

FORM U-1A MANUFACTURER'S DATA REPORT FOR PRESSURE VESSELS
(Alternative Form for Single Chamber, Completely Shop-Fabricated Vessels Only)
As Required by the Provisions of the ASME Code Rules, Section VIII, Division 1

1. Manufactured and certified by AIR COOLED EXCHANGERS, INC. ONE ACE AVE. BROKEN ARROW, OK. 74013
(Name and address of manufacturer)

2. Manufactured for TOROMONT PO BOX 5308 STN C CALGARY, AB T2C 3C6
(Name and address of purchaser)

3. Location of installation UNKNOWN
(Name and address)

4. Type VERTICAL 0502606-2 T1101.231 05026-H2-1 3272 2005
(Horiz or vert., tank) (Mfg's serial No.) (CRN) (Drawing No.) (Nat'l. Bd. No.) (Year built)

5. The chemical and physical properties of all parts meet the requirements of material specifications of the ASME BOILER AND PRESSURE VESSEL CODE. The design, construction, and workmanship conform to ASME Rules, Section VIII Division 1 2001
Year

to A2003 NONE NONE
Addenda (Date) Code Case Nos. Special Service per UG-120(d)

Tube & Plug

6. Shell: SA-516-70 .75" .0625" 4.375" 20.625"
Matl. (Spec. No., Grade) Nom. Thk. (in.) Corr. Allow. (in.) Diam. I.D. (ft. & in.) Length (overall) (ft. & in.)

7. Seams: SINGLE BEVEL NA NA NA NA NA NA NA
Long. (Welded, Dbl., Sngl., Lap, Butt) R.T. (Spot or Full) Eff. (%) H.T. Temp. (°F) Time (hr) Girth (Welded, Dbl., Sngl., Lap, Butt) R.T. (Spot, Partial, or Full) No. of Courses

8. Heads: (a) Matl. SA-516-70 (b) Matl. SA-516-70
(Spec. No., Grade) (Spec. No., Grade)

	Location (Top, Bottom, Ends)	Minimum Thickness	Corrosion Allowance	Crown Radius	Knuckle Radius	Elliptical Ratio	Conical Apex Angle	Hemispherical Radius	Flat Diameter	Side to Pressure (Convex or Concave)
(a)	TOP & BTM	.5"	.0625"	NA	NA	NA	NA	NA	4"	NA
(b)	ENDS	.5"	.0625"	NA	NA	NA	NA	NA	4"	NA

if removable, bolts used (describe other fastenings) _____
SERVICE: AC (Matl., Spec. No., Gr., Size, No.)

9. MAWP 400 psi at max. temp. 350 °F
Min. design metal temp. -20 °F at 400 psi. Hydro., ~~pres.~~, or comb. test pressure 520 psi.

10. Nozzles, inspection and safety valve openings: SAFETY RELIEF VALVE TO BE PROVIDED ELSEWHERE BY OTHERS

Purpose (Inlet, Outlet, Drain)	No.	Diam. Or Size	Type	Matl.	Nom. Thk.	Reinforcement Matl.	How Attached	Location
IN/OUTLET	2	4"	PIPE	SA-106B	XH	MATERIAL & WELD	UW16.1(a)	-----
	2	4"	RFWN	SA-105	300#	MATERIAL & WELD	WELDED	-----
	1	.75"	CPLG	SA-105	3000#	MATERIAL & WELD	UW16.1(a)	-----

11. Supports: Skirt NO Lugs 2 Legs 0 Other NA Attached TUBESHEET/WELDED
(Yes or no) (No.) (No.) (Describe) (Where and how)

12. Remarks: Manufacturer's Partial Data Reports properly identified and signed by Commissioned Inspectors have been furnished for the following items of the report: CONSTRUCTED IN CONFORMANCE WITH APPENDIX 28, IMPACT EXEMPT PER UG-20(f)(1)(b)
(Name of part, item number, Mfg's. name and identifying stamp)

TUBES:(37)SA-214 X .625" OD X .060" MW X 6' LONG STRAIGHT TYPE
PLUGS:(74)SA-105 SHOULDER
UT-ONE LONG SEAM & ONE END PER HEAD PER CUSTOMER REQUEST

CERTIFICATE OF SHOP COMPLIANCE

We certify that the statements made in this report are correct and that all details of design, material, construction, and workmanship of this vessel conform to the ASME Code for Pressure Vessels, Section VIII, Division 1. "U" Certificate of Authorization No. 7616 expires 4/30, 2005
Date 3-17-05 Co. name AIR COOLED EXCHANGERS, INC. Signed [Signature]
(Manufacturer) (Representative)

CERTIFICATE OF SHOP INSPECTION

Vessel constructed by AIR COOLED EXCHANGERS, INC. at BROKEN ARROW,
I the undersigned, holding a valid commission issued by the National Board of Boiler and Pressure Vessel Inspectors and/or the State or Province of OKLAHOMA and employed by ONEBEACON AMERICA INSURANCE CO. BOSTON, MASS.
have inspected the component described in this Manufacturer's Data Report on 3-17, 2005, and state that, to the best of my knowledge and belief, the Manufacturer has constructed this pressure vessel in accordance with ASME Code, Section VIII, Division 1. By signing this certificate neither the Inspector nor his employer makes any warranty, expressed or implied, concerning the pressure vessel described in this Manufacturer's Data Report. Furthermore, neither the Inspector nor his employer shall be liable in any manner for any personal injury or property damage or a loss of any kind arising from or connected with this inspection.
Date 3-17-05 Signed [Signature] Commissions 1B.8432-H OK. 266
(Authorized Inspector) (Nat'l Board (incl. endorsements), State, Prov. and No.)

AIR COOLED EXCHANGERS, INC.

P.O. BOX 577 - BROKEN ARROW, OKLAHOMA 74013

Ph (918) 251-7477

Fax (918) 258-1833

E-MAIL: MAILHUB@ACE-COOLERS.COM

COOLER PERFORMANCE SPECIFICATION

CUSTOMER	TOROMONT	PROPOSAL NUMBER	05026R3.DAT
REFERENCE	TPS90	DATE	3/9/2005
MODEL	J15B-51-6	PAGE	1

PERFORMANCE OF ONE UNIT

SERVICE	EJW/ELW/CW	AC
FLOW	40.0GPM	1.88MMSCFD
FLUID	50%GLY	.6
TEMPERATURE IN, F	179.3	180.0
TEMPERATURE OUT, F	155.0	119.0
INLET PRESSURE, PSIG		263.4
PRESSURE DROP, PSI	1.9	2.2
DUTY, BTU/HOUR	427000	126947
CORRECTED MTD	55.3	45.3
BARE TUBE RATE	149.1	80.5
FOULING	0.00050	0.00200
BARE SURFACE, SQ. FT.	52	35
TOTAL SURFACE SQ. FT.	823	553

CONSTRUCTION

NO. SECTIONS	1	1
NO. TUBES/SECTION	55	37
LENGTH	6.0	6.0
NO. ROWS	3	3
NO. PASSES	3	2
COUNTERFLOW		
TUBE O.D. AND BWG	5/8X16BWG	5/8X16BWG
TUBE MATERIAL	SA214(WLD)	SA214(WLD)
DESIGN PRESSURE, PSI	14	400
DESIGN TEMPERATURE, F	350/-20	350/-20
NOZZLES-INLET	2-3000# CPLG	4-300RF
NOZZLES-OUTLET	2-3000# CPLG	4-300RF
HEADER TYPE	RECT TUBE	BOX W/PLUGS
HEADER MATERIAL	STEEL	SA-516-70
ASME CODE STAMP		YES W/NB
GROOVED TUBE SHEET	YES	YES
CORROSION ALLOWANCE		0.063
PLUGS, TYPE	TAPER	SHOULDER
PLUGS, MATERIAL	STEEL	SA-105
TURBULATORS		
ACCELERATORS		
LOUVERS	MANUAL	MANUAL
STRESS RELIEVE	NO	NO
NDE		BUTT WELDS
ADDITIONAL CODES		
CANADIAN REGISTRATION		AB,BC,SASK
ADDITIONAL COUPLINGS		1
BYPASS NOZZLE		
FINS	HYPERF MARINE	HYPERF MARINE

AIR DATA

INLET AIR, F	90.0	ELEVATION, FT.	2500
OUTLET AIR, F	120.0	TOTAL SCFM	17004

MECHANICAL EQUIPMENT

NO FANS	1	HP/FAN	6.3	RPM	1154	DIA	42
FAN	MOORE SERIES 10	FAN MATERIAL	ALUM	NUMBER OF BLADES	4	PITCH	31 DEGREES
V-Belt Drive by Others							
DRAFT TYPE	INDUCED						
EST SHIPPING WEIGHT	2431	WIDTH	7.0	LENGTH	5.8	HEIGHT	5.0
ACCESSORIES	BUGSCREEN. FLASHING FRAME. FLOOR.						
FINISH ACE std prep. w/ one precoat and one finish coat of ACE std enamel with customer specified color							

Parts List



Air Cooled Exchangers, Inc.

1201 S. 9th Street
Broken Arrow, Oklahoma 74012
Phone: 918-251-7477
Fax: 918-251-7482

Customer: TOROMONT

ACE Serial Number(s): 0502601-10

Cooler Model: J15B-51-6

Fan Make & Model MOORE 1000 SERIES 10	1	3.5 Dia.	4 Blades	32 deg. Pitch at	CLEVIS	Fan RPM: 1154
		LEFT	1.4375 Bore with	STD Keyway	Special Note:	
Fan Shaft ### ##	1	1.4375 Dia.	40 Long with	6.5 in Keyway Fan end	6 in Keyway other end	
Idler Shaft		1.4375 Dia.	17.5 Long with	STD Keyway one end		
Fan Bearing ##	2	1.4375 in REXNORD MODEL ZA-2107				
Idler Bearing	2	1.4375in REXNORD				
Electric Motor	0	0 HP	0 RPM	0 Volt	0 Phase	0 Cycle
		0 Enclosure	0 Frame Size	WITH	SlideBase	
Motor Sheave		O.D.	Type	Groove	Bore	
Fan Sheave		O.D.	Type	Groove	Bore	
V-Belts						
EJW/ELW/CW		29.5 IN X 72 IN (Amarillo Chittom) MANUAL				
AC		20.88 IN X 72 IN (Amarillo Chittom) MANUAL				

FAN, SHAFT, BEARINGS & V-BELTS ARE RECOMMENDED SPARE PARTS.

ALL INQUIRIES AND ORDERS MUST BE ACCOMPANIED BY COOLER SERIAL NUMBER.



Air Cooled Exchangers, Inc.

