The NovusBloc™

OVERVIEW

I. Tranter Introduction

II. NovusBloc Construction

III. Design Improvements

IV. Quality

V. Heat Transfer

VI. Service

VII. Applications & References

I. TRANTER GLOBAL PRESENCE

Corporate Headquarters:

- USA

Wichita Falls, TX, USA

Production Facilities:

- USA
- Sweden
- India
- Brazil
- China
- Korea

Beijing, China

Service Facilities:

- USA (4 Locations including Houston, TX)
- Europe (4 locations)
- Canada
- Brazil
- China (Shanghai)
- India
- Africa
- Middle East

Vänersborg, Sweden

I. THE NovusBloc™ IS A TRANTER PRODUCT

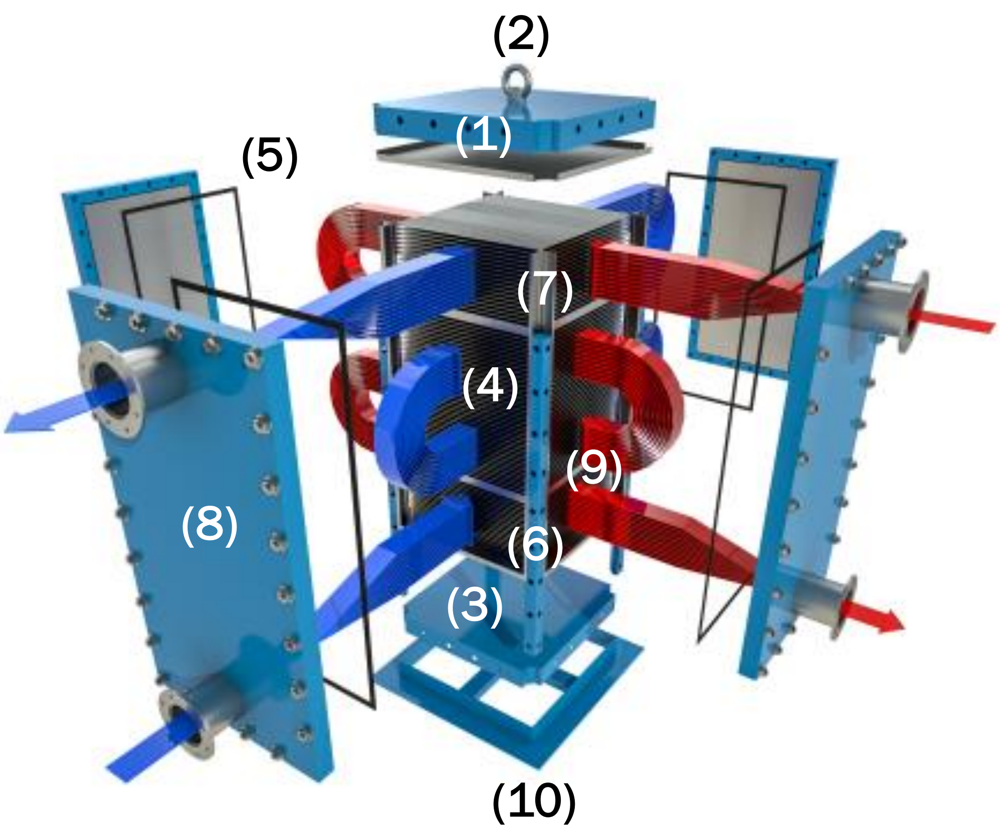
- Built at the Tranter-Group facility in Gimhae
- Tranter-negotiated terms & conditions
- Tranter warranty
- Tranter provides the service
- R&D function managed from Tranter-USA
- Differentiated from other bloc HX's

II. NOVUSBLOC CONSTRUCTION

A. Available Models
B. Plates
C. Columns
D. Column Liners
E. Heads/Liners
F. Cover Plates
G. Gaskets
H. Baffles
I. Nozzles

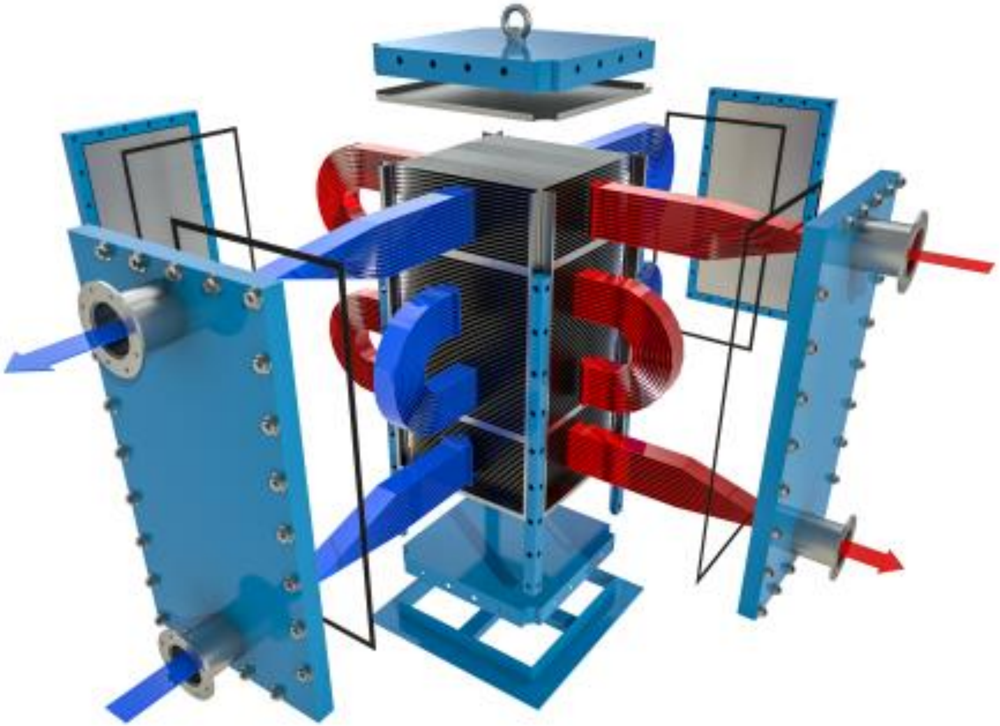
II. EXPLODED VIEW

1. Upper head (lined)
2. Lifting lugs
3. Lower head (lined)
4. Heat transfer plate pack
5. Panel gasket
6. Column (Girder)
7. Column liner
8. Panel
9. Baffle (removable)
10. Support

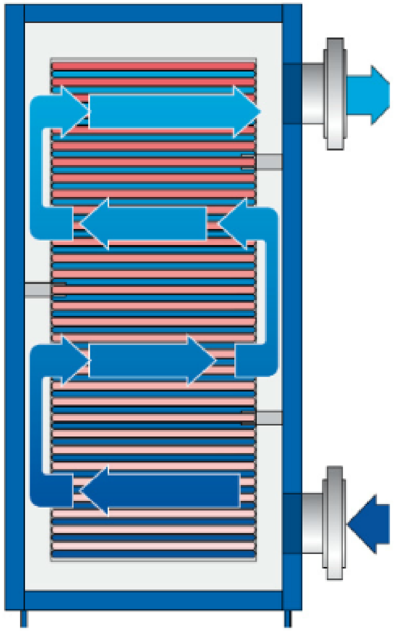


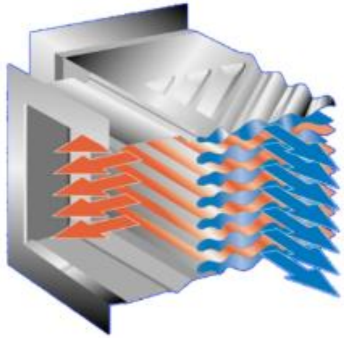
II. HOW IT WORKS

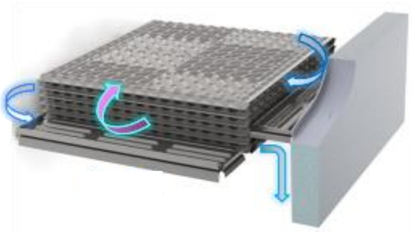
- The fluid flows through channels made of two plates welded together.
- Baffles re-direct both media back and forth through the all welded corrugated plate channels.
- Multi-pass (up to 30 passes) cross-flow arrangement can provide a temperature cross in a single-unit.



