temperature Approach를 1°C까지도 근접시킬 수 있다.

다관식(Shell & Tube)의 경우는 5°C 정도가 온도 근접 한계이다.

The turbulent flow, promoted by the wave pattern of the heat plates, enables a very high heat transfer coefficient. Proximity Limit: 1°C

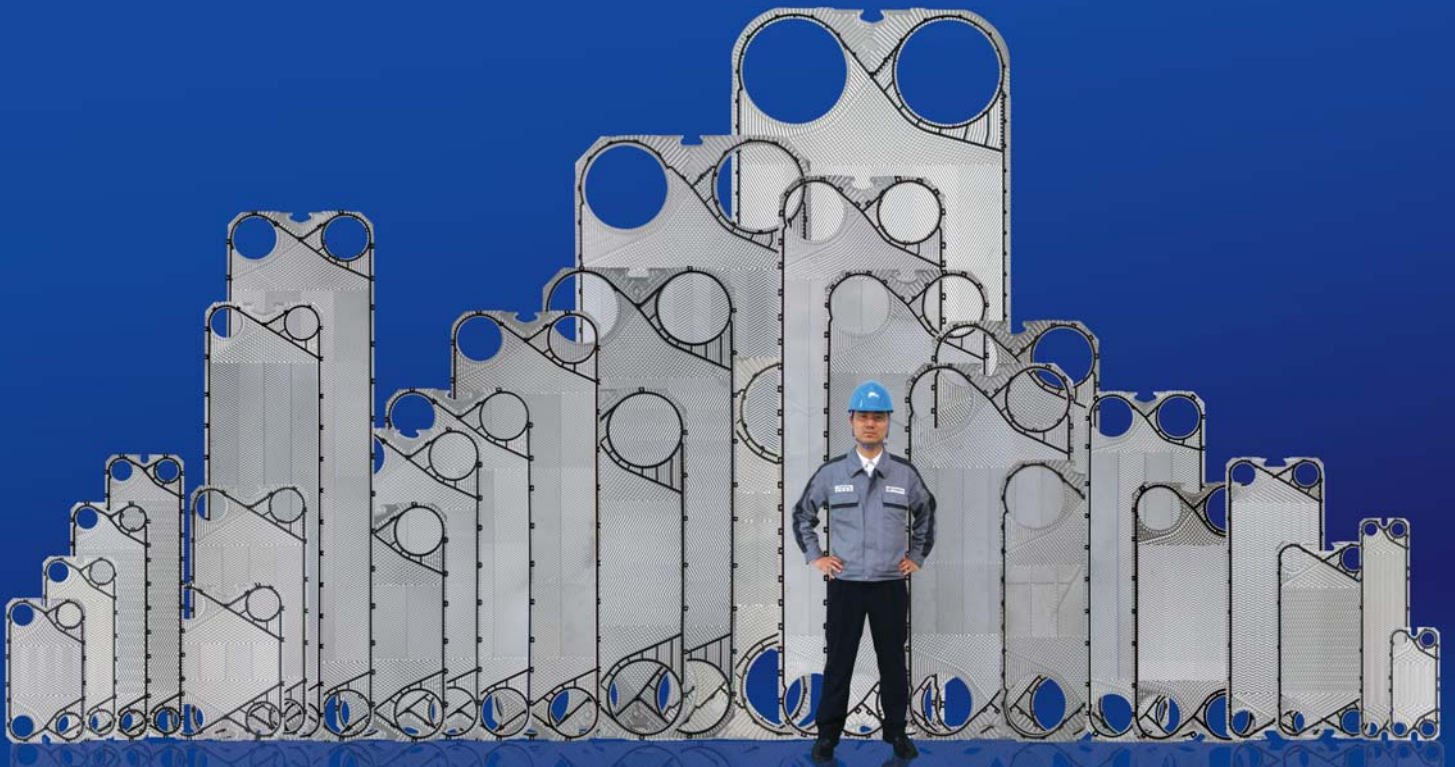


### ■ 용도 | Application

조선공업, 건축설비, 자동차공업, 섬유공업, 펄프제지공업, 화학공업, 제철, 금속공업, 기계공업, 식품공업, HVAC, 발전설비, 기타

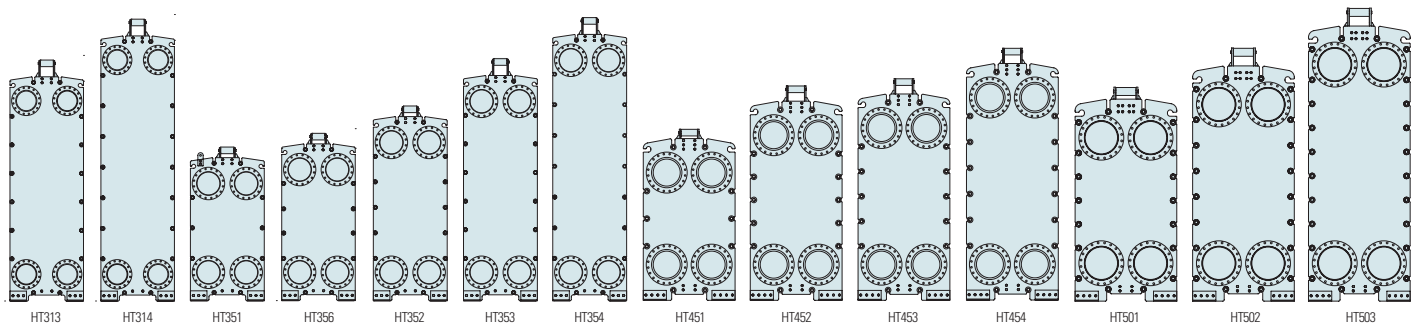
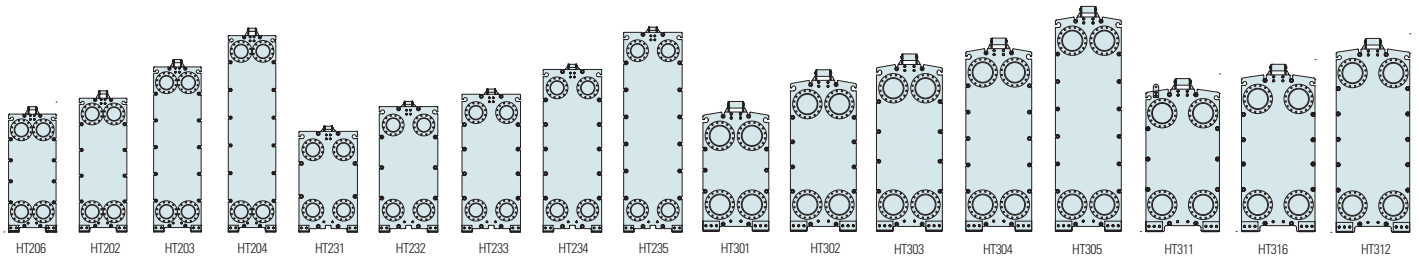
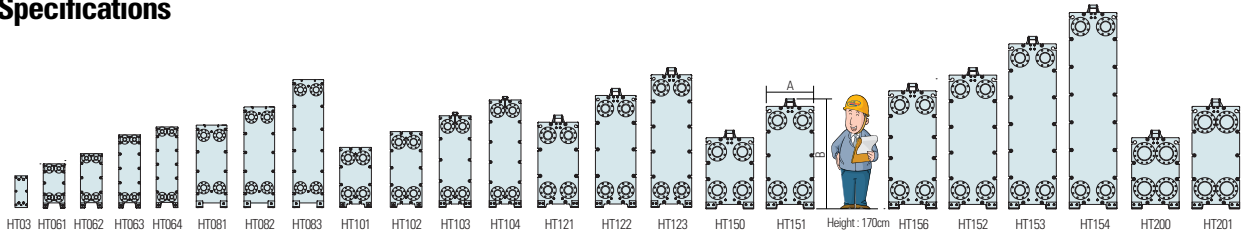
Marine Application and Engines, Architecture Industry, Automobiles Industry, Textile Industry, Pulp and Paper Industry, Chemical Industry, Steel Industry, Mechanical Industry, Food Industry, HVAC, Power Stations, Surface Treatment





# Plate and Frame heat exchanger

## ■ 제품규격 | Specifications





## Plate and Frame Heat Exchanger Technical Data

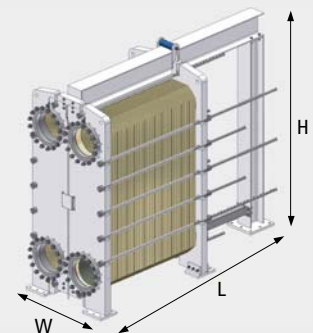
Model		HT02	HT03	HT061	HT062	HT063	HT064	HT081	HT082	HT083	HT101	HT102	HT103
Max. Flow	m <sup>3</sup> /hr	5	17	68	68	68	68	116	116	116	170	170	170
Max.Conn.Dia.	mm	25	40	80	80	80	80	100	100	100	150	150	150
Dimension - H	mm	196	540	668	820	1105	1220	1133	1410	1825	909	1149	1489
Dimension - W	mm	91	190	328	328	328	328	456	456	456	464	464	464
Dimension - C(min. - max.)	mm	80-400	150-500	330-830	430-830	435-930	430-830	435-930	535-930	535-930	435-1535	435-1535	535-1535

Model		HT104	HT121	HT122	HT123	HT151	HT156	HT152	HT153	H154	HT201	HT206	HT202
Max. Flow	m <sup>3</sup> /hr	170	210	210	210	360	360	360	360	360	640	640	640
Max.Conn.Dia.	mm	150	150	150	150	200	200	200	200	200	200	200	200
Dimension - H	mm	1629	1399	1805	2120	1663	1900	2137	2611	3085	1663	1900	2140
Dimension - W	mm	464	615	615	615	720	720	720	720	720	720	720	720
Dimension - L(min. - max.)	mm	535-1535	440-1640	440-1640	440-1640	450-1550	450-1550	450-1550	450-1550	450-1550	450-2850	450-2850	450-2850

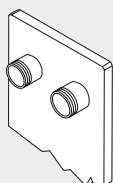
Model		HT203	HT204	HT231	HT232	HT233	HT234	HT235	HT301	HT302	HT303	HT304	HT305
Max. Flow	m <sup>3</sup> /hr	640	640	790	790	790	790	790	1700	1700	1700	1700	1700
Max.Conn.Dia.	mm	200	200	300	300	300	300	300	350	350	350	350	350
Dimension - H	mm	2615	3090	1670	1985	2175	2550	3105	1963	2445	2685	2925	3405
Dimension - W	mm	720	720	886	886	886	886	886	998	998	998	998	998
Dimension - L(min. - max.)	mm	450-2850	450-2850	560-3160	560-3160	560-3160	560-3160	560-3160	700-3400	700-3400	700-3400	700-3400	700-3400