STRUCTURE/ASSEMBLY CHECKLIST

S/N: 0502604-J15B-51-LDATE: 3-17-05

ITEM	BY	DATE	COMMENTS	QCI	DATE
STRUCTURE FITUP	#9	3-17-05		SW	3-21-05
STRUCTURE WELDING	J	3-17-05		SW	J
STRUCTURE CLEANING					
SIDEFRAME HEADER FITUP					
SIDEFRAME WELDING					
SIDEFRAME CLEANING					
PRIMER / PAINT / COATING PREPARATION					
SECTION ARRANGEMENT	MW	3/22/05		SW	3-23-05
FLANGE LOCATION	AWH	3/17/05			
FLANGE FACE	AWH	3/17/05			
BEARINGS - set screws, bolts	ETH/DB	3/22/05			
SHAFT - level & projection, alignment	ETH/DB	3/22/05			
SHEAVE & BELTS - size, # belts				NA	
FAN INSTALLATION & TORQUE	ETH/DB	3/22/05		SW	3-23-05
FAN PITCH & TORQUE	ETH/DB	3/22/05			
TIP CLEARANCE	ETH/DB	3/22/05			
IDLER - LEVEL, ALIGNMENT	JS	3/22/05			
MOTOR TAG / PER SPEC				NA	
LOUVERS - OPERATION	JS	3/24/05		SW	3-24-05
GUARDS - MEET OSHA				NA	
BUGSCREENS - SHIPS LOOSE	JS	3/24/05		SW	3-24-05
ACTUATORS - PRESSURE - MTD/LOOSE				NA	
TEMP CONTROLLERS - SHIPS LOOSE					
VIBRATION SWITCH - MTD					
SPECIAL MARKINGS				SW	3-23-05
PAINT OR COATING (FINAL)	Cherie	3-24-05			3-24-05
LUBE LINES / ZERKS - LOCATION	DB	3/22/05			3-23-05
TAGS: SECTION, CODE STAMPS, CRN'S & COOLER NAMEPLATE	Lon G	3/18/05			
LEGS, BRACING, BOLTING - MTD OR LOOSE	MW	3/24/05	Bugscreens		3-24-05
CUSTOMER INSPECTION, QA RELEASE					

NOTES / OTHER ITEMS: * CONTACT CUSTOMER FOR INSPECTION & FINAL RELEASE.

APPROVED FOR SHIPMENT

QCI

DATE:

3-24-05



Air Cooled Exchangers, Inc.

STRUCTURE/ASSEMBLY CHECKLIST

S/N: 0502605-J15B-51-6DATE: 3-17-05

ITEM	BY	DATE	COMMENTS	QCI	DATE
STRUCTURE FITUP	#9	3-17-05		SW	3-21-05
STRUCTURE WELDING	#9	3-19-05		J	J
STRUCTURE CLEANING					
SIDEFRAME HEADER FITUP					
SIDEFRAME WELDING					
SIDEFRAME CLEANING					
PRIMER / PAINT / COATING PREPARATION					
SECTION ARRANGEMENT	MW	3/22/05		SW	3-23-05
FLANGE LOCATION	AWH	3/17/05		J	J
FLANGE FACE	AWH	3/17/05		J	J
BEARINGS - set screws, bolts	ETH/DB	3/22/05		J	J
SHAFT - level & projection, alignment	ETH/DB	3/22/05		J	J
SHEAVE & BELTS - size, # belts	—	—		MA	
FAN INSTALLATION & TORQUE	ETH/DB	3/22/05		SW	3-23-05
FAN PITCH & TORQUE	ETH/DB	3/22/05		J	J
TIP CLEARANCE	ETH/DB	3/22/05		J	J
IDLER - LEVEL, ALIGNMENT	JS	3/22/05		J	J
MOTOR TAG / PER SPEC	—	—		MA	
LOUVERS - OPERATION	JS	3/24/05		SW	3-24-05
GUARDS - MEET OSHA	—	—		MA	
BUGSCREENS - SHIPS LOOSE	JS	3/24/05		SW	3-24-05
ACTUATORS - PRESSURE - MTD/LOOSE	—	—		MA	
TEMP CONTROLLERS - SHIPS LOOSE	—	—		J	
VIBRATION SWITCH - MTD	—	—		J	
SPECIAL MARKINGS				SW	
PAINT OR COATING (FINAL)	Chris	3-24-05		J	3-24-05
LUBE LINES / ZERKS - LOCATION	DB	3/22/05		J	3-23-05
TAGS: SECTION, CODE STAMPS, CRN'S & COOLER NAMEPLATE	KONG	3/18/05		J	J
LEGS, BRACING, BOLTING - MTD OR LOOSE	MW	3/24/05	BUG SCREENS	J	3-24-05
CUSTOMER INSPECTION, QA RELEASE					

NOTES / OTHER ITEMS: * CONTACT CUSTOMER FOR INSPECTION & FINAL RELEASE.

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DATE:

3-24-05



Air Cooled Exchangers, Inc.

STRUCTURE/ASSEMBLY CHECKLIST

S/N: 0502606-J15B-51-6DATE: 3-17-05

ITEM	BY	DATE	COMMENTS	QCI	DATE
STRUCTURE FITUP	#9	3-17-05		SW	3-21-05
STRUCTURE WELDING	L	3-19-05		L	2
STRUCTURE CLEANING					
SIDEFRAME HEADER FITUP					
SIDEFRAME WELDING					
SIDEFRAME CLEANING					
PRIMER / PAINT / COATING PREPARATION					
SECTION ARRANGEMENT	MW	3/22/05		SW	3-23-05
FLANGE LOCATION	ANH	3/17/05		L	L
FLANGE FACE	ANH	3/17/05		L	L
BEARINGS - set screws, bolts	ETH/DB	3/22/05		L	L
SHAFT - level & projection, alignment	ETH/DB	3/22/05		L	L
SHEAVE & BELTS - size, # belts	—	—		NA	
FAN INSTALLATION & TORQUE	ETH/DB	3/22/05		SW	3-23-05
FAN PITCH & TORQUE	ETH/DB	3/22/05		L	L
TIP CLEARANCE	ETH/DB	3/22/05		L	L
IDLER - LEVEL, ALIGNMENT	JS	3/22/05		L	L
MOTOR TAG / PER SPEC	—	—		NA	
LOUVERS - OPERATION	JS	3/24/05		SW	3-24-05
GUARDS - MEET OSHA	—	—		NA	
BUGSCREENS - SHIPS LOOSE	JS	3/24/05		SW	3-24-05
ACTUATORS - PRESSURE - MTD/LOOSE	—	—		NA	
TEMP CONTROLLERS - SHIPS LOOSE	—	—		L	
VIBRATION SWITCH - MTD	—	—		L	
SPECIAL MARKINGS				SW	3-23-05
PAINT OR COATING (FINAL)	CRN's	3-24-05		L	3-24-05
LUBE LINES / ZERKS - LOCATION	DB	3/22/05		L	3-23-05
TAGS: SECTION, CODE STAMPS, CRN'S & COOLER NAMEPLATE	LOWE	3/22/05		L	L
LEGS, BRACING, BOLTING - MTD OR LOOSE	MW	3/24/05	BOLTS & NUTS	L	3-24-05
CUSTOMER INSPECTION, QA RELEASE					

NOTES / OTHER ITEMS: * CONTACT CUSTOMER FOR INSPECTION & FINAL RELEASE.

APPROVED FOR SHIPMENT

QCI

DATE:

3-24-05



Air Cooled Exchangers, Inc.

STRUCTURE/ASSEMBLY CHECKLIST

S/N: 0502607-J15B-51-6DATE: 3-17-05

ITEM	BY	DATE	COMMENTS	QCI	DATE
STRUCTURE FITUP	#9	3-17-05		SC	3-22-05
STRUCTURE WELDING	#	3-21-05		+	+
STRUCTURE CLEANING					
SIDEFRAME HEADER FITUP					
SIDEFRAME WELDING					
SIDEFRAME CLEANING					
PRIMER / PAINT / COATING PREPARATION					
SECTION ARRANGEMENT	MW	3/23/05		SC	3-24-05
FLANGE LOCATION	ANH	3/17/05		+	+
FLANGE FACE	ANH	3/17/05		+	+
BEARINGS - set screws, bolts	RS	3/23/05		+	+
SHAFT - level & projection, alignment	RS	3/23/05		+	+
SHEAVE & BELTS - size, # belts	—	—		NA	
FAN INSTALLATION & TORQUE	RS	3/23/05		SC	3-24-05
FAN PITCH & TORQUE	RS	3/23/05		+	+
TIP CLEARANCE	RS	3/23/05		+	+
IDLER - LEVEL, ALIGNMENT	JS	3/23/05		+	+
MOTOR TAG / PER SPEC	—	—		NA	
LOUVERS - OPERATION	JS	3/24/05		SC	3-24-05
GUARDS - MEET OSHA	—	—		NA	
BUGSCREENS - SHIPS LOOSE	JS	3/24/05		SC	3-24-05
ACTUATORS - PRESSURE - MTD/LOOSE	—	—		NA	
TEMP CONTROLLERS - SHIPS LOOSE	—	—		+	
VIBRATION SWITCH - MTD	—	—		+	
SPECIAL MARKINGS				SC	3-24-05
PAINT OR COATING (FINAL)	Chris	3-24-05		+	+
LUBE LINES / ZERKS - LOCATION	DB	3/23/05		+	+
TAGS: SECTION, CODE STAMPS, CRN'S & COOLER NAMEPLATE	LONG	3/22/05		+	+
LEGS, BRACING, BOLTING - MTD OR LOOSE	MW	3/24/05	Bug Screens	+	+
CUSTOMER INSPECTION, QA RELEASE					
NOTES / OTHER ITEMS: * CONTACT CUSTOMER FOR INSPECTION & FINAL RELEASE.					
APPROVED FOR SHIPMENT	QCI			DATE:	3-24-05



Air Cooled Exchangers, Inc.

STRUCTURE/ASSEMBLY CHECKLIST

S/N: 0502608-J15B-S1-LDATE: 3-19-05

ITEM	BY	DATE	COMMENTS	QCI	DATE
STRUCTURE FITUP	#9	3-19-05		SW	3-22-05
STRUCTURE WELDING	L	3-22-05		SW	3-22-05
STRUCTURE CLEANING					
SIDEFRAME HEADER FITUP					
SIDEFRAME WELDING					
SIDEFRAME CLEANING					
PRIMER / PAINT / COATING PREPARATION					
SECTION ARRANGEMENT	MW	3/29/04		SW	3-29-05
FLANGE LOCATION	DM	3/23/05			
FLANGE FACE	DM	3/23/05			
BEARINGS - set screws, bolts	ETH	3/28/05			
SHAFT - level & projection, alignment	ETH	3/28/05			
SHEAVE & BELTS - size, # belts				MA	
FAN INSTALLATION & TORQUE	ETH	3/28/05		SW	3-29-05
FAN PITCH & TORQUE	ETH	3/28/05			
TIP CLEARANCE	ED	3/28/05			
IDLER - LEVEL, ALIGNMENT	JS	3/28/05			
MOTOR TAG / PER SPEC				MA	
LOUVERS - OPERATION	ASSM.	3/29/05		SW	3-30-05
GUARDS - MEET OSHA				MA	
BUGSCREENS - SHIPS LOOSE	ASSM.	3/29/05		SW	3-30-05
ACTUATORS - PRESSURE - MTD/LOOSE				MA	
TEMP CONTROLLERS - SHIPS LOOSE					
VIBRATION SWITCH - MTD					
SPECIAL MARKINGS				SW	3-29-05
PAINT OR COATING (FINAL)	Chris	3-30-05			3-30-05
LUBE LINES / ZERKS - LOCATION	DB	3/28/05			3-29-05
TAGS: SECTION, CODE STAMPS, CRN'S & COOLER NAMEPLATE	LONG	3/28/05			
LEGS, BRACING, BOLTING - MTD OR LOOSE	MW	3/28/05	Bug Screens		
CUSTOMER INSPECTION, QA RELEASE					

NOTES / OTHER ITEMS: * CONTACT CUSTOMER FOR INSPECTION & FINAL RELEASE.