II. FLUID FLOW (VERTICAL UNIT)

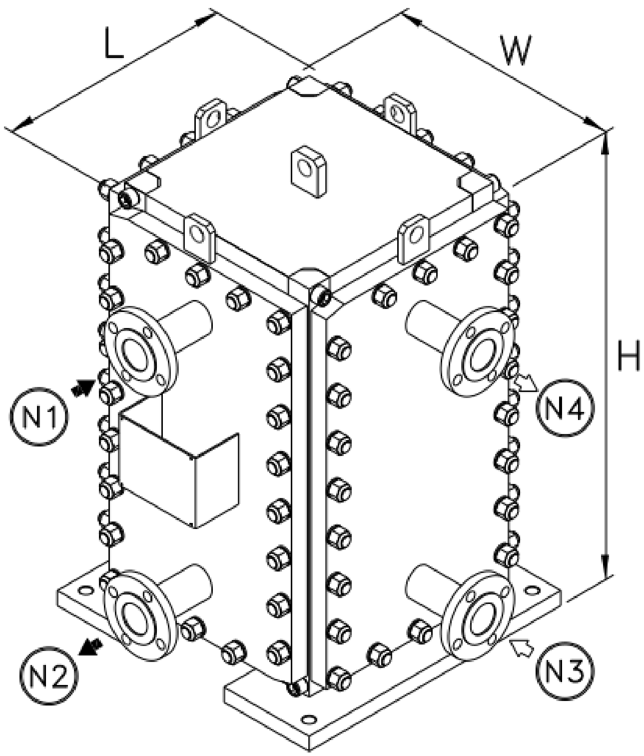


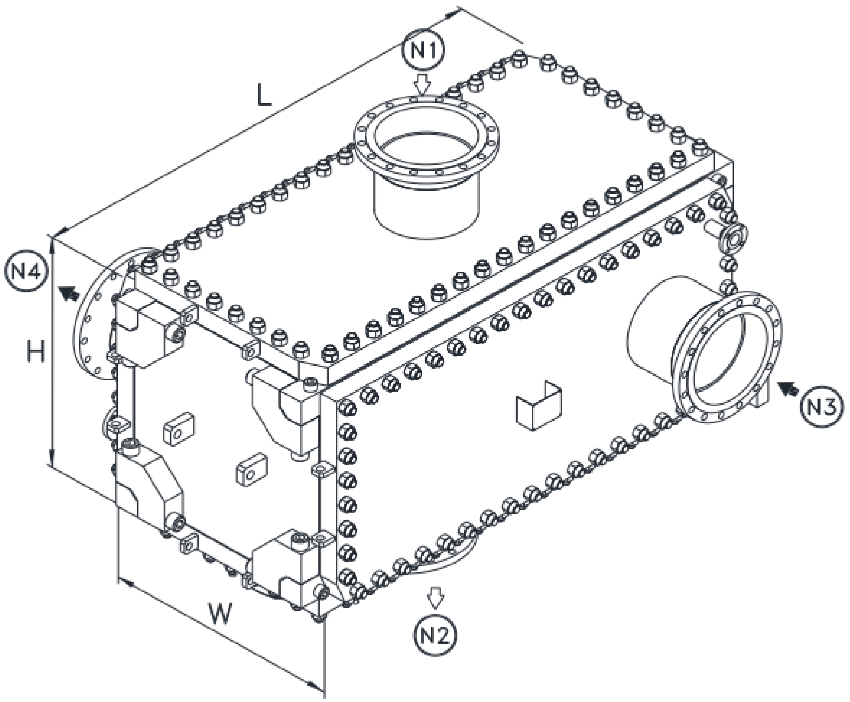




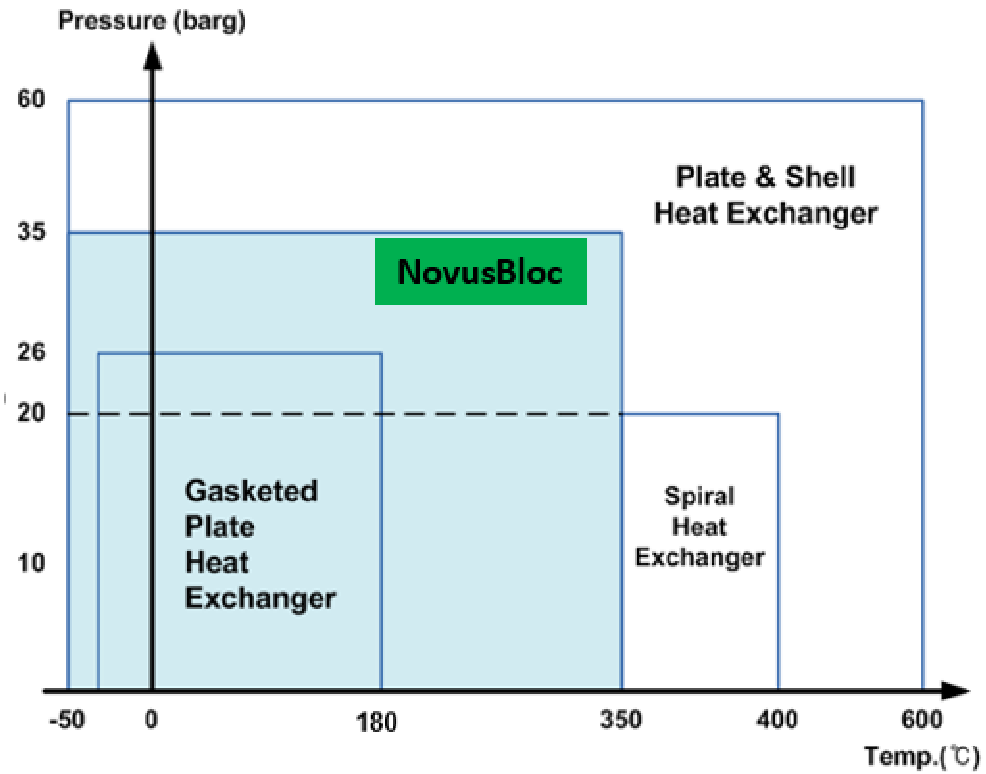
Vertical multi-pass units for single-phase and smaller vapor-break out duties.
Horizontal units for large vapor volumes in condensation and evaporation duties.

II. VERTICALLY VS. HORIZONATALLY MOUNTED





II. DESIGN LIMITATIONS



Pressure and temperature limits

	Minimum	Maximum
Area (m2/set)	6,6	865
Temperature (°C)	- 50	375
Pressure (bar)	Full Vacuum	42
Code / Directive	ASME, PED	
Plate Material	Stainless Steels : SS316L, 254SMO Nickel Alloys : C-276, 825 Titanium : Ti.Gr.1, Ti.Gr.11	
Plate Thickness	1.0 mm and 1.2 mm	

The NovusBloc™ comes in four - different models, depending on the user's heat transfer duty requirements.

II. GASKET MATERIALS

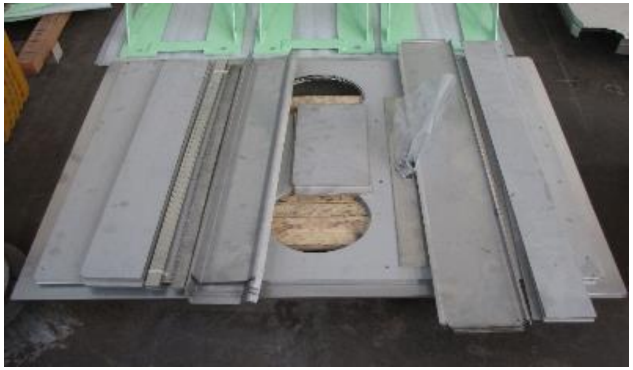
- The NovusBloc has 4 gaskets, referred to as panel gaskets, which seal between the panel and the column liner, or between the panel liner and the column liner when the panel is lined.
- Graphite gaskets are most commonly used as they provide the best sealing effect and compatibility with most process fluids. PTFE gaskets are used primarily for fine chemicals applications.

Graphite	PTFE
• Max 450 °C, Min -270 °C (atmospheric pressure) • Max pressure up to 100 barg • Graphite Laminate with a 0.1 mm stainless steel insert (compatible with most fluids).	• Max 270 °C, Min – 240 °C (atmospheric pressure) • Max pressure up to 20 barg • 100% PTFE material. Good chemical resistance (except fluorinated compounds).

