OIL & GAS DEVELOPMENT COMPANY LIMITED
KPD-TAY PLANT.

Phone#022-2789200 & Fax#022-2761410

Annexure-A

Schedule of Requirement

Tender Enquiry No. TE/MECH/WT/KPD-0008/E-4404B/2023

"Web Tender for Hiring of 3rd Party Technical Services for Repairing of Plate Type Heat Exchanger"

Sr #	Description	QTY	UOM
1	Repairing of Welded Plate-Type Heat Exchanger installed at Amine Sweetening Unit of KPD-TAY Plant	01	Lump Sum

a. OGDCL intends to acquire services of experienced contractor for repairing of plate type heat exchanger which was identified leaky during operation and need to be reinstated by repairing as per applicable standards and testing in line with code requirements.
b. The scope of work includes Packing of heat exchanger in wooden frame for movement from site (KPD-TAY Gas & LPG Processing Plant) to Contractor's Workshop and back, planning & supervision of rigging for loading and unloading at site and Contractor's workshop, Repairing, Assembling and Testing.

TERMS AND CONDITIONS (TECHNICAL):-

a. Contractor shall prepare lifting and Rigging to ensure safe execution.
b. The contractor shall follow all the vendor specifications, OGDCL KPD-TAY Plant specifications for welding, all relevant industrial standards (AMSE BPVC) and best practices.
c. Contractor shall provide detailed work methodology and Quality Assurance and Inspection Plan along with bid.
d. The contractor shall complete the repair work and handover the equipment in maximum 60 days from the date of receipt of firm purchase order. Any delay in rectification and handover of equipment will be liable to LDs as per OGDCL standard terms.
e. Piping assemblies, hydro test equipment and gaskets for hydro testing of heat exchanger will be arranged by contractor.
f. All gaskets required for assembly of Heat Exchanger after repair will be arranged by contractor.
g. All tools and tackles, consumables, manpower, machinery and equipment required to attend complete scope of work will be managed and arranged by Contractor.
h. Crane and Lifting Accessories for Loading of Heat Exchanger at KPD-TAY Site will be provided by OGDCL, while all arrangements for crane and lifting accessories to unload / load heat exchanger at Contractors' workshop will be sole responsibility of Contractor.
i. Trailer required for shifting of heat exchanger will be provided by OGDCL.
j. The master set of tender documents (Local) available on OGDCL website (www.ogdcl.com) is the integral part of this tender.

ANNEXURE-A-1

GENERAL TERMS AND CONDITIONS:

A. BIDS MUST BE SUBMITTED UNDER **SINGLE STAGE TWO ENVELOPES BIDDING SYSTEM** i.e. TECHNICAL & FINANCIAL BID SEPARATELY ON DUE DATE.

B. TRANSPORTATION CHARGES AND REPAIR CHARGES SHOULD BE QUOTED SEPARATELY IN THE BID.

C. PAYMENT SHALL BE MADE AFTER SUCCESSFUL COMPLETION OF COMPLETE SCOPE OF WORK. NO PAYMENT WILL BE MADE IN CASE OF UNSUCCESSFUL REPAIR WORK / PARTIAL COMPLETEION OF SCOPE OF WORK.

D. FINANCIAL BIDS OF ONLY TECHNICALLY RESPONSIVE BIDDERS WILL BE OPENED PUBLICLY.

E. AFTER TENDER OPENING "TECHNICAL BIDS" WILL BE REVIEWED. THE BIDS WILL BE BROUGHT TECHNICALLY AT PAR BY SEEKING CLARIFICATIONS. THE BIDDERS WILL **NOT** BE ASKED FOR ANY PRICE CHANGE IN THEIR FINANCIAL BIDS DUE TO CERTAIN CLARIFICATIONS AND SUBSEQUENT CHANGE IN THEIR TECHNICAL PROPOSALS. THE BIDDERS WILL **NOT** BE ALLOWED TO SUBMIT SUPPLEMENTARY PRICE PROPOSALS IN A SEPARATE SEALED ENVELOPE TO MAKE IT A PART OF THE ALREADY SUBMITTED UNOPENED FINANCIAL BIDS AND TO ADJUST THEIR QUOTED PRICE SUBSEQUENTLY AFFECTED DUE TO CHANGE IN TECHNICAL PROPOSALS.

F. SEALED FINANCIAL BIDS OF TECHNICALLY NON-RESPONSIVE BIDDERS WILL BE RETURNED UN-OPENED.

G. OGDCL RESERVES THE RIGHT TO REJECT ANY OR ALL THE BIDS WITHOUT ASSIGNING ANY REASON.

H. PRICES MUST BE QUOTED IN PKR INCLUSIVE OF ALL TAXES AND DUTIES, INDICATING UNIT PRICE AND TOTAL BID PRICES. GST MUST BE QUOTED SEPARATELY ALONG WITH COPY OF GST CERTIFICATE.

I. QUOTED PRICES SHALL BE VALID FOR **90 DAYS** FROM THE OPENING DATE OF THE TECHNICAL BID.

J. OGDCL RESERVES THE RIGHT TO EVALUATE THE BID(S) EITHER ITEM-WISE OR FULL PASKAGE BASIS WITHOUT ASSIGNING ANY REASON. TO QOUTE COMPETITIVE PRICES FOR ALL OR ANY ITEMS ENABLE COMPANY TO DECIDE PURCHASE**.**

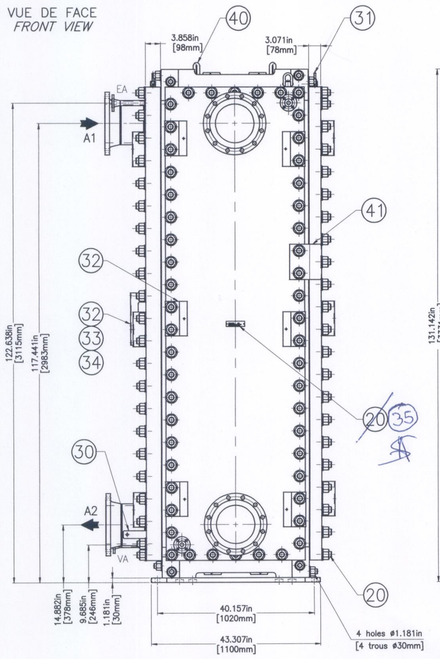
K. THE CONTRACTOR SHALL COMPLETE THE REPAIR WORK AND HANDOVER THE EQUIPMENT IN MAXIMUM 60 DAYS FROM THE DATE OF RECEIPT OF FIRM PURCHASE ORDER. ANY DELAY IN RECTIFICATION AND HANDOVER OF EQUIPMENT WILL BE LIABLE TO LDS AS PER OGDCL STANDARD TENDER DOCUMENT.

ANNEXURE-A-2

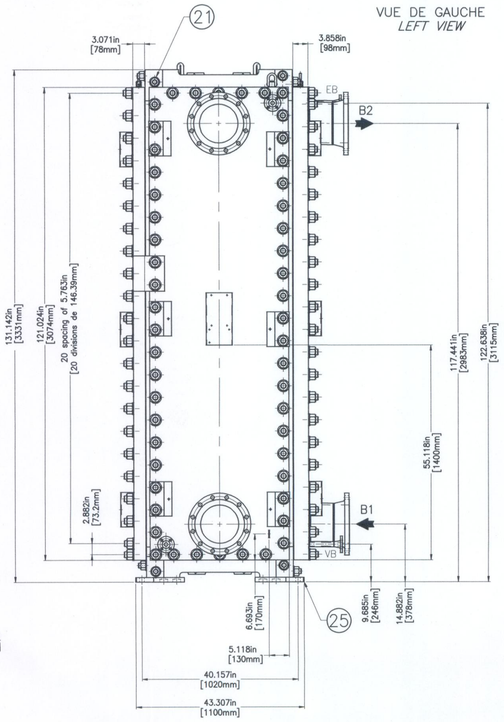
ATTACHMENTS:

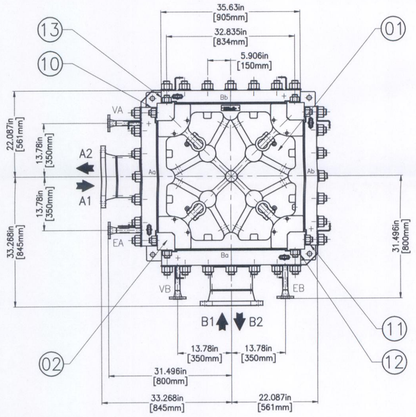
1. GA Drawing for Rich/Lean Amine Heat Exchanger E-4404 A/B/C
2. Operation and Maintenance Manual for Rich/Lean Amine Heat Exchanger E-4404 A/B/C

VUE DE FACE
FRONT VIEW



VUE DE GAUCHE
LEFT VIEW

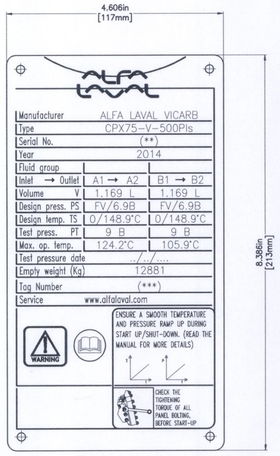




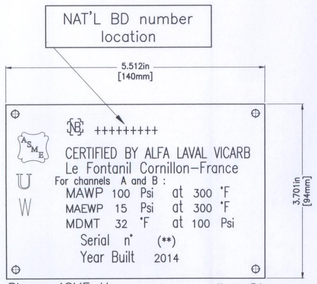
VUE DE DESSUS
TOP VIEW

Position of nozzles
±3mm
±0.118in

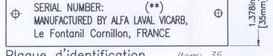
Anchoring
±5mm
±0.197in



Plaque de firme Alfa Laval
Alfa Laval name plate
Item:33



Plaque ASME-U
ASME-U plate
Item: 34



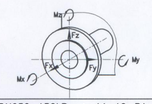
Plaque d'identification
Identification plate
Item: 35

DONNEES D'ETUDE / *DESIGN DATA*		CIRCUIT A *SIDE A*	CIRCUIT B *SIDE B*
		COTE PROCEDE *PROCESS SIDE*	COTE SERVICE *SERVICE SIDE*
FLUIDE VEHICULE	*VEHICULED FLUID*	L.Amine Inte.ex.	R.Amine Pakistan
PRESSION DE SERVICE	*WORKING PRESSURE*	Psig / barg: 15 / *1.03*	15 / *1.03*
PRESSION D'ETUDE INTERNE	*INTERNAL DESIGN PRESSURE MAWP (UG21-UG98)*	Psig / barg: 100 / *6.9*	100 / *6.9*
PRESSION D'ETUDE EXTERNE	*EXTERNAL DESIGN PRESSURE MAEWP*	Psig / barg: 15 / *1*	15 / *1*
PRESSION D'EPREUVE	*TEST PRESSURE (UG99)*	Psig / barg: 130 / *9*	130 / *9*
TEMPERATURE DE SERVICE	*WORKING TEMPERATURE*	°F / °C: 255.5/175.3 / *124.2/79.6*	160.7/222.7 / *71.5/105.9*
TEMPERATURE D'ETUDE	*DESIGN TEMPERATURE (UG20)*	°F / °C: 300 / *148.9*	300 / *148.9*
TEMPERATURE D'ETUDE MINI	*MDMT (UG20)*	°F / °C: 32 / *0*	32 / *0*
NOMBRE DE PASSES	*NUMBER OF PASSES*	6	6
SURFACE	*EXCHANGE SURFACE*	ft² / m²: 3546.7 / *329.5*	
POIDS A VIDE	*WEIGHT EMPTY*	Lbs / kg: 28397.7 / *12881*	
VOLUME	*CAPACITY*	Gal / l: 0.3 / *1.169*	0.3 / *1.169*
CHARGES EXTERNES	*EXTERNAL LOADS*	Yes (Nozzle loads)	
CODE DE CONSTRUCTION	*CONSTRUCTION CODE*	Acc. to ASME VIII Div.1 Ed.2010 Add.2011a	
COEFF. DE SOUDURE	*JOINT EFFICIENCY (UW12)*	0.7	
SERVICE DANGEREUX	*LETHAL SERVICE (UW2-UG120d)*	No	
SUREP. DE CORROSION	*CORROSION ALLOWANCE*	No	
TRAITEMENT THERMIQUE	*HEAT TREATEMENT -PWHT- (UCS56)*	No	
CONTROLE RADIO	*RADIOGRAPHY RT (UW11)*	N.A	
AUTRE CONTROLE	*OTHER TEST*	(*)	
FINITION INTERNE	*FINISH INTERNAL* — REVETEMENT / PEINTURE	SA240type316L	SA240type316L
FINITION EXTERNE	*FINISH EXTERNAL* — REVETEMENT / PEINTURE	ALV STD SYSTEM 6	
NUMERO DE SERIE	*SERIAL NUMBER*	(**)	
CONTROLE EXTERNE	*EXTERNAL INSPECTION*	ASME authorised inspector	
CAHIER DE SOUDAGE	*WELDING PROGRAM*	CDS-CP13-13037-01 REV00	
NOTE DE CALCUL	*CALCULATION SHEET*	NDC-CP13-13037-01 REV00	
L.O.F.C	*I.T.P.*	ITP-CP13-13037-01 REV00	
RESILIENCE	*IMPACT TEST (UCS66)*	See calculation note	