Model		HT311	HT316	HT312	HT313	HT314	HT351	HT356	HT352	HT353	HT354	HT451	HT452
Max. Flow	m <sup>3</sup> /hr	1700	1700	1700	1700	1700	2430	2430	2430	2430	2430	3550	3550
Max.Conn.Dia.	mm	400	400	400	400	400	400	400	400	400	400	500	500
Dimension - H	mm	2320	2540	2945	3565	4185	2320	2540	2945	3565	4185	2590	3160
Dimension - W	mm	1115	1115	1115	1115	1115	1115	1115	1115	1115	1115	1390	1390
Dimension - L(min. - max.)	mm	670-4370	670-4370	670-4370	670-4370	670-4370	670-4370	670-4370	670-4370	670-4370	670-4370	830-5230	830-5230

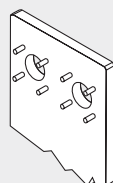
Model		HT453	HT454	HT501	HT502	HT503
Max. Flow	m <sup>3</sup> /hr	3550	3550	5000	5000	5000
Max.Conn.Dia	mm	500	500	500	500	500
Dimension - H	mm	3270	3730	3350	3850	4450
Dimension - W	mm	1390	1390	1540	1540	1540
Dimension - L(min. - max.)	mm	830-5230	830-5230	830-5330	830-5330	830-5330



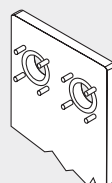
### Connection Option



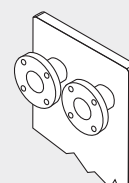
Threaded connection with alloy nozzle



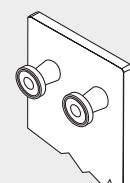
Studded connection



Studded connection with alloy lining



Flanged connection



Sanitary Quick-disconnect nozzle

Max. operation temp. 200°C  
 Heat transfer area 0.1 ~ 2,600m<sup>2</sup>/set\*  
 Max. operation press. 26 kg/cm<sup>2</sup>g  
 Max. flow rate 5000m<sup>3</sup>/hr.set

The following materials can be applied to plates : Stainless steel : SS304, SS316L, 254SMO, 940L, 317L Nickel : Ni.200  
 Nickel alloy : C-276, 825, 625, Incoloy, Hastelloy Titanium : Ti.Gr.1, Ti.Gr.11  
 The following materials can be applied to gaskets : NBR, EPDM, FPM, Neoprene, IIR, Butyls, Silicone, Teflon, Envelop(Special)

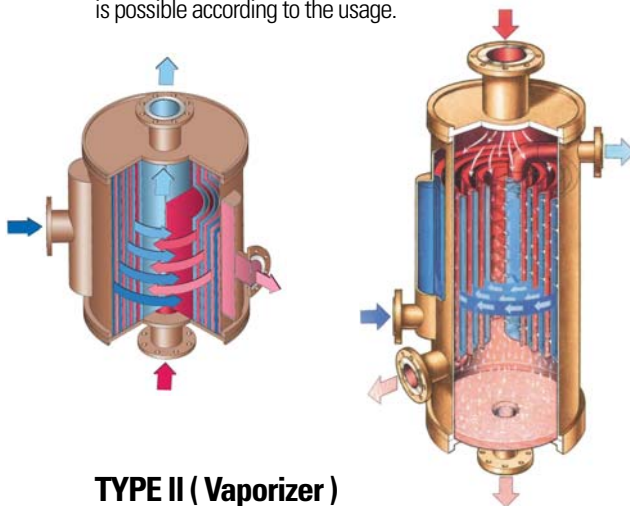
# Spiral heat exchanger

**구조 및 원리**  
Structure and Principle

### TYPE I (Liquid/Liquid)

가장 일반적인 형태이며 액체/액체, 가스/가스 및 가스/액체의 열교환에 사용된다. 고온 유체는 본체의 가운데에 있는 입구로 들어와서 중심에서 바깥쪽으로 흐르게 되며 저온 유체는 본체의 옆에 있는 입구로 유입되어 바깥에서 안쪽으로 흐르게 된다. 이러한 대향류(Counter Flow)로 인해 높은 열교환이 이루어지게 되어 작은 온도차에서도 이용할 수 있다. 용도에 따라 수직, 수평 어떠한 형태의 설치도 가능하다.

As the most common type, it is used for liquid-to-liquid, gas-to-gas and gas-to-liquid heat exchange. The high-temperature fluid comes in through the inlet, located in center of the main body, to flow from outside to the inside. Due to this counter flow, high-efficiency heat exchange is available and can be used for a tiny difference in temperature. Any type of installation (vertical or horizontal) is possible according to the usage.



### TYPE II ( Vaporizer )

이 형태는 특히 진공 상태나 낮은 운전 압력 조건에서의 리보일러 및 모든 유체의 증발기용으로 적합하다. 기체의 유속은 큰 부피에도 적절한 수준으로 유지되며 압력손실은 최소화된다. 2대 또는 3대를 다단으로 수직 연결하여 복합적인 목적으로 사용 가능하다.

This type is suitable for reboilers and evaporators for all kinds of fluid especially in the vacuum status and a low-pressure condition. The flow rate of air is maintained at a proper level even for a large volume, and the pressure loss is minimized. It can be used for multi purposes by vertically connecting three units in a row.

### TYPE II ( Condenser )

부피가 큰 기체(저압 또는 진공상태에서), 가스 및 기체와 액체의 혼합물과 같은 물질을 처리하기 위한 응축기 및 가스의 냉각 및 가열용으로 적합하다. 저온 유체는 본체의 옆에 있는 입구로 유입되어 나선형 유로를 따라 안쪽으로 흐르게 되며 고온 유체는 상부로 들어와서 하부로 수직으로 흐른다. 저온 유로쪽 전열판은 양단이 용접에 의해 모두 막혀 있고 고온쪽은 모두 개방되어 있다. 대부분 수직으로 설치하지만 용도에 따라 수평설치도 가능하다.

This type is suitable for cooling and heating of gas and the condenser for processing large-volume gases (at a low pressure or vacuum) and mixture of gas and/or liquid. The low-temperature fluid comes in through the inlet, located on the side of the main body, to flow to inside along the spiral fluid passage while the high-temperature fluid comes in through the top and vertically flows to the bottom.

The both ends of the heat transfer plates on the side of the low-temperature fluid passage is blocked by welding, and the high-temperature plates are all opened. In most cases, this type of heat exchanger is installed vertically, but horizontal installation is also available according to the usage.

### TYPE III ( Liquid / Vapor )

주로 액-증기계에 사용되며 가열기, 냉각기, 응축기 등 사용 범위가 넓다. 저온 유체는 본체의 옆으로 들어와 나선형으로 안쪽 방향으로 흐르게 되며 고온측 증기는 상부 입구로 들어가서 기체를 개방된 나선형 유로의 전면과 중앙부로 일정하게 분배되어 나선과 축방향유동이 복합적으로 이루어지며 응축액과 비응축 기체나 가스가 각각 다른 출구로 배출된다.

This type is mostly used for the liquid-vapor exchanges such as heaters, coolers and condensers, and has wide range of use. The low-temperature fluid comes in through the side of the main body to spirally flow into the inside while the high-temperature vapor comes in through the top. And the flowed-in air is distributed evenly to the front and center parts of the opened spiral-typed fluid passage, which generates combined flow in the spiral and axis directions. The condensed liquid and the non-condensed gas are discharged separately to different outlets.





Waste Water Cooler



Waste Water Cooler



PVC Slurry Heat Exchanger



PCW Cooler(JWS)

### TYPE IV ( Top Condenser )

상부 응축기(Top Condenser)는 증기가 유입되는 입구 연결부의 크기를 스파이럴 열교환기를 연결되는 기기의 출구 크기에 맞추어 제작할 수 있으므로 별도의 배관 작업없이 각종 탑(Top of Column)이나 반응기(Reactor or Kettle) 상단에 설치할 수 있다. 기체는 중심부의 관으로 유입되어 나선형 축방향 유동 또는 이 두 형태의 혼합형태로 분배된다.

냉각 유체는 본체의 주변에서 유입되어 중심부로 나선형 흐름으로 흘러 상부로 빠져 나가게 된다.

The condenser on the top can be installed on the top of column or the reactor of kettle without piping work as the size of the connection part of the inlet for incoming vapor can be adjusted according to the size of the outlet to which the spiral-typed heat exchanger. Air comes into the pipes of the center to be divided into the spiral flow, axial flow and/or mixture of the two types of flow. The cooling fluid comes in through the surface of the main body to spirally flow into the center, and discharged through the top. The condensed liquid is generated in the main body or collected in the condensed liquid-collecting part of the main body.

### Spiral Heat Exchanger Technical Data

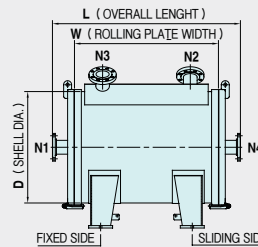
Model		DSP-W300	DSP-W400	DSP-W500	DSP-W600	DSP-W1000	DSP-W1200	DSP-W1500	DSP-W2000
Maximum flow	m <sup>3</sup> /hr	56	75	94	114	187	228	285	374
Maximum Transfer Area	m <sup>2</sup>	25	50	45	80	180	290	300	550
Chammel gap	mm	5-20	5-20	5-20	5-20	5-26	5-26	5-26	5-26
Heat Transfer Thickness	mm	2-3	2-3	2-3	2-3	2-3	2-3	2-3	2.5-3
Maximum nozzle size	mm	80	100	125	125	150	200	250	300

#### Possible Manufacture Dimension of each Model

Model		DSP-W300	DSP-W400	DSP-W500	DSP-W600	DSP-W1000	DSP-W1200	DSP-W1500	DSP-W2000
W(Flow width)	mm	300	400	500	610	1000	1220	1524	2000
D (Outside diameter)	mm	600	800	1000	1200	1400	1600	1800	2200
L(Overall length)	mm	700	800	900	1000	1500	1700	2000	2500

#### Specification

	Minimum	Maximum
Heat transfer Area	5 m <sup>2</sup>	600 m <sup>2</sup>
Design Temperature	-100 °C	400 °C
Design Pressure	Full Vacuum	20 kg/cm <sup>2</sup> G
Application Code	ASME, KS, CE Mark	
Standard Material	Stainless steel, carbon steel	
Available Material	Weldable Metals, Duplex, Titanium, Hastelloy, etc.	



# Spiral heat exchanger



Reactor Cooler

## 장점 Benefits

스파이럴(spiral) 열교환기는 2장의 금속판을 스파이럴 모양(소용돌이 형상)으로 휘감고, 2개의 유로를 형성하고 있다. 다관식 열교환기는 여러 개의 열전달관에 의하여 다수의 유로를 형성하고 있지만 스파이럴 열교환기는 단일의 유로이므로 열교환 능력을 저하시키는 오염물질은 대부분 부착되지 않고, 유체를 완전 향류로 흐르게 할 수 있기 때문에 열교환을 효율적으로 이용할 수 있다.

