

PLATE & FRAME / SHELL & TUBE HEAT EXCHANGERS FACT MANUAL



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An essential risk assessment reference guide for Maintenance Supervisors, Property and Plant Managers





"FAILING TO PLAN *IS* PLANNING TO FAIL"

How long can you be without hot water, air conditioning and heating?

The consequences of heating/cooling heat exchanger failure are critical!

The challenges facing building and plant managers are vast and increasingly complex.

Energy costs and lost production comprise a significant component of operational expenses.

In addition, identifying potential issues with thermal transfer equipment prior to a failure is essential.

> Greg David President & CEO

HEAT EXCHANGER APPLICATIONS



HVAC

Dairy

Pulp & Paper



Power

Breweries

Steel



 Marine
 Sugar Refineries
 Pharmaceutical

Petroleum/Chemical

Bioenergy

Mining

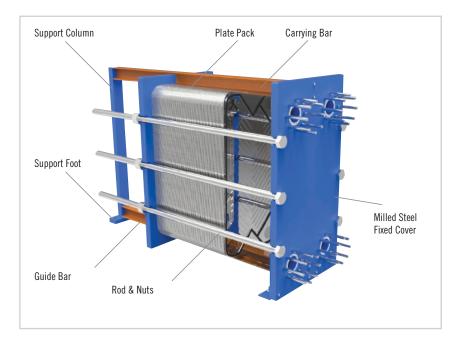


PLATE & FRAME HEAT EXCHANGERS



PLATE & FRAME HEAT EXCHANGERS (PHE)

The main components of a Plate & Frame Heat Exchanger consist of the following:



The most common material for the plates is 304 or 316 stainless steel in a (.4mm), (.5mm) or (.6mm) thickness. Gaskets type depends on the operating application, typically Buna (NBR/Nitrile), EPDM or Viton elastomer gaskets are usually specified.





PLATE & FRAME HEAT EXCHANGERS (PHE)

The main components of a Plate

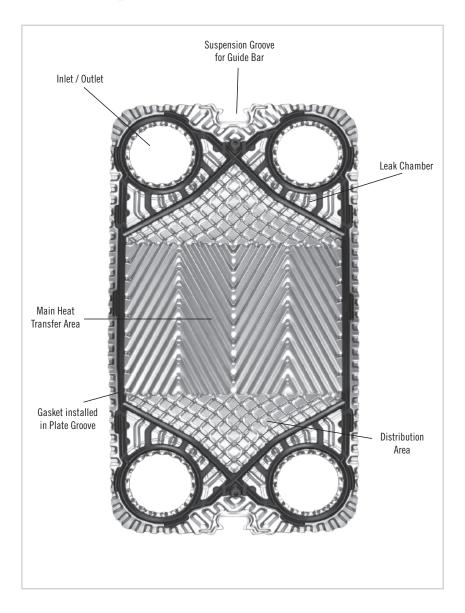
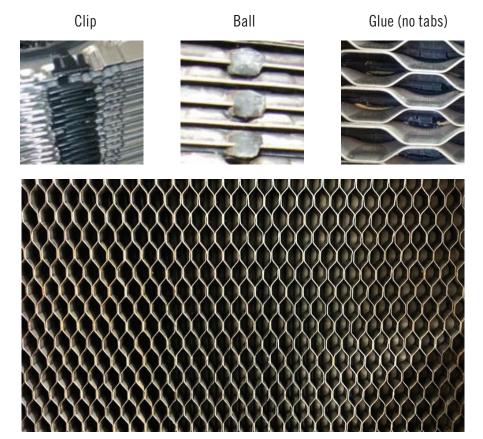


PLATE INSTALLATION

When plates are installed correctly they will form a honeycomb pattern and if glue-less gaskets (Clip, Ball) are used the tabs will be aligned.



Honeycomb Pattern

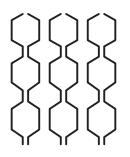
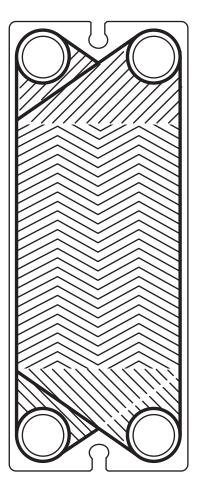


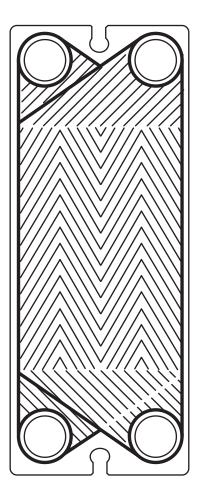


PLATE PATTERN



HIGH THETA PLATE PATTERN

- High turbulent flow
- High heat transfer coefficient
- Perfect temperature approach
- High pressure drop

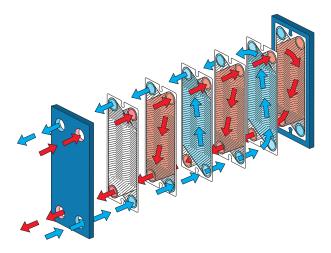


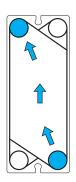
LOW THETA PLATE PATTERN

- Low turbulent flow
- Low heat transfer coefficient
- High temperature approach
- Low pressure drop