(*) 100% Dye penetrant test on all welds except pipe/flange welds

TABLEAU DES TUBULURES / *NOZZLES CHART*						
REP *ITEM*	NB *NB*	DN *NPS*	PN *CLASS*	FACE DE JOINT *FLANGE FACING*	NORME *NORME*	SERVICE *SERVICE*
A1	1	10"	150LB	Raised Face	ASME B16.5	L.Amine Inte.ex. Inlet
A2	1	10"	150LB	Raised Face	ASME B16.5	L.Amine Inte.ex. Outlet
B1	1	10"	150LB	Raised Face	ASME B16.5	R.Amine Pakistan Inlet
B2	1	10"	150LB	Raised Face	ASME B16.5	R.Amine Pakistan Outlet
EA	1	1"	150LB	Raised Face	ASME B16.5	L.Amine Inte.ex. Vent
VA	1	1"	150LB	Raised Face	ASME B16.5	L.Amine Inte.ex. Drain
EB	1	1"	150LB	Raised Face	ASME B16.5	R.Amine Pakistan Vent
VB	1	1"	150LB	Raised Face	ASME B16.5	R.Amine Pakistan Drain

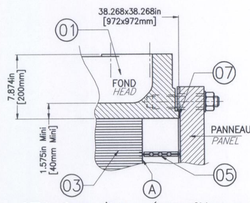
EFFORT TUBULURE / *NOZZLE LOADS*							
Acc. to API 662 Table 2							
(N)			(N.m)				
FX	FY	FZ	MX	MY	MZ		
7166	7166	7166	9047	9047	9047	DN250-150LB -> A1-A2-B1-B2	
452	452	452	2	2	2	DN25-150LB -> EA-VA-EB-VB	



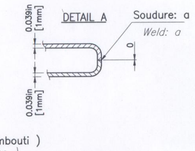
Rep. *Rep.*	Nbr *Nbr*	DESIGNATION *DESIGNATION*	MATIERE *MATIERE*	OBSERVATIONS *OBSERVATIONS*
01	2	FOND MOULE CP75 Ep.=212mm *CASTEDHEAD CP75 Th.=8.346in*	SA352grLCB	Machined to 7.874in (200mm)
02	4	LONGERON 500 PLAQUES Ep.=130mm *LONGITUDINAL GIRDER 500 PLATES Th.5.118in*	SA516gr60	
03	1	COEUR D'ECHANGE 500 PLAQUES (1) *HEAT TRANSFER PLATE PACK 500 PLATES*	SA240type316L	Th=0.039in (1mm)
05	2	CHICANAGE EMBOUTI 6 PASSES (1) *STAMPED BAFFLE ASSEMBLY 6 PASSES*	SA240type316L	
07	4	JOINT DE PANNEAU Ep.=3mm *PANEL GASKET Th.=0.118in*	SIGRAFLEX HD	m=2.5 y=4000Psi
10	1	PANNEAU ACIER Ep.=100mm *CARBON STEEL PANEL Th.=3.937in*	SA516gr60	Mini Th.=3.445in (87.5mm)
11	1	PANNEAU ACIER Ep.=80mm *CARBON STEEL PANEL Th.=3.15in*	SA516gr60	Mini Th.=2.657in (67.5mm)
12	1	PANNEAU ACIER Ep.=100mm *CARBON STEEL PANEL Th.=3.937in*	SA516gr60	Mini Th.=3.445in (87.5mm)
13	1	PANNEAU ACIER Ep.=80mm *CARBON STEEL PANEL Th.=3.15in*	SA516gr60	Mini Th.=2.657in (67.5mm)
14	2	REVETEMENT DE PANNEAU (CIRCUIT A) Ep.=3mm *PANEL LINING (SIDE A) Th.=0.118in*	SA240type316L	
15	2	REVETEMENT DE PANNEAU (CIRCUIT B) Ep.=3mm *PANEL LINING (SIDE B) Th.=0.118in*	SA240type316L	
A1	4	BRIDE A COLLERETTE A SOUDER EN BOUT DN250 150LB *WELDING NECK FLANGE NPS10" 150LB Sch60*	SA350LF2 Cl1	Machined Th.=0.443in Ep. Usinée=11.25mm Mini. Th.=0.364in Ep. Mini.=9.25mm
A2	4	TUBE ACIER SS DN250 Ep.=12.7mm Lg.=247mm *SEAMLESS CS PIPE NPS10" Sch60 Lg.=9.724in hot finish*	SA333gr6	
B1	4	COLLET AVANT DN250 150LB Ep.=3mm *FRONT LAP JOINT NPS10" 150LB Th.=0.118in*	SA240type316L	
B2	4	REVETEMENT TUBULURE DN250 Ep.=2mm *NOZZLE LINING NPS10" Th.=0.079in*	SA240type316L	
	4	FOURRURE DN250 Ep.=2mm *PACKING NPS10" Th.=0.079in*	SA240type316L	
EA	4	BRIDE SPECIALE A COLLERETTE A SOUDER EN BOUT DN25 150LB *SPECIAL WELDING NECK FLANGE NPS1" 150LB Sch160*	SA350LF2 Cl1	Machined Th.=0.195in Ep. Usinée=4.95mm Mini. Th.=0.136in Ep. Mini.=3.45mm
VA	4	TUBE ACIER SS DN25 Ep.=6.35mm Lg.=247mm *SEAMLESS CS PIPE NPS1" Sch160 Lg.=9.724in hot finish*	SA333gr6	
EB	4	COLLET AVANT DN25 150LB Ep.=3mm *FRONT LAP JOINT NPS1" 150LB Th.=0.118in*	SA240type316L	
VB	4	REVETEMENT TUBULURE DN25 Ep.=1mm *NOZZLE LINING NPS1" Th.=0.039in*	SA240type316L	
	4	FOURRURE DN25 Ep.=1mm *PACKING NPS1" Th.=0.039in*	SA240type316L	
20	104	TIGE FILETEE M39x215mm ZINGUEE *THREAD ROD M39x215mm ZINC-COATED*	SA193grB7	Root area=1.3904sq.in METRIC THREAD
	104	TIGE FILETEE M39x235mm ZINGUEE *THREAD ROD M39x235mm ZINC-COATED*	SA193grB7	Root area=1.3904sq.in METRIC THREAD
	208	ECROU Hh,M39 ZINGUE *NUT Hh,M39 ZINC-COATED*	SA194gr7	Metric Thread
	208	RONDELLE M39,N ZINGUEE *WASHER M39,N ZINC-COATED*	STEEL C45	
21	8	TIGE FILETEE M33x215mm ZINGUEE *THREAD ROD M33x215mm ZINC-COATED*	SA193grB7	
	8	ECROU Hh,M33 ZINGUEE *NUT Hh,M33 ZINC-COATED*	SA194gr7	
	8	RONDELLE M33,N ZINGUEE *WASHER M33,N ZINC-COATED*	STEEL C45	
25	2	SUPPORT VERTICAL CP75 (2) *VERTICAL FEET CP75*	S185 JR	
	8	VIS HM20x40mm ZINGUEE (2) *SCREW HM20x40mm ZINC-COATED*	Class 8.8	
30	1	PATTE DE TERRE *EARTHING LUG*	SA240type304L	
31	4	ANNEAU ARTICULE M20 (2) *M20 PIVOTING SHACKLE*	42CD4	
32	1	PONTET PLAQUE DE FIRME *NAME PLATE SUPPORT*	SA516gr60	
33	1	PLAQUE DE FIRME ALFA LAVAL *ALFA LAVAL NAME PLATE*	A240type304	
34	1	PLAQUE ASME-U *ASME-U PLATE*	A240type304	
35	5	PLAQUE D'IDENTIFICATION *IDENTIFICATION PLATE*	A240type304	
40	4	MANILLE WLL 17T (2) *LIFTING LINK*	AF42C20	
41	2	CORNIERE PORTE ETIQUETTE (2) *LABEL BEARER*	S235 JR	
42	24	SUPPORT ISOLATION 80mm (2) *INSULATION SUPPORT 3.15in*	A240type304	

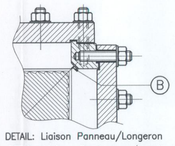
(1) NON CODE PART (2) NON PRESSURE COMPONENT

(**) N° de série *Serial Nbr.*	(***) Rep. *Tag*
CP75-4254	E-4404A
CP75-4255	E-4404B
CP75-4256	E-4404C
CP75-4257	E-5404A
CP75-4258	E-5404B
CP75-4259	E-5404C

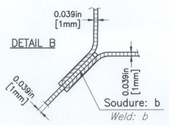


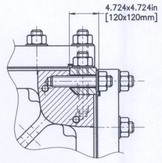
DETAIL: Coeur d'échange (avec Chicanage Embouti)
DETAIL: Plates pack (With Stamped Baffles)



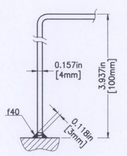


DETAIL: Liaison Panneau/Longeron
DETAIL: Liaison Steel panel/Longitudinal girder

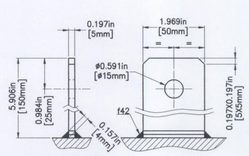




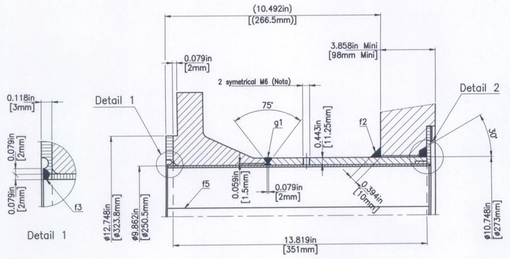
DETAIL: Liaison Longeron/Fond
DETAIL: Liaison Longitudinal girder/Head



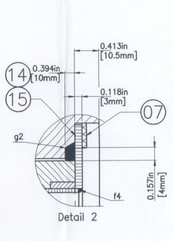
Détail de soudure pour pontet
Welding detail of name plate support
Item:32



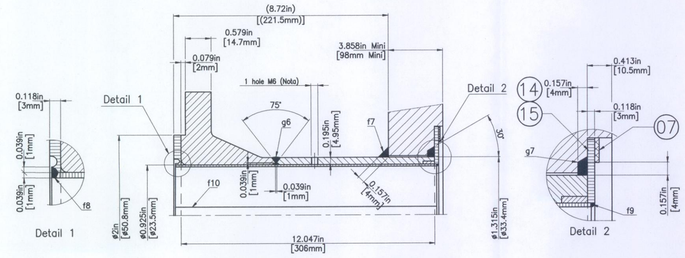
Détail de soudure pour patte de terre
Welding detail of earthing lug
Item:30



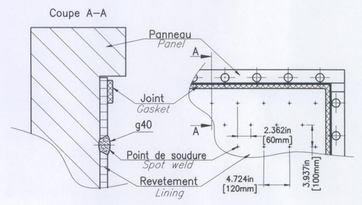
Tubulure DN250 150LB (A1-A2-B1-B2)
Nozzle NPS10" 150LB



Nota : Temoin de fuite. Obligatoirement en position basse
Leak indicator. Necessarily in the low position



Tubulure DN25 150LB (EA-VA-EB-VB)
Nozzle NPS1" 150LB



DETAIL: Soudure revetement/panneau
DETAIL: Welding of lining/Panel

QCM. Review:
FD. JP CONCOLATO
Rev.00 oct.01, 2013.