APPROVED FOR SHIPMENT

QCI

DATE:

3-30-05



Air Cooled Exchangers, Inc.

STRUCTURE/ASSEMBLY CHECKLIST

S/N: 0502609-J15B-51-6DATE: 3-21-05

ITEM	BY	DATE	COMMENTS	QCI	DATE
STRUCTURE FITUP	#9	3-21-05		SW	3-23-05
STRUCTURE WELDING	L	3-23-05		SW	L
STRUCTURE CLEANING					
SIDEFRAME HEADER FITUP					
SIDEFRAME WELDING					
SIDEFRAME CLEANING					
PRIMER / PAINT / COATING PREPARATION					
SECTION ARRANGEMENT	MW	3/29/05		SW	3-30-05
FLANGE LOCATION	DM	3/22/05			
FLANGE FACE	DM	3/22/05			
BEARINGS - set screws, bolts	RS	3/23/05			
SHAFT - level & projection, alignment	RS	3/23/05			
SHEAVE & BELTS - size, # belts	—	—		MA	
FAN INSTALLATION & TORQUE	RS	3/23/05		SW	3-30-05
FAN PITCH & TORQUE	RS	3/23/05			
TIP CLEARANCE	RS	3/23/05			
IDLER - LEVEL, ALIGNMENT	JS	3/23/05			
MOTOR TAG / PER SPEC	—	—		MA	
LOUVERS - OPERATION	JS	3/24/05		SW	3-30-05
GUARDS - MEET OSHA	—	—		MA	
BUGSCREENS - SHIPS LOOSE	JS	3/24/05		SW	3-30-05
ACTUATORS - PRESSURE - MTD/LOOSE	—	—		MA	
TEMP CONTROLLERS - SHIPS LOOSE	—	—			
VIBRATION SWITCH - MTD	—	—			
SPECIAL MARKINGS				SW	3-30-05
PAINT OR COATING (FINAL)	CRN	3-30-05			L
LUBE LINES / ZERKS - LOCATION	DB	3/23/05			3-30-05
TAGS: SECTION, CODE STAMPS, CRN'S & COOLER NAMEPLATE	LOWE	3/23/05			
LEGS, BRACING, BOLTING - MTD OR LOOSE	MW	3/24/05	Bug Screens		
CUSTOMER INSPECTION, QA RELEASE					

NOTES / OTHER ITEMS: * CONTACT CUSTOMER FOR INSPECTION & FINAL RELEASE.

APPROVED FOR SHIPMENT

QCI

DATE:

3-30-05



Air Cooled Exchangers, Inc.

STRUCTURE/ASSEMBLY CHECKLIST

S/N: 0502610-J15B-51-LDATE: 3-21-05

ITEM	BY	DATE	COMMENTS	QCI	DATE
STRUCTURE FITUP	#9	3-21-05		SL	3-23-05
STRUCTURE WELDING	J	3-23-05		J	J
STRUCTURE CLEANING					
SIDEFAME HEADER FITUP					
SIDEFAME WELDING					
SIDEFAME CLEANING					
PRIMER / PAINT / COATING PREPARATION					
SECTION ARRANGEMENT	MW	3/29/05		SL	3-30-05
FLANGE LOCATION	DM	3/23/05		J	J
FLANGE FACE	DM	3/23/05		J	J
BEARINGS - set screws, bolts	ED	3/28/05		J	J
SHAFT - level & projection, alignment	ED	3/28/05		J	J
SHEAVE & BELTS - size, # belts				NA	
FAN INSTALLATION & TORQUE	ED	3/28/05		SL	3-30-05
FAN PITCH & TORQUE	ED	3/28/05		J	J
TIP CLEARANCE	ED	3/28/05		J	J
IDLER - LEVEL, ALIGNMENT	JS	3/28/05		J	J
MOTOR TAG / PER SPEC				NA	
LOUVERS - OPERATION	ASSM.	3/29/05		SL	3-30-05
GUARDS - MEET OSHA				NA	
BUGSCREENS - SHIPS LOOSE	ASSM.	3/29/05		SL	3-30-05
ACTUATORS - PRESSURE - MTD/LOOSE				NA	
TEMP CONTROLLERS - SHIPS LOOSE				J	
VIBRATION SWITCH - MTD				J	
SPECIAL MARKINGS				SL	3-30-05
PAINT OR COATING (FINAL)	Chin	3-29-05		J	J
LUBE LINES / ZERKS - LOCATION	DB	3/28/05		J	J
TAGS: SECTION, CODE STAMPS, CRN'S & COOLER NAMEPLATE	LOWE	3/28/05		J	J
LEGS, BRACING, BOLTING - MTD OR LOOSE	MW	3/28/05	BUG SCREENS	J	J
CUSTOMER INSPECTION, QA RELEASE					

NOTES / OTHER ITEMS: * CONTACT CUSTOMER FOR INSPECTION & FINAL RELEASE.

APPROVED FOR SHIPMENT

QCI

DATE:

3-30-05



TULSA GAMMA RAY, INC.

1127 SOUTH LEWIS AVENUE
TULSA, OKLAHOMA 74104-3900
918 / 585-3228 • FAX 918 / 584-5598
1 - 800 - 625-9288
www.tulsagammaray.com

CUSTOMER DATA

NAME ACE
ADDRESS _____
PHONE _____ ATTN: _____
W.O. # 0502601-10 P.O. # _____
JOB LOCATION _____
DESCRIPTION REP MATERIAL TYPE: FE

TECHNIQUE/INSPECTION REPORT

DATE 3-10-05 DAY Thurs

DEFECT CODE

AB - ARC BURN
AI - ALIGNED INDICATION
BT - BURN THROUGH
CON - CONCAVITY
CRACK - CRACK

HB - HOLLOW BEAD
IF - INADEQUATE FUSION
IP - INCOMPLETE PENETRATION
MA - MISALIGNMENT
POR - POROSITY

SLI - SLAG INCLUSION
SLL - SLAG LINE
SURF - SURFACE INDICATION
UCE - UNDERCUT EXTERNAL
UCI - UNDERCUT INTERNAL

ABBREVIATED TERMS

SOD = SOURCE TO OBJECT DISTANCE
OFD = SOURCE SIDE OF OBJECT TO FILM DISTANCE
OD = OUTER DIAMETER
WT = WELD THICKNESS
WR = WELD REINFORCEMENT
REP = REPAIR
RET = RETAKE
RES = RESHOOT
BM = BASE MATERIAL

WELD/FILM NUMBER	JOB NUMBER	OD	BM	WR	WT	WITHIN STD'S		# FILM	FILM SIZE / MFG / TYPE	SOD	OFD	IQI S-F	# EXP	DEFECT LOCATION
						YES	NO							
1 3-T	N-12	4.5	337	25	442	/		1	3 1/2 x 8 1/2 - 50	4.5	442	12	1	
2 T-2	N-16						X							SLI
3 3-T	N-18						X							SLI
4 T-2	N-7					/								
5														
6														
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METHOD <u>RT</u>	SOURCE SIZE DIAG. <u>.157</u>	ISOTOPE <u>Ir192</u>	NO. CURIES <u>69</u>	DEV. TIME <u>Auto</u>	DEV. TEMP <u>Auto</u>	DENSITY <u>2.0 4.0</u>
NO. OF WELDS <u>4</u>	FT. LONG SEAMS <u>2</u>	STANDARDS <u>ASME</u>	NO. OF FILM <u>4</u>	FILM/ CASSETTE <u>50</u>	EXPOSURE: DBL WALL <u>1</u> S. WALL <u>1</u>	MR/R SCREENS <u>4.5 16</u>
TRUCK NO. / <u>TGR</u>	REPORT NO. <u>OF</u>	PAGE NO. <u>OF</u>	TECH. HOURS	ASST. HOURS	TRAVEL HOURS	TOTAL HOURS
FILM INTERPRETER <u>[Signature]</u>			ASST. NAME <u>[Signature]</u>		ASNT LEVEL <u>II</u>	
COMPANY REPRESENTATIVE <u>[Signature]</u>			NDT TECHNICIAN <u>[Signature]</u>		ASNT LEVEL <u>II</u>	

SIGNATURE CERTIFIES TIME & MATERIALS CORRECT

SIGNATURE



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TECHNIQUE/INSPECTION REPORT

DATE 3-10-05

DAY THURS.

CUSTOMER DATA

NAME Air Cooled Exchangers
ADDRESS _____
PHONE _____ ATTN: _____
W.O. # 0502601-10 P.O. # 260A3
JOB LOCATION Tulsa Gamma Ray
DESCRIPTION 100% X-Ray MATERIAL TYPE: FE

DEFECT CODE

AB - ARC BURN
AI - ALIGNED INDICATION
BT - BURN THROUGH
CON - CONCAVITY
CRACK - CRACK

HB - HOLLOW BEAD
IF - INADEQUATE FUSION
IP - INCOMPLETE PENETRATION
MA - MISALIGNMENT
POR - POROSITY

SLI - SLAG INCLUSION
SLL - SLAG LINE
SURF - SURFACE INDICATION
UCE - UNDERCUT EXTERNAL
UCI - UNDERCUT INTERNAL

ABBREVIATED TERMS

SOD = SOURCE TO OBJECT DISTANCE
OFD = SOURCE SIDE OF OBJECT TO FILM DISTANCE
OD = OUTER DIAMETER
WT = WELD THICKNESS
WR = WELD REINFORCEMENT
REP = REPAIR
RES = RESHOOT
RET = RETAKE
BM = BASE MATERIAL

WELD/FILM NUMBER	JOB NUMBER	OD	BM	WR	WT	WITHIN STD'S		# FILM	FILM SIZE / MFG / TYPE	SOD	OFD	ICL	# EXP	DEFECT LOCATION
						YES	NO							
1 T-2	N-11	W.S	337	0.62	399	/		1	3 1/2 X 8 1/2 F30	4.5	399	15	1	
2 2-3						/								
3 3-T						/								
4 T-2	N-12					/								
5 2-3						/								
6 3-T						/	X							SLI
7 T-2	N-13					/								
8 2-3						/								
9 3-T						/								
10 T-2	N-14					/								
11 2-3						/								
12 3-T						/								
13 T-2	N-15					/								
14 2-3						/								
15 3-T						/								
16 T-2	N-16					/	X							SLI
17 2-3						/								
18 3-T						/								
19 T-2	N-17					/								
20 2-3						/								
21 3-T						/								
22 T-2	N-18					/								
23 2-3						/								
24 3-T						/	X							IF
25 T-2	N-19					/								
26 2-3						/								
27 3-T						/								
28 T-2	N-20					/								
29 2-3						/								
30 3-T						/								