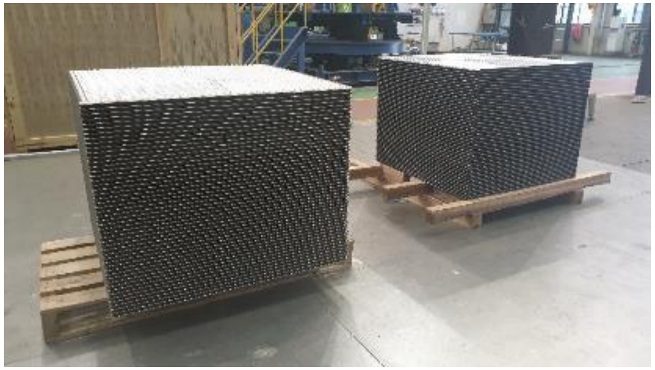
II. IMAGES OF KEY COMPONENTS

Upper/Lower Head

Columns



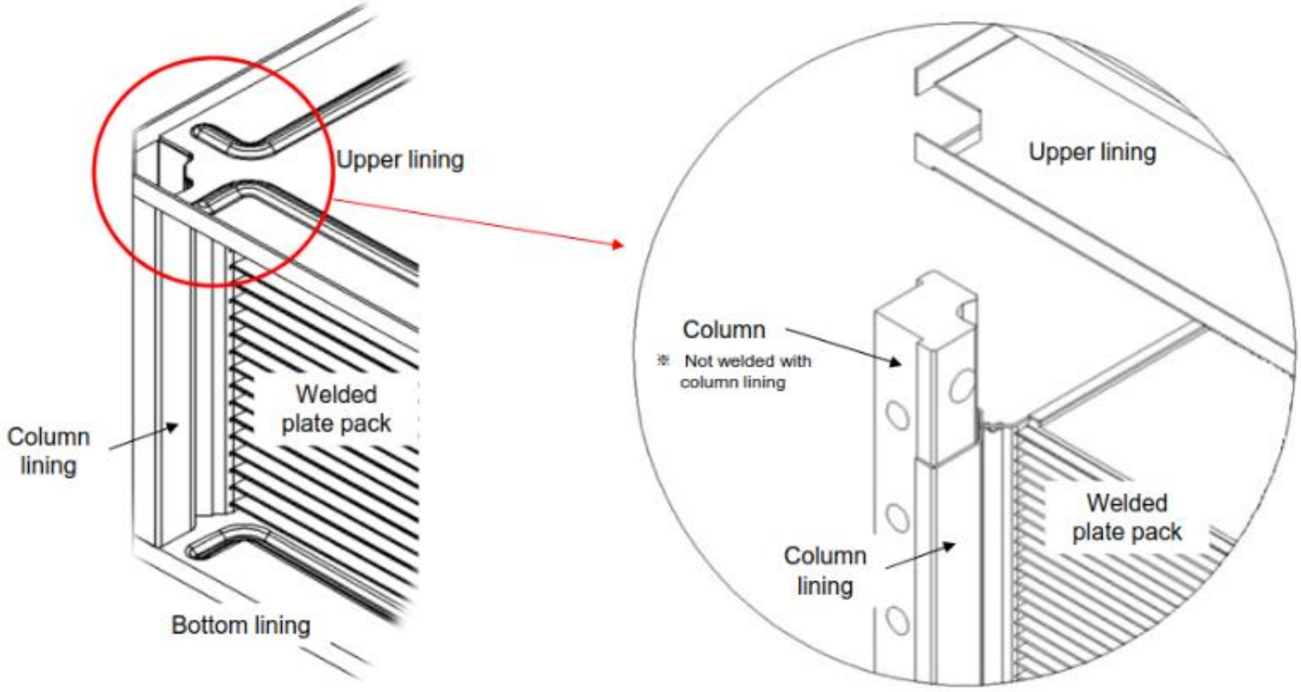
Column Liners



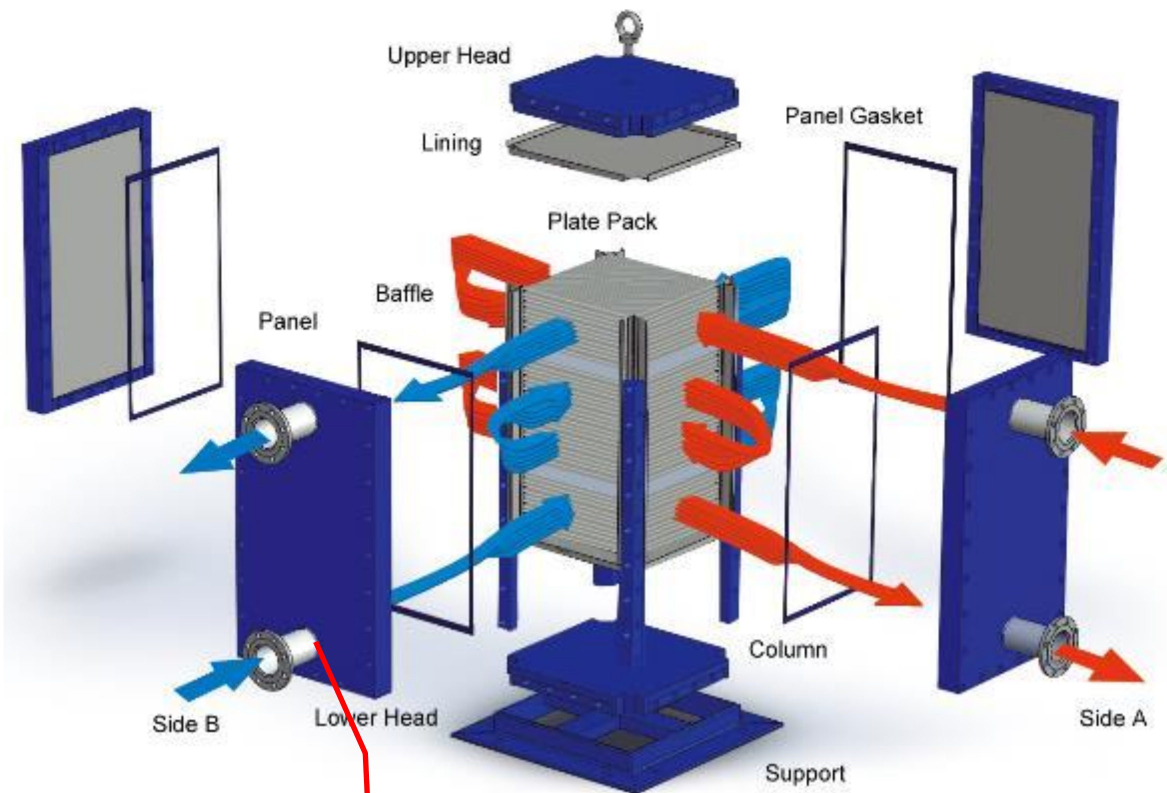
Welded Plate Pack

II. WELDING OF LINERS AND PLATE PACK

Plate pack welding: Manual GTAW without filler material
Liner to plate pack welding: Manual GTAW welding with filler material

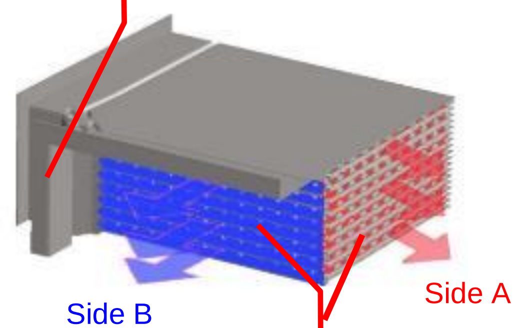


II. WELDING OF MAIN COMPONENTS



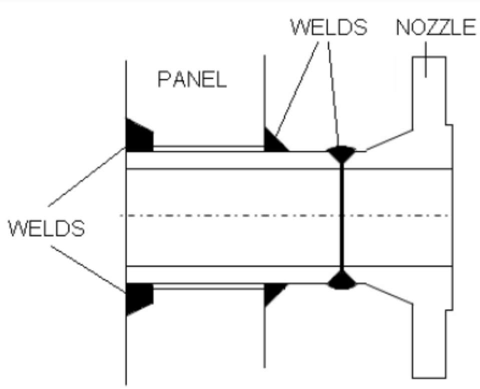
GTAW, FCAW
WPS NO. : W8-GT-13_Rev.2
WPS NO. : W1-GT.FC-10_Rev.4

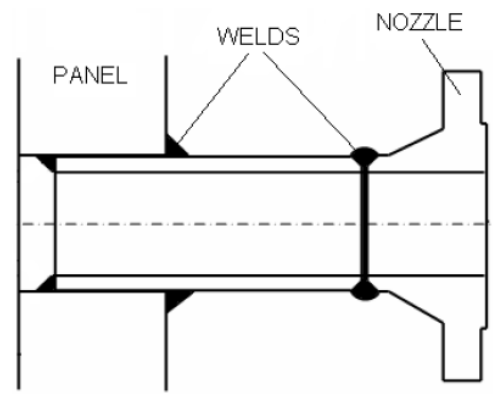
GTAW
WPS NO. : W8-GT-13_Rev.2



GTAW
WPS NO. : W8-GT-12_Rev.1

II. TRANTER BLOC NOZZLES





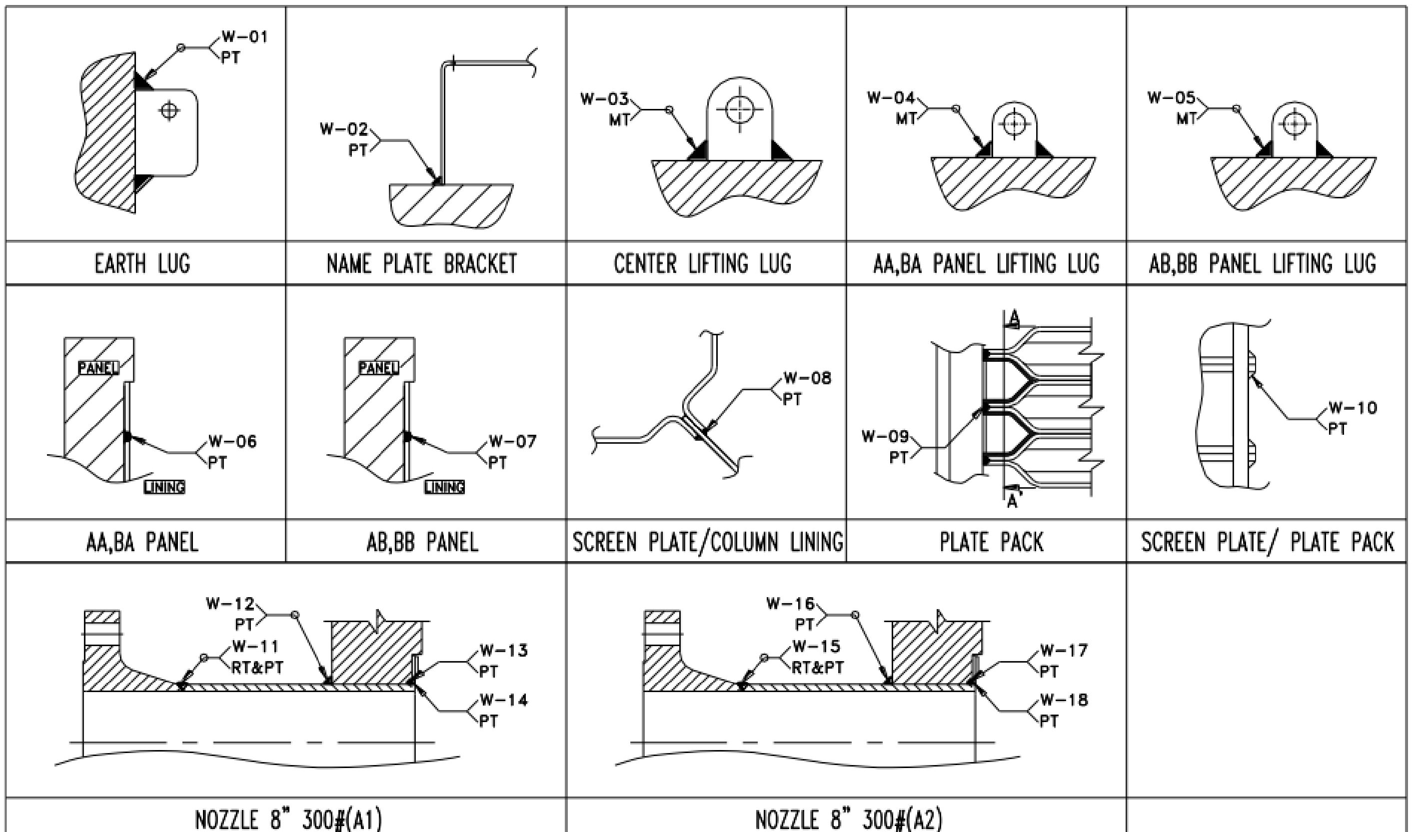
C.S panel / S.S nozzle
C.S panel / C.S nozzle with lining

C.S panel / C.S nozzle

Additional drain & vent - Standard is welding neck flange
None for TB030, 1-inch for TB050 & TB075 and 2-inch for TB120.