AI. Review:
REVIEWED BY / VERIFIE PAR
D. STEIB
ON / DATE
04.10.2013

Approved: A.SIERRA
Rev00, oct. 02. 2013

INDICE *REVIEW*	DATE *DATE*	NOM *AUTHOR*	VERIFIE *CHECKED*	APPROUVE *APPROVED*	W.E. *APPROVAL*	OBJET DE LA REVISION *REVIEW SUBJECT*
03						
02						
01						
00	23/08/13	FML ~~FML~~	~~FRDA~~	~~AFA~~	CRU	First Issue

ECHANGEUR TYPE COMPABLOC ®
CPX75-V-500 Plaques
HEAT EXCHANGER TYPE COMPABLOC ®
CPX75-V-500 Plates

CLIENT / *CUSTOMER*: KARACHI
Cde CLIENT / *CUSTOMER ORDER*: H13-0485-PEE
Cde ALFA LAVAL / *ALFA LAVAL ORDER*: CP2013-13037

Alfa Laval
1-9 RUE DU RIF TRONCHARD
38120 LE FONTANIL CORNILLON - FRANCE
TEL: (33) 04 76 56 50 50 FAX: (33) 04 76 75 79 09

N° de SERIE / *SERIAL NB*: (**)
REPERE / *ITEM or TAG*: (***)
ECHELLE / *SCALE*: 1/20
DWG-CP13-13037-01 | 00

DESIGN, MANUFACTURING, SUPPLY, INSTALLATION, CONSTRUCTION & COMMISSIONING OF AMINE SWEETENING, LPG & CONDENSATE STABILIZATION UNITS, POWER GENERATION PACKAGE, SALES GAS METERING SKID, HOT OIL SYSTEM AND OTHER RELATED UTILITIES

KPD667-MAN-A44-SK-10

Lean/Rich Amine Heat Exchanger SK-4414

2.7 Instruction & Operating Manual

COMPABLOC

OPERATING INSTRUCTIONS

IMCP0002 Rev. F / ENGLISH

This Instruction Manual IMCP0002 Rev. F is a revision of IMCP0002 Rev. E.

This document is English version.

Scope of application:

- Standard Normal range : CP15, CP20, CP30, CP40 , CP50, CP75 and CP120
- Standard Hygienic range: HCP15, HCP20, HCP30 and HCP40
- Standard Free Flow range: CPF15, CPF20 and CPF30

Editions & Revisions:

F	22/10/12	M.BLANCHARD		S. PELENC		A.MACIVER		Sixth edition
E	23/10/09	C. RIETHMULLER		S. PELENC		A.MACIVER		Fifth edition
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B	18/07/05	M. LAVANCHY		C. ROUSSEL		R. CONSONNI		Second edition
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		EDITED BY		**VERIFICATION**		**APPROVAL**		**OBSERVATIONS**

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Please visit **www.alfalaval.com** and contact your
local representative.

1- Description

1.1 - General description

Compabloc is a welded plate heat exchanger without interplate gaskets allowing a large heat transfer area within a very compact space (low footprint). It is made from stacks of welded plate packs inserted in a rigid rectangular bolted frame for mechanical strength and the separation of the various circuits. Each circuit can be fitted with a detachable baffle plate assembly. Only 4 panel gaskets are installed, as indicated on the exploded view Figure 1.

Compabloc is designed and manufactured in accordance with a Pressure Vessel Code (ASME, AD2000, EN-13445, GB150-1998, etc.) and for defined working conditions. The Design & Manufacture of the Compabloc is made per a Quality System Management according to ISO 9001.

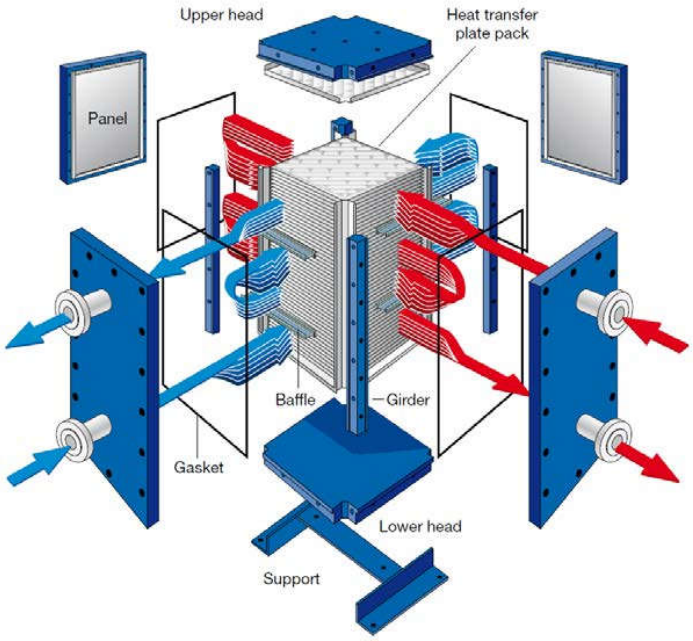


Figure 1: Compabloc exploded view

Four carbon-steel panels fitted with nozzles enable the connection of the pipework. Optionally, these panels can be lined with the same material as the plates themselves. The plates, baffle plates, nozzles and panels linings can be m ade from stainless steel 316L, Titanium, 254 SMO, Hastelloy, or other pressable and weldable material. The flow can be d irected using baffles (number of passes chosen to maximize heat transfer and minimize fouling).

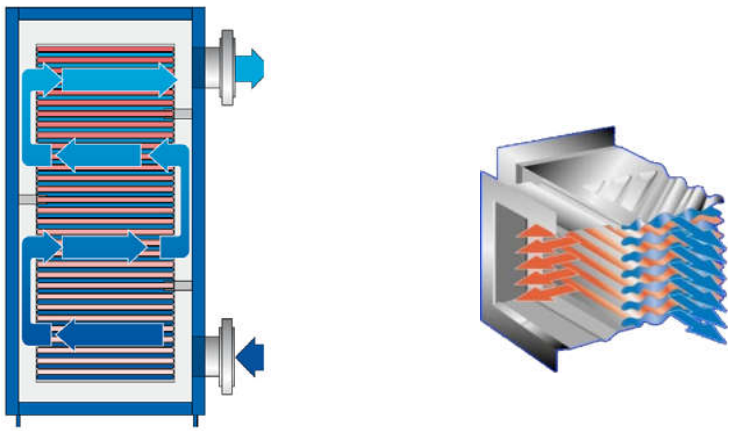


Figure 2: flow through Compabloc and cross-section in plate pack

1.2 - Function & duty

The Compabloc is a heat exchanger used for heating or cooling (with or without heat recovery), steam heater, condenser, 2-pass process condenser, reflux condenser, reboiler, gas cooler, etc...
Each of those duties requires a specific installation and the installation must be in conformity with the thermal data sheet and the general assembly drawing of the unit.

If necessary, a vacuum relief valve must be installed in the case of Full Vacuum. During operation or during transient period, make sure your Compabloc has been designed for Full Vacuum (FV design).

- **Pressure and temperature limits**
  Never run the Compabloc at lower/higher pressures and/or lower/higher temperatures than those indicated on the name plate.

- **Continuous & cyclical duty**
  Compabloc has been designed for continuous and stable operating conditions. Compabloc must not be used in cases of cyclical operating conditions, especially when sudden temperature changes with high amplitude (above 150 °C / 302°F) could occur.
  High cyclical duty (temperature and/or pressure) may create fatigue leading to a reduced lifetime of the unit.

- **Operating pressures**
  Unlike most heat exchangers, Compabloc must have a minimum differential pressure of around 2 bars (28 psi) between the operating pressures of each circuit. An identical operating pressure on both circuits could make the plate pack behave like an accordion, creating fatigue, with the risk of a decreased lifetime.

- **Duty**
  In order to ensure optimal efficiency, it is strongly recommended to run your Compabloc as close as possible to design conditions.

- **Corrosion risk**
  The material of the parts in contact with the used medium has been s pecified or chosen based on data supplied by the customer (fluid, composition, temperature, etc.). If the media passing through the unit and operating temperatures is different from those specified in the data sheet, the Customer is responsible for ensuring that the corrosion resistance is suitable.
  Special attention shall be given to the chloride content of the streams, as this is a frequent cause of corrosion of Stainless Steel materials.
  Responsibility regarding the duty or cleaning medium and checking its compatibility with the materials used in the heat exchanger is with the customer or contractor, if otherwise not agreed with Alfa Laval. The quality of medium, can considerably affect the operation and life time of the heat exchanger.

1.3 - PED/Risk Analysis

All units delivered in the EEC follow the PED (Pressure Equipment Directive) with a level of risk depending on parameters such as nature of the fluid (gas, liquid, steam, fluid vapour pressure), and the danger level of the fluid, Design Pressure, Volume of each circuit or Design temperature.

These parameters will determine a PED Category to which is linked a risk analysis as per the PED.
Make sure that the category of your unit matches your operating conditions.

2- Installation

2.1 - General requirements & precautions

- To allow maintenance and inspection, we recommend leavinge a 50 t o 120 cm (19 to 48") wide space all around the Compabloc unit to facilitate panel dismantling.
  At the top of the exchanger, it is necessary to have a 100cm (40”) free space to allow the possible setting of a panel-lifting device.

- Follow good engineering practice both in the design and operation of the plant. Take appropriate precautions to avoid hydraulic shocks (water hammer), which could damage Compabloc (see Start up section 3.2).

- The connecting pipework should be provided with valves in order to isolate the unit. Valves are essential between any pump and the Compabloc.

- All valves should have a slow valve action. Flowrates should be increased slowly and gradually during start up and reduced gradually during shut down.

- Centrifugal pumps are recommended**.** Do not use piston-type pumps in line with the Compabloc (these generate repetitive pulsations in flowrate which may cause serious damage to the plate pack).

- Preferably pumps should be installed on the outlet instead of inlet so as to limit stress on the plate pack when pump load varies.

- When specifying pumps and heat exchangers, allow ample margins for pressure drop increases above stated design values. These can be the result of possible variations in fluid properties, flow rates, scaling or deposits on the heat transfer surfaces.

- When using live steam as heating medium, install a steam trap on the condensate outlet pipe, preferably with automatic venting of non-condensables.

- Make a check of the torques of the panel bolting before insulating the unit (see para 3.1 for more details) and piping it.

- When provided with the unit, place the shearing pins in position before fastening the feet on the Compabloc.

- Detach any label fastened to vent and/or drain before connecting.

2.2 – Installation

- **Pipework**
  No specific precaution needs to be t aken when connecting the Compabloc. However, if the connection pipework includes long, straight runs, it is essential to insert correct bends, or expansion devices, and to position the pipe supports at a maximum of 2 meters (72 in) distance from the unit.

- **Venting & draining**
  CP15, CP20, CP30 and CP40 are provided with nozzles located as low and high as possible acting as vents and drains, thus allowing a complete draining and venting of the units. They are self-venting and self-draining.

  For CP50, CP75 & CP120 range, which have separate vent and drain connections, there is a n eed to provide, as a minimum, a permanent venting of the cold circuit (the one which is heated up) in order to allow proper gas release, preventing the gas released being trapped inside the unit.
  Connection of the nozzles with the drain and vent circuits should be done with isolation valves provided by the end customer or contractor.

  A typical way to have the unit self vented is shown in Figure 3.

If the Compabloc is used as a condenser in vertical position, it is mandatory to have the drain on the condensing circuit connected to the outlet pipe or to a separation tank to prevent possible re-evaporation of the condensate.

The vent valve shall be always opened, allowing a continuous and permanent self-venting of Compabloc. The warranty may be voided if the vent valves are not connected, since working medium streams can generate gases. This is the case in most heat recovery systems - “feed / pumpdown” where the cold stream generally releases a lot of trapped gas or air.

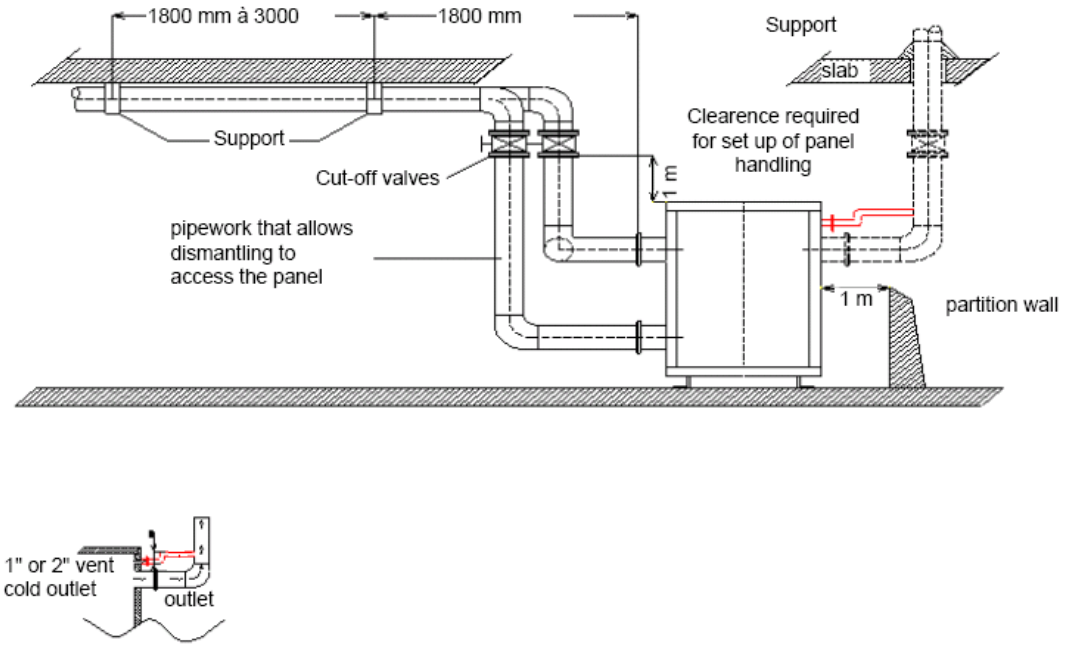


Figure 3: typical Vertical Compabloc installation

- **Isolation valves**
  The isolation valves for the process circuits should be positioned in such a way as to enable the panels to be dismantled without having to remove the valves.
  Valves must be kept in good working order. The use of globe or butterfly valves is recommended.