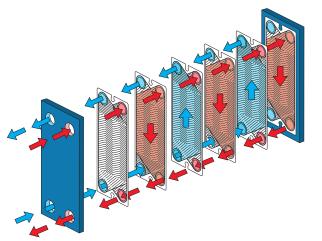
DIAGONAL VS PARALLEL FLOW

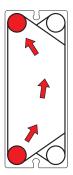
DIAGONAL FLOW





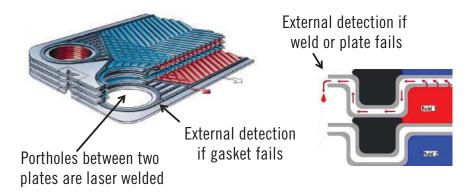
PARALLEL FLOW





DOUBLE-WALL PLATES

The Double-Wall Plate consists of two identical plates laser welded together leaving a thin air gap between the plates acting as a safety zone in case either of the plates were to fail. In the case of failure, one of the two fluids would leak through the first plate preventing it from going any further due to the air gap and the second plate. The leak would be seen externally on the heat exchanger. This design offers maximum safety against cross contamination.



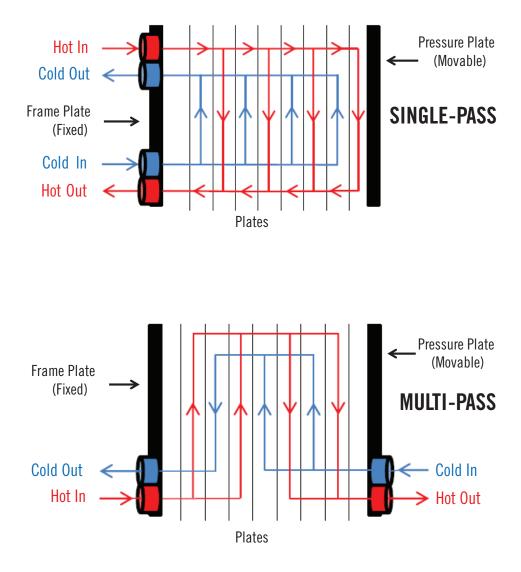
EXAMPLES OF DOUBLE-WALL PLATE HEAT EXCHANGER APPLICATIONS:

Transformer Oil Cooling – Water / Oil mixture can result in severe damage to transformer

Chemical Processes – Intermixing can cause contamination, explosions, chemical reactions, corrosion

Potable Water Heating – Distributing heat generated in a centralized location for residential and commercial heating requirements such as space heating and water heating, intermixing could scald, pollute tap water

SINGLE-PASS AND MULTI-PASS APPLICATIONS



TYPICAL GASKET TYPES

Clip

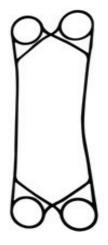


Glue

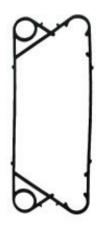
Ball



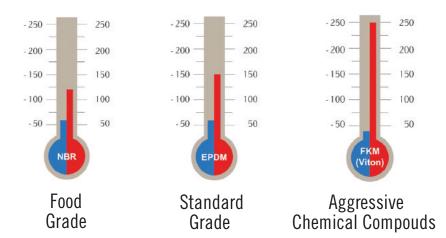








BUNA (NBR/NITRILE), EPDM OR VITON MATERIALS ARE THE MOST COMMON ELASTOMER GASKETS DEPENDING ON THE OPERATING APPLICATION.



Changes in Gaskets:

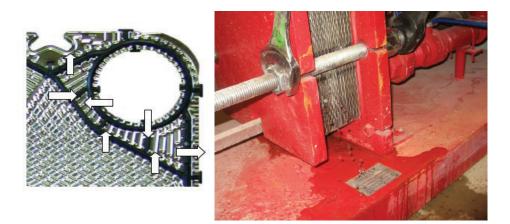
- ≻ Time Relaxes
- > Temperature Deteriorates
- Oxidizing Agents Hardens
- Swelling Chemical Absorption

Gaskets Material Depends on:

- ≻ Fluids Used
- Temperature and Pressure



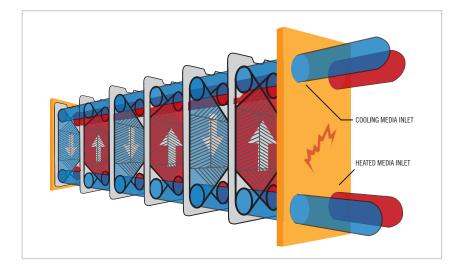
GASKETS ARE DESIGNED WITH VENTING PORTS, THESE PORTS PREVENT CROSS CONTAMINATION INSIDE THE HEAT EXCHANGER. WHEN A GASKET FAILS, THE LEAK IS DETECTED ON THE OUTSIDEOF THE PLATE PACK



T.H. Industrial Solutions goal is to supply the most common and obscure, or hard to find gaskets. We offer custom fabrication and laser cutting for unique metal style gasket requirements.