II. SAMPLE WELD MAPS

Sketch



II. BAFFLE CAGE DESIGN

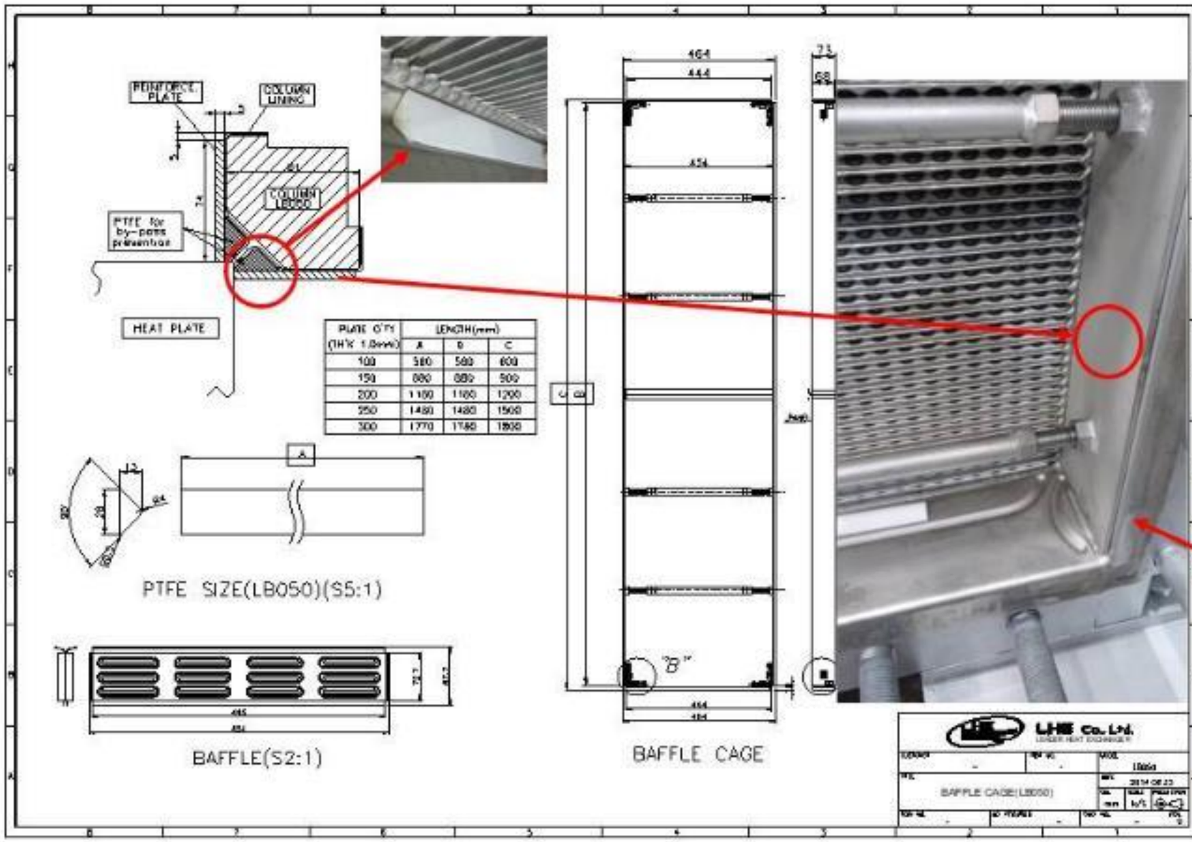


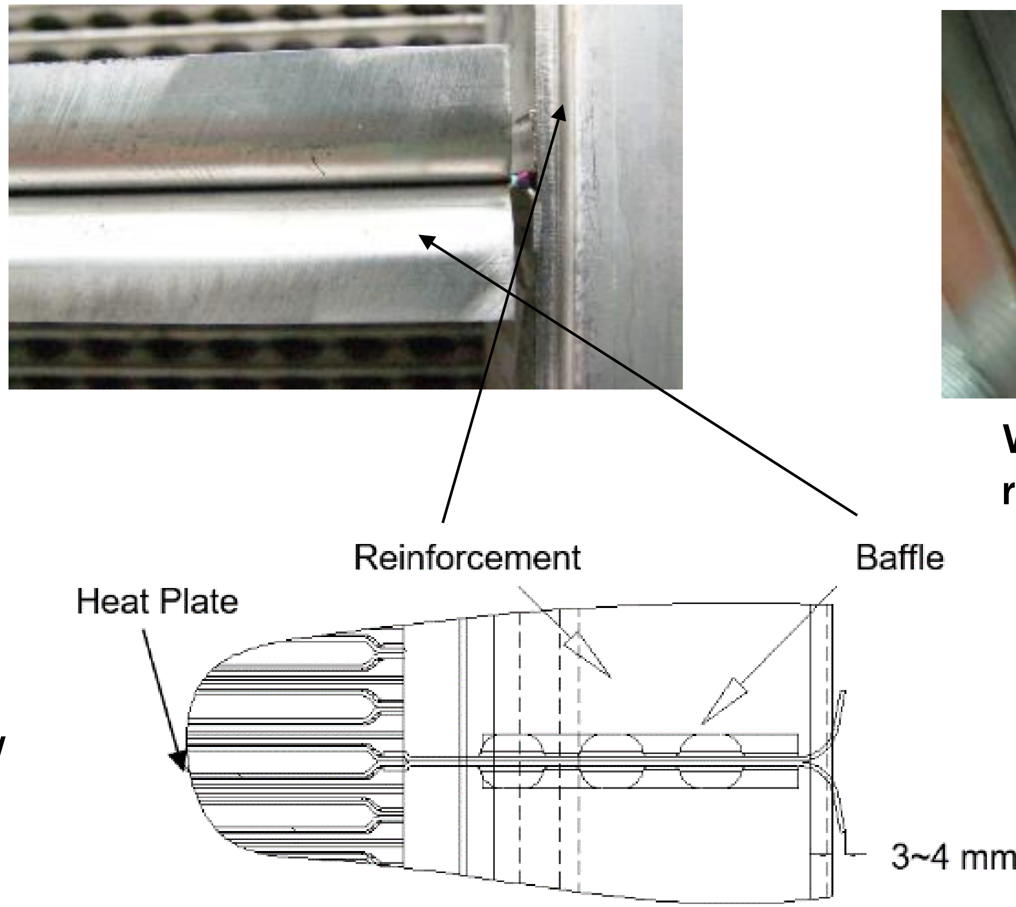
PLATE Q'TY (TH'K 1.0mm)	LENGTH(mm)		
	A	B	C
100	580	580	600
150	880	880	900
200	1180	1180	1200
250	1480	1480	1500
300	1770	1780	1800

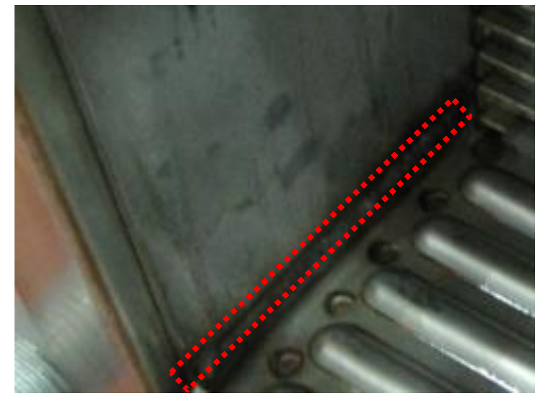
Baffles can be made with or without reinforcement rods.

II. BAFFLE CONSTRUCION

Front view

Section view

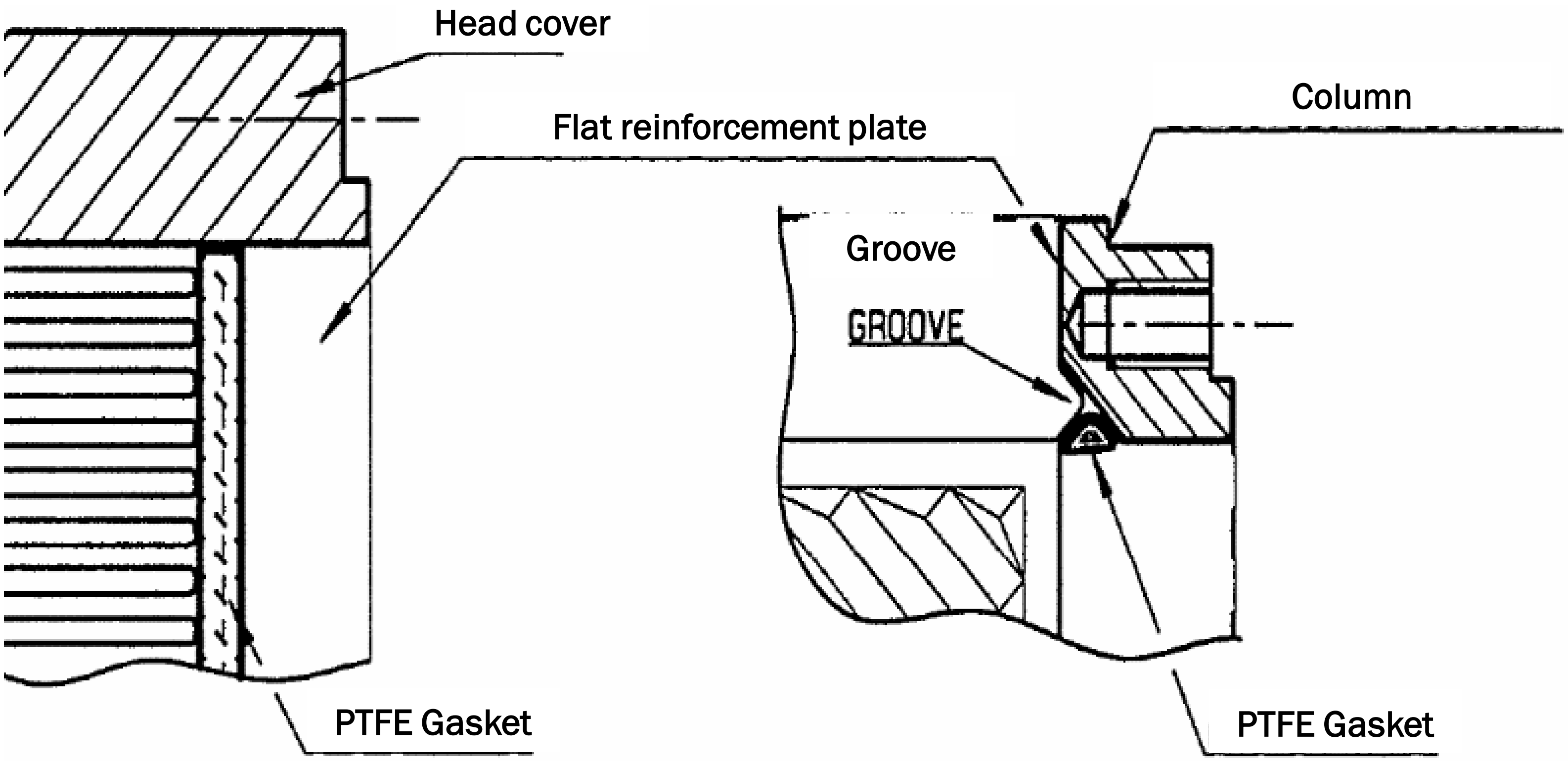




Welded area between reinforcement plate & baffle

II. BYPASS PREVENTION

Triangular PTFE gasket is installed between the column and the flat reinforcement plate to prevent fluid by-passing.