- **Filters**
  If the service conditions require it, or if the fluid is loaded with particles, install a filter with maximum mesh of 3 mm (1/8") for all Compablocs, except the CP15 which shall have a maximum filter mesh of 2 mm (1/12"), upstream of the exchanger.

- **Connections/nozzles**
  All connections/nozzles are marked and should be piped accordingly. In case of doubt, check with the arrangement drawing. Allowable nozzle loads and moments can be defined on request.

- **Controls and adjustments**
  To prevent water hammer and shock, all valves must be opened gradually.
  The adjustments and controls, as well as the process used in the circuit, must be studied with care to avoid any thermal or mechanical stress-during the start up and transient operating conditions.

- **Earthing lugs**
  The connection of the Compabloc to Earth is mandatory prior to operation start-up. Please use earthing lugs provided for this purpose

Always use control valves with a PID system, set for the maximum proportional range. Avoid operating conditions with only one circuit in operation.

Depending on the properties of the fluid, install Compabloc within a containment sump to avoid any pollution due to potential leakage.

For the convenience of maintenance it is recommended to install the Compabloc on a foundation. The size and height of the foundation shall provide the free access to the lower bolting of the piping flanges or the support plate when the manual or automatic wrench is used.
For more information on supports, please refer to Appendix 5.

2.3 - Lifting

The handling of heat exchangers Compabloc should be done by using certified straps, slings and shackles, and also by appropriate lifting means (jib or bridge crane).

The nozzles must never be used for handling purposes.
Do not use the welded or screwed lifting lugs located on the panels for lifting of the complete unit, these are for lifting individual panels only !

It is very important to check that the capacity of the lifting means correspond to the lift weight.
In general it is not recommended to handle the Compabloc by using a fork lift truck.

For safety reasons, never stand or work under suspended loads.

- **Vertical Compabloc**
  Lifting rings and lugs are located on the top of the unit.

	Number of lifting lugs
CP15/CP20/CP30	1
CP40/CP50	2
CP75/CP120	4

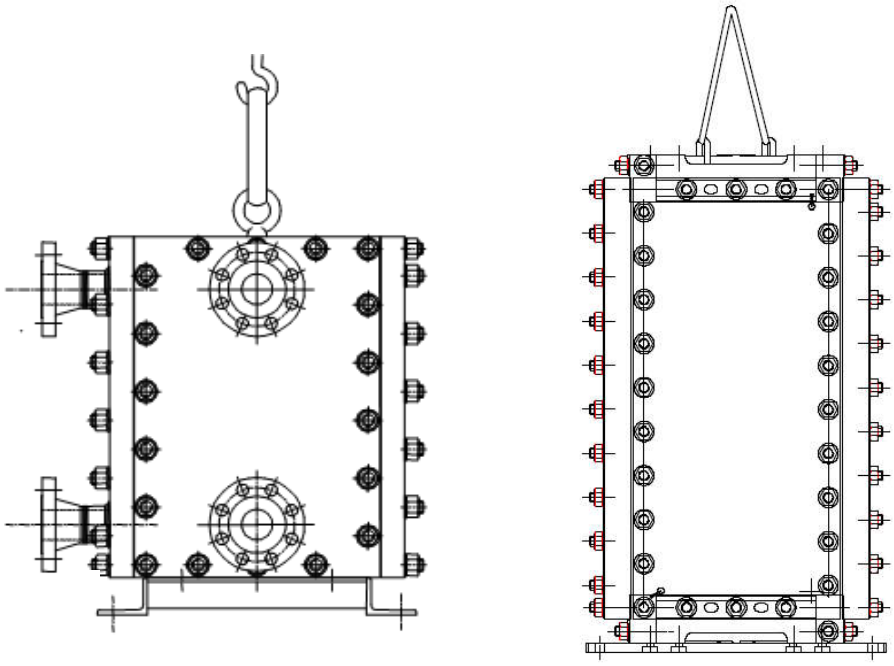


Figure 4: lifting of Vertical Compabloc

- **Horizontal Compabloc**
  CP15-CP20-CP30-CP40 **:** lift the exchanger using two soft slings fixed on the lifting lugs.

  CP50, CP75 and CP120 range : use the lugs located on the end heads.
  For a CP75 unit fitted with more than 200 plates or any CP120, a lifting-beam must be used.

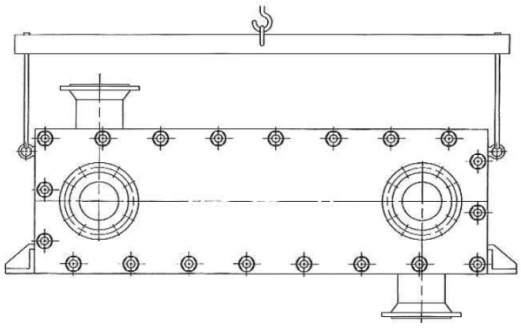


Figure 5: lifting of Horizontal Compabloc

	Number of lifting lugs
CP 15/CP20/CP30/CP40	2
CP50 to CP120	4

3- Operation

3.1 - Before start up (& before eventual insulation)

- **Check of panel bolt torques**
  Before start up, make sure the unit is correctly installed and make a c heck of the tightening torques of the panel bolts as per the values in appendix 2. Panel loosening (with loose bolts as a consequence) may occur during transportation or storage. In case where the torque values are below the recommended ones, it is necessary to retighten the bolting with an appropriate torque wrench before starting up the unit.

Leaks due to not properly tightened panels is not covered by warranty.

- **Individual precautions**
  Since the heat exchanger in operation can be connected with high temperatures and aggressive media, it is necessary to provide personnel protection measures, in accordance with the applicable safety regulations and work safety codes at the customer site.

- **Personal protection**
  Make sure the unit has personal protection (a protection screen or cover is generally enough) or the appropriate insulation so that nobody can be hurt or burnt by touching the panel surfaces.

3.2 - Start up

In order to extend lifetime of the unit, start up must be gradual and smooth. Flowrate adjustments should be done slowly in order to avoid the risk of water hammer.

Water hammer is a short pressure peak that can occur during start up or shut-down of a system, causing liquid to travel along the pipe as a wave at the speed of sound. This may cause considerable damage to the equipment.

- Check that the Compabloc is correctly installed, with the cold circuit flowing upward (in case of gas/air release).
- Generally speaking, unless specifically recommended, the cold circuit must be filled and started first.
- Open the air vent (it concerns only models CP50, CP75 and CP120, other models are self venting).
- Open the outlet valve on the cold circuit.
- Fill the cold circuit. Start the pump for this circuit with the exchanger inlet valve still closed.
- Slowly open the inlet valve at the heat exchanger.
- When all the air is out, the vent can be closed (CP50, CP75 and CP120 only). **Note : Vent can remain open if connected to the pipeline.**
- Once the cold circuit is running, open progressively the valves of the hot circuit (taking at least 5 minutes), while its vent is open. Apply the same procedure as for the cold circuit.

Start-up must be gradual and heat rate shall not exceed 60°C per hour to avoid thermal shocks or unnecessary stress on the unit.
Pressure buildup rate must not exceed 1 bar/min.

3.3 - Unit in operation

General technical equipment operating rules should be observed. During operation, the following shall be checked:

- There is no leakage from the gaskets. Normally no retightening should be necessary. Nevertheless should a leak be observed, do not hesitate to retighten the panels as per the torque indicated in appendix 2. Cold retightening is advised. The pressure must be released.

- The operating pressures and temperatures must not exceed the maximum design values stated on the name plate.

- In case of thermal cycling duty, try to keep the temperature of the unit as close as possible to the normal operating temperatures (natural cooling during shutdown for example is better than sudden cooling) in order to minimize the stress when re-starting the unit.

- Bolts and nuts are kept clean and greased.
- Avoid sudden changes in fluid flow rates in order to reduce hydraulic shock and fatigue effects caused by thermal expansion and contraction.
- Maintain flow rates at the designed values as much as possible. Lower velocities reduce pressure drop and thermal efficiency. Flow rates much lower than design values may also result in accelerated fouling.
- For fluids containing solids, the tendency of settling and clogging increases if the flow rate is reduced.
- In installations with multiple units in parallel, variations in capacity are best handled by varying the number of units in operation rather than by major variations in flow per unit.

3.4 - Shut down

It is the reverse procedure of start up, with generally the hot circuit being closed first and the cold circuit still running.

- Slowly close the valve controlling the flowrate of the pump you are about to stop.
- When the valve is closed, stop the pump.
- If the Compabloc is shut down for several days, it must be drained.
  Draining must also be done if the process is shut down and the ambient temperature is below freezing temperature of the media. Draining is a simple operation because the lower nozzles allow a self draining for the CP15 to CP40, while for CP50 to CP120 models, flanged drains have to be used. They should be piped to the drain circuit or connected to an evacuation system.
- Depending on the process fluids used, it is also recommended to rinse and dry the unit if the shutdown is of longer duration.

If fluids are hot, allow the unit to cool down before draining to prevent possible injury to operators.

Make sure toxic, hazardous, lethal vapors or liquids are NOT released to the atmosphere or to the ground. These could cause injury to people and/or damage to the environment.

After a long shut down (several months), check the tightening torque of all bolts and nuts, before re-starting.

4- Maintenance

The more often cleaning is carried out, the better the heat transfer performance is maintained at original levels. Delaying cleaning makes the recovery of initial heat transfer performances more difficult.

4.1 - Chemical cleaning

Chemical cleaning must be achieved by authorized and qualified personnel.
Take all necessary protection precautions regarding chemicals.

Chemical cleaning is the most efficient way to clean the unit. In general, inorganic deposits are cleaned with acidic cleaning solutions and organic deposits with alkaline cleaning solutions.

Proprietary cleaning agents should be used in accordance with the manufacturer's instructions. In this way, the compatibility with the materials of construction (metal and gaskets) is secured and warranties apply. The whole cleaning protocol (choice of cleaning agent, its concentration, temperature and time) must be related to the composition of the fouling species. Some guidelines are given in the Table below to clean various common fouling species.

Cleaning agents - Fouling

Type of deposit	Cleaning agent	Typical conditions
Organic (microbiological growth, algae, slime, proteins, grease…)	AlfaCaus	10 vol.%, 60°C
Oil-related	Alpacon Multi CIP Super AlfaCaus	10 vol.%, 60°C
Asphaltic,tar, hydrocarbon-based	Paraffin or naphtha-based solvents followed by AlfaCaus	
Calcium carbonate Calcium phosphate	Alpacon Descalant	10 vol.%, 60°C
Iron oxides	AlfaPhos	10-20 vol.%, 60°C

Check suitability of the cleaning protocol with the materials of your Compabloc.

Never use hydrochloric acid or other cleaning substances containing chlorides as their presence will inevitably lead to corrosion of stainless steel alloy components.

For optimal results, the flow direction should be in the opposite direction of normal flow ("back flushing" mode). The circulation of the cleaning solution must be upstream, if possible with a flow of 50 % of the nominal flow.

It is strongly recommended to monitor the pressure drop through the unit and to carry out chemical cleaning once a set maximum pressure drop value has been reached.

After every chemical cleaning, rinse the exchanger thoroughly with hot water and drain it.

Always use the appropriate waste container to recover the spent cleaning solution.

For additional information on cleaning protocols, please contact your nearest Alfa Laval representative.

4.2 - Mechanical cleaning

If chemicals cannot be used for cleaning, the panels and the baffle cage can be removed to permit access to the heat transfer surfaces.
Clean with steam or high pressure water - High pressure water hydroblasting can be made up to 1000 barg (14500 psig). Do not go above 1000 barg (14500 psig)!
As the corrugations are oriented at 45°, it is possible to have good access to the heat exchange surface by orienting the cleaning device at 45° (hydroblast gun or cleaning bar).

Before opening a Compabloc, make sure it is empty. Collect the remaining fluid to avoid any pollution of the environment.

4.3 - Panels dismantling & re-assembly procedure

It is forbidden to make any marking damaging the surface of the plate pack or the lining.

First, drain completely the 2 circuits.
Mark the panels with identification symbols (to clarify for which circuit) prior to dismantling (so that they can be correctly re-installed later).