We supply direct replacement gaskets for Alfa Laval, Vicarb, Graham, Mueller, ITT, Armstrong, Fischer, Tranter, Bell & Gossett, APV, & Sondex. Advantages of a PHE are:

- Servicing plates are removed easily for maintenance cleaning or replacement
- Small Footprint the design is compact, requiring less space than a shell & tube heat exchanger
- Efficiency higher heat transfer from a greater fluid distribution over a larger surface area which rapidly increases the speed of the temperature changing
- Expandable Design plates can be easily added to increase the required heat transfer capability



Disadvantages of a PHE are:

- **Contamination** over time plates will become build up with scale and debris
- **Replacement** gaskets tend to leak after 10–13 years and will require replacement
- Application not compatible for higher temperature and pressure

WHAT CAUSES PLATE & FRAME HEAT EXCHANGERS TO LEAK EXTERNALLY?

- 1 Rubber gaskets installed on each plate create a seal, when gaskets become worn or damaged;
- 2. As the PHE ages the gaskets can dry out, lose their elasticity and become brittle;
- 3. Operating temperatures, pressures and exposure to process fluids can all reduce the life of a gasket;
- 4. Spiking or water hammer can force a gasket out of the plate groove;
- 5. Overheating can melt the rubber and cause the gasket to become brittle and crack;
- 6. Over tightening the groove the gasket sits in can become deformed. When this occurs the gasket will not sit flat & pushes outwards.

*.4mm thick gaskets are very susceptible to this issue



DAMAGE CAUSED TO PHE PLATES/GASKETS BY A PRESSURE SPIKE

Water hammer is the result of a pressure surge, or highpressure shockwave that propagates through a piping system when a fluid in motion is forced to change direction or stop abruptly.

Water hammer can occur when an open valve suddenly closes, causing the water to slam into it, or when a pump suddenly shuts down and the flow reverses direction back to the pump. Since water is incompressible, the impact of the water results in a shock wave that propagates at the speed of sound between the valve and the next elbow in the piping system or within the column of water after the pump.

Pressure spikes may exceed the operational pressure of the systems by ten times.



WHAT CAUSES PLATE & FRAME HEAT EXCHANGERS TO LEAK INTERNALLY?

- 1. Higher pressure side will leak into the lower pressure side, if a plate develops a pin hole or crack;
- Over time the plates can crack since they are continuously flexing, this is often referred to as a "pop can effect" – continually bending the can back and forth in the same area will break it apart;
- Cross contamination is preventable when "double walled" designed plates are used with potable water.
 *Municipal codes verify from region to region with most new construction by-laws requiring this safety measure



ADDITIONAL GENERAL PHE INFORMATION

- The life span of a gasket in a cooling application is 10-15 years and for a heating application 8-10 years;
- Gaskets exposed to steam will typically wear quicker than if exposed to boiler water;
- PHE's used strictly for seasonal heating will often leak during the first month of startup and seal after a few weeks as the gaskets expand.

WHEN SHOULD A PLATE & FRAME HEAT EXCHANGER BE SERVICED?

As a heat exchanger becomes fouled with dirt, debris or scale, often the modulating valve provides additional hot or cold liquid to help compensate for the loss of efficiency of the heat exchanger.

Over time the control valve will continue to open fully. Unfortunately, on the hottest or coldest days, even with the valve fully open the heat exchanger cannot meet the thermal transfer requirements and the situation becomes critical.

Monitoring just the operating temperature provides a false sense of security. Recording the difference in the outlet and inlet pressures provides a more accurate result of the amount of fouling.

Fouling equal to the thickness of a piece of paper represents a 20% loss of thermal efficiency. In addition, the energy cost for pumps increases since the pump must work harder to overcome the increased pressure resistance through the PHE.

Differential pressure average for a PHE equals 2-4 psi when equipped with new or refurbished plates.

PHE service should be scheduled when the differential pressure increases up to 7-10 psi.

Fouled Plates

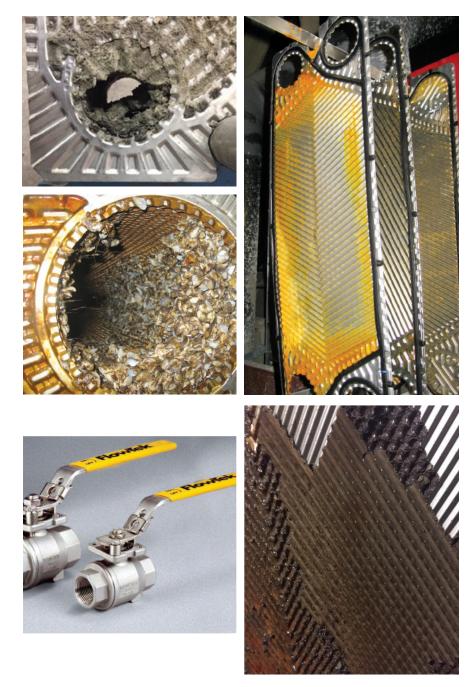


PLATE & FRAME HEAT EXCHANGE CLEANING SERVICE OPTIONS

CHEMICAL FLUSHING (1-2 DAYS) ON-SITE

A portable chemical flushing unit consists of a pump, tank, filter and hoses. THS service technicians pump a citrus based cleaning chemical or mild acid solution through the heat exchanger for 6-8 hours, during the flushing any debris is collected in the filter.