METHOD <u>RT</u>	SOURCE SIZE DIAG. <u>.187</u>	ISOTOPE <u>Ir192</u>	NO. CURIES <u>65ci</u>	DEV. TIME <u>9min</u>	DEV. TEMP <u>27°C</u>	DENSITY <u>2.0-4.0</u>
NO. OF WELDS <u>10</u>	FIL. LONG SEAMS <u>NA</u>	STANDARDS <u>ASME</u>	NO. OF FILM <u>30</u>	FILM/ CASSETTE <u>1/1</u>	EXPOSURE: DBL WALL <u>X</u> S. WALL <u>X</u>	MIRRO SCREENS <u>4.5 Pb</u>
TRUCK NO. / SHOP <u>TGR</u>	REPORT NO. OF <u></u>	PAGE NO. OF <u></u>	TECH. HOURS <u></u>	ASST. HOURS <u></u>	TRAVEL HOURS <u></u>	TOTAL HOURS <u></u>
FILM INTERPRETER <u>Charles J. Pace</u>	COMPANY REPRESENTATIVE <u></u>	ASST. NAME <u>Charles J. Pace</u>	ASST. LEVEL <u>II</u>	ASST. NAME <u></u>	ASST. LEVEL <u></u>	ASST. LEVEL <u></u>

SIGNATURE CERTIFIES TIME & MATERIALS CORRECT

SIGNATURE



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www.tulsagammaray.com

CUSTOMER DATA

NAME ACE
ADDRESS _____
PHONE _____ ATTN: _____
W.O. # 050260 P.O. # 26093
JOB LOCATION TLR
DESCRIPTION _____ MATERIAL TYPE: _____

TECHNIQUE/INSPECTION REPORT

DATE 3-10-05 DAY Monday

DEFECT CODE						ABBREVIATED TERMS					
AB - ARC BURN		HB - HOLLOW BEAD		SLI - SLAG INCLUSION		SOD = SOURCE TO OBJECT DISTANCE		OFD = SOURCE SIDE OF OBJECT TO FILM DISTANCE		REP = REPAIR RET = RETAKE	
AI - ALIGNED INDICATION		IF - INADEQUATE FUSION		SLL - SLAG LINE		OD = OUTER DIAMETER		WT = WELD THICKNESS		RES = RESHOOT	
BT - BURN THROUGH		IP - INCOMPLETE PENETRATION		SURF - SURFACE INDICATION		WR = WELD REINFORCEMENT		BM = BASE MATERIAL			
CON - CONCAVITY		MA - MISALIGNMENT		UCE - UNDERCUT EXTERNAL							
CRACK - CRACK		POR - POROSITY		UCI - UNDERCUT INTERNAL							

WELD/FILM NUMBER	JOB NUMBER	OD	BM	WR	WT	WITHIN STD'S		# FILM	FILM SIZE / MFG / TYPE	SOD	OFD	IQI S-F	# EXP	DEFECT LOCATION
						YES	NO							
1	1	4			337	/		1	3/4 x 8 1/2 504	4		12	1	
2						/								
3						/								
4	2					/								
5						/								
6						/								
7	3					/								
8						/								
9						/								
10	4					/								
11						/								
12						/								
13	5					/								
14						/								
15						/								
16	6					/								
17						/								
18						/								
19	7					/								
20						/								
21						/								
22	8					/								SLAG
23						/								
24						/								
25	9					/								
26						/								
27						/								
28	10					/								
29						/								
30						/								

METHOD <u>RT</u>	SOURCE SIZE DIAG.	ISOTOPE <u>Ir192</u>	NO. CURIES <u>80</u>	DEV. TIME <u>AUTO</u>	DEV. TEMP <u>81</u>	DENSITY <u>2.4</u>
NO. OF WELDS <u>10</u>	FT. LONG SEAMS	STANDARDS <u>ASME</u>	NO. OF FILM <u>30</u>	FILM/ CASSETTE <u>1</u>	EXPOSURE: DBL WALL S. WALL	MR/R SCREENS
TRUCK NO. /	REPORT NO.	PAGE NO.	TECH. HOURS	ASST. HOURS	VIEWING: DBL WALL S. WALL	MILEAGE
SHOP	OF	OF	ASST. NAME	ASST. LEVEL		
FILM INTERPRETER <u>DBurget</u>	COMPANY REPRESENTATIVE	NDT TECHNICIAN <u>DBurget</u>	ASST. LEVEL			

SIGNATURE CERTIFIES TIME & MATERIALS CORRECT



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www.tulsagammaray.com

TECHNIQUE/INSPECTION REPORT

CUSTOMER DATA

NAME ACE
ADDRESS _____
PHONE _____ ATTN: _____
W.O. # 0502401-10 P.O. # _____
JOB LOCATION _____
DESCRIPTION Repair MATERIAL TYPE: FE

DATE 3-11-05

DAY Fri

DEFECT CODE			ABBREVIATED TERMS		
AB – ARC BURN	HB – HOLLOW BEAD	SLI – SLAG INCLUSION	SOD – SOURCE TO OBJECT DISTANCE		
AI – ALIGNED INDICATION	IF – INADEQUATE FUSION	SLL – SLAG LINE	OFD – SOURCE SIDE OF OBJECT TO FILM DISTANCE		
BT – BURN THROUGH	IP – INCOMPLETE PENETRATION	SURF – SURFACE INDICATION	OD – OUTER DIAMETER	REP – REPAIR	RET – RETAKE
CON – CONCAVITY	MA – MISALIGNMENT	UCE – UNDERCUT EXTERNAL	WT – WELD THICKNESS	RES – RESHOOT	
CRACK – CRACK	POR – POROSITY	UCI – UNDERCUT INTERNAL	WR – WELD REINFORCEMENT	BM – BASE MATERIAL	

WELD/FILM NUMBER	JOB NUMBER	OD	BM	WR	WT	WITHIN STD'S		# FILM	FILM SIZE / MFG / TYPE	SOD	OFD	IOI	# EXP	DEFECT LOCATION
						YES	NO							
1 T-2	N-16	4.5	337	062	39A		X	1	3 1/2 X 8 1/2 FS04.2	4.2	39A	15	1	IP
2														
3 3-T	N-18						X							IP
4														
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METHOD <u>RT</u>	SOURCE SIZE DIAG. <u>.187</u>	ISOTOPE <u>Ir192</u>	NO. CURIES <u>6921</u>	DEV. TIME <u>9min</u>	DEV. TEMP <u>27°C</u>	DENSITY <u>2.0-4.0</u>
NO. OF WELDS <u>2</u>	FT. LONG SEAMS <u>NA</u>	STANDARDS <u>ASME</u>	NO. OF FILM <u>2</u>	FILM/ CASSETTE <u>11</u>	EXPOSURE: DBL WALL <u>X</u> S. WALL <u>X</u>	MP/ SCREENS <u>2.5 Pb</u>
TRUCK NO. <u>10R.</u>	REPORT NO. <u>OF</u>	PAGE NO. <u>OF</u>	TECH. HOURS	ASST. HOURS	TRAVEL HOURS	TOTAL HOURS
FILM INTERPRETER <u>Marcel P.</u>			ASST. NAME <u>4II</u>			ASNT LEVEL <u>II</u>
COMPANY REPRESENTATIVE <u>Marcel P.</u>			NDT TECHNICIAN <u>Marcel P.</u>			ASNT LEVEL <u>II</u>

SIGNATURE CERTIFIES TIME & MATERIALS CORRECT SIGNATURE



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TULSA, OKLAHOMA 74104-3900
918 / 585-3228 • FAX 918 / 584-5598
1 - 800 - 625-9288
www.tulsagammaray.com

CUSTOMER DATA

NAME ACE
ADDRESS _____
PHONE _____ ATTN: _____
W.O. # 0502601-10 P.O. # _____
JOB LOCATION _____
DESCRIPTION Repair MATERIAL TYPE: _____

TECHNIQUE/INSPECTION REPORT

DATE 3-17-05 DAY THUR

DEFECT CODE

AB - ARC BURN
AI - ALIGNED INDICATION
BT - BURN THROUGH
CON - CONCAVITY
CRACK - CRACK

HB - HOLLOW BEAD
IF - INADEQUATE FUSION
IP - INCOMPLETE PENETRATION
MA - MISALIGNMENT
POR - POROSITY

SLI - SLAG INCLUSION
SLL - SLAG LINE
SURF - SURFACE INDICATION
UCE - UNDERCUT EXTERNAL
UCI - UNDERCUT INTERNAL

ABBREVIATED TERMS

SOD - SOURCE TO OBJECT DISTANCE
OFD - SOURCE SIDE OF OBJECT TO FILM DISTANCE
OD - OUTER DIAMETER
WT - WELD THICKNESS
WR - WELD REINFORCEMENT
REP - REPAIR
RET - RETAKE
RES - RESHOOT
BM - BASE MATERIAL

WELD/FILM NUMBER	JOB NUMBER	OD	BM	WR	WT	WITHIN STD'S		# FILM	FILM SIZE / MFG / TYPE	SOD	OFD	IQI S-F	# EXP	DEFECT LOCATION
						YES	NO							
1 T-2	W-16	4.5	80	1/2		/		1	3 1/2 x 8 1/2 SO	4.5		RF	1	
2 2-3	W18					/								
3 3-T						/								
4														
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30														

METHOD <u>RT</u>	SOURCE SIZE DIAG. <u>- 150"</u>	ISOTOPE <u>1.192</u>	NO. CURIES <u>60</u>	DEV. TIME <u>Avg</u>	DEV. TEMP <u>Avg</u>	DENSITY <u>20-40</u>
NO. OF WELDS <u>2</u>	FT. LONG SEAMS	STANDARDS <u>API</u>	NO. OF FILM <u>2</u>	FILM/CASSETTE <u>1</u>	EXPOSURE: <u>1 DBL WALL</u>	S. WALL <u>1.5</u> SCREENS <u>1.5</u>
TRUCK NO. /	REPORT NO.	PAGE NO.	TECH. HOURS	ASST. HOURS	VIEWING: <u>DBL WALL</u>	S. WALL <u>1</u>
SHOP <u>STAMP</u>	OF	OF			TRAVEL HOURS	TOTAL HOURS
FILM INTERPRETER <u>Reed</u>	ASST. NAME <u>Ken Kendall</u>					ASNT LEVEL <u>I</u>
COMPANY REPRESENTATIVE					NDT TECHNICIAN <u>Reed</u>	ASNT LEVEL <u>I</u>

SIGNATURE CERTIFIES TIME & MATERIALS CORRECT

SIGNATURE



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TULSA, OKLAHOMA 74104-3900
918 / 585-3228 • FAX 918 / 584-5598
1 - 800 - 625-9288
www.tulsagammaray.com

CUSTOMER DATA

NAME ACE
ADDRESS _____
PHONE _____ ATTN: _____
W.O. # 0502401-10 P.O. # _____
JOB LOCATION _____
DESCRIPTION Repair MATERIAL TYPE: FE

TECHNIQUE/INSPECTION REPORT

DATE 3-11-05

DAY Fri

DEFECT CODE				ABBREVIATED TERMS			
AB - ARC BURN	HB - HOLLOW BEAD	SLI - SLAG INCLUSION	SOD - SOURCE TO OBJECT DISTANCE	OD - OUTER DIAMETER	REP - REPAIR	RET - RETAKE	
AI - ALIGNED INDICATION	IF - INADEQUATE FUSION	SLL - SLAG LINE	OFD - SOURCE SIDE OF OBJECT TO FILM DISTANCE	WT - WELD THICKNESS	RES - RESHOOT		
BT - BURN THROUGH	IP - INCOMPLETE PENETRATION	SURF - SURFACE INDICATION		WR - WELD REINFORCEMENT	BM - BASE MATERIAL		
CON - CONCAVITY	MA - MISALIGNMENT	UCE - UNDERCUT EXTERNAL					
CRACK - CRACK	POR - POROSITY	UCI - UNDERCUT INTERNAL					