- Check that none of the two circuits are pressurized (and that drains are open).
- Check that the panel being dismantled is firmly secured and cannot fall once unscrewed (see panel weight Appendix 1).

4.3.1 - Dismantling procedure for one panel

Refer to Figure 6.
In order to avoid any deformation of the grider columns, first it is necessary to relax the nuts (marked 4) and then progressively loosen the bolts of the panel being dismantled, starting with the nuts of the girder (marked 3) then the nuts of the top and bottom heads (marked 1 & 2).

Use the welded or screwed lifting lugs located on the panels to lift the panels in a safe way.

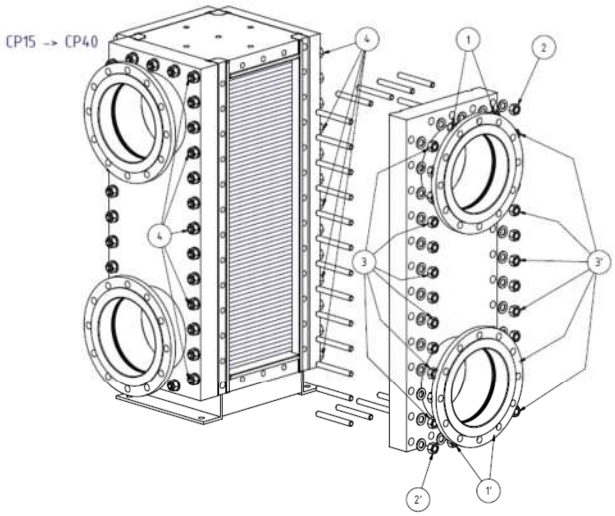


Figure 6

4.3.2 - Dismantling procedure for the 4 panels

Progressively loosen the nuts, one girder after the other. When all the nuts of the girders are relaxed, loosen the nuts of the bottom, one panel after the other.

For models CP15/CP20/CP30/CP40, never unscrew the stud bolts used for the girder assembling to the top and bottom heads.
For CP50/CP75/CP120, never unscrew nuts used for assembling the girder column to the top and bottom heads.

Use the welded or screwed lifting lugs located on the panels to lift the panels in a safe way.

Please find details of the panel weights in Appendix 1.

4.3.3 - Baffle dismantling and reassembly procedure

There are different types of baffles: pressed baffles and r einforced baffles (see Figures 7 & 8). Prior to dismantling the baffles, locate their position in the block, in order to reassemble them correctly. It may be difficult to put back the baffle cage (baffles + their support) as one piece, the best is to put back the baffles one by one, as the platepack may have bent a little after use.

- **Dismantling**
  Pull the ladder made by the two uprights (beams) and the baffle plates.
  Take the triangular PTFE Cord gaskets off the triangular part of the longitudinal girder lining.
  Take off the complete baffle cage.

- **Reassembly**
  Clean the triangular groove of the longitudinal girder lining; remove any traces of grease.
  Put a new self-adhesive triangular PTFE Cord gasket in this groove if necessary and press it into its form, as shown in Figures 9 and 10.

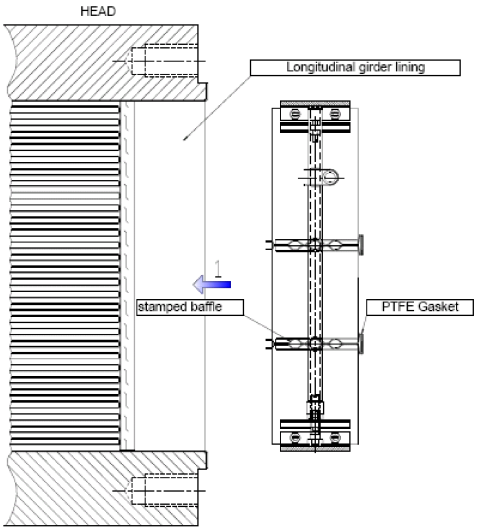


Figure 7

Figure 8

There is no triangular PTFE cord gasket in the triangular part of the longitudinal girder lining for CP120 nor Hygienic CP.

Re-inforcement tie-rods are only available on CP50, CP75 or CP120 models.

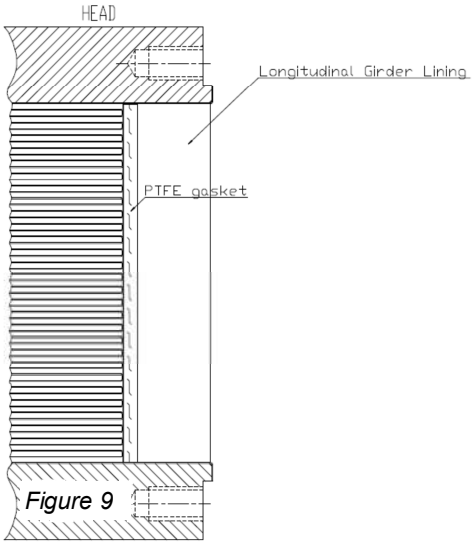


Figure 9

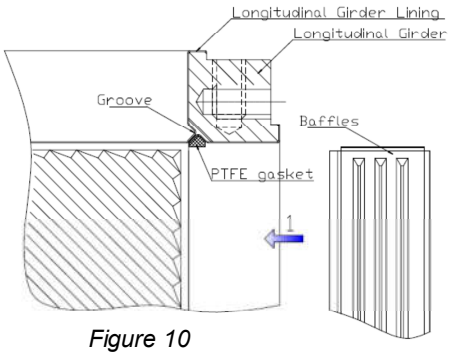


Figure 10

Try to put back the baffle cage as one piece; if impossible then cut the weld between the vertical sheet and the baffles.
Install the vertical sheets (avoid mixing sheets and baffles between different sides).
Bring the baffle plate progressively into the exchanger block. Ensure it is reassembled in accordance with the position noted before disassembling (figure 11).
Ensure the gasket is correctly mounted and fits the baffle plates on the plates (figure 11 and figure 14).
Check the distance between the frame and the sealing strips (figure 12).

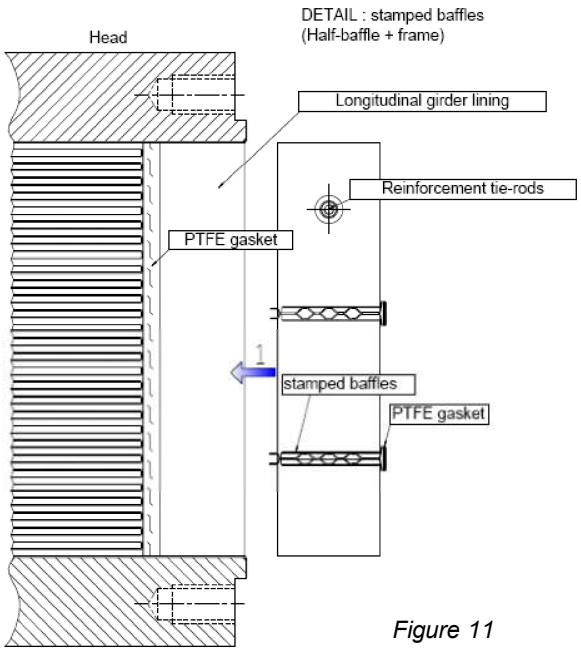


Figure 11

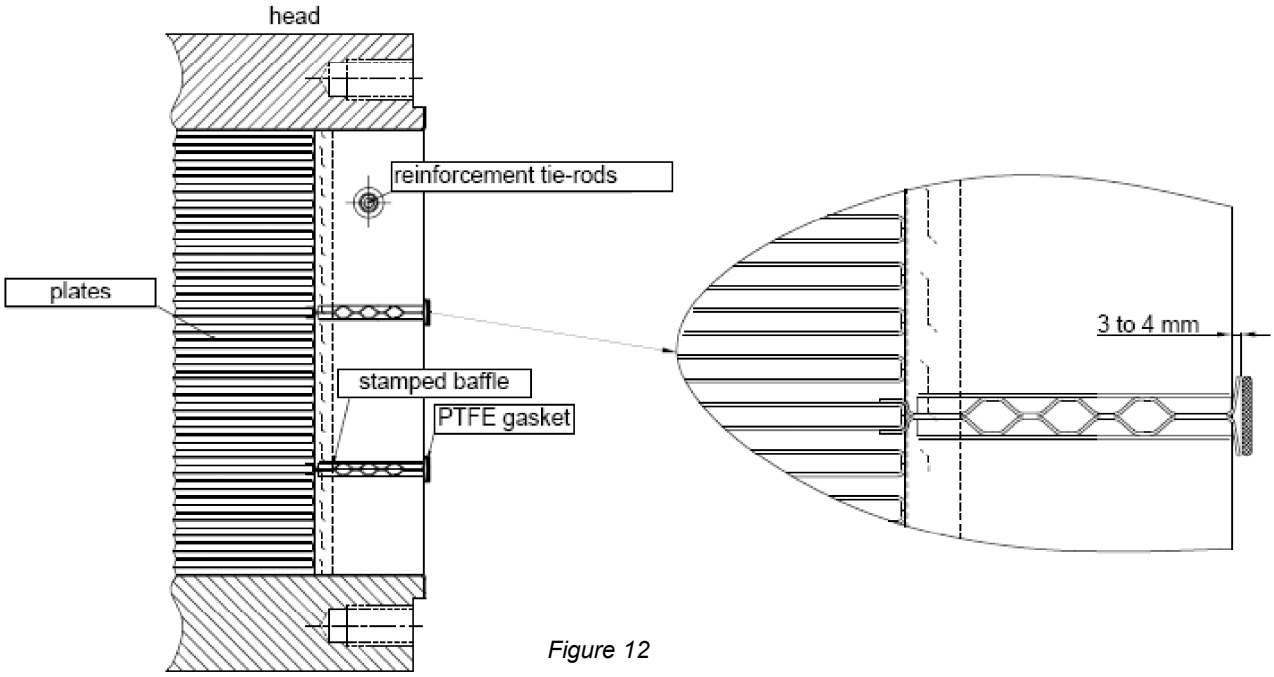


Figure 12

Spot weld the baffles on the two uprights.
Install a new PTFE gasket on each baffle (see fig. 13).

Figure 13: PTFE Gaskets

Figure 14: triangular PTFE cord installed in the groove of the column liner

In case of very viscous fluids or in the risk of sudden high flowrate surges (water hammer), reinforced baffles must be used. In this case vertical tubes support the baffle, creating a baffle cage making the whole baffle construction stiffer.

4.3.4 - Panel re-assembly procedure

4.3.4.1 – Panel Gasket assembly

After reassembling the baffle plates using the procedure described in Section 4.3.4 above, clean the surface "receiving" the gasket thoroughly, taking care not to scratch the gasket's surface.

Put the gasket in place.

Gaskets must be replaced with new ones after dismantling. You may have to replace an obsolete gasket model with a new model. Only use gaskets that have been supplied by Alfa Laval.
Depending on the Heat Exchanger Duty, gasket material can be either Modified PTFE or Reinforced Graphite. The large gaskets may be supplied in several pieces.

Compabloc sealing can be assured only with gaskets supplied by Alfa Laval.

Always put the old gaskets in an appropriate waste container.

4.3.4.2 - Panels re-assembly & pre-tightening

- Re-place the panels on the threaded rods in accordance with general drawing.
- Check interlocking of panels on girders is OK before going on.

Figure 15

- Grease tips of threaded rods 1, 2, 3 and 4 (figure 16).
- Pre-tighten nuts 1, 2, 3 and 4 (in this order) with impact wrench.
- Repeat these 2 operations above for the other panels.
- Grease tips of threaded rods 5 (figure 17).
- Pre-tighten nuts 5 with impact wrench but turning around the unit.
- Grease tips of all resting threaded rods.

Figure 16

Figure 17

- Pre-tighten all nuts of “circling around the top of the unit” with an impact wrench (figure 18 & 19).

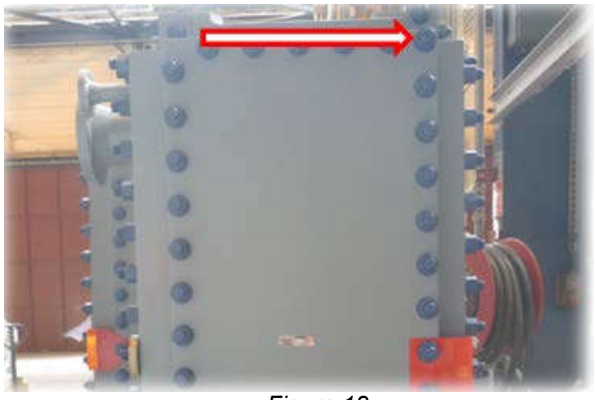


Figure 18

- Respect pre-tightening sense as on figure 19.

Figure 19

- Pre-tighten all nuts of “circling around the bottom” with impact wrench (figure 20 & 21).