*The volume and velocity of the pump package is limited, PHE's over 3 ft in height and with connections over 2", will not experience significant benefits using this sized pump package since most power supplies available are 120V



HIGH PRESSURE PUMPS (1-2 DAYS) ON-SITE

PHE's can be taken apart and cleaned with high pressure water. The water is effective in cleaning dirt and biofilm, however may not remove scale and rust buildup. Clip or ball style gaskets can be supplied and changed on-site during service; glued gaskets should be removed off-site.



*Chances of a PHE leaking increases to 50-60% probability when re-assembling a unit using gaskets that are over 10 years old, visibly damaged or brittle, causing the PHE not to seal completely. In addition, each time a PHE is taken apart the gaskets can be potentially damaged or may not reseat correctly when retightened.

Full Service (2-3 weeks) Off-Site

- The most effective method to remove glue style gaskets is to complete the service off-site.
- Plates are submerged in either a caustic acid bath or nitrogen to break the glue bond.
- After the gaskets have been removed, the plates are submerged in a second bath of heated phosphoric or hydrofloric acid to remove scale and contamination.
- Using this method plates are returned 95% 99% to new condition.
- The plates are then cleaned with water and a Infiltration UV Tracer is applied.

(if there are pinholes or cracks in the plates the dye test reveals this.)

• Rubber adhesive is then applied to the plate groove and new gaskets are installed.



LEAK AND DAMAGE DETECTION SERVICE OPTIONS

PRESSURE TESTING

The primary side is filled under pressure with air or water, the secondary side is pressure free. On a plate defect, there's a pressure reduction on primary side.

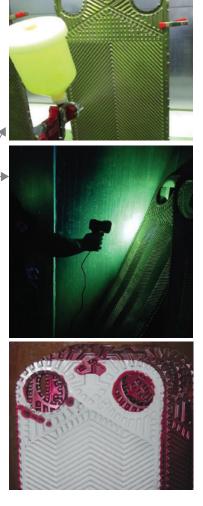
CONUCTOMETRY TESTING

The primary side is filled e.g. with sodium sulfate, the secondary side with water. Driven by the osmotic differential pressure the tracer substance diffuses on the water side.

INFILTRATION UV TRACER

The surface of the plates must be chemically cleaned, then a fluorescent color is up-sprayed on each plate. After a response time each plate is checked with UV light in a darkened area.

*Dye penetrant is applied to damaged plates for customers revealing the pinholes or cracks in the affected area.

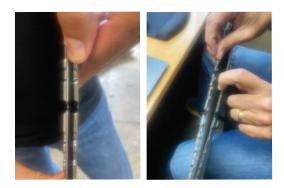


DOMESTIC HOT WATER REGULATIONS:

- Double wall PHEs are commonly used for domestic hot water applications.
- Most municipal building code specify this design to prevent cross contamination of potable water.
- Typically, two 0.3mm thick or 0.4mm plates are welded together. The four ports are fully sealed & most of the perimeter is welded.
- Some OEMs only weld the four ports & the entire perimeter is open.
- If a hole or crack develops, liquid will enter into the cavity between the (2) plates & leak externally preventing cross contamination.
- If a PHE is leaking externally, the causes include: worn gaskets, deformed/fatigued plates i.e. the plate gasket track has dished & the gaskets are shifting, or the plates have holes or cracks.
- The standard process to check the plates for hole or cracks is to perform a dye test. This can be done using a Chromalux dye & a black light test, or using red & white dye penetrant.
- Unfortunately, neither tests work on double wall plates.
- When installing new gaskets, it is very important the plate is extremely clean to ensure the gasket seats properly.
- On domestic hot water applications, the contamination on the plates is usually ferrous oxide (rust) and calcium.
- The most effective option to clean is to fully submerge the plates in an acid bath.
- Since we can not guarantee all of the acid is flushed out of the cavity, we do not acid clean double wall plates.

Note:

- In light of the aforementioned, we recommend installing a new plate pack on any DW PHEs that develop a leak.
- The exception is a PHE that has been in service for only under 1-year.



SERVICING DOUBLE WALL PLATE & FRAME HEAT EXCHANGERS

Please be informed that, designers and installers are required to conform to the following requirements.

7.6.2.1. Connection of Systems

- (1) Connections to potable water systems shall be designed and installed so that non-potable water or substances that may render the water non-potable cannot enter the system.
- (2) No connection shall be made between a potable water system supplied with water from a drinking-water system and any other potable water system without the consent of the water purveyor.

Therefore, if the designers, manufacturers and installers cannot assure that, "non-potable water or substances that will NOT render the water non-potable" (i.e. warranty of a single wall heat exchanger does not work, it only means when there is a break, someone will fix it but the damage has been done), as such, fail safe design must be included within the design and installation.