WELD/FILM NUMBER	JOB NUMBER	OD	BM	WR	WT	WITHIN STD'S		# FILM	FILM SIZE / MFG / TYPE	SOD	OFD	IOI 90	# EXP	DEFECT LOCATION
						YES	NO							
1 T-2	N-16	U.S	337	062	399		X	1	3 1/2 X 8 1/2-FS04.5	4.5	399	15	1	IP
2							X							
3 3-T	N-18													IP
4														
5														
6														
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METHOD <u>RT</u>	SOURCE SIZE DIAG. <u>.187</u>	ISOTOPE <u>Ir192</u>	NO. CURIES <u>6921</u>	DEV. TIME <u>9min</u>	DEV. TEMP <u>27°C</u>	DENSITY <u>2.0-4.0</u>
NO. OF WELDS <u>2</u>	FT. LONG SEAMS <u>NA</u>	STANDARDS <u>ASME</u>	NO. OF FILM <u>2</u>	FILM/CASSETTE <u>1/1</u>	EXPOSURE: DBL. WALL <u>X</u> S. WALL <u>X</u>	METER SCREEN <u>2.5 Pb</u>
TRUCK NO. <u>TOR.</u>	REPORT NO. <u>OF</u>	PAGE NO. <u>OF</u>	TECH. HOURS <u>4H</u>	ASST. HOURS	TRAVEL HOURS	TOTAL HOURS
SHOP <u>TOR.</u>	REPORT NO. <u>OF</u>	PAGE NO. <u>OF</u>	TECH. HOURS <u>4H</u>	ASST. HOURS	TRAVEL HOURS	TOTAL HOURS
FILM INTERPRETER <u>Marcel P.</u>	REPORT NO. <u>OF</u>	PAGE NO. <u>OF</u>	TECH. HOURS <u>4H</u>	ASST. HOURS	TRAVEL HOURS	TOTAL HOURS
CUSTOMER REPRESENTATIVE <u>Marcel P.</u>	REPORT NO. <u>OF</u>	PAGE NO. <u>OF</u>	TECH. HOURS <u>4H</u>	ASST. HOURS	TRAVEL HOURS	TOTAL HOURS
SIGNATURE CERTIFIES TIME & MATERIALS CORRECT				SIGNATURE		

OPERATING AND MAINTENANCE INSTRUCTIONS FOR ACE COOLERS**IMPORTANT**

Before start up, check set screws and bolts in the fan assembly and set screws in locking collars of all bearings and sheaves. These items should be checked again several days after start up.

FAN & DRIVE

Although the fan and drive are inspected before shipment, clearance between the fan blades and the fan ring and guard, and alignment of the fan shaft should be checked to assure that rough handling during shipment has not loosened bearing mounting bolts or caused misalignment.

V-belt drives should be adjusted until tight enough to prevent excessive belt slippage. The belt is generally tight enough when it can be twisted one-quarter of a turn with the thumb and fore-finger.

LUBRICATION

Bearings should be greased in accordance with normal maintenance practice. Over-lubrication is the most common cause of bearing failure. In general, about one cubic inch of grease in each bearing every 2 to 3 months is adequate. The operating temperature of the bearing may indicate how much lubrication is required.

Normal temperature may range from "cool to warm to touch" up to a point "too hot to touch for more than a few seconds" depending on bearing size and speed, and surrounding conditions. Unusually high temperature accompanied by excessive leakage of grease indicates too much grease. High temperature with no grease showing at the seals, particularly if the bearing seems noisy, usually indicates too little grease. Normal temperature and slight showing of grease at the seals indicates proper lubrication.

TUBE CLEANING

Operating conditions sometimes cause an accumulation of dirt on the outside fin surface. This can be removed by directing compressed air, or a greaseless solvent followed by a water spray through the fins in a direction opposite the normal air flow. The inside of the tubes will require periodic inspection and cleaning as necessary. Removal of access plugs allows visual inspection, and if necessary, the use of mechanical tube cleaners.

PLUG LEAKS

Should tapered plugs develop leaks, additional tightening is normally all that is required. Thread dope may be used if tightening alone is not sufficient. If shoulder type plugs develop leaks, the gaskets should be replaced. Tapered plugs that are removed for the tube inspection or cleaning should be replaced in the same hole.

TUBE LEAKS

Tube leaks can be of two types: (1) leaks in the tubewall itself (usually corrosion) and (2) leaks in the tube to tubesheet joint. In the first case, it is usually most practical to plug both ends of the tube with the resulting loss in heat transfer surface. When so many tubes have been plugged that performance is affected, retubing will be necessary. If leaks develop in the tube to tubesheet joints, re-rolling of the tube will be required. Care must be used in selection of the proper tube expander for the size and BWG of the tube being used. As with all rolled tube joints, over-rolling must be avoided.

GENERAL

If it is ever necessary to contact our plant for service or replacement parts, it is essential that our serial number or other identifying data be obtained from the metal nameplate attached to the cooler. This is the only way to positively identify the correct parts that may be required.

**AIR COOLED HEAT EXCHANGER
SUGGESTED START UP PROCEDURE**

Before any start up procedure is begun, a thorough inspection of the Air Cooled Exchanger should be made.

- 1.) Be sure all bolted connections are properly tightened.
- 2.) After tube bundle and piping hydrotest, remove hydrotest connections. Be sure tube bundle is properly drained, and if required, dried. Connect process piping and any auxiliary connections.
- 3.) Inspect all process connection, as well as, vent drain, temperature and pressure, or any other auxiliary connections to be sure they are plugged or connected properly.
- 4.) Check mechanical equipment before starting process through the tube bundle(s).
 - a.) Thoroughly check the plenum and fan drive area to be sure all tools and construction materials are removed.
 - b.) Rotate the fan by hand and check fan tip clearance and alignment of belts and sheaves.
 - c.) Check belt tension.
 - d.) Check all fan drive bolts to be sure they are properly tightened. This includes bearing bolts, fan and sheave bushing bolts, set screws, motor bolts and fan blades attachment bolts.
 - e.) If air operated auto-variable pitch fans are used, check for proper pitch with the air off. Fans may go to either minimum or maximum pitch at air failure. Check specifications for requirements. If fan pitch is not satisfactory, set pitch per manufacturer's instructions (see Operation and Maintenance Instructions). If fan pitch is satisfactory, cycle fan through it's range, using plant air and an air regulator.

- f.) If air operated louvers are provided, it is advisable to disconnect the air motor linkage and cycle the louvers by hand to assure there is no binding or obstruction of the louvers blades. If binding occurs, check to be sure louver frames are square. Attaching bolts may have to be loosened and frames shifted to ease binding. If louvers operate smoothly, reconnect air motor. Cycle the air motor, using plant air and an air regulator.
 - g.) If manually adjusted pitch fans are provided, check fan pitch and re-pitch per manufacturer's instructions if required.
 - h.) If manual operated louvers are provided, check for binding of the blades, as in instruction (f). Operate louvers to be sure there is no linkage obstruction or binding.
 - i.) Remove condensate drain plugs, if provided, in electric motors and other electrical components to drain any condensation that might have occurred during storage. If space heaters are furnished in electric motors, louver actuators, controls, etc, activate the space heaters and allow approximately 24 hours before starting equipment.
 - j.) After all the applicable steps previously stated are completed, the mechanical equipment may be cycled.
 - k.) Be sure all personnel and equipment are away from the fan and fan drive area. For safety reasons, equipment guards should be installed. Activate the drive motor and let it reach speed. Check for vibration and excessive noise. If vibration or excessive noise occurs, immediately shut motor down, and check for loose connections or insufficient clearance between moving parts. If the system is running smoothly, replace any guards removed and move to the next drive and repeat above steps.
- 5.) Start the process through the tube bundle(s). Open the inlet valves slowly and let the process "Warm" the bundles slowly. This will allow the components of the tube bundle to expand at the same rate and lessen the thermal shock.



CLASS 1000 FANS

INSTALLATION INSTRUCTIONS

The clevises on the hubs are set at approximately the required angle for the specified fan performance. Install hubs without loosening the clevises. The bushing has been installed and lubricated at the factory. No further lubrication is required. Place the hub/bushing on the shaft with the key in place (preferably bolts will be towards free end of shaft, continue tightening the bolts sequentially until the specified torque of 50 ft-lb (6.9 kg-m) is reached. Do not over tighten the bolts as this could cause damage to the hub.

The bolts holding the clevis to the hub should be torqued to 50 ft-lb (6.9 kg-m). Install blades so they extend straight out from the hub and torque the clevis bolt/nut to 50 ft-lb (6.9 kg-m). The threads on the clevis bolt are supplied from the factory with a lubricant coating. Be sure the lubricant is still present before tightening.

To install the air seal, screw the three aluminum studs into the center hub of the fan and then place the air seal on the studs, use the stainless steel locknuts to secure the air seal in place.

Before starting the fan, manually check all bolts and nuts to see if they are tightened. Take care not to exceed torque limits. Manually rotate the fan while checking each blade for proper clearance. Start the fan and watch it in operation. All blades should move to the same operating position, indicating that the blade angles are properly set and that all blades are equally loaded. After the fan has been operating for several minutes, stop the fan and observe the blades as the fan comes to rest. All of the blades should return to their original position at the same rate. Inspect the inner surface of the fan ring and the blade tips for any indication of scoring. The horsepower given on the fan specifications is the calculated horsepower that is required for specified performance. Consult the factory before increasing the blade angle.

Grease Lubrication Schedule

Link-Belt Ball Bearing Units – Series U300

Lubrication Guidelines for Horizontal Shaft, Grease Lubricated Fan, Blower or Other High Speed Rotating Equipment

Relubrication Interval				6 months	4 months	2 months	1 month
Shaft size range		Amount of grease		Operating speed (RPM)			
Inches	MM	IN ³	CM ³	Up to	Up to	Up to	Up to
$\frac{3}{4}$	20	.15	2.5	4,785	7,520	10,940	14,360
$\frac{7}{8} - \frac{15}{16} - 1$	25	.21	3.4	4,085	6,420	9,340	12,260
$1\frac{1}{8} - 1\frac{3}{16}$	30	.3	4.9	3,620	5,610	8,145	10,860
$1\frac{1}{4} - 1\frac{3}{8} - 1\frac{7}{16}$	35	.44	7.2	3,285	5,095	7,395	9,860
$1\frac{1}{2}$	40	.59	9.7	3,080	4,930	7,190	9,450
$1\frac{5}{8} - 1\frac{11}{16} - 1\frac{3}{4}$	45	.81	13.3	2,640	4,225	6,160	8,100
$1\frac{15}{16}$	50	1.03	16.9	2,310	3,850	5,580	7,315
$2 - 2\frac{1}{8} - 2\frac{3}{16}$	55	1.36	22.3	2,045	3,410	4,945	6,480
$2\frac{1}{4} - 2\frac{7}{16}$	60	1.66	27.2	1,830	2,990	4,320	5,815
$2\frac{11}{16} - 2\frac{3}{4}$	70	2.47	40.5	1,660	2,580	3,865	5,155
$2\frac{15}{16}$	75	2.97	48.7	1,550	2,410	3,620	4,825
$3 - 3\frac{3}{16}$	80	3.58	58.7	1,370	2,225	3,420	4,450
$3\frac{7}{16} - 3\frac{1}{2}$	90	4.84	79.3	1,350	2,025	3,040	4,050
$3\frac{15}{16}$	100	6.54	107.2	1,200	1,885	2,740	3,600

Lubricate with a premium quality NLGI 2 or 3 multi-purpose ball bearing grease having corrosion inhibitors, anti-oxidant additives and mechanical stability for high speed operation. The grease should also have a minimum base oil viscosity of 500 SUS at 100° F and be suitable to operate continuously at 225° F. Do not use a heavy, long fibered grease.