III. DESIGN IMPROVEMENTS

A. Design Improvements (3 main value propositions)

III. DESIGN IMPROVEMENTS

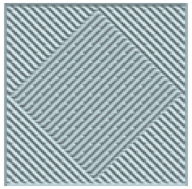
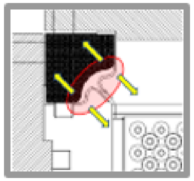
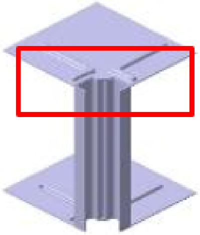
1. 

Plate Design → The optimized plate for Bloc type H/X
→ High performance, less deformation, higher weld quality and mechanical integrity (Patent)

2. 

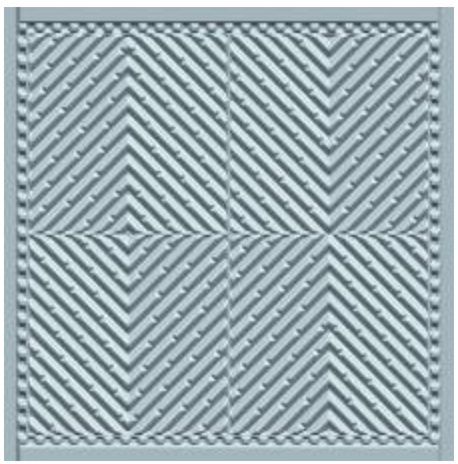
Empty space and Round type column lining → Mitigates thermal expansion
→ Improved life span (Patent).

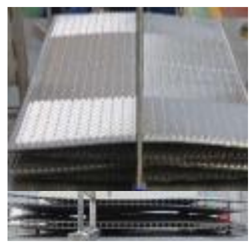
3. 

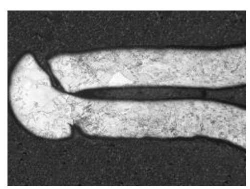
Wave in Head Lining → Stress reduction at the welding point by 50%
→ Improved reliability (Patent)

III. PLATE DESIGN IMPROVEMENTS

Old Plate Design:
Due to the spring-back phenomenon the plate becomes slightly rhombic after pressing.

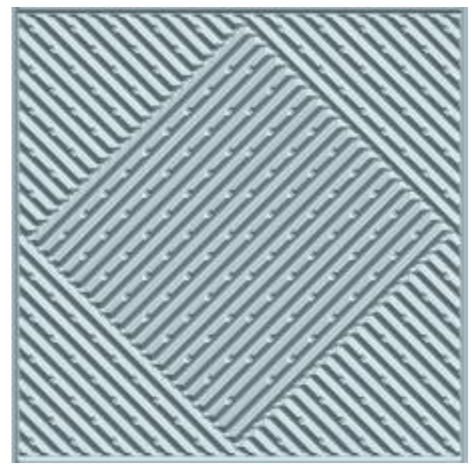






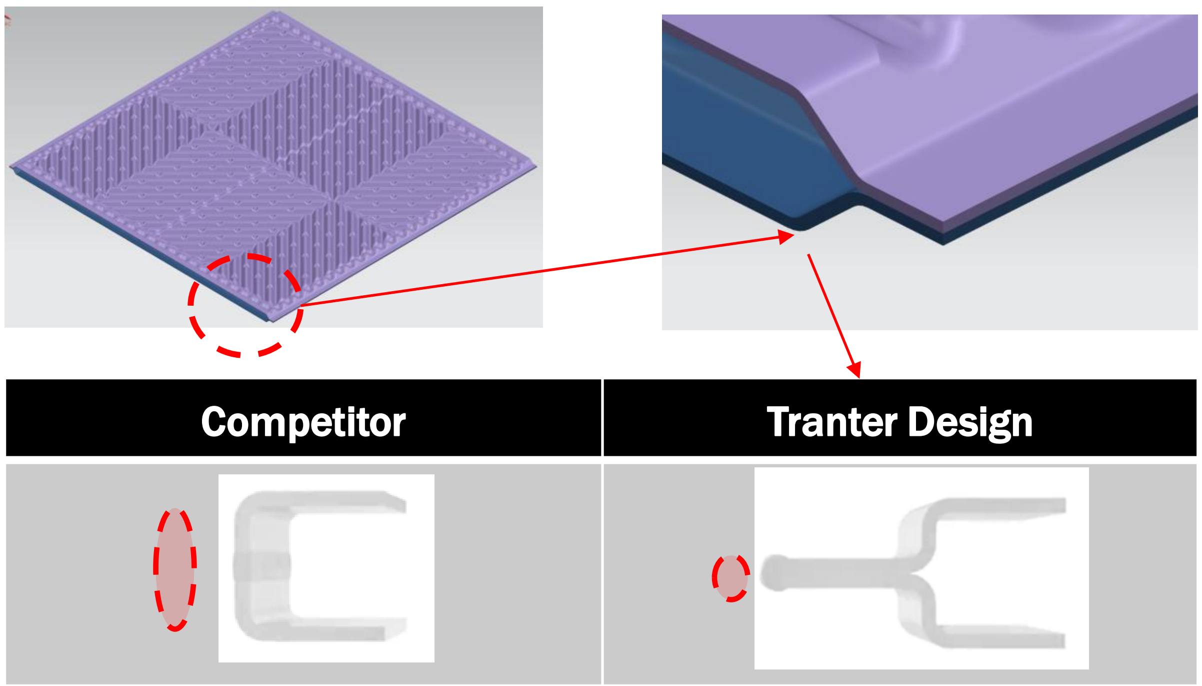
- Large plate deflection
- Low weld quality
- Fatigue and corrosion fractures

New Plate Design:
The corrugations extend in different directions thus forming a completely square plate.



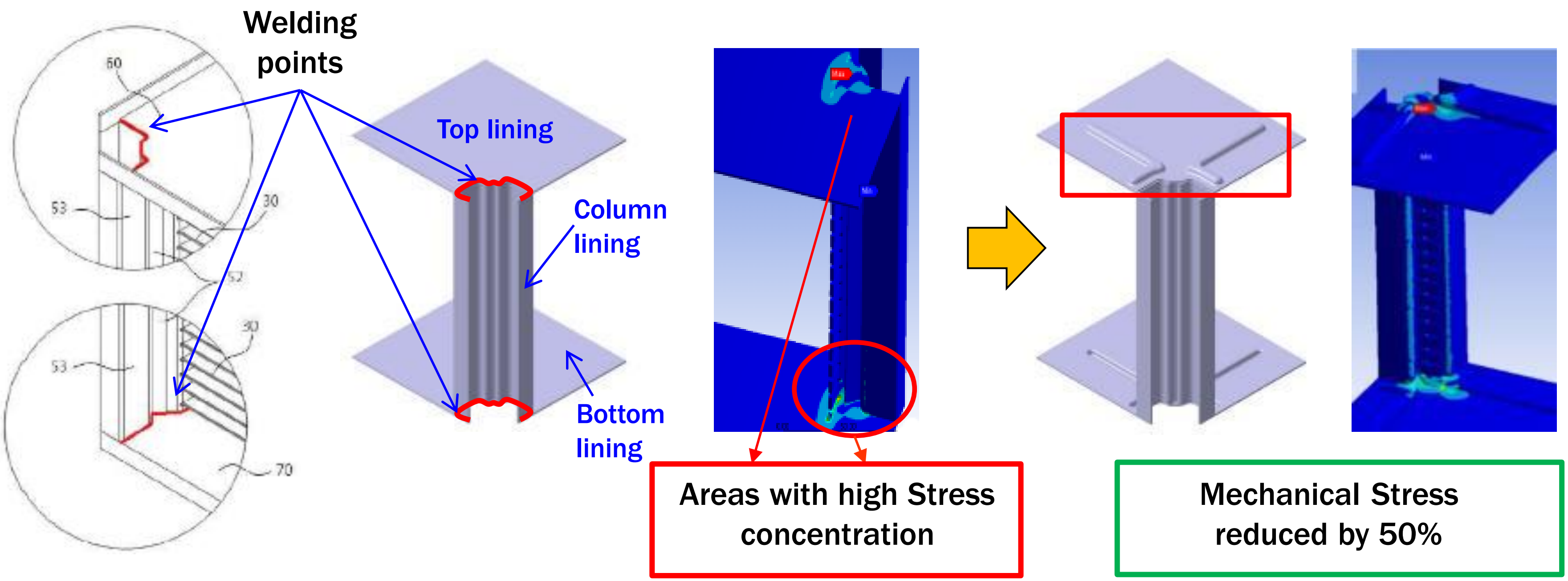
- Small plate deflection
- Weld quality improved
- Increased pressure and thermal cycling resistance

III. PLATE DESIGN IMPROVEMENTS



A lower drag coefficient creates lower pressure drop at the fluid inlet of each pass for multi-pass units >> More pressure drop available for heat transfer!