Figure 20

- Respect pre-tightening sense as on figure 21.

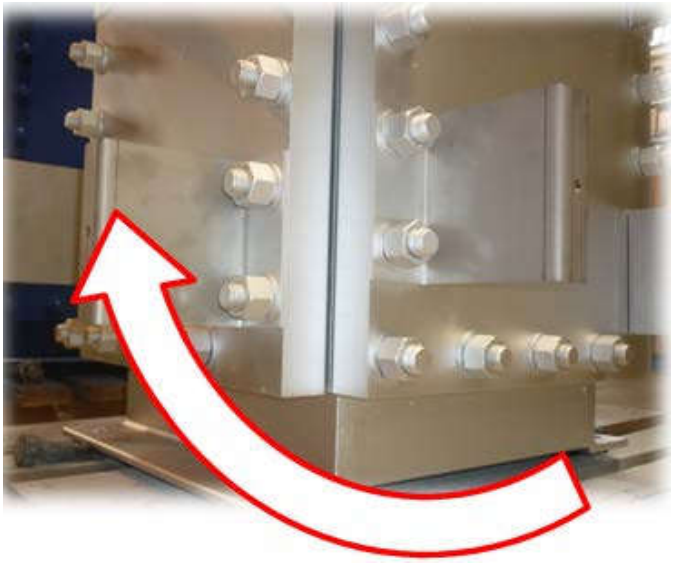


Figure 21

- Pre-tighten all nuts of girders with impact wrench from down to up or up to down (figure 22).

Figure 22

4.3.4.3 - Panel tightening

Then find the recommended tightening torque in Appendix 2 “Nominal tightening forces of threaded panels (Nm)”.

We strongly recommend the use of a Hytorc wrench for tightening (figure 23). Hytorc must not be used on bolts that are loose, pre-tighten then use the Hytorc for final tightening.

Figure 23

- Tighten “around the top” and proceed in same sense as during pre-tightening (Figure 23).
- Do the same operation for “around the bottom” (Figures 20 & 21).

- Always with the same torque, tighten all the nuts of each panel (Figure 24).
- Re-check interlocking of panels on girders is OK before going on.

Figure 24

4.3.5 - Hydraulic test

After reassembly with original components, a hydraulic test at 1.1 design pressure indicated on the name plate is mandatory (unless other local regulation applies).

Hydraulic test should be carried out with one circuit empty, the other circuit being full & pressurized at the test pressure.

Always perform the hydraulic test with the 4 panels fully tightened in place.

The pressure of the circuit in test may decrease due to compression of trapped gases, or a slight plate adjustment. In that case, it does not mean that the heat exchanger is leaking, adjust pressure and check again. It should have stabilized after half an hour.

A heat exchanger is leaking when a leak is observed between 2 circuits or when it leaks externally.

If leakage occurs, retighten at nominal torque around the leak area. If leakage still occurs, please contact Alfa Laval Service Center or your Alfa Laval representative.

5- Trouble shooting

(see the **Trouble-shooting questionnaire in Appendix 4)**.

5.1 - Leak detection

5.1.1 – External leak

External leaks are generally caused by a gasket, panel or column liner failure or core failure.

- **Gasket leak**
  Leaks due to gaskets can be detected by fluid dripping and fluid accumulation on the ground. Check that the gasket is correctly positioned, tighten the panel, if possible, or replace the gasket.

- **Panel lining leak**
  This leak is generally detected by liquid coming out through the Argon hole located nearby the butt weld on the flange tube. It means that there is a crack or a spot weld failure on the panel lining.
  The unit must be shut down. A dye penetrant examination of the liner can confirm that this is the cause. Full vacuum and/or sudden partial vacuum conditions is often the cause. Verify if the unit is designed for vacuum.

- **Core leak**
  If the gasket and panel liners are sealed, the external leak may come from the core itself. Contact Alfa Laval.

5.1.2 - Internal leak

This type of leak is generally detected when one stream is mixed with the other stream and means that a cross contamination between the 2 circuits has happened.
Call Alfa Laval in order to define the best detection and repair procedure to apply.
Recommendations can be provided, allowing you to fine tune the possible causes of the problem.

5.2 - Control system

5.2.1 - Control system for liquid/liquid applications

A classical system where the outlet process temperature drives the control valve at the service inlet is good as long it is a PID system and the control valve is correctly sized.
An oversized control valve creates the risk of ON/OFF operation which is not good for any equipment as it turns a control valve into a ON/OFF valve, thus creating fatigue and stress.

5.2.2 - Control system for steam heaters

It is generally a continuous process with the purpose of heating a fluid by condensing live or secondary steam (while with process condensers the purpose is to condense the vapours, not to heat the cooling medium).

2 example cases:

- **Steady flowrate of the media to be heated :**
  It is mandatory that a control system as indicated in Figure 25 below is installed:
  The control system must be based on a condensate level control and not on steam control.
  The temperature relay (TIC) starts up the condensate control valve located after the steam trap.
  The steam trap is essential as it will allow only the condensate to pass.
  The condensate control valve must not be oversized! It should operate within 80-110 % of its range to avoid ON/OFF behavior.
  The system will act as a liquid level control allowing smooth control as long a PID system is installed with it.

  Check the design so that the condensate connection has a much smaller diameter than the steam inlet (a ratio of 1:3 is generally the best when there are no, or very small amounts, of inerts in the steam).

- **Unsteady flowrate of the media to be heated :**
  If the liquid flowrate is expected to vary a lot, it is important that a bypass system is installed as per Figure 26 below. In this case the TIC controls the recirculation flowrate in order to reach the right outlet temperature irrespective of the steam flowrate.

The 2 sketches below illustrate these 2 possibilities.

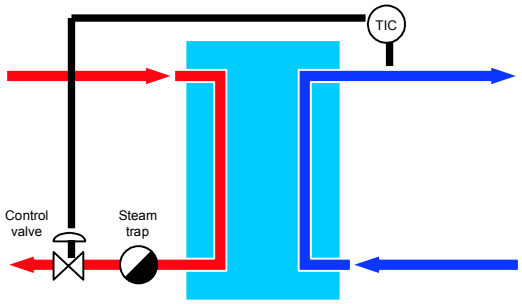


Figure 25:
Steam heater – liquid level control

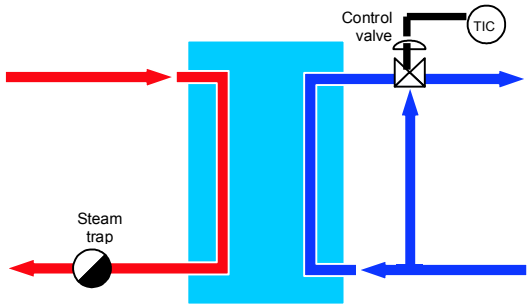


Figure 26:
Steam heater – bypass control

To avoid a sudden vacuum inside the unit, due for example to an emergency shut down and a sudden closure of the steam inlet valve, it is strongly recommended to install a vacuum breaker valve (safety valve) on the steam inlet pipe near the Compabloc steam inlet. If the steam inlet valve is closed suddenly, air will be admitted in the steam inlet pipe and will avoid vacuum inside the Heat Exchanger.

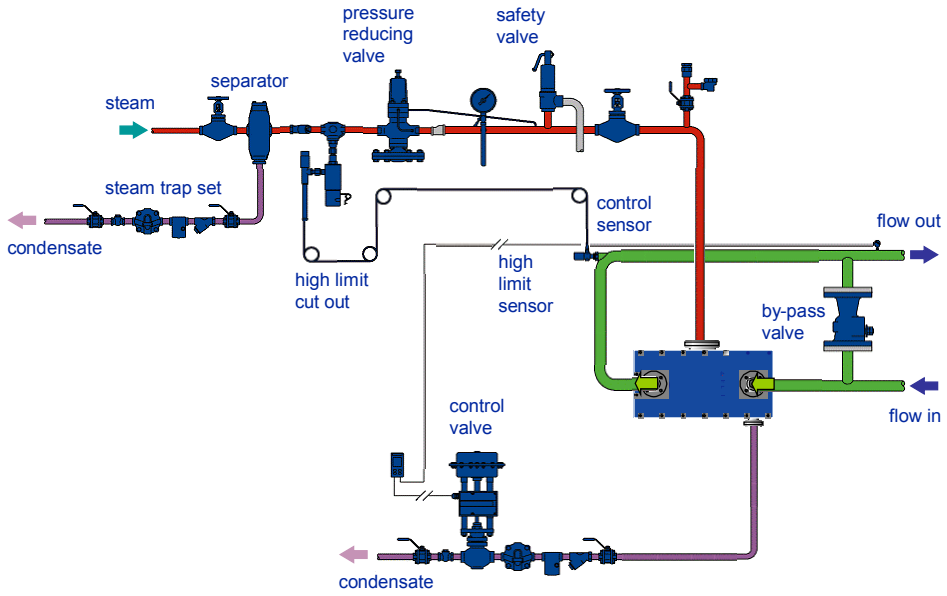


Figure 27: Primary condensate two-port control

5.2.3 - Control system on Process condensers

For many pharmaceutical/fine chemical applications, the system is a batch system, starting with low flowrates and heat load, reaching a peak after a while and decreasing afterward. For other condensing applications, it can be a continuous process.
As explained above the control system is different, as the purpose is to condense as much as possible of the process vapours which most of the time include non-condensables such as N_2.
Generally no control is installed as the system is usually operating with a constant cooling medium flowrate where the return temperature will vary depending on the heat load.
It is the condensation heat load which will control everything as long as there is enough heat transfer area.

For all condensation duties, make sure the Compabloc has been designed for Full Vacuum. If not, consult Alfa Laval immediately. Also make sure a vacuum relief valve is installed in order to avoid sudden vacuum when shutting down the unit.

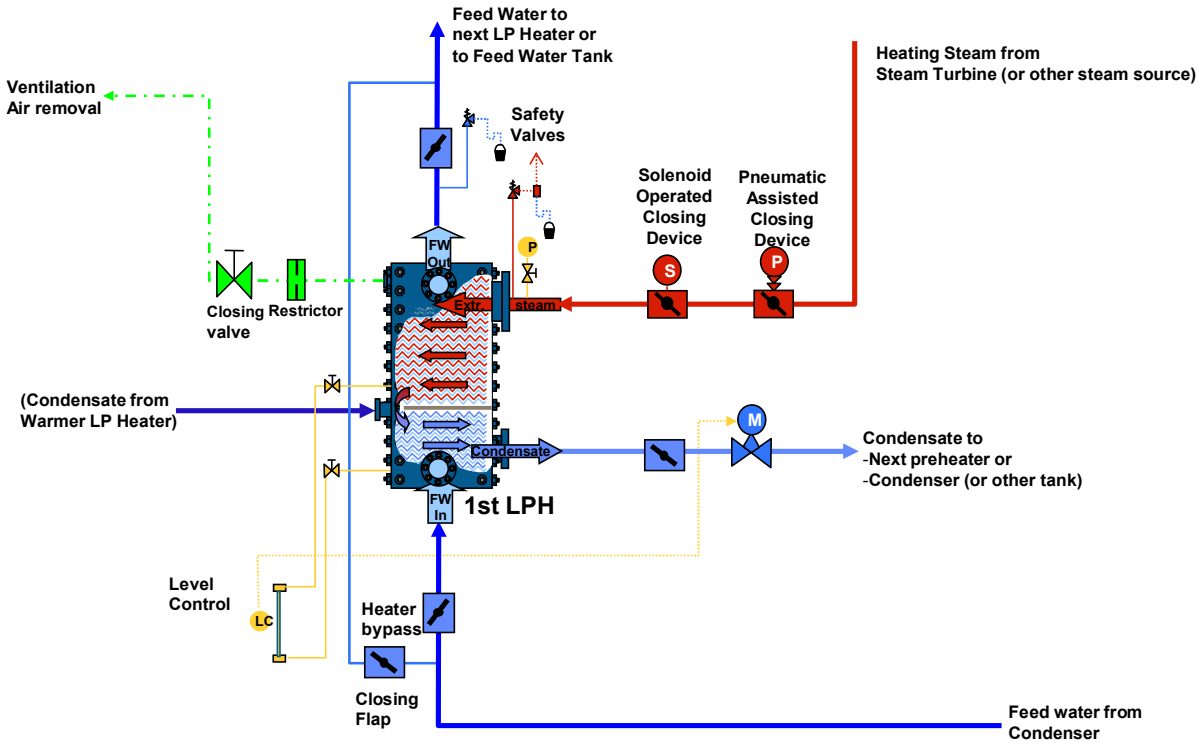


Figure 28: P&I Diagram For LPFW Heater

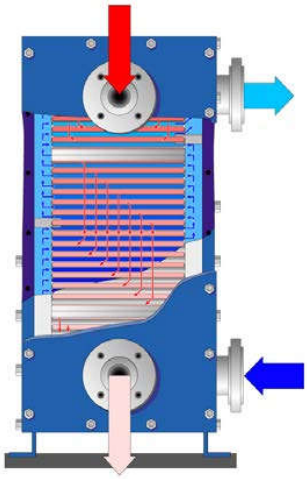
For LP heater vertical condenser, it is highly recommended to use a level control for the condensate with high and low level.The outlet valve situated on the condensate outlet pipe is opening in order to prevent the condensate level to go higher than the high limit.