Some suggested greases are:

Mobil Mobilith AW2
Shell Alvania #2 or #3

Gulfcrown No. 2 or 3
Texaco 1939 Premium RB

These units are prelubricated with a multi-purpose Lithium soap grease. When relubricating with greases of different types (especially synthetic soaps or oils) complete flushing is recommended.

The presence of dirt, moisture or chemical fumes around the bearings requires more frequent lubrication. Ambient temperatures below 20° F or above 200° F will require special lubricants. Consult the machinery manufacturer for recommendations.

When vibration exceeds .1 in./sec., frequent lubrication is required and a need for equipment rebalancing is indicated.

Fill bearings with lubricant prior to extended shutdown or storage. Rotate the shaft several revolutions each month during idle periods.

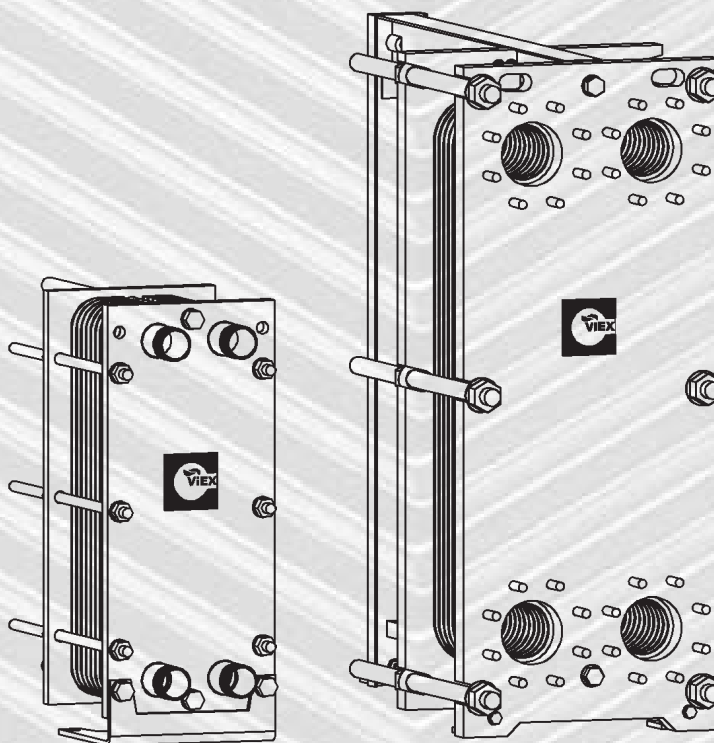
These guidelines are for applications approved by Link-Belt Bearing Operation, Indianapolis, Indiana 46206.





Viexplate® Gasketed Plate Heat Exchangers

INSTALLATION OPERATION and MAINTENANCE MANUAL



Your Right Choice in Heat Exchangers!

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1.1 INTRODUCTION

This manual is intended as your general guide for the proper installation, operation and maintenance of your Viexplate® Gasketed Plate Heat Exchangers. We advise you to study it thoroughly and follow the instructions.

ViEX accepts no responsibility or liability for damage caused by incorrect installation, operation or maintenance due to failure to observe these instructions.

1.2 DESCRIPTION

A Viexplate® Heat Exchanger consists of a plate pack of thin metal plates specially designed to transfer heat from one fluid to another. These thin metal plates are separated and sealed by a set of rubber gaskets that provide the desired distribution of the fluids through the plate pack. The plate pack is installed in a frame, which provides the nozzles for the fluids, and the proper compression of the plates by means of a set of tightening rods.

1.3 FRAME

1.3.1 TYPICAL FRAME COMPONENTS

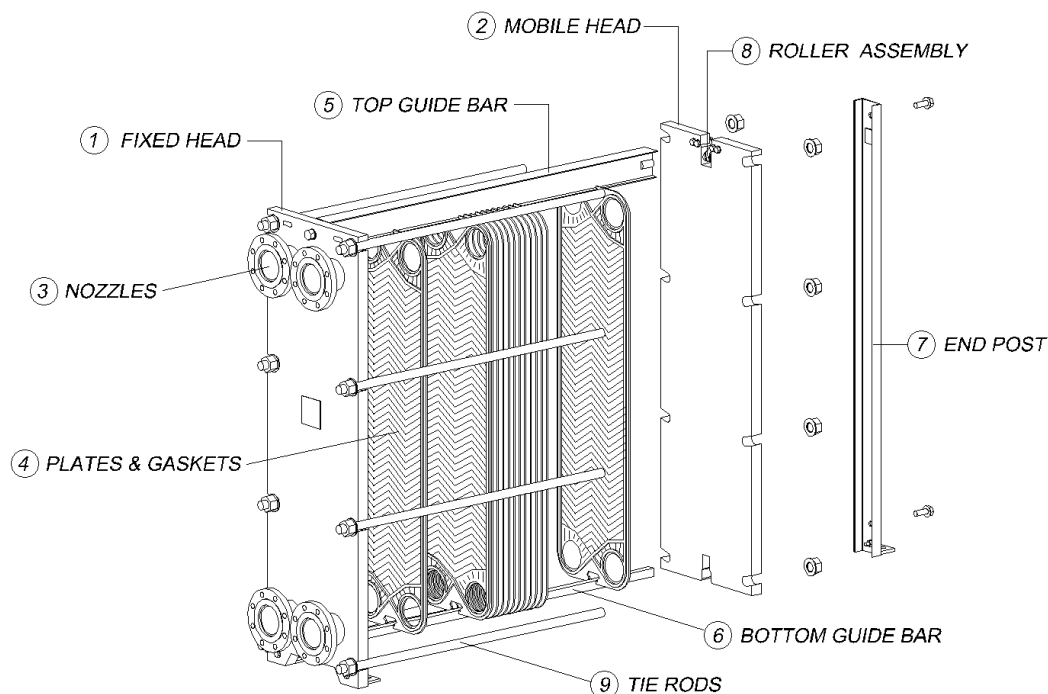


Figure 1.1 Exploded view

(1) Fixed Head and, (2) Mobile Head

Made of thick, rigid, pressure-vessel quality steel plates. They are used to compress the plate pack.

(3) Nozzles

There are three types nozzles :

NPT Nipples: for Model VX20 and smaller, size from 1" to 2 1/2". Rated from Sch40 to Sch80.

Studded ports: for Model VX28 and larger, size to fit 4" ANSI flanges and up, rated from 150# to 300 #.

ANSI flanges: available for all models. Size from 1" ANSI and up, rated from 150# and 300# slip on, lap joint and weld neck.

Standard exchanger consists of one inlet and one outlet for each flow. Special designed exchangers could have more than 4 nozzles with different types on different ports. See section 1.3.3 for nozzle terminology

(4) Plates and Gaskets

See section 1.4 for detail.

(5) Top Guide Bar and (6) Bottom Guide Bar

Attached to the fixed head and the end post. It supports the plate pack and mobile head allowing easy disassembly of the exchanger for maintenance.

(7) End Post

Available on Series FF, FS and FN for full support. Keeps the exchanger in rigid position.

(8) Roller Assembly

Installed on Mobile head of Model VX28 and larger, helping the movement of Mobile Head along Top Guide Bar during assembly of the exchanger.

(9) Tie Rods

Evenly spaced around the periphery of the exchanger to clamp the plate pack between the fixed and mobile head. Hydraulic cylinders may be used for tightening and loosening of the plate pack.

1.3.2 FRAME SERIES

Viexplate® frame types are titled with two or three letters. The first letter indicates the type of footprint, the second letter indicates the type of nozzles and the last letter indicates frame revision number.

The first letter:	F:	With end post
	P:	Without end post
The second letter:	S:	With studded port nozzles
	N:	Threaded nipple nozzles
	F:	With flanged nozzles

The following frame series are available:

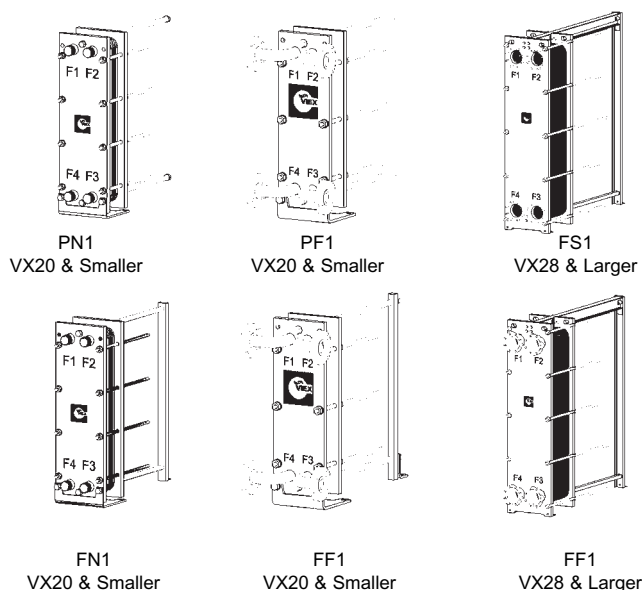


Figure 1.2 Available Frame Series

1.3.3 NOZZLES TERMINOLOGY

The nozzle locations in the frame heads are identified using the following convention of a letter followed by a number:

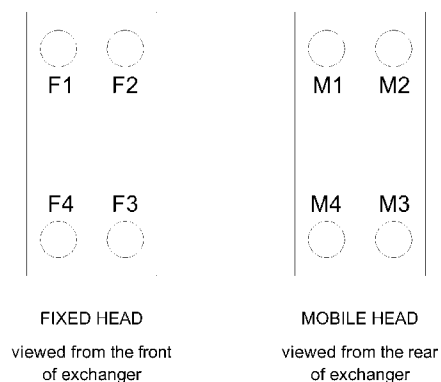


Figure 1.3 Nozzle Terminology

1.4 PLATES & GASKETS

1.4.1 THE PLATE PACK

The General Assembly Drawing, supplied with each Viexplate® Heat Exchanger provides all of the information regarding the composition of your plate pack. However, the following conventional rules must be observed when performing maintenance work to your exchanger.

- All plates have the letters "N" and "S" stamped at opposite ends to assist in orienting them correctly during hanging.
- The plates are referred to as *EVEN PLATE* or *ODD PLATE* depending on the orientation of their gasket with respect to the N and S ends, and the ports that it blocks off.
- ODD and EVEN plates control the orientation of flow of the fluids in the exchanger (See figures 1.7 and 1.8 for details.)
- ODD PLATES (3,5,7,...) by convention are installed with the letter "N" at the top. EVEN PLATES (2, 4, 6,...) are installed with the letter "S" at the top.
- The first, last and pass plates are considered *SPECIAL PLATES* and are installed with the letter "N" at the top.