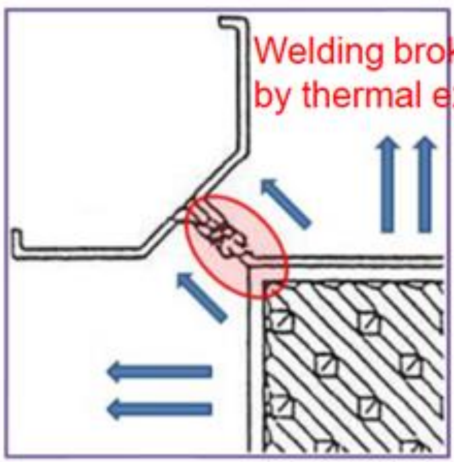
III. DESIGN IMPROVEMENTS



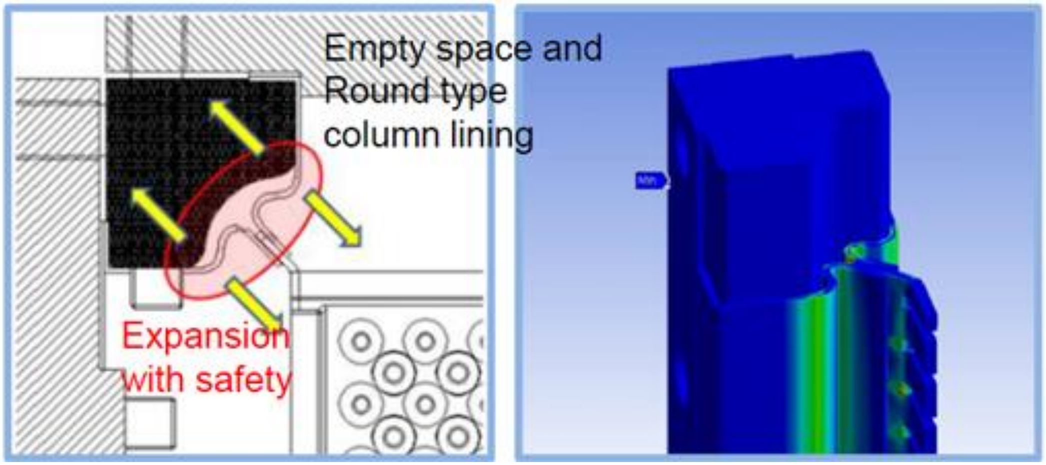
- Welding between Column Liner and Top & Bottom Liners (typical failure point)
- High stress concentration in the welds seams
- Design of the Top & Bottom Liners reduces mechanical stress in the weld seams & provides a uniform stress contour along the liner.

III. PLATE DESIGN IMPROVEMENTS

Accommodating column-associated thermal expansion



Legacy Design



Enhanced Design

IV. QUALITY

A. QC Program
B. NDE
C. Fatigue Testing

IV. STANDARD QUALITY CHECK

- Quality system per ISO 9001
- The draw depth of the plate is checked every 50 plates
- Light box check on every 25th plate for stainless steel and every plate for titanium. Other NDE such as dye penetrant test can be performed upon request / in compliance with specification/standard requirements
- PT (Dye Penetrant Test) – All manual GTAW welds of plate pack
- All welds are 100% visually inspected
- All units are hydrostatically tested per design code / standards as applicable

IV. ADDITIONAL/OPTIONAL NDE

(upon request and per design code)

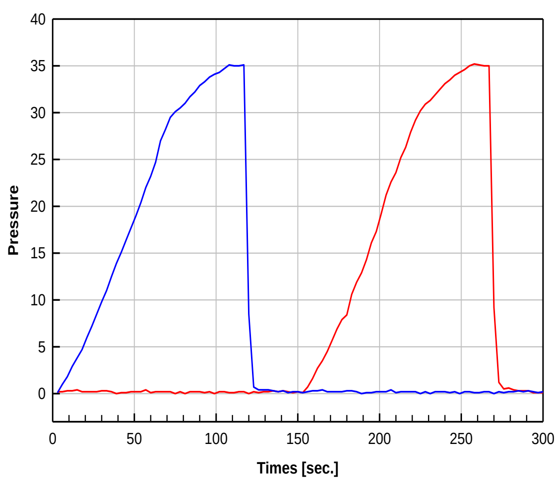
- UT (Ultrasonic Testing) of covers and nozzle weld connection. Typically UT requires a minimum of ¼” thickness in material
- RT (Radiographic Testing) of nozzle connections. Typically for RFWN flange connection, butt weld joints
- MT (Magnetic Particle Testing) of lifting lugs/supports or nozzles. Applicable only to carbon steel welds
- PT (Dye Penetrant Test) can be applied to any welding components/location as long as the location to be tested is accessible
- Weld Hardness Testing - In compliance with NACE MR0175/MR0103 or as requested
- PMI (Positive Material Identification) – Can be performed as requested (usually applies to high alloy materials)
- Helium Leak Test – Helium leak test can be performed as requested or per specification/standard requirement.

IV. R&D LAB CAPABILITY – FATIGUE TESTING

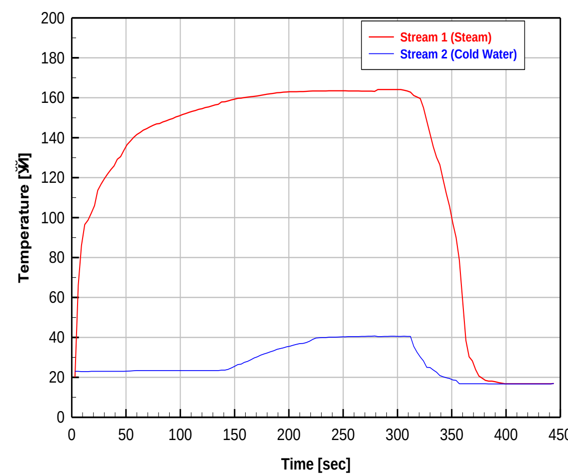
- Cycling Test Facility: To check product life span under max. severe conditions
- Pressure up to 45 bar & temperature up to 170℃