This system prevents any contact between steam and condensate.

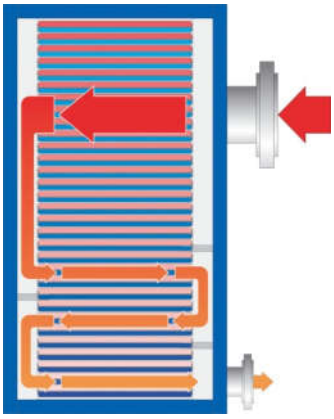
6- Duty summary for Compabloc

Compabloc Vertical position duties :

Liquid/liquid dut

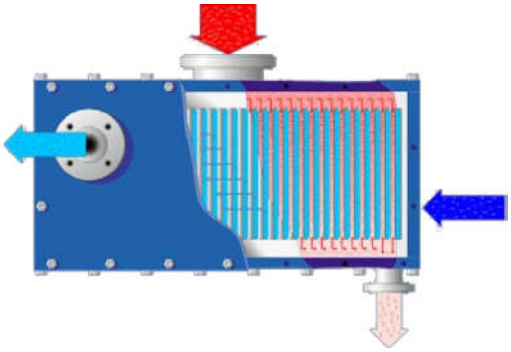


Condensation with subcooling

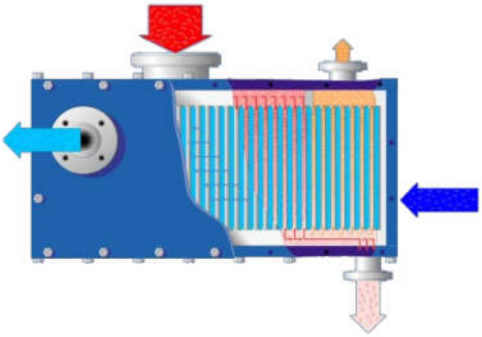


Compabloc Horizontal position duties :

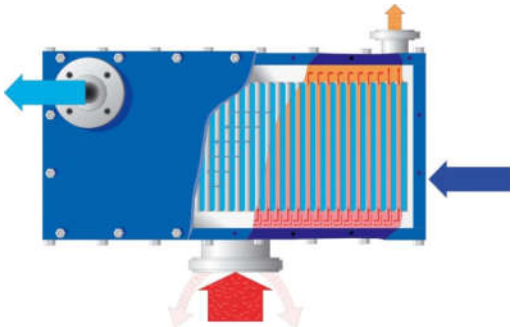
Horizontal one pass condenser



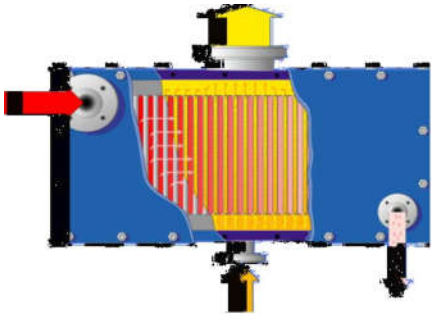
Horizontal two pass condenser



Horizontal reflux condenser



Horizontal reboiler



Appendix 1: Panel weights (kg (lbs))

CP15 MODEL				
PANEL Thickness	NUMBER OF PLATES			
	30	50	70	90
30 mm (1” 1/4”)	9 (20)	13,5 (30)	18 (40)	22,5 (50)
40 mm (1” 1/2”)	12,5 (28)	18,5 (41)	24,5 (54)	30,5 (67)
50 mm (2”)	16 (35)	24 (53)	32 (71)	40 (88)

CP20 MODEL					
PANEL Thickness	NUMBER OF PLATES				
	25	40	60	80	100
40 mm (1” 1/2”)	22 (49)	29,5 (65)	39 (86)	49 (108)	59 (130)
60 mm (2” 3/8”)	34,5 (76)	46 (101)46	61,5 (136)	77 (170)	92,5 (204)

CP30 MODEL							
PANEL Thickness	NUMBER OF PLATES						
	60	80	100	130	160	200	240
40 mm (1” 1/2”)	48 (106)	60,5 (133)	72,5 (160)	91 (201)	109 (240)	134 (295)	158 (348)
60 mm (2” 3/8”)	75,5 (166)	95 (209)	114,5 (252)	143,5 (316)	173 (381)	212 (467)	250 (551)
80 mm (3” 1/8”)	103,5 (228)	130 (287)	156,5 (345)	196 (432)	236 (520)	290 (639)	343 (756)

CP40 MODEL			
PANEL Thickness	NUMBER OF PLATES		
	120	160	200
60 mm (2” 3/8”)	171 (377)	218 (481)	265 (584)
80 mm (3” 1/8”)	235 (518)	299 (659)	364 (802)
100 mm (4”)	297 (655)	380 (838)	462 (1019)

CP50 MODEL					
PANEL Thickness	NUMBER OF PLATES				
	100	150	200	250	300
60 mm (2” 3/8”)	189 (417)	265 (584)	340 (750)	416 (917)	492 (1085)
80 mm (3” 1/8”)	260 (573)	363 (800)	467 (1030)	571 (1259)	675 (1488)
100 mm (4”)	330 (728)	462 (1019)	594 (1310)	726 (1601)	859 (1894)
120 mm (4” 3/4")	400 (882)	560 (1235)	721 (1590)	882 (1944)	1042 (2297)

CP75 MODEL								
PANEL Thickness	NUMBER OF PLATES							
	150	200	250	300	350	400	450	500
60 mm (2” 3/8”)	443 (977)	567 (1250)	690 (1521)	814 (1795)	937 (2066)	1061 (2339)	1174 (2588)	1308 (2884)
80 mm (3” 1/8”)	596 (1314)	762 (1680)	928 (2046)	1094 (2412)	1260 (2778)	1427 (3146)	1593 (3512)	1759 (3878)
100 mm (4”)	748 (1649)	957 (2110)	1166 (2571)	1375 (3031)	1583 (3490)	1792 (3951)	2001 (4411)	2210 (4872)
120 mm (4” 3/4")	901 (1986)	1152 (2540)	1404 (3095)	1655 (3649)	1907 (4204)	2158 (4758)	2409 (5311)	2661 (5866)
140 mm (5” 1/2")	1053 (2321)	1347 (2970)	1642 (3620)	1936 (4268)	2230 (4916)	2524 (5564)	2818 (6213)	3112 (6861)
160 mm (6” 1/4")	1206 (2659)	1543 (3402)	1879 (4142)	2216 (4885)	2553 (5628)	2890 (6371)	3226 (7112)	3563 (7855)
180 mm (7")	1359 (2996)	1738 (3832)	2117 (4667)	2497 (5505)	2876 (6340)	3255 (7176)	3635 (8014)	4014 (8849)

Remark: Cell in grey = obsolete models (not available for New Sales anymore).

CP120 MODEL							
	NUMBER OF PLATES						
PANEL Thickness	200	250	300	350	400	450	500
90 mm (3 ½")	1429 (3150)	1733 (3821)	2098 (4625)	2342 (5163)	2646 (5833)	2949 (6501)	3252 (7169)
100 mm (4")	1585 (3494)	1924 (4242)	2263 (4989)	2601 (5734)	2938 (6477)	3275 (7220)	3611 (7961)
110 mm (4 ½ ")	1897 (4182)	2118 (4669)	2491 (5492)	2864 (6314)	3235 (7132)	3606 (7950)	3978 (8770)
120 mm (4 ¾")	2060 (4542)	2486 (5481)	2716 (5988)	3122 (6883)	3528 (7778)	3932 (8669)	4377 (9650)
130 mm (5")	2223 (4901)	2684 (5917)	3144 (6931)	3592 (7919)	3819 (8419)	4259 (9389)	4698 (10357)
140 mm (5 ½")	2387 (5262)	2881 (6352)	3376 (7443)	3857 (8503)	4338 (9564)	4819 (10624)	5300 (11684)
150 mm (6")	2550 (5622)	3080 (6790)	3607 (7952)	4123 (9090)	4638 (10225)	5153 (11360)	5668 (12496)
170 mm (7")	2876 (6340)	3473 (7657)	4070 (8973)	4653 (10258)	5237 (11546)	5821 (12833)	6404 (14118)
190 mm (7 ½")	3203 (7061)	3868 (8527)	4537 (10002)	5185 (11431)	5838 (12871)	6488 (14304)	7140 (15741)
210 mm (8 ¼")		4262 (9396)	4995 (11012)	5716 (12602)	6436 (14189)	7156 (15776)	7877 (17366)
230 mm (9")			5458 (12033)	6247 (13772)	7035 (15510)	7823 (17247)	8612 (18986)
240 mm (9 ½")							8980 (19798)

Appendix 2: Nominal tightening forces of threaded panels (Nm)

The torques values given in the table below are applicable for standard gaskets for retightening. Compabloc before initial start-up and after re-assembly of panels after maintenance.

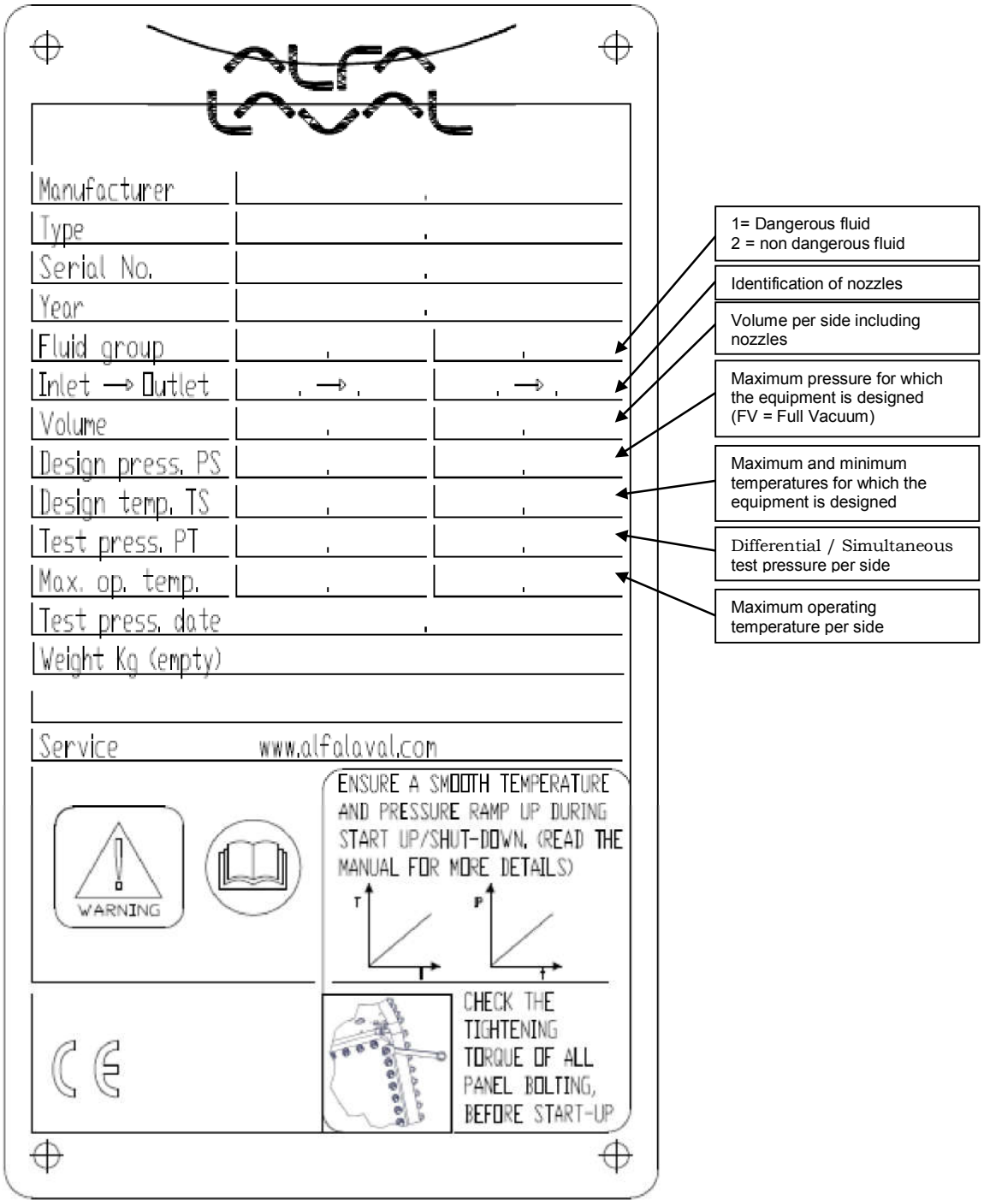
Compabloc Model	Bolting Ø	Reinforced Graphite Gasket
CP15	M16	150
CP20 & CP30	M20	300
CP40	M24	530
CP50	M30	1000
CP75	M33	1400
	M39	2400
CP75 & CP120	M42	2900
CP120 $0 < P_{test} < 30$ bar	M56	4500
CP120 $30 < P_{test} < 60$ bar	M56	6500

Tolerances on tightening torques

It is necessary to stay within the tolerances of the tightening torques.
Undertightening may cause leaks and overtightening may cause mechanical strain in the gasket region and damage the gaskets. A ± 10 **%** tolerance of the tightening device is applicable.