The local authority having jurisdiction can accept either an applicable Acceptable Solution in Division B, or an applicable Alternative Solution that will achieve the level of performance required by the applicable Acceptable Solution in respect of the Objectives and Functional Statements attributed to the applicable Acceptable Solutions in Supplementary Standard SA-1.

Under the Building Code Act, the local municipality is the authority having jurisdiction for enforcing the Act and its Regulations, and the permit applicants should contact the appropriate official with respect to any specific proposal.

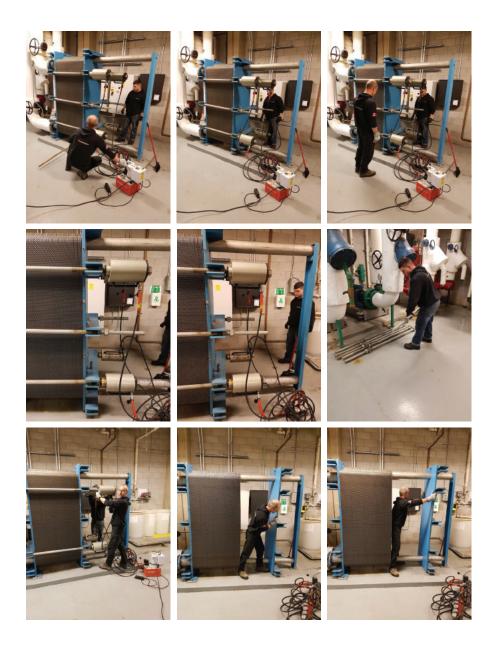
Danny Hui, P.Eng. Building Code Advisor, Building Services Specialist, Code Advisory Unit, Building and Development Branch Ministry of Municipal Affairs & Housing, Tel: 416-585-7368

Single Wall Plate Dye Testing



After being chemically cleaned, plates are high pressure washed and then plates are hung and sprayed with UV dye. Once sprayed the UV dye is allowed to soak in for 5 to 10 minutes and then using ultraviolet lights plates are inspected in a dark room for cracks, pin holes and deterioration. Any plates that are suspected of failure are then red/white dye penetrant tested so that failure can be confirmed.

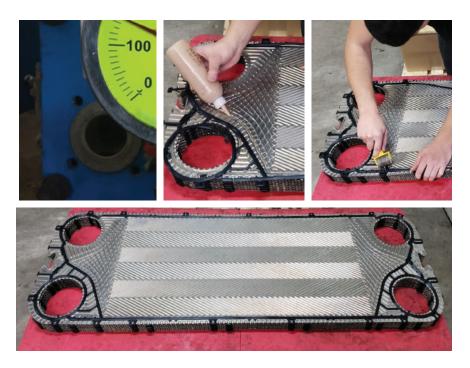
USING HYDRAULICS PLATE & FRAME



TO DISASSEMBLE A HEAT EXCHANGER



GASKET INSTALLATION



* Gasket and/or Plate Delivery (depending on shipping location):

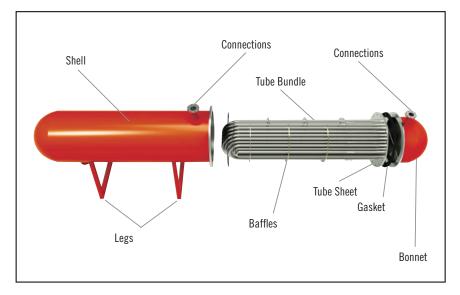
- stock approximately 1-3 weeks
- non-stock approximately 6-12 weeks (must be molded and/or stamped)
- * Complete replacement is often not practical:
 - > due to the weight and size of many heat exchangers
 - > accessibility to mechanical rooms is often severely limited
 - many heat exchangers were installed during initial construction before walls were installed
 - major piping changes are often required when installing new heat exchangers
 - piping standard connections may have changed from a diagonal pattern (X) to parallel

SHELL & TUBE HEAT EXCHANGERS



SHELL & TUBE HEAT EXCHANGERS

The main components of a Shell & Tube Heat Exchanger consist of the following:



Advantages of a Shell & Tube Heat Exchanger are:

- Tubes less likely to plug and foul
- Gaskets typically only 2-4 gaskets to replace
- Application higher pressure and temperature used
- Design basic, heavy duty, rugged and durable
- Lifespan average life of a shell and tube is 15-20 years, however, it is not uncommon to have shell and tube heat exchangers in service for over 30 years

DISADVANTAGES OF A SHELL & TUBE HEAT EXCHANGER ARE:

- Efficiency not as thermally efficient as a PHE
- Footprint larger size in comparison to a PHE

TUBE BUNDLE COMPONENTS

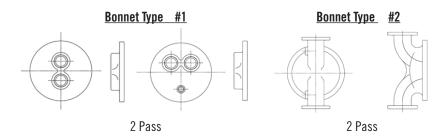
The tubes are typically copper or stainless steel with a ³/₄" or 5/8" outside diameter, while the remaining components are usually manufactured from milled steel.

Tie rods (circular metal rods) and spacers hold the tube bundle together while holding the baffles in the correct position. The tie rods are fastened into the tube sheet then secured at the farthest baffle. The number of tie rods, baffles and tubes depends on shell diameter and required application.