1.4.2 Plate Corrugation Patterns

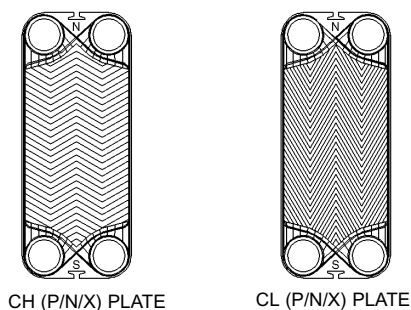


Figure 1.4 Plate Corrugation Patterns

All plates are identified with three letter code. The first two letters identify High Theta (CH), Medium Theta (CM) and Low Theta (CL). The last letter identifies plate gap – process gap (P), narrow gap (N), and mixed gap (X).

1.4.3 TYPES OF GASKETS

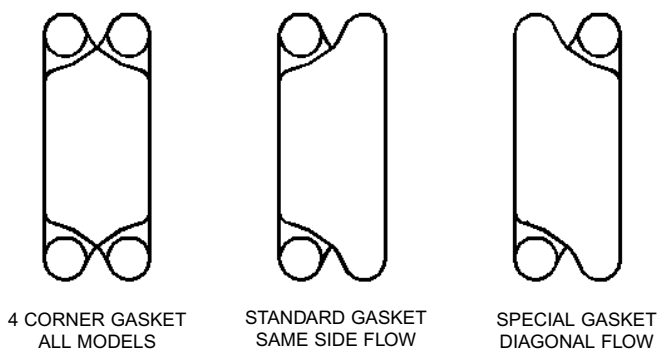


Figure 1.5 Types of Gaskets

NOTES:

- The first plate is equipped with a special 4 CORNER GASKET which isolates the four ports, preventing fluid passage between the first plate and the fixed head.
- All other plates are equipped with standard gaskets.
- Multi-pass units are supplied with one or more port gaskets (Ring gaskets) which are glued in place on the reverse side of the last plate.
- Port gaskets are also used in exchangers with nozzles in the mobile head, such as multi-pass or triple fluid units.
- All gaskets have a double safety feature to prevent fluid intermixing. The isolated port has a double retaining gasket, which forms a leakage chamber. This leakage chamber is connected to the atmosphere by three notches in the gasket. (See Figure 1.6 Below.)

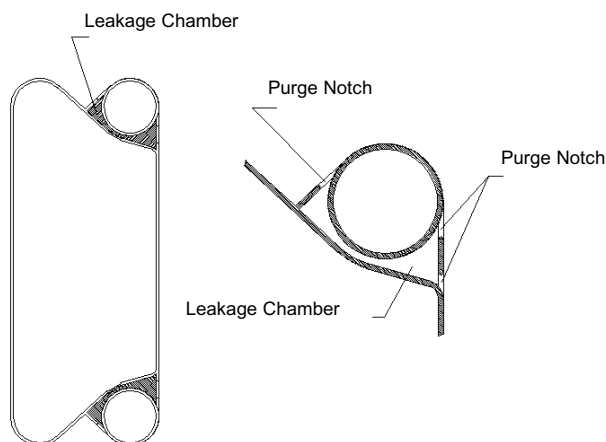


Figure 1.6 Corner Gasket Leakage Chamber

1.4.4 GASKETED PLATES

A standard plate is classified as ODD or EVEN depending on the orientation of the ports isolated by the gasket and the location in the plate pack with reference to the fixed head.

ODD plates mounted "N" side on top.
with port F2 isolated by gasket.

EVEN plates mounted "S" side on top.
with port F1 isolated by gasket.

Model-Same Side Flow: ODD and EVEN plates are physically identical, thus could be interchangeable by hanging in opposite direction. (See figure 1.7 below.)

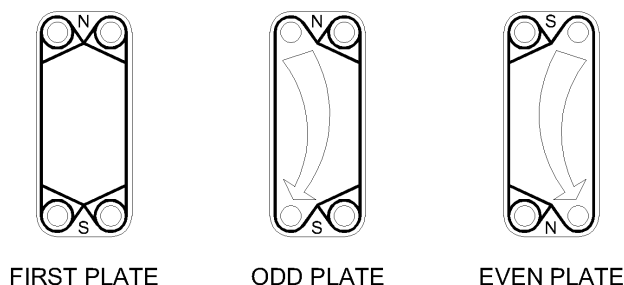


Figure 1.7 - Models Same-Side Flow
- ViEX standard design

Model-Diagonal Flow: ODD and EVEN plates are different from each other and are not interchangeable without replacing the gaskets. (See figure 1.8 below.)

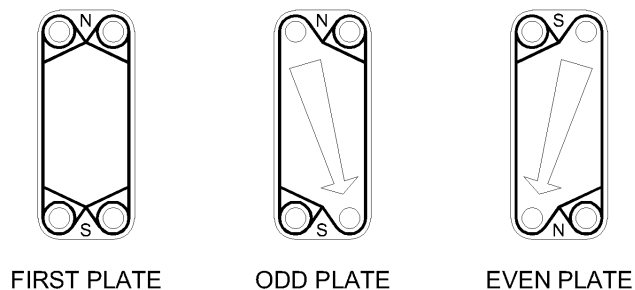


Figure 1.8 Models with Diagonal Flow
- ViEX special designs

1.4.5 SPECIAL PLATES

A standard plate is a plate with four port openings. Plates with any or all ports blanked off are called Special Plates and are designated as such in the heat exchanger drawing.

Plates are named according to the position of their "filled" ports.

(See Figure 1.9 below.)

Examples:

4F = 4 Filled ports
2FN = 2 Filled North
FNW = 1 Filled North-West
2FN FSW = 2 Filled North & 1 Filled South-West

NOTE: Special Plates are typically ODD plates.

Here are the names of the various Special Plates:

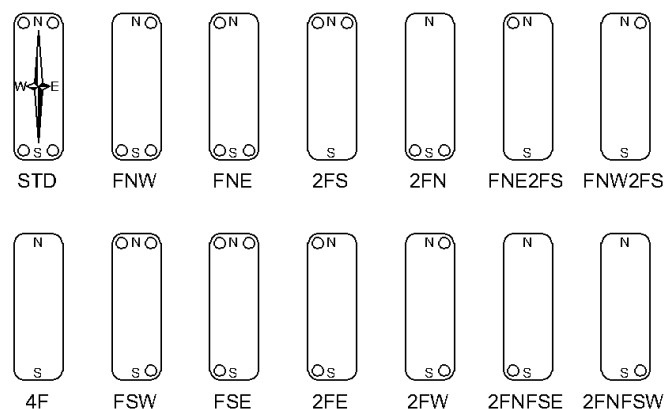
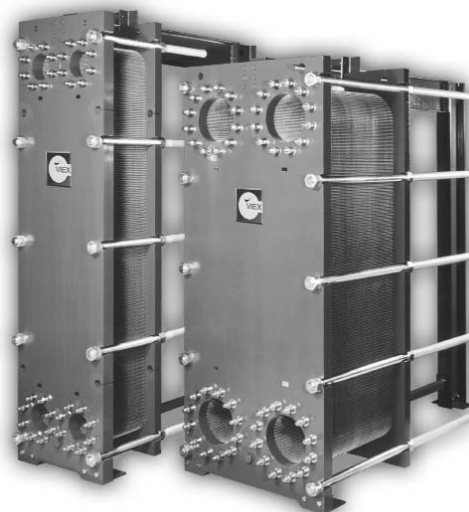


Figure 1.9 Special Plates



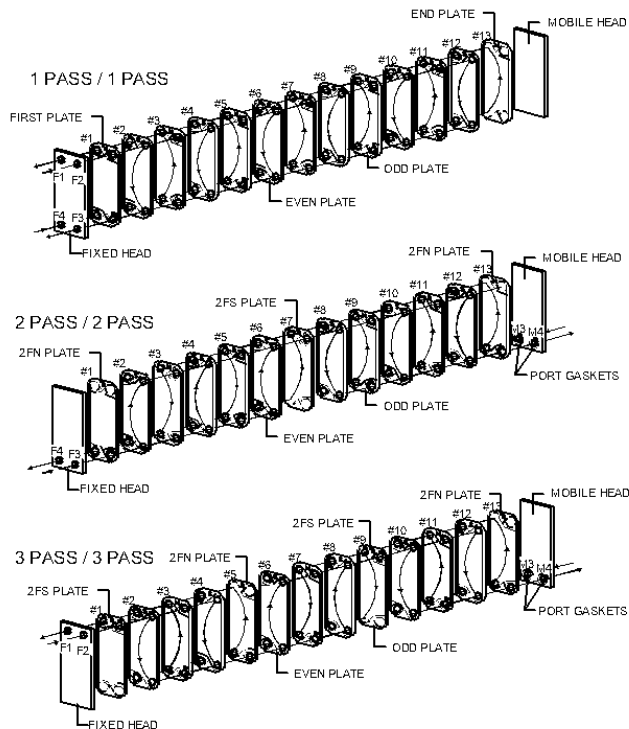
1.4.6 REINFORCED PLATES

Plates with reinforced port areas are provided for units with higher operating/design pressures. This reinforcement consists of a corrugated strip of the same material as the plate which is welded into

the gasket groove, around the section of the port that is not supported by the gasket.

1.4.7 TYPICAL PASS ARRANGEMENTS FOR STANDARD MODELS

ViEX Standard Models

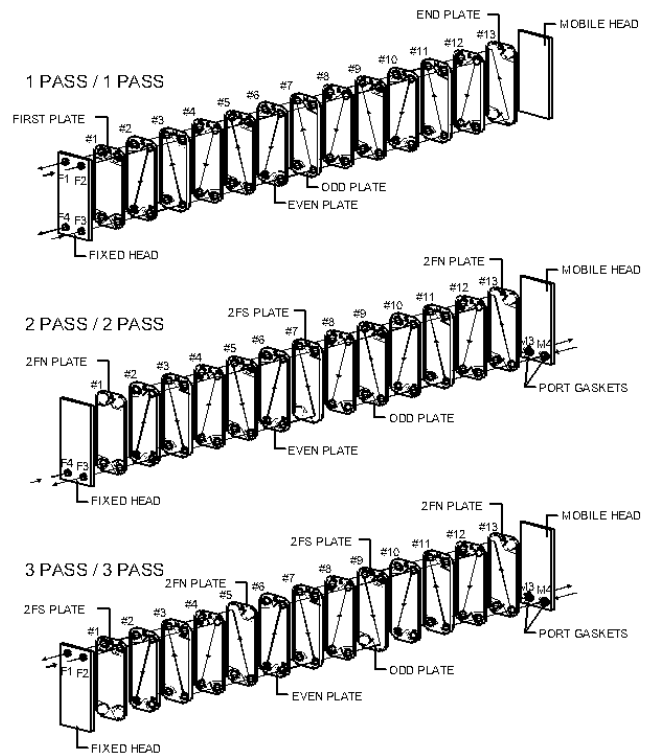


(Same side flow)