The spiral heat exchanger has two metal plates in the form of spiral and comprises two fluid passages. While the multi-pipe heat exchanger depends on the several heat transfer pipes and has a number of fluid passages, the spiral heat exchanger has a single passage. As it can prevent adhesion of contaminated materials lowering heat exchange efficiency, and make the fluids form the counter flow which enables the highly efficient heat exchange.

### 높은 총괄 열전달 계수

#### High Total Heat Transfer Coefficient

나선형 유로는 난류를 발생시키기 쉽고, 전열판 폭과 유로 간격의 선택에 의하여 최적의 유속이 얻어지기 때문에 열전달 성능은 극히 높아진다.

As the spiral fluid passage is likely to create turbulent and the optimum flow rate is obtained by how adjusting the width of the heat transfer plates and the gap of fluid passage, the spiral heat exchanger has high heat transferring performance

### 적은 오염 | Low Fouling

단일 유로는 균일하게 유체를 배분하여 오염 물질의 부착이 적고, 부착된다 하더라도 유속에 의하여 박리시키는 Self-Cleaning이 일어나 슬러지(Sludge)를 포함한 유체에 탁월한 능력을 발휘한다.

The single fluid passage of one pass structure distributes the fluid evenly to have less polluting materials adhered. Even when they are adhered, its self cleaning function peels off them by the speed of the fluid. It can be also applied to sludge.

### 온도차의 유효 활용

#### Effective Usage of Temperature Difference

완전 향류로 인하여, 극히 작은 온도차까지 열교환할 수 있으므로, 에너지절약에 최적의 효과를 발휘한다.

The transferred counter flow enables heat exchange for even tiny temperature difference, and thus the spiral type is optimized for saving energy.

### 공간 절약 | Space Saving

고성능인 동시에 구조가 콤팩트(Compact)하여 설치 비용이 저렴하다.

Its high-performance and optimized structure allows the compact design and low installation cost.

### 용이한 보수, 점검

#### Easy Repair & Maintenance

내부의 점검은 양단의 커버(Cover)를 개방하여 손쉽게 보수 및 점검을 할 수 있다.

The internal checkup can be done by just opening the cover of the both ends, which enables easy repair and maintenance.



Vapor Condenser





Alkali Solution Heater



Waste Water Cooler

**용도  
Usage**

**1. Petroleum**

- a) Refinery
  - ① Produced water / Fresh water interchanger
  - ② Treated crude oil / Fresh feed water interchanger
- b) Desulphurization
  - ① Acid gas partial condenser ② Stripper reboiler
- c) Ethylene Oxide
  - ① Effluent gas / Feed gas interchanger
- d) Ethylene Glycol
  - ① Reactor feed / Recycle Interchanger
  - ② Reactor feed heater
- e) Caprolactam
- f) Acrylic Fibers
  - ① Condensing of ACN recovered from the strippers
- g) Polyester
  - ① Preheating of Glycol & monomer
- h) Polystyrenes
  - ① Preheating of strength & additives
- i) PVC
  - ① PVC Slurry interchanger ② VCM stripper / condenser
- j) Formaldehyde
  - ① Formaldehyde / Methanol Interchanger
  - ② Product cooler / Heater
- k) ABS / SAN
  - ① Vapor condenser
- l) Epoxy
  - ① Resin cooler ② Condenser
- m) F.E & P.P
  - ① Azeotrope still Interchanger (PP) ② Heptane cooler
  - ③ Live p.p slurry cooler ④ Granulate water cooler

**2. Steel & Inorganic**

- a) Alumina
  - ① Bauxite slurry heater ② Bauxite slurry heater
  - ③ Red mud heater recovery ④ Hydrate slurry cooler
- b) Zinc
  - ① Zinc solution preheater ② Zinc solution cooler
- c) TiO<sub>2</sub>

**3. Branch industries**

- a) Explosives
  - ① H<sub>2</sub>SO<sub>4</sub> Cooler ② UDMH Cooler
- b) Waste water
  - ① Textile waste water ② Slurry interchanger
- c) Photographic
  - ① Glycol cooler ② Gelatine heater
- d) Paint
  - ① Paint suspension cooler ② Fatty acid heater
- e) Pharmaceutical
  - ① Methanol / water condenser
  - ② Sludge interchanger ③ Nitric acid cooler

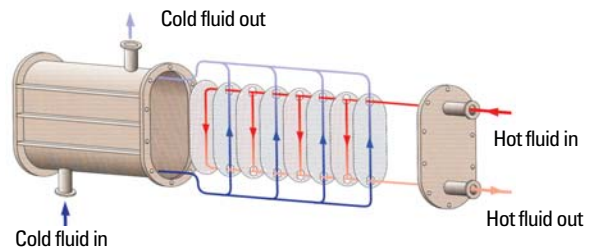


# Oblong plate & shell heat exchanger

## 구조 및 특징 Structure and Characteristics

Oblong Plate & Shell 열교환기는 판형 열교환기의 장점과 다관식 열교환기의 단점을 보완한 제품이다. 전열판의 형상은 Oblong형으로 주름져 있으며 원형인 Plate & Shell에 비하여 원형부의 중간부분을 직사각형 판형상으로 연장시킴으로서 전열판의 전열 길이(Thermal length) 및 전열 면적을 증가시켜 열교환 효율을 획기적으로 증대시킨 Full welded type이다. 가스켓을 사용하지 않는 구조이므로 고온·고압에서 사용이 가능한 차세대형 고효율 Compact 열교환기이다.

Accepting the merits of the plate-type heat exchanger and supplementing the demerits of the multi-pipe heat exchanger, the oblong plate & shell heat exchanger has the heat plates, which are wrinkled in the oblong shape. As its center part in shape of round is extended into the oblong plate shape, the increased heat transfer length and area revolutionarily enhance the heat transfer efficiency. It is a high-efficiency compact and fully-welded heat exchanger of the next generation, that can be used in high-temperature and high-pressure conditions, without a gasket.



### ■ 특징 | Characteristics

#### 높은 열전달 효율 | High Heat Transfer Efficiency

전열판의 주름은 낮은 Reynolds No.에서 난류를 형성하므로 총괄전열계수가 다관식 열교환기 보다 4~5배인 3,000~6,000 kcal/m<sup>2</sup>h°C 정도임.

The wrinkles of the heat transfer plates generate turbulent at a low Reynolds number, and the total heat transfer coefficient is 3000 kcal/m<sup>2</sup>h°C ~ 6000 kcal/m<sup>2</sup>h°C (4-5 times higher than that of the multi-pipe heat exchanger).

#### 고내압성 | High Pressure Resistance

전열판과 전열판 사이 및 Shell 구조가 Full Welded 타입이므로 최고사용압력이 80 kg/cmG까지 가능.

The fully-welded structure of the heat transfer plates and the shell allows the maximum usable pressure up to 80 kg/cmG.

#### 고내열성 | High Thermal Resistance

가스켓을 사용하지 않는 Full Welded 타입이므로 사용온도가 600°C 까지 사용 가능.

As it is the fully-welded type not using a gasket, the available temperature is 600 °C (up to 900 °C in maximum).

#### 높은 경제성 | High Economical Efficiency

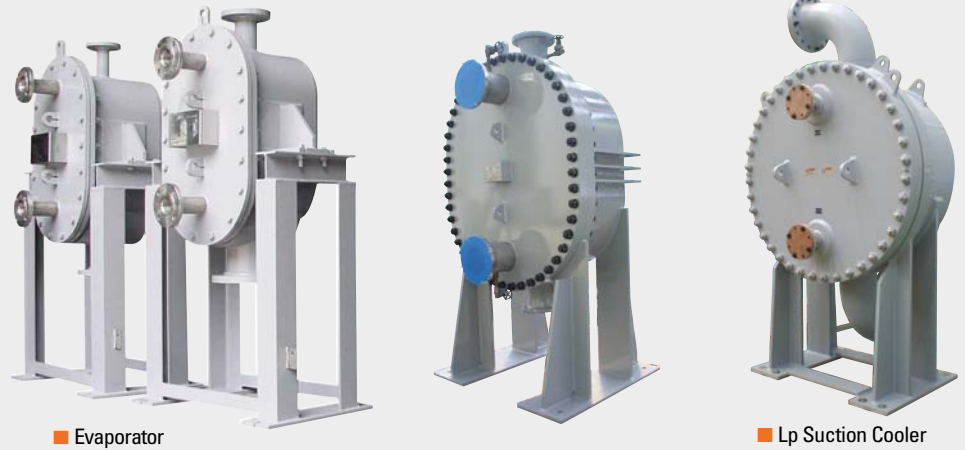
다관식 열교환기에 비하여 가격이 저렴하며 크기가 1/4이하로 작아지므로 설치 공간 및 무게가 감소되며, Full Welded 구조이므로 주기적으로 가스켓을 교체하지 않아 유지 보수비를 최소화 할 수 있다. 또한 대용량의 Vapor용 콘덴서에 소형으로 탁월한 효과가 있다.

The price is lower than that of the multi-pipe heat exchanger. Its small size (1/4 of the multi-pipe heat exchanger) reduces the required space for installation and the weight, and the fully-welded type without requiring periodical replacement of a gasket minimizes the maintenance cost. Also, the small-sized condenser for a large-capacity vapor provides prominent effects.