BLOC

Shell & Plate H/X



1 Cycle demonstration



V. HEAT TRANSFER

A. Single Phase

B. Two-phase

C. Simulations

V. R&D LAB CAPABILITY – PERFORMANCE

Water to Water test facility

Water to Oil test facility

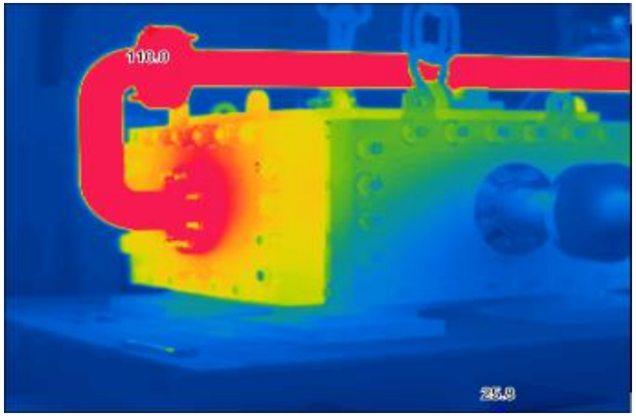
Cycling test facility

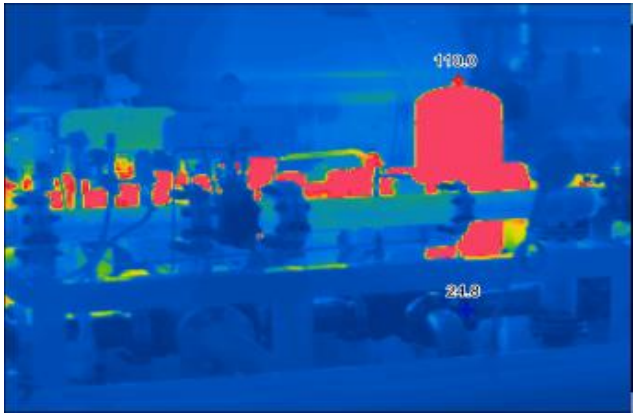
Seawater supply facility

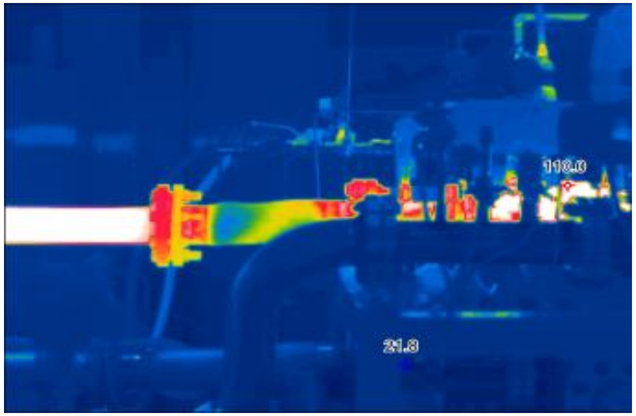
Steam supply facility

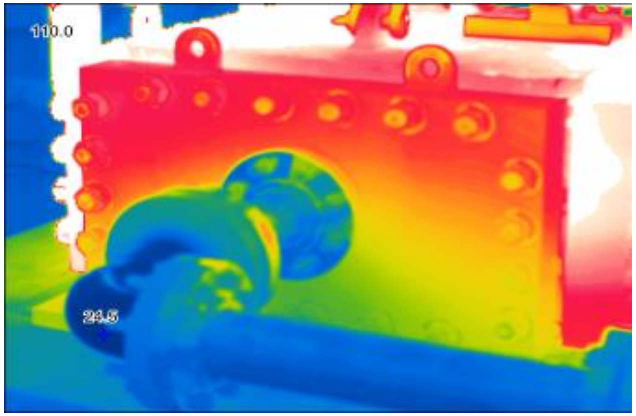
The heat transfer people

V. R&D LAB CAPABILITY – THERMAL IMAGING CAMERA

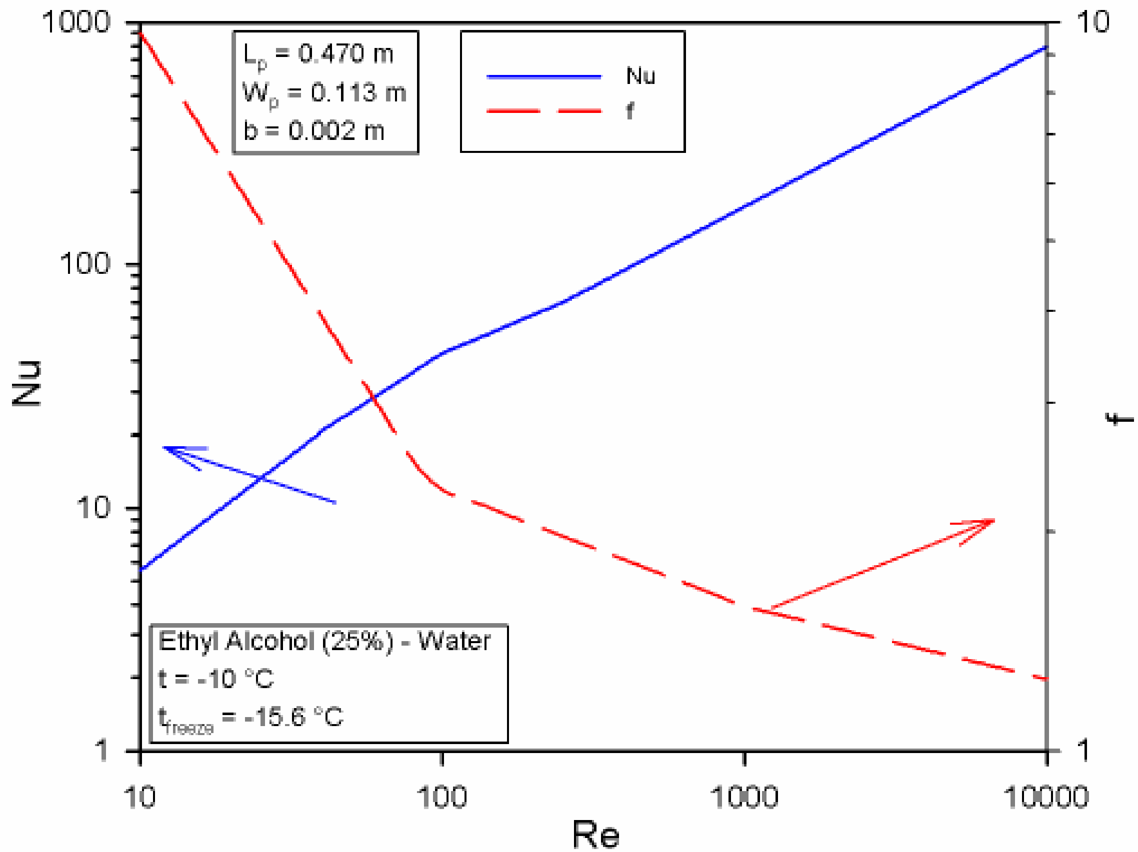






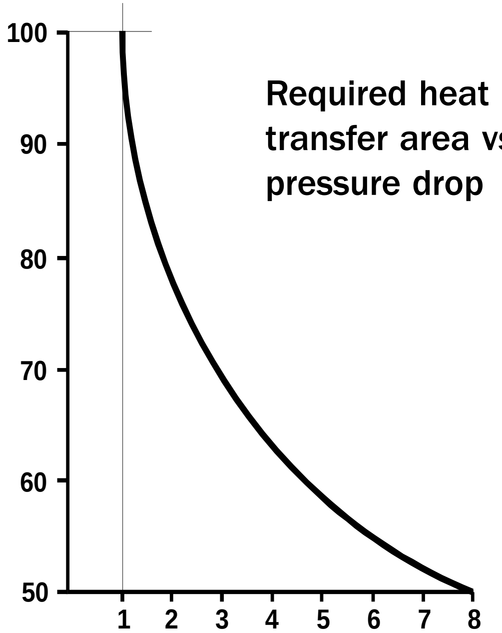


V. REYNOLDS ANALOGY - PLOTTED



Single-Phase Heat Transfer Correlations are developed in-house by R&D.

V. RELATION BETWEEN HEAT TRANSFER AND PREASSURE DROP



U ~ $(\Delta p)^{1/3}$

The pressure drop, Δp, is the “price” you must pay for the heat transfer.

High pressure drop ➔ high velocity ➔ high U-value ➔ smaller heat exchanger, BUT higher pumping cost.

Tranter recommends Δp not less than 50 kPa for the NovusBloc

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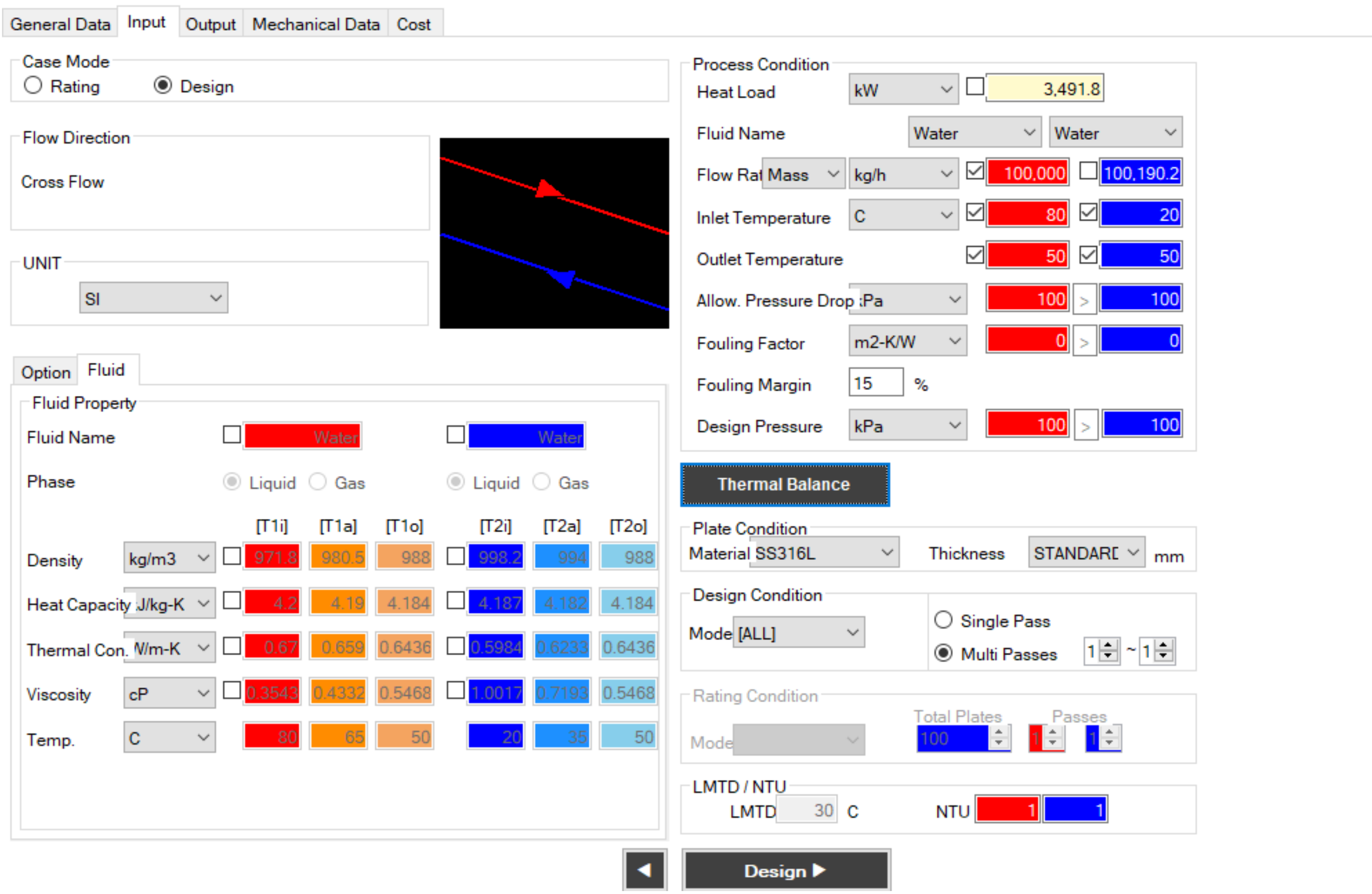
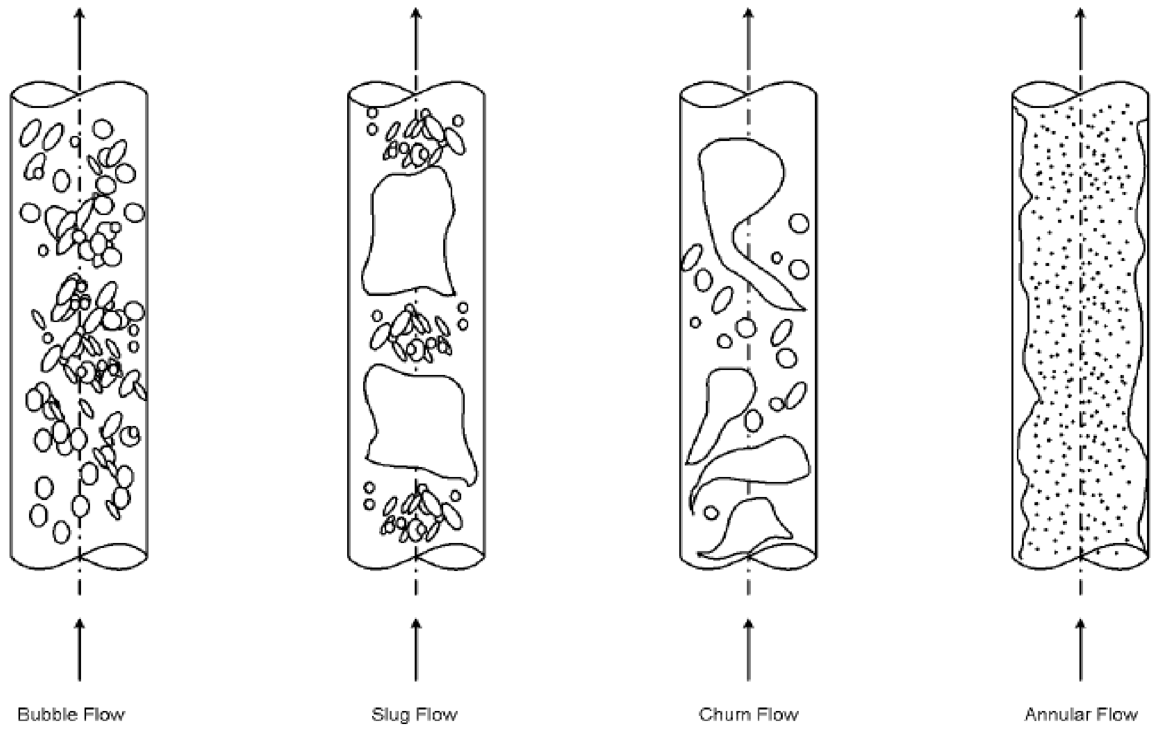
V. THERMAN DESIGN SOFTWARE



Capability for single-phase and two-phase (semi-empirical)

V. TWO-PHASE FLOW REGIMES



Different from single-phase flow patterns (Laminar / Turbulent). Normal single-phase correlations cannot be used. Calculated using semi-empirical correlations developed by R&D.