If leakage occurs after tightening at the above nominal torques, please contact your Alfa Laval representative.

Appendix 3: Compabloc Name Plate



The “CE” tag is only used in the countries belonging to the European Union. A paper copy of filled nameplate is attached to documentation accompanying physically the Compabloc.

Appendix 4: Compabloc Troubleshooting questionnaire

If the Compabloc fails, following documents are requested for analysis/ expertise:

- ✓Trouble shooting questionnaire / TS FOFF1121
- ✓Process Flow Diagram
- ✓Design Datasheet (CAS print out)
- ✓Pictures of the failures

Thank you in advance for sending these as soon as possible, in order for us to have as many details as possible to handle the problem and help you out.

Troubleshooting Questionnaire TS FOFF1121:

1-General data **(mandatory when grey)**

Customer Name		Shipping date from Fontanil		
Through Contractor		Start up date		
Serial Nr.	CP	Failure date		
GA-Drawing Nr	CP	Guarantee still valid	Yes	No
Application		Customer claim	Yes	No
Market		Reference of the claim		
Contact AL name		First time there is a problem	Yes	No
		Serviced by Alfa Laval	Y / N : Date:	

2-Design and operating data

Model	CP -	Plate material		
Position (Choose the right one)	Vertical (liquid/liquid, condenser)		Horizontal (condenser, reboiler, air cooler, other…….)	
	Side 1		Side 2	
Linings Full Vacuum	Yes	No	Yes	No
Design pressure	barg		barg	
Design temperature	°C		°C	
Gasket material				
Lining material/thickness				
Fluid				
Operating pressure	barg		barg	
Operating temperature	°C To	°C	°C To	°C

3-Type of problem and observations

Hydro-Thermal	Pressure drop	Yes	No	Thermal Performance: ok	Yes	No
Mechanical	External Leak			Internal leak		
Location of damages	Please indicate with pictures or sketches					
Importance of the leakage	Stopped by itself	Stopped after panels retightening		Droplets	Continuous flow	
Corrosion risk	Yes	No				
Cooling Water Quality	Chlorides content	Yes		No	Ppm:	
Process stream composition						
Other						

4-Process description

Cyclical Duty	Pressure	Temperature	Both	
If cyclical,	Frequency		Amplitude	
Continuous	Steady	Unsteady		
Vents /Drains connected	Yes	No		
Start up	Side1 first	Side 2 first	Both sides at the same time	
Shut down	Side1 first	Side 2 first	Both sides at the same time	
Failure happened	During start up	During normal operation	During pre-commissioning	
Start up ramp	Bar/h	°C/h		
Shut down ramp	Bar/h	°C/h		

5. Control system

Control system	Yes	No		
Type of control system	On/off	Proportional %	Integrative %	Differential %
Risk of full vacuum at shut down	Yes	No		
Pump location	Upstream	Downstream		
If reboiler, fluid with	Partial vaporisation	Total vaporisation		
If condenser, control valve on	Steam inlet	Condensate outlet		
If air cooler, compressor type	Centrifugal	Piston		

6. Consequence of the problem

Unit is still in operation	Yes	No
Unit stopped but plant still operating	Yes	No
Unit stopped and plant stopped	Yes	No
Unit can operate until next planned shut down	Yes	No
Unit can be sent to Alfa Laval for repair	Yes	No
Intervention desired by a Alfa Laval Service Engineer	Yes	No

7. Any comment which can help the expertise of failure (drawing, pictures, history)

Others possible causes for failure:

- ✓ Water hammering
- ✓ Fouling
- ✓ Sudden full vacuum
- ✓ Pressure Inversion between the two circuits
- ✓ Pressure spikes

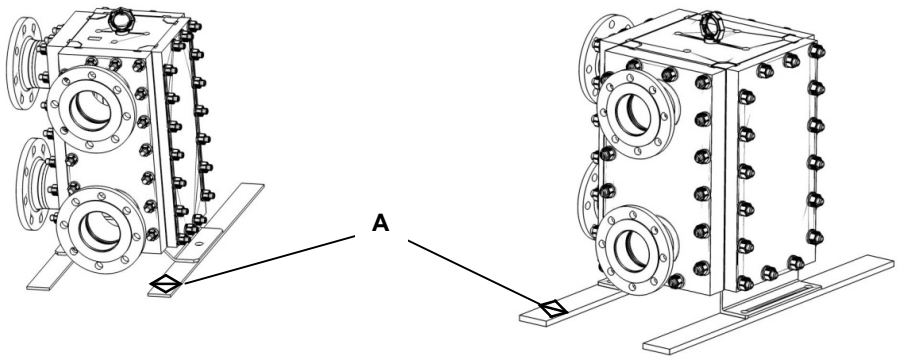
Appendix 5: Installation recommendations (supports)

Following recommendations are applicable for both horizontal and vertical Compabloc installation even if the figures are showing vertical ones.

It is required that the Compabloc supports are entirely in contact with the bearing surface.
The bearing surface can be either a concrete foundation or a metallic construction.
Please find enclosed the minimum dimensions of the bearing surface depending on the Compabloc sizes.

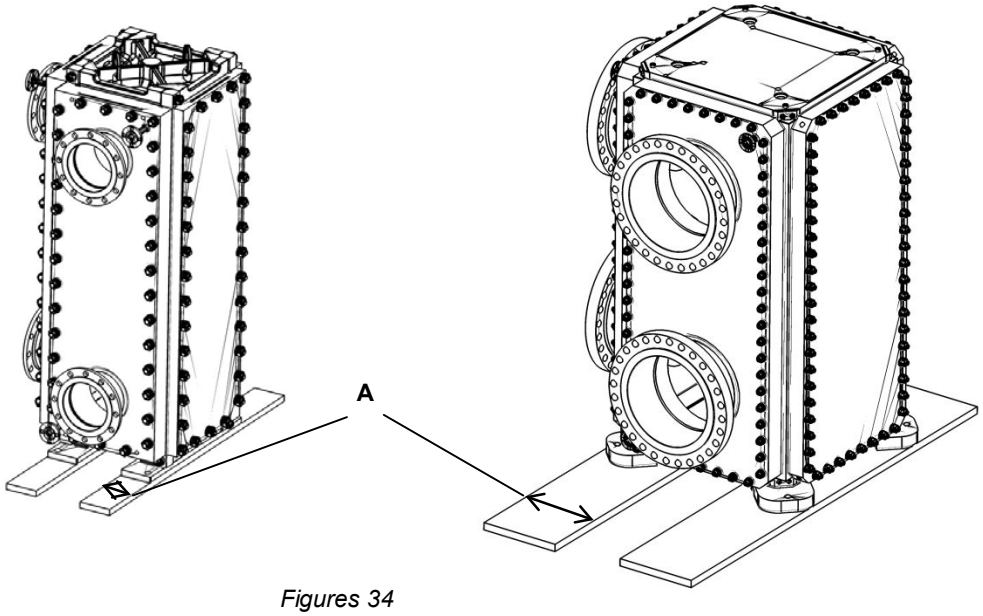
Model	Support dimension **A** Vertical installation	Support dimension **A** Horizontal installation
CP15	34 mm (1" ½)	60 (2 ½")
CP20	80 mm (3" ½)	70 mm (3")
CP30	80 mm (3" ½)	70 mm (3")
CP40	100 mm (4")	90 mm (3" ¾)
CP50	175 mm (7")	80 mm (3" ½)
CP75	220 mm (9")	140mmm (5 ½")
CP120	610 mm (24")	170 mm (7")

CP15 **CP20 ⇨ CP40**



Figures 33

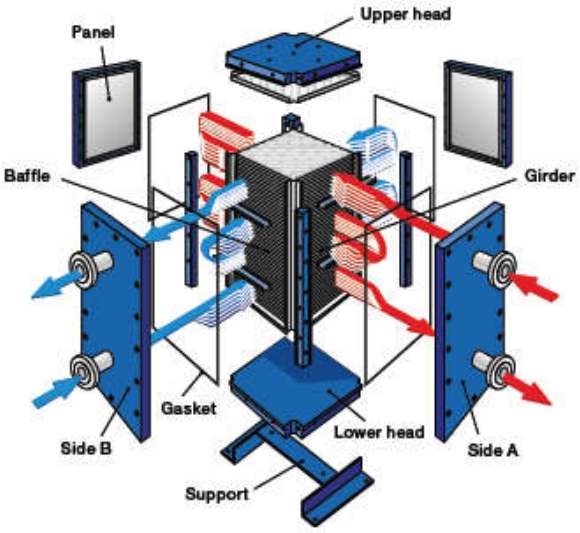
CP50 ⇨ 75 **CP 120**



Figures 34

Appendix 6: Ten top tips to keep your Compabloc in tip top condition!

1. Ensure that key operating conditions (pressure, temperatures and flow rates) match the original design specifications.
2. Use pre-filters and strainers to protect the Compabloc from foreign objects and fouling.
3. Open and close valves slowly to avoid water hammer from pressure surges during start-up and shutdown.
4. Make sure that the unit is properly vented. For large units the vent connections should be kept opened/connected.
5. To ensure stable operation and smooth temperature and pressure ramp up during start up or shut-down, check that the control system complies with the Compabloc manual.
6. Use predictive maintenance including regular checks of the pressure drop to determine the cleaning frequency required.



7. Use chemical Cleaning-In-Place (CIP) or mechanical cleaning (steam or high pressure water jets) to remove deposits and fouling to avoid having to open the exchanger unnecessarily.
8. Panel gaskets ***must*** be changed after each panel opening, so keep a spare set of panel gaskets on site.
9. After a long shutdown, double-check the tightening torque of all panel bolts before re-starting operation.
10. In case of an external leakage, through the gasket, tighten the panel bolts to nominal torque values or replace the panel gaskets. If the leakage cannot be fixed, contact Alfa Laval for advice. Field repair may be possible.

Alfa Laval Parts & Service
Extending Performance

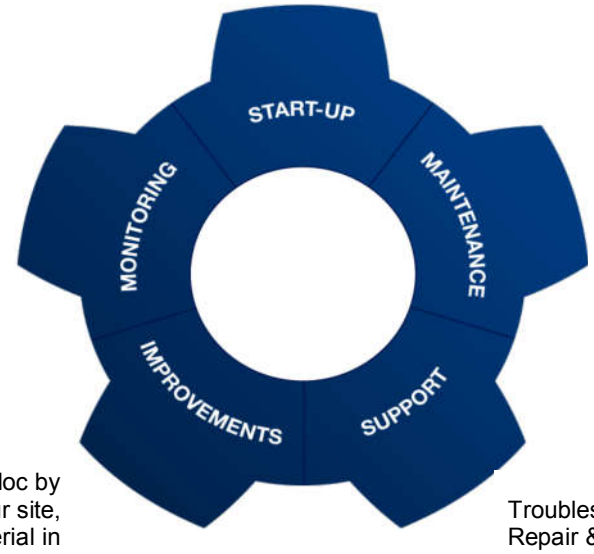
Let’s go further together!

Alfa Laval can provide you everything needed to ensure Availability, Uptime and Optimization of your Compabloc.

Discover our Service offer.

Make sure your start-up goes smoothly with support by Alfa Laval Installation Supervision: Remote review, Pre-installation review on-site, Commissioning

Performance analysis (AlfaCheck) to get the most possible efficiency all along life-time of your Compabloc



Ensure efficiency with regular cleaning where we can support with Cleaning-In-Place, Mechanical cleaning or Pyrolisis
With regular "Full Inspection", you extend lifetime of your Compabloc and you avoid unexpected break-down

Get the most out of your Compabloc by keeping spare blocks at our site,
Upgrade plate pattern or material in case of process changes
Customer training

Troubleshooting
Repair &Welding expertise
Spare parts advice

Please contact your local Alfa Laval representative for extending your performance.

Visit our website at
www.alfalaval.com