■ Recuperator





Evaporator

Lp Suction Cooler

### ■용도 | Application

- 화학공업 : VOC Condenser, 고온 고압폐열 회수 열교환기, 에탄올 응축, Solvent Recovery System, EO/EG 열교환기
  - HVAC : 지역 난방, 급탕 용수 가열, 공조설비, 냉난방 장치, Steam 가열기
  - 냉 동 : 증발기, 응축기
  - 조 선 : HFO Heater, Steam Heater, Oil Cooler, Vacuum Condenser, LPG Condenser
  - 기 타 : 발전소, 고온 · 고압의 각종 열교환 및 폐열 회수 시스템
- Chemical Industry : VOC Condenser, High Temperature & Pressure Recovery System, Ethanol Condenser
  - Evaporator - Condenser - Generator - EO/EG Heat Exchanger
  - High Temperature & Pressure Waste Heat Recovery Heat Exchanger
  - Ethanol-Condensed Solvent Recovery System
  - District Heating - Hot Water Heating - Ventilation Facility
  - Cooling & Heating System - Steam Heater
  - Various Types of High-Temperature & High-Pressure Heat Exchangers and Waste Heat Recovery Systems

### Oblong Plate & Shell Heat Exchanger Technical Data

Model		2A	2B	2B0	3A	3B	3B0	6A	6B	6C	6A1	6B1
Maxium Flow	m <sup>3</sup> /hr	60	60	70	100	100	120	250	250	250	300	300
Maxium Transfer Area	m <sup>2</sup>	3.0	7.0	7.5	10	24	26	70	110	150	75	120
Heat Transfer Thickness	mm	0.6-0.7	0.6-0.7	0.6-0.7	0.6-0.7	0.6-0.7	0.6-0.7	0.6-0.7	0.6-0.7	0.6-0.7	0.6-0.7	0.6-0.7
Max./Min Nozzle Size	mm	10/80	10/100	10/100	15/125	15/150	15/150	32/250	32/250	32/250	50/300	50/300

Model		6C1	6B2	6C2	10A	10B	10C	10A1	10B1	10C1	10B2	10C2
Maxium Flow	m <sup>3</sup> /hr	300	330	330	900	900	900	1000	1000	1000	1150	1150
Maxium Transfer Area	m <sup>2</sup>	160	130	170	400	550	700	450	600	750	650	800
Heat Transfer Thickness	mm	0.6-0.7	0.6-0.7	0.6-0.7	0.7-0.8	0.7-0.8	0.7-0.8	0.7-0.8	0.7-0.8	0.7-0.8	0.7-0.8	0.7-0.8
Max./Min Nozzle Size	mm	50/300	65/350	65/350	80/350	80/350	80/350	100/400	100/400	100/400	125/500	125/500

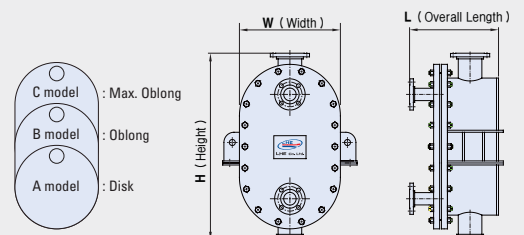
#### Possible Manufacture Dimension of each Model

Model		2A	2B	2B0	3A	3B	3B0	6A	6B	6C	6A1	6B1
W	mm	350	350	350	490	490	490	795	795	795	795	795
H	mm	410	600	600	580	900	900	1000	1250	1550	1000	1250
L	(max) mm	500	500	570	600	600	700	1700	1700	1700	1900	1900

Model		6C1	6B2	6C2	10A	10B	10C	10A1	10B1	10C1	10B2	10C2
W	mm	795	795	795	1480	1480	1480	1480	1480	1480	1480	1480
H	mm	1550	1250	1550	1600	1950	2250	1600	1950	2250	1950	2250
L	(max) mm	1900	2100	2100	1800	1800	1800	2000	2000	2000	2300	2300

#### Specification

	Minimum	Maximum
Heat transfer Area	0.62 m <sup>2</sup> /set	800 m <sup>2</sup> /set
Design Temperature	-50 °C	800 °C
Design Pressure	Full Vacuum	80 bar g
Application Code	ASME, KS, CE Mark	
The follow materials applied to plates	SS304, SS316L, Titanium, Hastelloy C-276, Any other weldable metal	

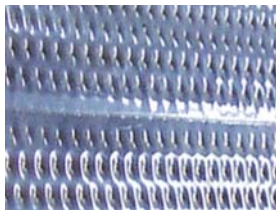


# Plate Coil heat exchanger



■ Jacket Panel heater

**구조와 특징**  
Structure and Characteristics



■ Hydro Forming Type Heating Panel



■ Pressing Type Heating Panel

## ■ 구조 | Structure

금형에 의해서 한면 또는 양면을 Embossing 또는 Pressing한 Plate 2장을 용접을 하여 내부에 독특한 유로를 형성하여 전열이 가능하도록 만든 구조로 설계, 사이즈, 형상에서 유연성과 다양성을 줄 수 있다. 용접 가능한 모든 금속에서 사용이 가능하며 액체-액체, 액체-가스, 가스-가스 등에 경제적이고 편리하게 사용할 수 있으며 높은 온도와 압력 조건 하에서도 사용할 수 있다. 당시의 Plate Coil의 장점은 Plate Coil을 설치 장소에 맞는 모양으로 성형을 하여 열교환 효율을 극대화하였고 장소에 구애 받지 않고 설치하여 사용할 수 있다. Vessel(반응기 등) 내·외부 부착용, Jacket 대응으로 사용함.

It has a structure, available for heat transfer with unique fluid passages inside by welding two plates of which one side or both sides are embossed or pressed, to provide flexibility and diversity in design, size and figure. Applicable to all weld able metals, it can be used economically and conveniently to the liquid-liquid, liquid-gas and gas-gas transfer, and in a high-temperature and high-pressure condition. The plate coil is a heat exchanger that can be easily mounted inside and outside the tanks with a clamp. The merits of our plate coil are that the customized forming for an installation site maximizes the heat transfer efficiency and thus it can be installed regardless of the place.

## ■ 특징 | Characteristics

### 높은 열전달 효율 | High Heat Transfer Efficiency

Plate Coil은 Service Side와 Process Side에 높은 열전달계수를 얻을 수 있다. High Serviced Side(Inside Plate Coil)은 큰 난류유동과 Dead Point가 발생하지 않고, 내측 체적에 비해 큰 표면적으로 인해 큰 경막 전열계수를 얻을 수 있다. High Process Side(Outside Plate Coil)은 부드러운 곡률에 의한 Fouling에 대한 저항으로 인해 경막전열계수를 얻을 수 있어 Pipe Coil에 비하여 전열효율이 월등하다. (약 2배)

The high serviced side inside the plate coil does not creates big turbulent flow and dead points, and a high film coefficient of heat transfer can be obtained due to the large surface area, compared to the internal volume.

### Diversity of Wrinkles

각 열매 · 냉매에 적합한 표준형식을 선택할 수 있다.

A standard type, suitable for each heat medium and cold medium, can be selected.

### 폭넓은 재질 선택 | Various Option for Materials

내구성(부식)에 의해 S.S 304(L), SS 316(L), Titanium, Ti-Pd 등의 재질선택이 가능하다.

Materials such as SS304(L), SS316(L) and Titanium Ti-Pd can be selected according to durability or corrosion resistance.

### 편리한 설치와 분해 조립 | Convenient Installation, Disassembly and Assembly

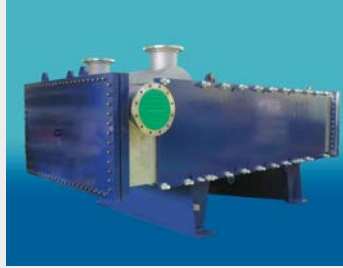
구조가 간단하여 설치 및 분해 조립이 용이하고 Scale제거가 용이하다. 그의 특징으로는 Vessel 내 · 외부에 쉽게 부착되며, 용량의 증감이 용이하고 일반 Pipe Coil을 설치하기 어려운 곳에도 쉽게 적용, 설치가 가능하고 Vessel 외부 설치시 Vessel 에 외압이 걸리지 않는다

Its simple structure allows convenient installation, disassembly, assembly and scale removing.



■ 사양 | Specification

Temperature : less than 400°C  
Heat transfer area : 0.2 ~ 20 m<sup>2</sup>/pc, 500 m<sup>2</sup>/set

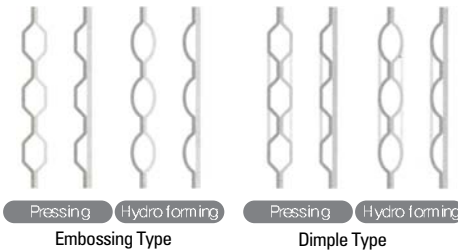


A10590-C Heat Recovery



Cryogenic Vacuum Chamber  
Cryogenic temperature control unit for Vacuum chamber

■ 형상 | Feature



Double Embossed

양측이 Embossing된 형태로 독립적으로 또는 Vessel 내부에 장착이 용이하다.  
As being embossed on both sides, easy to assemble independently or inside vessels.

Single Embossed

한쪽이 Embossing된 형태로 Vessel 외부에 설치가 용이하다.  
As being embossed on one side, easy to assemble outside vessels.



Crystallizer Heater & Cooler



EPS Slurry Cooler (Free Flow Type)



PVC Dryer Heating Panel

■ 용도 | Application

화학 공업, 기계공업, 전착도장, INK, 고무, 석유, 금속 도금, 초저온 용기, 제지, 수지, 섬유공업, 식품 산업  
Chemical Industry / Machinery Industry / Electro Painting / Rubber Industry / Petroleum Industry / Metal Coating / Cryo Cylinders / Paper Manufacturing / Resins / Textile Industry / Food Industry

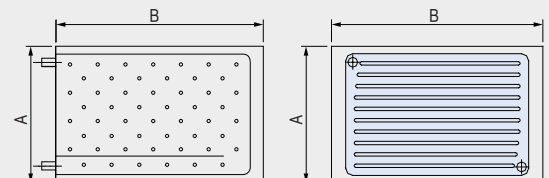
Plate Coil Heat Exchanger Technical Data

MODEL SPECIFICATION (AREA, m<sup>2</sup>)

A-DIMENSION (mm)		B-DIMENSION (mm)						
		400	900	1400	1900	2400	2900	3400
480	SINGLE	0.19	0.43	0.67	0.91	1.15	1.39	1.63
	DOUBLE	0.38	0.86	1.34	1.82	2.30	2.78	3.26
720	SINGLE	0.29	0.65	1.01	1.37	1.73	2.09	2.45
	DOUBLE	0.58	1.30	2.02	2.74	3.46	4.18	4.90
960	SINGLE	0.38	0.86	1.34	1.82	2.30	2.78	3.26
	DOUBLE	0.77	1.73	2.69	3.65	4.61	5.57	6.53

MAX. OPERATING PRESSURE

MATERIAL	THICKNESS	UNIT : kg/cm <sup>2</sup>	
		SINGLE	DOUBLE
STAINLESS STEEL	1.5mm	9	6
	2.0mm	13	9
	2.5mm	20	14

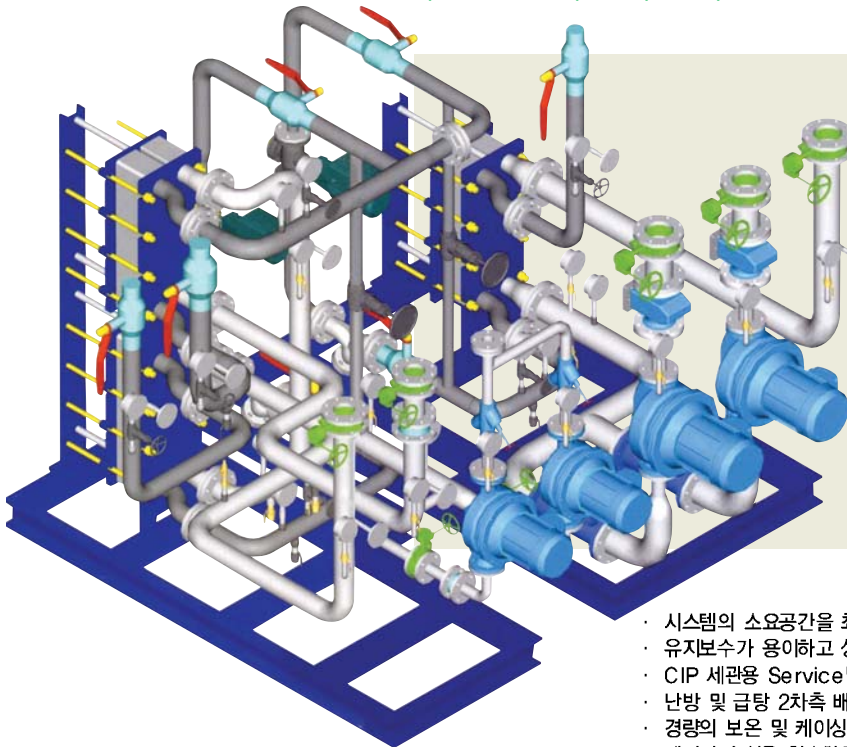


# CHU

## Compact heat exchanger unit

지역난방 콤팩트 설비유닛(CHU, COMPACT HEAT EXCHANGER UNIT)는 열교환기, 펌프, 온도조절밸브 등 지역난방 사용자설비를 구성하는 주요장비와 부품을 미리 표준 모듈로 구성하여 현장여건과 발주자의 요구 시방에 따라 공장에서 설계, 제작, 조립, 검사 및 시험을 거쳐 공급함으로써, 현장에서의 설치공사나 배관 용접작업을 최소화하여 공사품질을 혁신적으로 향상시키고, 공사비의 절감 및 공기단축을 실현하는 최신품법입니다.