VI. SERVICE

A. Services

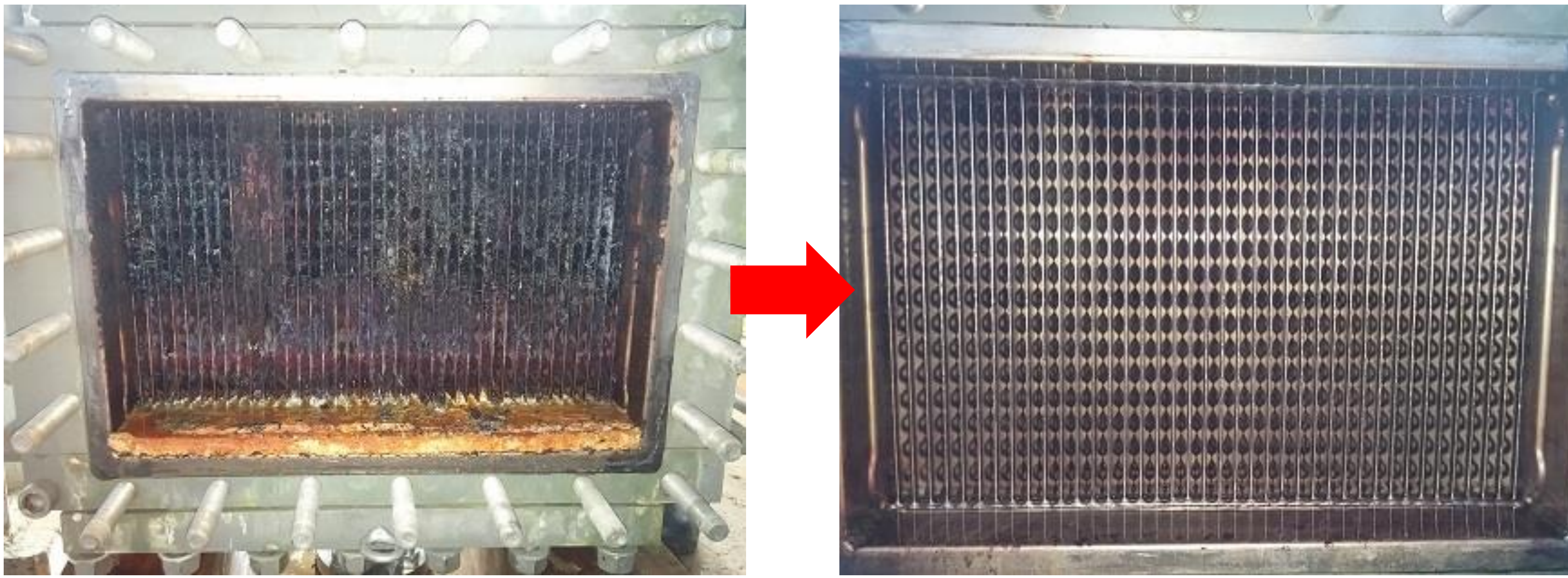
VI. SERVICE

1. Core Replacement
   a) Hydrotest
   b) Nitrogen purge

2. In-Shop Clean-in-Place
   a) Chemical flush (8/hrs/side)
   b) Hydrotest

3. Chemical Cleaning
   a) Remove cores for chemical soak
   b) Power wash, flush, purge

VI. CLEANING



Mechanical Cleaning with high pressure water, 3,000 psig

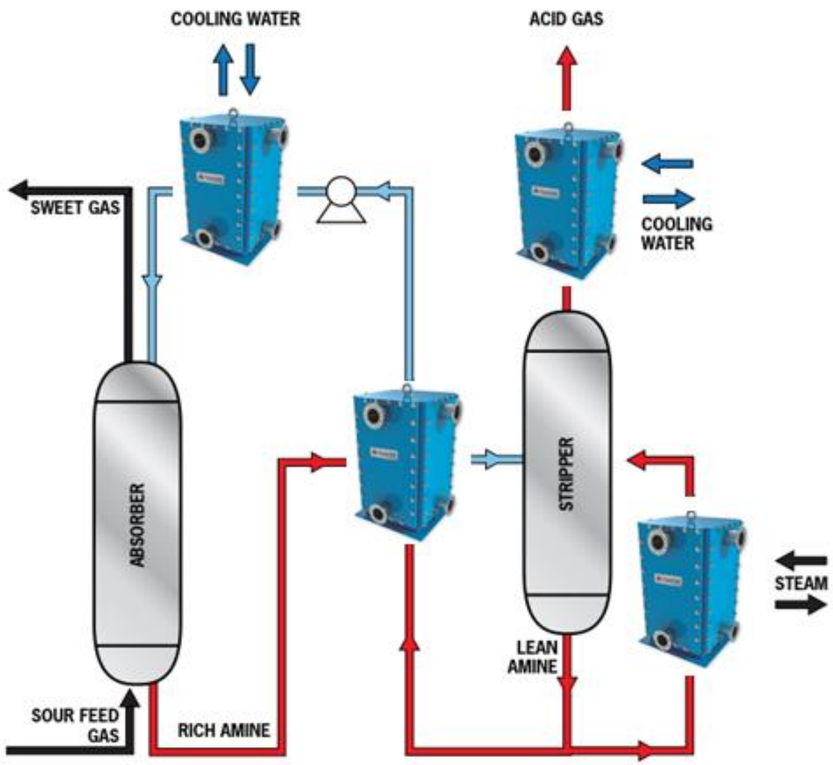
VII. APPLICATIONS AND REFERENCES

A. Gas Sweetening

B. Sour Water Stripper

C. References

VII. GAS SWEETENING



Why NovusBloc:

- Gasket free design (fluid compatibility issues).
- Higher resistance against process upsets (temperature, pressure, H2S, aliphatic HCs etc.).
- Ease of maintenance (two-side cleanable).
- High NTU and heat recovery (ability to operate with crossing temperatures ~approach temperature 3°C (5.4°F). Lower OPEX.
- Horizontal mounting of OHC enables reflux and low dP on the OH stream.

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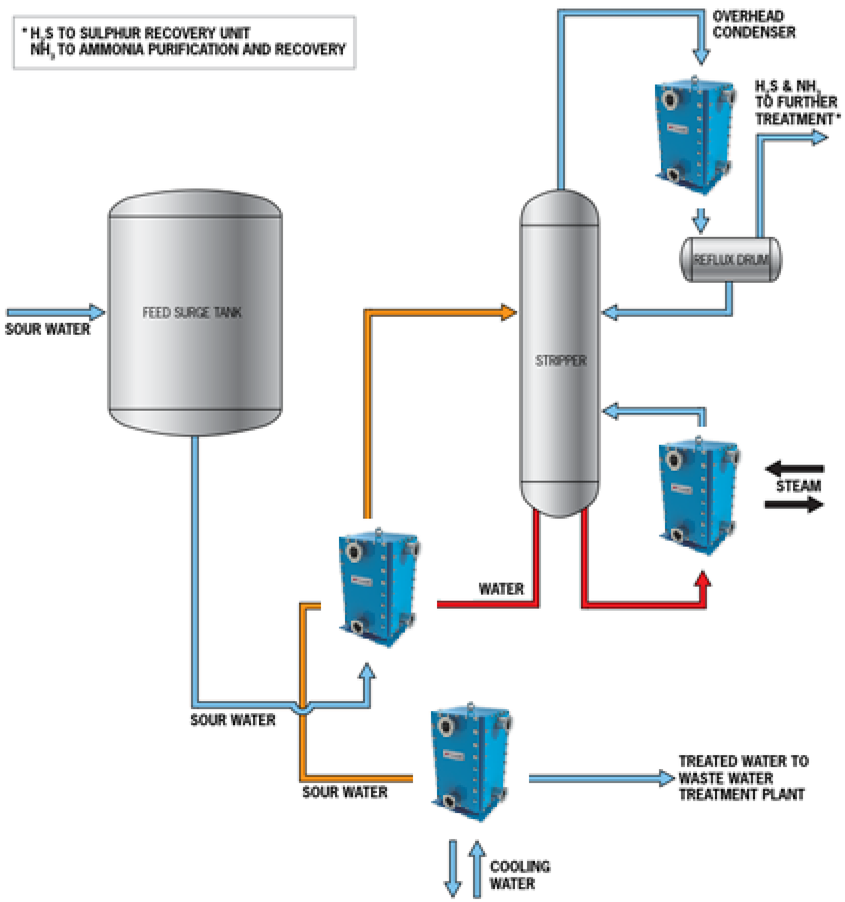
VII. SOUR WATER STRIPPER



Why NovusBloc:

- Gasket free design (fluid compatibility issues)
- Closer temperature approach in the reboiler allows lower pressure steam to be used.
- High shear stress reduces fouling and increases the operating time between cleanings.
- Exotic Materials can be used thus reducing CAPEX.
- High energy efficiency helps save operational costs.
- Compact design helps minimizing installation costs.

QUESTIONS AND ANSWER SESSION

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