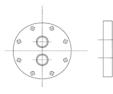


SHELL & TUBE BONNET TYPES







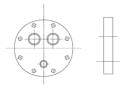




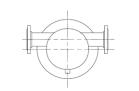




2 Pass



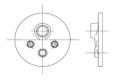
4 Pass



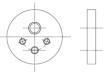




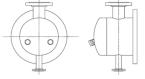
Steam Bonnet Types



2 Pass

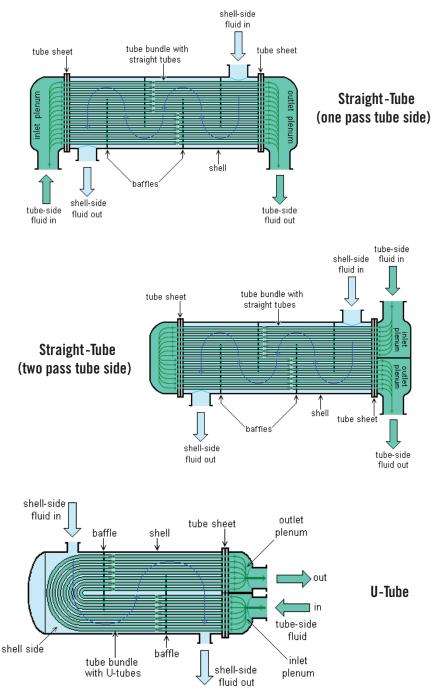


2 Pass



4 Pass

COMMON SHELL & TUBE HEAT EXCHANGER DESIGNS



STEAM OR WATER HAMMER

Pressure spikes, surges or shock waves as a result of a sudden and rapid acceleration or deceleration of any liquid can cause damaging steam or water hammer to the exchanger. Pressure surges have been seen in levels in excess of 20,000 psi, which would result in the complete rupture or collapse of the tubing of a heat exchanger. As an example, drawn copper ¾ in x 20 BWG tubing typically has a rated burst pressure of 2100 psi, along with a collapse pressure of 600 psi

Pressure surges can be a result of an interruption in cooling water flow, stagnant water heated with a resulting generation of steam, or a resumption of flow producing steam. All these processes would likely cause a pressure surge, steam or water hammer. Therefore, the flow of the cooling fluid should always start prior to adding the heat load



Tube Damage from Steam Hammer

Control valves that open or close suddenly to control fluid flow can produce water hammer. A modulating control valve is a preferable option to "on-off" types. A vacuum breaker vents are a must if the process involves a fluid that can or may condense on either the shell or tube side. Vacuum breakers prevent steam hammer from developing and causing damage as a result of condensate accumulation. Figure (B) is an example of typical tube damage caused by steam hammer. In the example provided, condensate accumulated in the shell rapidly, producing a high pressure shock wave that subsequently collapsed the tubes and caused multiple tear holes. Correctly sized steam traps with installed return lines pitched to a receiving container for condensate or a condensate return pump should be installed as to prevent such damage

SHELL & TUBE BUNDLE REMOVAL



60 Ton Hyrdraulic Ram Setup



Seal Broken



Removing Tube Bundle



Removing Tube Bundle



Removing Tube Bundle



Removing Tube Bundle



Removing Tube Bundle



Removing Tube Bundle

OPERATION

Start up - Open cold side first; then start hot side fluid slowly to gradually bring unit to operating condition. Bring unit from ambient temperature up to operating temperature gradually. Do not introduce hot or cold fluids suddenly. This could damage the unit and void the warranty.

Shut down - Always close off flow of hot fluid first.

Important - Never admit hot fluid suddenly when unit is empty or cold. Do not shock with cold water when unit is hot.

Gasket Creep is inherent to most gasket joints, and retorquing is required. The greater the operating temperature and pressure the greater the problem can become. It is imperative that the head bolts be torqued after installation, after initial startup, and inspected seasonally to be sure the bolts are torqued correctly.

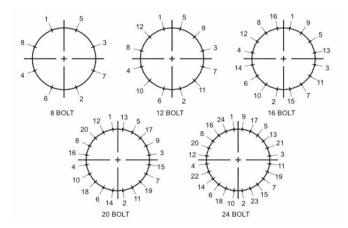
The bolts should be torqued incrementally to 30%, 60%, and then to 100% of the appropriate value in Figure 1. They should be torqued in the sequential order of the appropriate pattern in Figure 2.