CHU (Compact heat exchanger unit) for district heating is an up-to-date construction method to revolutionarily improve the construction quality, and to reduce the construction cost and period by minimizing installation works, and piping and welding operations at sites. These are possible by supplying the main equipments and parts such as heat exchangers, pumps and thermostats, composing a district heating facility, in standard modules, which are designed, manufactured, assembled, inspected and tested at the factory according to the site requirements and the specifications required by the buyer.



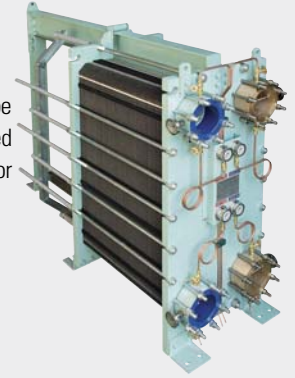
- 시스템의 소요공간을 최소화 할 수 있는 Compact한 배관설계를 적용합니다
- 유지보수가 용이하고 성능을 극대화 할 수 있는 배관 Layout으로 구성 합니다.
- CIP 세관용 Service 밸브 장착으로 세관작업이 용이 합니다
- 난방 및 급탕 2차측 배관에 안전밸브를 설치 합니다
- 경량의 보온 및 케이싱 재료를 사용합니다
- 에너지 손실을 최소화하는 보온공법을 적용합니다.

### 보온, 배관제작공법 Insulation and Piping

- Applied the compact piping design to minimize the installation space for the system.
- Piping layout is structured for the maximum performance and the easiness of maintenance.
- Applied CIP Service valve for the easiness of cleaning pipes.
- Installed safety valves on the pipes for heating and hot tap water.
- Adopted light materials for heat insulation and casing.
- Adopted a heat insulation technology to minimize the energy loss.

● **HEAT EXCHANGER**

Gasketed plate heat exchangers shall be the standard selection, however, brazed plate heat exchangers can be applied for small capacity units.



**CHU Technical Specification**

HEATING Capacity (Mcal/hr)	PIPE SIZE		HEATING INLINE PUMP		TCV SIZE	HOT WATER Capacity (Mcal/hr)	PIPE SIZE			HOT WATER INLINE PUMP		TCV SIZE	DIMENSION (W x L X H)mm
	Primary SIDE	Second SIDE	PUMP QUANTITY (50%)	POWER (KW)			Primary SIDE	HOT WATER /DOMESTIC WATER	DOMESTIC RETURN WATER	PUMP QUANTITY (100%)	POWER (KW)		
~ 300	50A	100A	2 or 3	2.2	32A	~ 100	32A	40A	40A	2	0.55	15A	2800 x 2400 x 1700
~ 400	65A	100A	2 or 3	3	32A	~ 200	50A	65A	40A	2	0.55	25A	
~ 500	65A	125A	2 or 3	3	40A	~ 300	50A	65A	40A	2	0.55	32A	
~ 600	65A	125A	2 or 3	4	40A	~ 400	65A	65A	40A	2	0.55	40A	3000 x 2500x 1800
~ 700	65A	125A	2 or 3	4	50A	~ 500	65A	80A	40A	2	0.75	40A	
~ 800	80A	125A	2 or 3	5.5	50A	~ 600	65A	80A	40A	2	0.75	40A	
~ 900	80A	150A	2 or 3	5.5	65A	~ 700	80A	80A	40A	2	0.75	50A	3200 x 2500x 1800
~ 1,000	80A	150A	2 or 3	7.5	65A	~ 800	80A	100A	50A	2	1.1	50A	
~ 1,100	80A	150A	2 or 3	7.5	65A	~ 900	80A	100A	50A	2	1.1	65A	



● **PUMPS**



● **CONTROL VALVES**



● **SENSORS & GAUGES**



● **STRAINER & VALVES**



● **CONTROLLER**

**NOTE**

1. INLET, OUTLET TEMPERATURE

HEATING 1'ST SIDE 115°C/50°C, HEATING 2'ST SIDE 45°C/60°C (radiation HEATING)  
 HEATING 1'ST SIDE 115°C/55°C, HEATING 2'ST SIDE 50°C/70°C (CONVECTION HEATING)  
 RE-HEATING 1'ST SIDE 55°C/35°C, RE-HEATING 2'ST SIDE 75°C/55°C  
 PRE-HEATING 1'ST SIDE 35°C/15°C, PRE-HEATING 1'ST SIDE 55°C/35°C

2. Standard pressure drop of Temperature Control Valve : 0.3 bar

3. HEATING INLINE PUMP HEAD

Case for Heating (50% flow late x 3ea) - 1 pump(STAN-BY)

Number of households	0~150 households	151~250 households	250 households
LOW FLOOR HEAD	18M	19M	21M
HIGH FLOOR HEAD	19M	21M	23M

Case for HOTWAER 100% flow late x 2ea, HEAD: 7M.

4. Condition of PIPE FRICTION LOSS

District heating 20 / heating 10 / Hotwater 10 (Unit :mmAq/m)

5. Pressure Drop of HEATING PLATE HEAT EXCHANGER

Primary side : 0.2bar, Second side : 0.3ba

6. Pressure Drop of HOT WATER PLATE HEAT EXCHANGER

Primary side RE-HEAT & PRE-HEAT : 0.1bar Second side RE-HEAT & PRE-HEAT : 0.08bar

7. HOT WATER OF CAPACITY

In the case of 150Mcal/hr low, application of ONE-STAGE HOT WATER SYSTEM  
 More than 150Mcal/hr, TWO-STAGE HOT WATER SYSTEM does application  
 (RE-HEATING, PRE-HEATING), division of capacity is 50% : Divide by 50%



# Special type Gas heat exchanger

타입  
Type

### ■ Plate Coil Type

Plate Coil Type Gas Cooler는 Dimple Type Plate를 용접하여 내부에 유체의 통로를 형성한 Plate Coil을 여러 개를 조합하여 Header로 연결하여 양 유체가 혼합되지 않도록 한 직,교류 및 향류형 열교환기이다. Plate coil은 압력에 충분히 견딜 수 있는 구조로 되어 있으며 높은 열전달 효율과 내부의 Dimple파형에 의하여 자정 능력을 가지고 있으므로 Gas에 대하여 적은 오염도를 유지한다.

조립형으로 제작되어 Arrangement 배관을 제거하지 않고 Gas측(오염유체)에 접근하기 쉽기 때문에 유지 보수 및 청소가 용이하다. 전열판 사이의 간격은 10 ~ 40 mm까지 적용이 가능하며 가스켓을 사용하지 않으므로 온도 입력으로 인한 가스켓 문제가 없다.

※ 설계온도 : -40 ~ 400°C

The plate-coil-typed gas cooler is a straight & turbulent flow and counter flow-typed heat exchanger that prevents mixture of both fluids by welding the dimple-typed plates to combine and connect several plate coils, forming the fluid passages inside, with the header.

The plate coil has a structure to withstand the pressure, and its self-cleansing function, by the high heat transfer efficiency and the internal dimple wave form, allows maintaining the low pollution rate against gas. Its assembly-typed structure enables easy access to the gas part (polluted fluid) without removing the piping arrangement and thus convenient maintenance and cleaning. The gap between the heat plates can be 10 mm~ 40 mm. Non-gasket feature does not generate a gasket problem due to temperature and pressure.

※ Design Temperature : -40 ~ 400°C

### ■ Welded Type

Welded Type Gas Cooler는 금속 박판을 파형 또는 요철 형으로 Press 성형한 후 2매 1조의 수조를 엇갈리게 조립하여 Block화하고 양끝단을 마감 용접한다. 방열유체와 수열유체가 Element의 다양한 유체 성분 온도에 따라서 Element의 재질, 두께, 형상등을 선정 할 수 있다. 폐열 회수 System에 주로 사용되며 가온,냉각, 응축등의 공정에도 활용할 수 있다.

The welding-typed gas cooler is manufactured by press forming thin metal plates into a concavo-convex shape, assembling several pairs of sheets staggered (two sheets as a pair) to become a block, and finishing the both ends with welding. Material, thickness and figure of the element can be selected according to the various components and temperatures of the heat absorbing and emitting fluids. It is mainly used for the waste heat collecting system, and processes of temperature elevating, cooling and condensation.



■ Recuperator



■ 재탄산폐가스 냉각기



■ Air Preheater

**특성과 용도  
Characteristics  
& Usage**

■ **특성 | Characteristics**

— **높은 효율과 낮은 오염도 | High Efficiency and Low Fouling Rate**

Element Plate를 파형 요철등의 방법으로 제작하여 Tube Type에 비하여 상대적으로 높은 열효율을 쉽게 얻을 수 있고, 내부의 파형에 의하여 자정능력을 가지고 있으므로 Gas에 대하여 적은 오염도를 유지한다.

As manufacturing the element plates in the methods of wave form and concavo-convex, this type of heat exchanger can get comparatively high heat efficiency, and maintain a low fouling rate for gas due to its self-cleansing function by the internal wave form.

— **경량 소형화 | Light and Compact Design**

동일한 용적의 Tube Type에 비하여 전열면적이 크고 열전도율이 높도록 설계할 수 있기 때문에 경량 소형화가 용이하다.

Its larger heat transfer area and higher heat transfer rate, compared to the tube type of the same size, allow light and compact design.

— **다양한 재질 선택 | Various Options for Material**

수열 및 방열 측의 온도, 성분, 형상에 따라 다양한 최적의 재질을 선택할 수 있다.

You can select the optimized material according to temperatures, components and figures of the heat-absorbing and heat-emitting parts.

— **고온에 적용 | Applicable to High Temperature**

고온에 대하여는 온도에 알맞은 내열강 재질로 선정하며 열팽창을 충분히 흡수할 수 있는 구조로 설계된다

It is designed to have a structure that can absorb heat expansion sufficiently by selecting a heat-resistant steel material against high temperature.

— **광범위한 적용 | Wide Range of Applications**

증래의 기체대 기체 열교환기의 저효율과 좁은 적용범위에 비하여 고효율 조건으로 광범위하게 응용할 수 있다.

It can be widely applied to variety of area with high-efficiency conditions, compared with the existing low-efficient and narrow-applicable gas-to-gas heat exchangers.

■ **용도 | Application**

- 공업로용 : 열풍로, 열처리로, 소둔로, 균열로
- 건조로용 : 도장건조로, 식품건조로
- 탈취로용 : 직접연소 탈취로, 촉매식 탈취로의 취가스 예열용
- 배기가스처리용 : 백필터 보호용, 백연방지용, 방직, 염색, 제지공장, 배기가스회수용
- 소각로용 : 폐액소각로, 쓰레기 소각로, 화학플랜트용
- For Industrial Furnaces : Hot Blast Stove, Heat Treatment Furnace, Annealing Furnace, Soaking Pit
- For Drying Furnaces : Paint Drying Furnace, Food Drying Furnace
- For Deodorizing Furnaces : Direct-Combustion-Typed Deodorizing Furnace, Pre-heating Odorous Gas in Deodorizing Furnace
- For Treatment of Exhaust Gas : Protecting Bag Filter, Preventing White Smoke, Recollecting Exhaust Gas, Weaving Industry, Dyeing, Paper Manufacturing
- For Incinerating Furnace : Incinerating Furnace for Waste Liquid, Waste Incinerating Furnace
- For Chemical Plants

# Pressure Vessel

## Special type Mist & dust collector

### 특성 Characteristics

Mist & Dust collector는 Cyclone에 열교환기의 원리를 접합한 새로운 개념의 복합기로서 배가스 중의 Mist 및 Dust를 응축시켜서 수분의 입자를 크게 만든 후에 Mist를 Cyclone에서 회전을 주어 입자를 크게 만들어서 배가스 중의 Dust 및 수분 회수를 획기적으로 높인 복합형 제품이다.

As a combined device of a new concept that the principle of the heat exchanger is applied to the cyclone, the mist & dust collector revolutionarily increases collecting rate of dust and mist in exhaust gas by condensing them and thus enlarging moisture particles with rotation in the cyclone.



1st Mist & Dust Collector



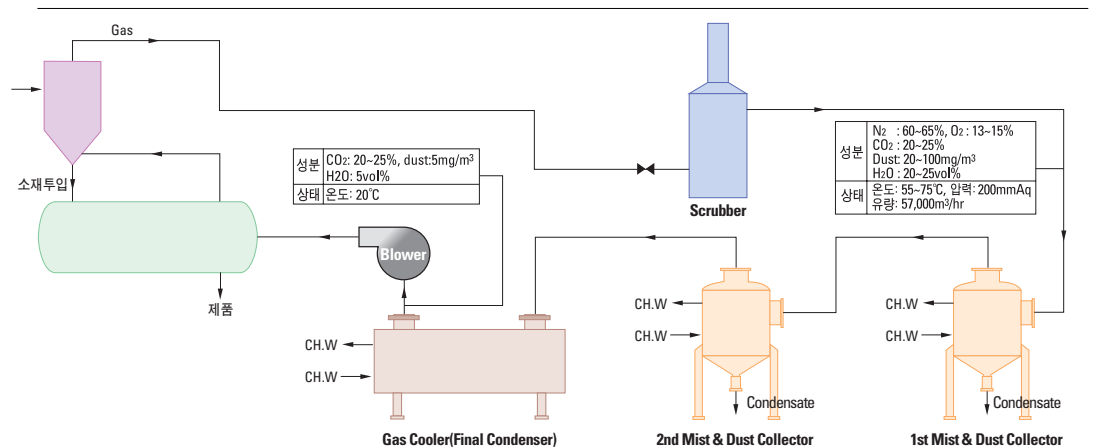
2nd Mist & Dust Collector



3rd Mist & Dust Collector



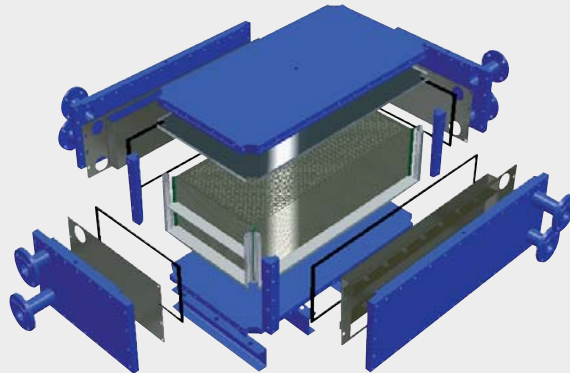
Mist & Dust Collector



폐 CO<sub>2</sub> 저장 및 재활용 장치 (Mist & Dust Collector P & ID)



# COMPABOX heat exchanger



COMPABOX는 고온, 고압의 작동환경에서 사용 가능하도록 설계되어진 완전 용접형 열교환기이다. 작은 점유면적에 비하여 높은 효율을 낼 수 있으며, 고온 작동환경에서의 열충격에 대해서도 우수한 내구성을 지니고 있다. 특히, 멀티 패스 구조를 자유롭게 적용시켜 하나의 제품으로 응축과 냉각이 동시에 가능하며 경제적이며, 대단히 컴팩트(Compact) 하여 설치 공간상의 제약이 따르는 시스템에 적용 가능하다. 각종 철강, 화학 및 정유 산업 등 고온 고압의 작동유체와 오염의 발생이 과다한 환경에서 예열기(Pre-Heater), 응축기(Condenser), 냉각기(Cooler) 등으로 사용이 가능하다.

COMPABOX is the fully welded type which can be used for the operating condition under high pressure and temperature. It has not only excellent durability against thermal shock but also high efficiency comparing with the small space. Especially multi-pass structure and compact design allow that it can be operated the condensation and cooling at one time and used for the system which has the limitation of space for installation. It's normally applied for the fluid under high temperature & pressure and environment which can be easily polluted like a steel, chemical & petroleum industry as a pre-heater, condenser and cooler.

## 특성 Characteristics

### 대향류 방식의 열교환 및 유지보수의 편리성 Counter-current Heat Exchanging and the Convenience of Maintenance

기존의 판형 열교환기가 지니는 대향류 방식과 동일한 열교환 방식을 채택하여 타사의 직교류 방식에 비하여 효율을 높였으며 4개의 커버를 모두 여닫을 수 있도록 하여 세척 및 유지보수가 편리 하다.

Like conventional Plate Heat Exchangers COMPABOX® adopted counter-current heat exchanging system to have higher efficiency than other manufacture's free flow system, and let the whole four covers openable for the easy maintenance and cleaning.

### COMPABOX Heat Exchanger Technical Data

Model		HCB051	HCB052	HCB071	HCB072
Dimension-A	mm	480	480	750	750
Dimension-B	mm	980	1960	980	1960
Heat Transfer Area.	m <sup>2</sup>	0.48	0.96	0.75	1.5
Plate Depth.	mm	6 (8)	6 (8)	6 (8)	6 (8)

Design Temperature : Up to 350°... Design Pressure : Up to 35bar

# DOUBLE WAVE heat exchanger



### 신기술인증제품 제0239호

기존의 주름형상에 미세한 주름을 삽입함으로써 단위 부피당 전열면적을 극대화 하여 적은 설치면적이 요구되며 미세 주름의 구조로 인해 오염(fouling) 현상을 억제하고 난류형성을 용이하도록 하여 열전달 효율을 극대화한 제품이다.

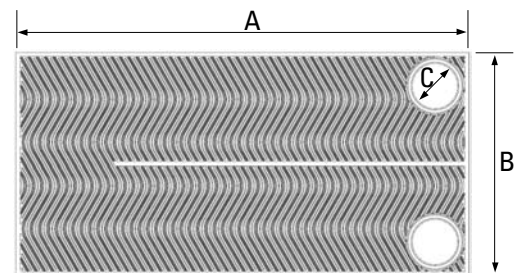
Double Wave Heat Exchanger maximized the heat transfer area by adding small-scale corrugation to the existing large-scale hence smaller floor space required, and the structure of small-scale corrugation enables less fouling and greater turbulent flow for the maximum heat transfer efficiency.



## 특성 Characteristics

Air Cooled 이중굴곡 주름 구조의 특징은 유체의 공기접촉을 막음으로 인하여 유체내부의 오염도를 없애고 외부 비산을 막아 내외부 오염이 없는 구조로 설계가 되어있다. 고효율 전열판을 이용하여 낮은 유속에서도 난류형성을 용이하게 하여 열전달 효율을 극대화 시켰으며 유지보수가 용이하다.

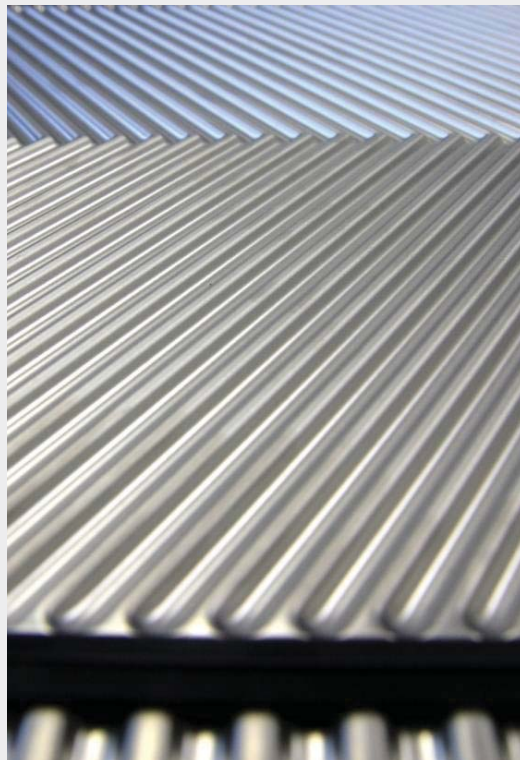
Air-cooled Double Wave Corrugation structures are specially designed to not allow internal and external contamination by preventing the internal fluid directly contacting from outer air and splashing to the outside. It also maximized heat transfer efficiency through its super-efficient heat plate which allows to form turbulent flow easily under the low flow velocity, and maintenance easiness.