Figure 1: Bolt size and Torque requirements

Heat Exchanger	Bolt	Number	Torque Ft/Lb.	
Size	Size	of Bolts	150# Flgs.	
4"	.62	8	30	
6"	.75	8	50	
8"	.75	8	50	
10"	.87	12	80	
12"	.87	12	80	
14"	1.00	12	123	
16"	1.00	16	123	
18"	1.12	16	195	
20"	1.12	20	195	
22"	1.25	20	273	
24"	1.25	20	273	
26"	1.25	24	273	

Heat Exchanger Size	Bolt	Number	Torque Ft./Lb. 300# Flgs.	
	Size	of Bolts		
4"	.75	8	100	
6"	.75	12	100	
8"	.87	12	160	
10"	1.00	16	245	
12"	1.12	16	390	
14"	1.12	20	390	
16"	1.25	20	545	
18"	1.25	24	545	
20"	1.25	24	545	

Figure 2: Sequential Order for Torquing Flange Bolts



SHELL & TUBE HEAT EXCHANGERS ISSUES

- 1. When vacuum breakers or thermostatic vents are not installed or functional the tube can be sucked in and break.
- 2. If the bundle is subjected to temperature extremes, (thermal shock), the tubes will develop spiral cracks.
- 3. On steam applications, harmonics can occur. This constant vibration can cause the steel baffles to eventually cut into the copper tubes.
- 4. Chemical corrosion resulting from interaction between the heat exchanger and the circulated fluids.
- 5. Marine film or coating on tubes such as scale, mud, algae and zebra mussels plugging tubes, this results in higher corrosion and restricts heat flow.



SHELL & TUBE HEAT EXCHANGER CLEANING OPTIONS

CHEMICAL FLUSHING (1-2 DAYS) ON-SITE

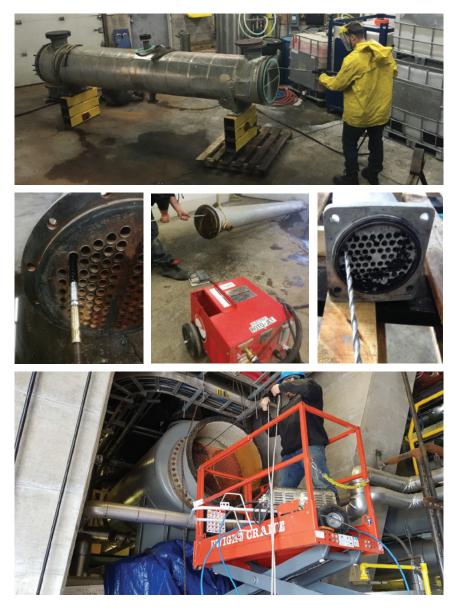
A portable chemical flushing unit consists of a pump, tank, filter and hoses. THS service technicians pump a citrus based cleaning chemical or mild acid solution through the heat exchanger for 6–8 hours, during the flushing any debris is collected in the filter.



*The level of success for this cleaning method is determined by the amount and type of contamination. If the scale has hardened, which is very common on heating applications, the chemical flush effectiveness can be limited.

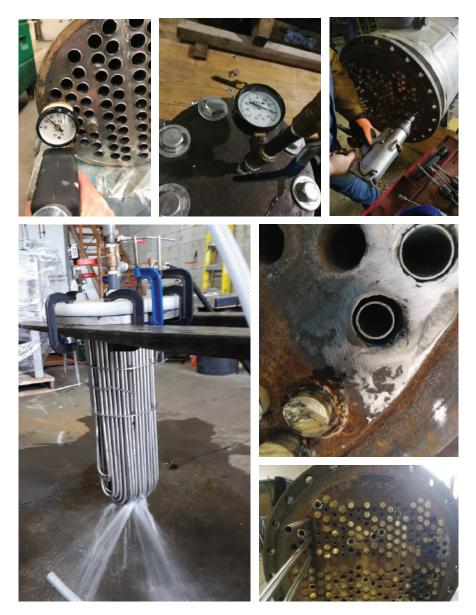
CLEANING RODDING OR DRILLING TUBES (2-3 DAYS) ON-SITE

Recommended for heat exchanger tubes that have hardened scale, the bonnet must be removed. Tube cleaning brushes, or drills, are inserted into each tube and the scale and contamination is grinded or cut away.



PRESSURE TESTING, TUBE VACUUM TESTING, TUBE REPLACEMENT AND PLUGGING ON OR OFF SITE

THS is also equipped to provide pressure testing, individual tube vacuum testing, complete tube replacement and tube plugging both onsite and at our service facilities.



CHEMICAL CLEANING OFF-SITE (2-3 WEEKS)

Tube bundle or complete heat exchanger is serviced at one of our service facilities. A mild acid solution is pumped through the heat exchanger for 6-8 hours, during the flushing all debris is collected in the filter. Before and after flow rates are recorded to gauge the effectiveness of the cleaning. A borescope is utilized to examine the tube internals. Pressure testing is completed on both the bundle and shell.

*Extreme fouling applications - tube bundle is submerged in a heated chemical bath. After 4 hours the bundle is removed and high pressure washed. If the contamination remains the process is repeated.



Borescope images of tube internals *Blockage in Bottom Tube

*Complete Replacement of Shell and Tube Heat Exchanger Delivery (depending on location):

- Stock approximately 2-4 weeks
- Custom fabricated tube bundles can be manufactured in 6-10 weeks

*Without drawings, the bundle will need to be removed and measured to fabricate a replacement

*Due to the large footprint, accessibility is often a major issue

SHELL & TUBE SERVICE BEFORE AND AFTER IMAGES



























SHELL & TUBE SERVICE BEFORE AND AFTER IMAGES





















HEAT EXCHANGER RISK ASSESSMENT GUIDE

WHAT ARE THE EFFECTS FROM A FAILED HEAT EXCHANGER?