### DOUBLE WAVE Heat Exchanger Technical Data

Model		DW 120 Series	DW 120L Series
Plate Hole Dia. ( C )	mm	120	120
Max. Conn. Dia.	mm	150	150
Plate Depth.	mm	5	5
HPC ( B )	mm	412	412
Length ( A )	mm	1464	3004

# Super High Efficiency Plate Heat exchanger



Super high Efficiency Plate Heat Exchanger는 골 깊이가 2.4~2.7mm로 깊이가 낮은 Gasket Type 판형 열교환기이다.

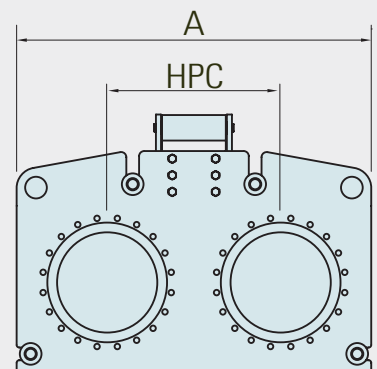
에너지 소비 절감의 필요성이 점차 대두됨에 따라 보다 높은 열교환 효율과 L.M.T.D 1°C이하로 요구되는 사양에 대응하기 위하여 기존 Plate 보다 높은 효율과 고압에서 견디는 Plate를 개발하였다.

주로 중동 지역 및 기타 냉방부하가 높은 지역에서 지역 냉난방시설의 냉수 공급라인에 적용된다.

Super High Efficiency Plate Heat Exchanger (SHEPHE) is gasketed plate heat exchanger with lower plate gap from 2.4 to 2.7mm. To meet the expectation of higher heat transfer efficiency with less energy consumption we are developing Super High Efficient Plate which satisfies the harsh operating condition requiring less than 1°C L.M.T.D and higher pressure. Super High Efficiency Plate Heat Exchanger shall be mostly applied to district heating and cooling facilities in Middle East Countries.

## 특성 Characteristics

LMTD	1 °C
NTU	9
PRESSURE DROP	: 30~50 kPa
OPERATING PRESSURE	10~ 20 bar
ROOM HEIGHT	3.5~6.4 M
FLOW RATE	100 ~ 600 m <sup>3</sup> /h



## Super High Efficiency Plate Heat exchanger Technical Data

Model		SH 300 Series	SH230 Series	SH100 Series	SH040Series
Plate Hole Dia.	mm	330	225	106	42
Max. Conn. Dia.	mm	350	300	150	40
Dimension-A	mm	860	746	435	250
HPC	mm	486	465	223	105



## PHE Gaskets



당사는 다양한 산업분야에 적용되는 판형열교환기의 고무가스켓에 있어서 단연 선두주자로서 자동차, 조선, 해양, 중공업, 제철, 발전, 화학플랜트, 식품산업등에서 내구성이 뛰어난 가스켓을 요구하고 있으며, 판형열교환기용 가스켓시장에서의 많은 경험을 통해 고객을 위한 종합적인 해결책을 가지고 있다

Our company is a top leader of rubber gasket for Plate Heat Exchangers used in diversified industries. Automotives, shipbuildings, marine, heavy industries, steel works, power plants, chemical plants, food industries & etc. require excellent durability of gaskets due to their highest operation ratio.

We can provide total solution to our customers with rich experiences in PHE GASKET MARKET.



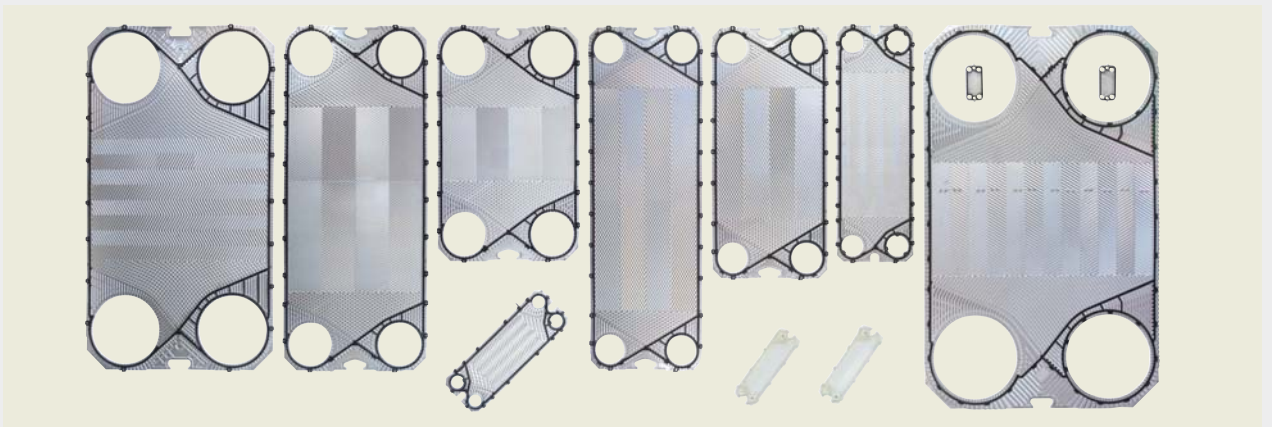


### 원천기술 보유 | Possession of the fundamental technology

당사는 자체개발한 배합비에 따라 혼합된 원재료를 사용한 독자적인 기술을 보유하고 있습니다.  
Our products are manufactured by our unique technology using the mixed raw materials according to mixture proportion of our own development.



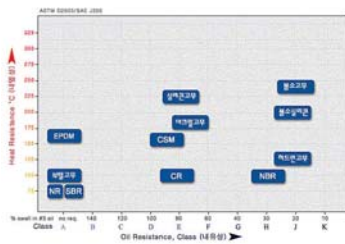
당사는 고객에게 빠른 서비스를 제공할 수 있으며 다양한 모델의 금형을 보유하고 있습니다.  
We can provide rapid service and have a various selection of gasket molds.





# PHE Gaskets

Heat and Oil Resistance of Elastomers



- FKM : fluorocarbon
- FVMQ : fluorosilicone
- H-NBR : hydrogenated nitrile
- EPDM : ethylene propylene terpolymer
- NBR : acrylonitrile butadiene
- IIR : Butyl
- ACM : Polyacrylic
- CR : Neoprene
- CSM : Hypalon
- NR : Natural Rubber

## Comparative Properties of Rubbers

ASTM Classifications										
D1418	ERR, EPDM	IIR	NBR	H-NBR	FKM	FVMQ	ACM	CR	CSM	NR
D2000	DA	AA	BF	BF	HK	FK	DH	BC	CE	AA
Density, Mg m <sup>3</sup>	0.86	0.92	1.00	1.00	1.85	1.47	1.09	1.23	1.10	0.93
Hardness, Shore A	75-90	70-80	75-85	75-85	60-95	40-70	40-90	20-95	45-95	20-90
Typical Tensile Strength										
Pure Gum, Mpa	3	10	7	13	14	-	3	21	14	21
Reinforced, Mpa	21	14	14	24	14	10	12	21	19	21
Resilience										
Room Temp.	VG	L	G	G	L	G	L	VG	G	E
Hot	VG	VG	G	G	VG	VG	VG	VG	G	E
Resistance to										
Tear	G	G	F	F	F	P	P	G	F	E
Abrasion	G	G	G	G	G	P	F-P	E	E	E
Compression Set	VG	F	G	G	VG	VG	G	F-G	F	G
Weathering	E	VG	F-G	VG	E	E	E	E	E	E
Oxidation	E	E	G	E	O	E	E	VG	E	G
Ozone	E	G	P	VG	O	E	G	VG	O	P
Temperature Range										
High Temp.	E	G	VG	VG	O	O	E	G	VG	G
Low Temp.	E	G	G	G	P-G	O	P	G	F	E
Aqueous Fluid Resistance										
Dilute Acid	E	E	G	G	E	E	F-P	VG	E	E
Conc. Acid	G	E	G	G	E	G	F-P	G	E	F-G
Water	E	VG	F-G	G	VG	VG	P	G	G	VG
Organic Fluid Resistance										
Aliphatic(A)	P	P	E	E	E	E	E	G	G	P
Oxygenated(B)	G	G	P	P	P-G	P	P	P	P	F
Chlorinated(C)	P	P	P-F	P-F	E	G	P	P-F	P-F	P
Aromatic(D)	P	P	G	G	E	E	F-P	F	F-G	P
Fuels(E)	P	P	E	E	E	E	G	G	E	P
Fats and Oils(F)	G	VG	E	E	E	E	VG	G	G	P-G
Permeability	F-P	VL	L	L	L	F	L	L	L	F
Flame Resistance	P	P	P	P	G	G	P	G	F-G	P
Dielectric Properties	E	G-E	P	P	G	G	F-P	VG	E	E

Key to Ratings O = Outstanding E = Excellent VG = Very Good G = Good F = Fair P = Poor L = Low VL = Very Low  
 Footnotes A = hexane, isoctane, etc B = acetone, methyl-ethyl ketone, etc C = chloroform, perchlorethylene, etc  
 D = toluene, xylene, etc E = kerosene, gasoline, etc F = animal and vegetable product





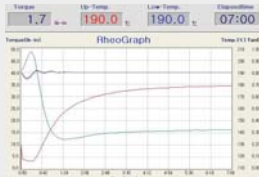


## Lab Service

(주)비이저의 연구소에서는 가스켓의 소재인 고무의 물리적 성질 및 유체중의 유기, 무기물의 분석은 물론 예측수명시험을 통해 내구수명의 예측이 가능하다.

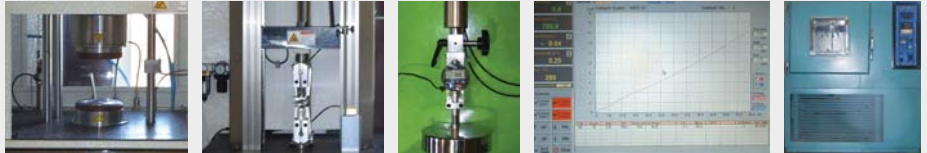
Our lab facilities have capability of testing rubber physical properties, analyzing organic & inorganic materials in fluids and predicting durability of gasket by simulation tester.

### Physical Properties



가스켓의 모든 고무재료는 보다 효과적인 시험으로 사전 확인되고 통계적 관리가 되고 있다. 모든 공정은 품질관리체계하에 있다.

All batches of rubber compounds are efficiently inspected by proper equipment and controlled statistically. All the processes are under quality control system.



### Material analysis

전자현미경, 적외선 분광기, 개스크로마티 그래퍼, 열분석기등으로 열교환기의 기동중 발생될 수 있는 미지의 물질을 검출분석이 가능하다.

Scanning electronic microscope, FTIR, TGA, PGC & etc can detect and analyze unknown materials which come out during operation of PHE.



### Simulation test



신뢰성을 위하여 주기적으로 모든 타입의 가스켓에 대해서는 주기적인 시뮬레이션시험을 실시하고 있다.

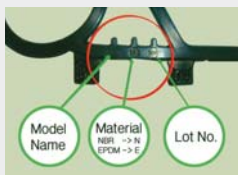
모든 시험조건은 판형열교환기의 실가동에 의한 실적치에 근거하여 계산되며 시험은 보다 가혹한 설계조건하에서 실시되고 있다.



For reliability of gasket we perform the simulation test of all types periodically.

All the test conditions are calculated thru actual results of PHE operations and the tests are performed under severer design condition.

### Traceability



# Quality Management System



내사는 고객의 요구를 최우선으로 하며, 고객이 만족할 수 있는 양질의 서비스를 제공하기 위해 인증받은 ISO 9001:2000규격에 따라 품질경영체제를 구축하여 이행하고 있습니다. 열교환기의 전열판 생산시 Vacuum을 이용한 검출기술을 활용하여 Crack검사를 실행하고 있습니다.

LHE is offering high quality service in order to satisfy the customers and we constructed quality management system according to the ISO 9001:2000 standard acquired.

We are performing heat plate crack detection system by using "vacuum leak detecting technology".

<b>PED</b>	Certificate No. : 0038/PED/MUM/0410015/1 Original Approval : 01 June 2004 Current Certificate : 06 June 2007 Certificate Expiry : 31 May 2010 Certificate Organization : Lloyd Register	<b>ISO 9001</b>	Approval Certificate No. : SEO 0041007 Original Approval : 21 Jun 2004 Current Certificate : 16 August 2008 Certificate Expiry : 15 August 2011 Issued By : LRQA Ltd.
<b>National Board</b>	ASME Stamp : U Issue Date : January 11, 2008 Expiration Date : January 11, 2011	<b>ISO14001</b>	Approval Certificate No. : SEO 6003542 Original Approval : 22 July 2008 Current Certificate : 22 July 2008 Certificate Expiry : 21 July 2011 Issued By : LRQA Ltd.
<b>ASME "U" Stamp</b>	Scope : Manufacture of pressure vessels Certificate No. : 33,038 Authorized : December 1, 2004 Revised : July 18, 2006 Expires : January 11, 2008 Issued By : Boiler And Pressure Vessel Committee	<b>ISO18001</b>	Approval Certificate No. : SEO 6003543 Original Approval : 19 July 2008 Current Certificate : 19 July 2008 Certificate Expiry : 18 July 2011 Issued By : LRQA Ltd.
		<b>CLASS</b>	DNV, ABS, LR, GL, BV, NK, KR, CCS, RS, RINA, ETC.



■ Cad



■ Heat Plate Leak Detection System

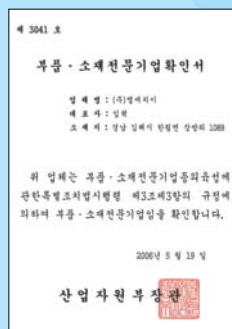
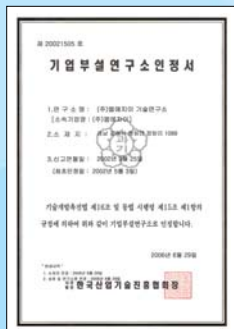
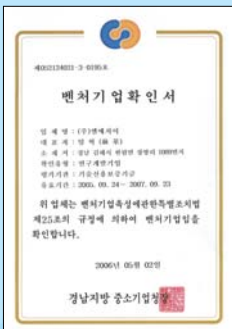
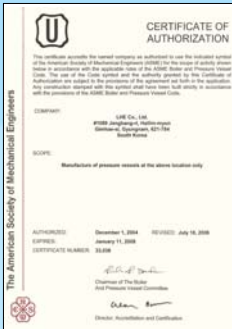


■ Pilot Testing Room



■ Light Box Tester

# Certificates





# Reference data

특수한 용도에 적합한 고효율의 열교환기 선정을 위해서는 사용온도, 사용 압력, 물리적 특성, 유체의 특성, 설치 공간의 제약 그리고 보수 유지의 필요성 및 빈도에 있다. 선택의 기준은 유체의 특성에 기준을 두지만 운전비용과 보수 유지비와 같은 경제적인 변수가 고려됩니다. 고객 여러분이 (주)LHE에 문의하시면 고객이 원하는 조건에서 가장 적합한 열교환기를 선정하는데 도움을 드릴 것입니다.

To select a high efficient heat exchanger suitable for the special purposes, operational temperature, pressure, physical properties of the fluids, limitation of the installation space, and maintenance requirements should be considered.

The properties of the fluids are the basic standards for the selection, but economic factors such as operational and maintenance costs shall be considered as well. We, LHE Co., Ltd. always welcome your request for selecting the most suitable heat exchanger meeting your requirement.

## Guide for selecting Heat Exchangers (LHE)

	Plate & Frame Heat Exchanger	Spiral Heat Exchanger	Oblong Plate & Shell Heat Exchanger	Plate Coil Heat Exchanger
<b>Performance Data</b>				
Pressure range (F.V to kg/cm <sup>2</sup> G)	26	20	80	12
Temperature range (°C)	-30 to 180	-40 to 400	-50 to 600	-30 to 400
<b>Service</b>				
Liquid / Liquid	1	1	1	2
Gas / Liquid	2-3 ★	1-3 ★	1-3 ★	1-3 ★
Gas / Gas	2-3 ★	2-3 ★	2-3 ★	1-3 ★
Condensation	1-3 ★	1-3 ★	1-3 ★	1-3 ★
Vaporization	2-3 ★	1-3 ★	1-3 ★	2-3 ★
<b>Nature of Media</b>				
Corrosive	1	3	2	2
Aggressive	3	2	3	3
Viscous	1	1	1	1
Heat sensitive	1	1	1	2
Hostile reactions	3	2	2	2
Fibrous	4	1	4	1
Slurries and suspensions	3	1	3	1
Fouling	1	1	2	1
<b>Inspection</b>				
Corrosion	A	A	B	A
Leakage	A	A	A	A
Fouling	A	A	B	B
<b>Maintenance</b>				
Mechanical cleaning	A	A	B	B
Modification	A	C	C	C
Repair	A	(A)	A	A

- 1 Usually best choice
- 2 Often best choice
- 3 Sometimes best choice

- 4 Seldom best choice
- A Both sides
- B One side
- C No side

★Depending on Operating pressure, gas vapor density etc.

## General data for compact heat exchangers (LHE)

	Plate & Frame Heat Exchanger	Spiral Heat Exchanger	Oblong Plate & Shell Heat Exchanger	Plate Coil Heat Exchanger
Surface area per unit ( m <sup>2</sup> )	0 ~ 2,000	0 ~ 600	0 ~ 500	0 ~ 500
Liquid flow rates per unit ( m <sup>3</sup> /h)	3,400	720	1,500	3,500
Suitable for	Liquid condensate, steam, oil, etc	Liquid oil, steam, vapors(one side), boiling liquids,gas(air), etc	Liquid oil, condensate, steam, vapors, gas(air), etc	Liquid oil, steam, vapors, gas(air), etc
Normal k with normal deposits1) ( kcal/ m <sup>2</sup> h °C)				
water	2,500 ~ 6,000	1,700 ~ 4,000	2,650 ~ 5,700	500 ~ 1,700
water solution, 50 cSt	600 ~ 1,500	500 ~ 1,100	650 ~ 1,600	400 ~ 800
mineral oil, 50 cSt	250 ~ 1,000	200 ~ 500	260 ~ 1,100	200 ~ 300
organics, 1~10 cS4	700 ~ 2,100	300 ~ 1,500	750 ~ 2,200	300 ~ 1,200
Channel spacing (mm)	1.6 ~ 6.0	5 ~ 28	2.5 ~ 3.5	10 ~ 100
Plate gauge (mm)	0.4 ~ 1.0	1.8 ~ 4.0	0.6 ~ 0.8	1.5 ~ 3.5
Materials available				
Stainless steel 18 8	○	○	○	○
Stainless steel 18/10/2.5	○	○	○	○
Titanium , Ti-Pd	○	○	○	○
Cu, Ni, Albrass	○	-	○	○
Monel	○	○	○	○
Others	○	○	○	○
Over-all dimensions nozzles excluded				
width, smallest ~ biggest unit (m)	0.1 ~ 1.0	0.2~ 2.0	0.19 ~ 1.0	0.2 ~ 1.5
length, smallest ~ biggest unit (m)	0.2 ~ 3.6	1.0 ~ 200	0.19 ~ 2.0	0.5 ~ 5.0
height, smallest ~ biggest unit (m)	0.3 ~ 4.0	0.5 ~ 2.8	0.3 ~ 2.5	1.0 ~ 6.0
diameter, smallest ~ biggest4 unit (m)		0.25 ~ 2.5	0.2 ~ 1.0	-

1 ) Values normally reached when, from economic point of view the most favorable pressure drop can be utilized.

## Conversion factors

Volume	1 m <sup>3</sup> = 35.3 cu.ft	1 cu.ft = 16.04 m <sup>3</sup>
	1 m <sup>3</sup> = 264.2 gallon	1 gallon = 0.0283 m <sup>3</sup>
Mass	1 kg =2.205 lb	1 lb = 0.454 kg
Density	1 kg/ m <sup>3</sup> = 0.0624 lb/cu.ft	1 lb/cu.ft = 16.02 kg/ m <sup>3</sup>
Pressure	1 kg/ m <sup>2</sup> = 14.223 psi	1 psi = 0.0703 kg/ cm <sup>2</sup>
	1 kg/ m <sup>2</sup> = 0.098 MPa	1 MPa = 10.197 kg/ cm <sup>2</sup>
Heat	1 kcal = 3.968 BTU	1 BTU = 0.252 kcal
	1 kcal = 4.187 kJ	1 kJ = 0.2388 kcal
Latent heat	1 kcal/kg = 1 .80 BTU/lb	1 BTU/lb = 0.556 kcal/kg
Specific heat	1 kcal/kg °C = 1 BTU/lb °F	1 BTU/lb °F = 1 kcal/kg °C
Heat flow rate	1 kcal/h = 3.968 BTU/h	1 BTU/h = 0.252 kcal/h
Conductivity	1 kcal/mh °C = 0.672 BTU/ft h °F	BTU/ft h °F = 1.488 kcal/mh °C
Heat transfer coefficient	1 kcal/ m <sup>2</sup> h °C = 0.205 BTU/ft h °F	1 BTU/ft h °F = 4.882 kcal/ m <sup>2</sup> h °C
Overall	1 kcal/ m <sup>2</sup> h °C = 1 .163 W/ m <sup>2</sup> °C	1 W/ m <sup>2</sup> °C = 0.86 kcal/ m <sup>2</sup> h °C
Dynamic viscosity	1 kg/mh = 0.278 cP	1 cP=3.6kg/mh
Ton of refrigeration	1 RT = 3320 kcal	1 US RT = 3024 kcal