- loss of production
- loss of revenue
- no common area heating or cooling in condominiums or hotels
- no cooling for the computer main frames in office towers
- no hot water for hospitals, hotels and condominiums
- no hot water for pools and hot tubs

Without a backup contingency plan what is the effect on business or property interruption?

At a minimum, service interruption due to a broken heat exchanger is 1 day, without a spare bundle, plate pack or gaskets the interruption could be 1-6 weeks depending on the severity of the repair and/or availability of parts.

NOTES:

HEAT EXCHANGER DATA

Make:	Model Number:	
Manufacture Date:	Serial Number:	
Application (heating/cooling)	Service (water/glycol/steam/other)	
PLATE AND FRAME HEAT EXCHANGER	SHELL & TUBE HEAT EXCHANGER	
Operating Pressures Side 1: Side 2:	Operating Pressures Shell: Tube:	
Operating Temperatures Side 1: Side 2:	Operating Temperatures Shell: Tube:	
Number of Plates Flow #	Number of Tubes #	
Starter# Port #	Number of Baffles #	
Gasket Material (NBR/EPDM/Viton)	Shell Material:	
	Tube Material:	
Gasket Style (glue/clip/ball)	Gasket Material (NBR/EPDM/Viton)	

Pressure Inlet:	Pressure Outlet:
Differential Pressure:	Last Service Date:

OUR GOAL IS TO SOLVE YOUR PROCESS PROBLEMS

On-Site and Off-Site Services available:

Heat Exchanger Service in Canada, Replacement Gaskets & Plates, Pressure Testing Shell & Tube / Plate & Frame Heat Exchangers, Chemical Cleaning & Descaling of Pipes, Tanks, Boilers, Air Coolers etc, Oxygen & Silicone Cleaning, Pipe/Tank Passivation, Valve Selection/Automation, Borescope Inspection

Filtration Systems Sales/Service including:

Sand Filters, Centrifugal Separators, Disc Filters, Magnetic Filters, Indexing Filters, Self-Cleaning Screen Filters, Wedge Wire Filters & Strainers

23 88178AND AVENUE TOXONTO, ONTARIO CANADA ANI 243 MIL 243 +1 416 755 2291	ARMSTRONG
	January 1, 2018
	To whom it may concern, This letter is to confirm that TH- IS (Total Heat Exchangers - Industrial Solutions) are a factory approved service dealer of Armstrong Fluid Technology (S.A. Armstrong Ltd.) and have been since December of 2009. They are qualified and authorized to conduct field service, including field assembly, commissioning and repair services which require special knowledge, skills and equipment, on behalf of Armstrong Fluid Technology (S.A. Armstrong Ltd.). Yours truly, S.A. Armstrong Ltd. / Armstrong Pumps Inc. Jacobian
TORONTO +1 416 755 2291 80#ALO +1 716 693 8813 818 NIGMAM +44 (03 8444 145 145 MANCHESTER +44 (03 8444 145 145 8444 145 145 940 64 69 64 435 155 940 64 69 64 3555 544 65 84	AMISTRONG FLUID TECHNOLOGY ESTABLISHED 1934



- Total Heat Exchanger Solutions
- Plate & Frame
- Shell & Tube
- Sales / Service
- Cleaning / Testing / Regasketing





 Brazed Heat Exchanger Services



- Custom Bag Filter Vessels
 CRN / ASME
- **FILTER SOLUTIONS INC**
- Cartridge Filters















As part of our corporate social responsibility, each time an order is placed with our company a tree will be planted by Forests Canada. Over a lifetime, with the addition of each tree, eventually a forest will be created which will help to ensure the health of our environment for future generations to come.



Double Walled Heat Exchanger Requirements

Designers and installers are required to conform to the following requirements.

7.6.2.1. Connection of Systems

(1) Connections to potable water systems shall be designed and installed so that non-potable water or substances that may render the water non-potable cannot enter the system.

(2) No connection shall be made between a potable water system supplied with water from a drinking-water system and any other potable water system without the consent of the water purveyor.

Therefore, if the designers, manufacturers and installers cannot assure that, "non-potable water or substances that will NOT render the water non-potable" (i.e. warranty of a single wall heat exchanger does not work, it only means when there is a break, someone will fix it but the damage has been done), as such, fail safe design must be included within the design and installation.

The local authority having jurisdiction can accept either an applicable Acceptable Solution in Division B, or an applicable Alternative Solution that will achieve the level of performance required by the applicable Acceptable Solution in respect of the Objectives and Functional Statements attributed to the applicable Acceptable Solutions in Supplementary Standard SA-1.

Under the Building Code Act, the local municipality is the authority having jurisdiction for enforcing the Act and its Regulations, and the permit applicants should contact the appropriate official with respect to any specific proposal. Danny Hui, P.Eng. Building Code Advisor Building Services Specialist Code Advisory Unit Building and Development Branch Ministry of Municipal Affairs & Housing Tel: 416-585-7368

REFERENCES

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3RD PARTY ACCREDITATION













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