Figure 1.10 Typical Pass Arrangements for all Standard Models

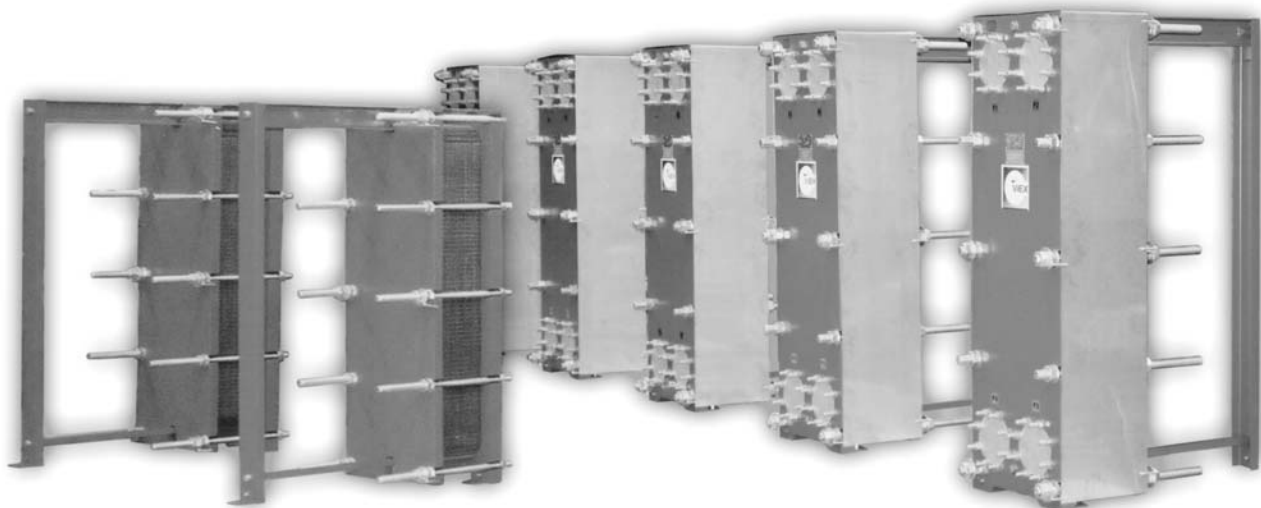
1.4.8 TYPICAL PASS ARRANGEMENTS FOR SPECIAL MODELS

ViEX Special models



(Diagonal Flow)

Figure 1.11 Typical Pass Arrangements for special models



2

INSTALLATION

Viexplate® Heat Exchangers are delivered pre-assembled and tested. They should be rigidly fixed on the floor by means of anchor bolts.

2.1 LIFTING THE PLATE HEAT EXCHANGER

To lift the Viexplate®, use the lifting holes provided in the fixed head and wrap the lifting cable around the upper guide bar next to the mobile head, as shown in figure 2.1 below. Please note that exchangers with shrouds might require the removal of the shroud prior to lifting.

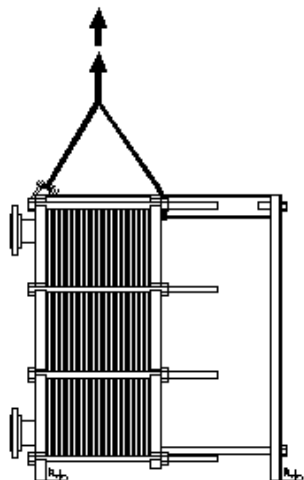


Figure 2.1 Lifting the Plate Heat Exchanger

2.2 DRIP TRAY

A drip tray with a volume capacity of at least the capacity of the heat exchanger is recommended for exchangers operating with corrosive liquids.

2.3 INSTALLATION AND PIPING

The following steps are recommended for the correct installation of the heat exchanger:

- Locate the exchanger in an area not congested by piping or other equipment.
- Provide approximately 3 feet (1 meter) of free space around the exchanger for easy maintenance.

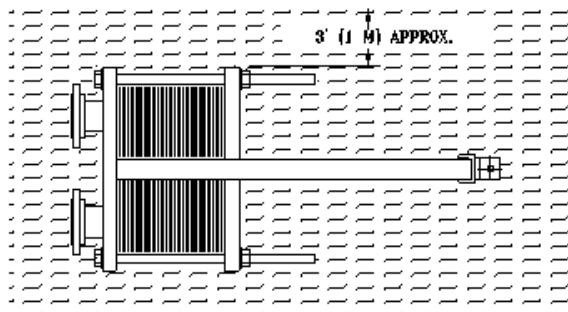


Figure 2.2 - Clearance for Viexplate® Installation

- Ensure that the exchanger is level when installed.
- Ensure flexibility in piping system. Thermal expansion in restricted piping can cause overloading of the heat exchanger nozzles, leading to leakage and/or over-stressing.
- Piping should be adequately supported to minimize misalignment or overloading of the exchanger nozzles.
- Nozzles located at the mobile head must be installed with spool pieces as shown in figure 2.3, to allow the head to move fully backward.

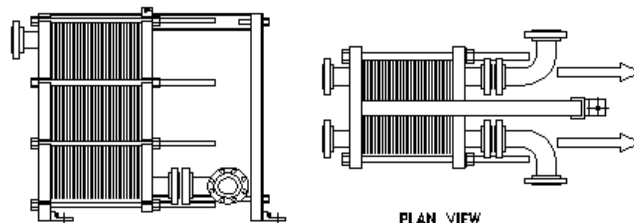


Figure 2.3 Mobile Head Fitted with Spool Nozzles

- Shut-off valves are recommended for all nozzles so that Viexplate® can be shut down and opened without disturbing adjacent systems. Quick action valves should be avoided to prevent water hammer.

CAUTION

Models VX20 and smaller are provided with alloy insert nozzles which are not welded to the frame. The nozzles must be held in position with a wrench when connecting the exchanger to the piping system.

Failure to do so will cause damage to the gasket between the nozzle inner face and the adjacent plate

- Pumps sending fluids to the heat exchanger should be equipped with throttling valves. Where the maximum pump discharge pressure might exceed the maximum working pressure of the exchanger, a safety relief valve should be provided. Pressure control valves (when installed) should be located at the inlets to the exchanger. Positive displacement pumps (especially reciprocating pumps), must be equipped with vibration dampers.

2.4 STORING VIEXPLATE®

If it is necessary to store Viexplate® for a long period of time, before commissioning or after extensive maintenance and decommissioning, the following procedure is recommended.

To avoid deterioration of the gaskets, protect the plate pack from UV radiation by covering it with a dark plastic sheet. Avoid storing Viexplate® in a room with ozone generating equipment, such as electric motors, arc welding, etc.

Apply a coat of rust preventative to all carbon-steel machined surfaces, such as bolts and flange faces.

Cover over nozzles with wooden or metal covers, using rubber gaskets.

2.5 ALLOWABLE NOZZLE LOADS

Care must be taken not to damage the nozzles of a heat exchanger. Damage can occur in a number of common ways that excessively push, pull or twist the nozzles. For example:

- If piping has insufficient play in it (or too much play) it can pull on or push against the nozzle, or twist the nozzle
- Inappropriate use of a wrench on the nozzle can twist the nozzle
- An exchanger may be seriously damaged if its nozzles are used as lifting points, so always use lifting holes and the procedure given in 2.1.

CAUTION

Make sure that the piping system connected to the exchanger is secured to protect Viexplate® against sudden pressure surges and temperature fluctuations

Unless specifically allowed for in your heat exchanger's design, the maximum external nozzle loads should not exceed those given in the following table. Please note that these values apply only to studed-ports and nozzles welded to the frame.

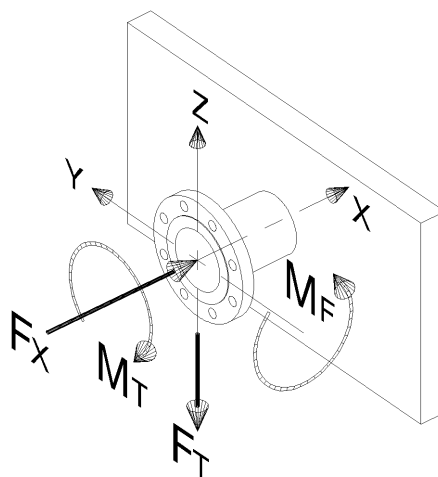


Figure 2.4 Nozzle Loads & References Axes

Nozzle Size		Fx (direct force)		Ft (radial force)		Mt (torision moment)		Mf (bending moment)	
DN	IPS	N	lbf	N	lbf	Nm	Ft lbf	Nm	Ft lbf
50	2"	600	135	600	135	160	120	80	60
65	2½"	750	170	750	170	260	190	130	95
80	3"	1000	225	1000	225	300	220	150	110
100	4"	1400	315	1400	315	740	540	370	270
150	6"	2700	605	2700	605	1600	1180	800	590
200	8"	4400	990	4400	990	4500	3320	2200	1660
250	10"	5800	1300	5800	1300	7600	5600	3800	2800
300	12"	7000	1570	7000	1570	12000	8850	6000	4425
400	16"	8900	2000	8900	2000	20360	15000	10180	7500

N = newton, Nm = newton meters, lbf = pound force, Ft lbf = foot pound force

Fx = resultant direct force on nozzle
Ft = resultant radial force on nozzle

Mt = resultant torsion moment on nozzle
Mf = resultant bending moment on nozzle

TABLE 1 - Maximum Allowable Nozzle Loads

3

OPERATION

3.1 INITIAL OPERATION

- Make sure that the tightening dimension 'a' (distance between the inner faces of the fixed and mobile heads) is within the limits specified in the General Assembly Drawing, otherwise see section 4.2.1 or 4.2.2 of this manual for tightening instructions.

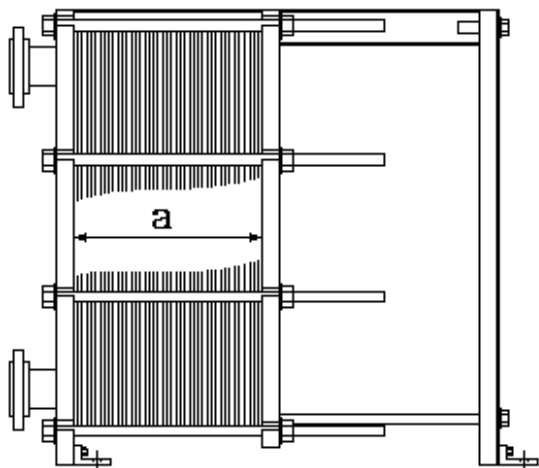


Figure 3.1 - Plate Pack Dimension 'a'

- Before start-up, especially after a long period of stoppage, ensure that the piping system connected to Viexplate® is free of scaling or any other foreign matter that will clog the plate pack. The exchanger will act as a filter for solid particles of any considerable size.
- Make sure that all nozzles are properly fastened.
- Ensure that your system set up is within the heat exchanger's design limits for temperature and pressure as allowed by the nameplate.

3.2 START-UP

To start up the heat exchanger, follow steps 'a' to 'f'. Begin with the circuit with the least severe operating conditions, and then repeat the procedure for the second circuit. (Steam should always be turned on last.)

- Close the feed valve between the pump and Viexplate®.
- Fully open the shut-off valve at the outlet (if one was installed).
- Open the vent valve.
- Start the pump.
- Slowly open the feed valve.
- Close the vent valve when all air has been removed.

NOTE FOR STEAM APPLICATIONS:

- The steam must be turned on last and off first. Do not leave the steam on with the liquid side turned off.
- Sudden opening and closing of the valves may deform plates to the point of being nonserviceable. Valves must be set to open gradually.
- Start-up and shut down must be controlled to protect the exchanger from shocks. The amount of heating or cooling should be controlled using throttling valves in conjunction with the process thermometers.

3.3 SHUT DOWN

3.3.1 BRIEF STOPPAGE

If Viexplate® is to be shutdown for a short period of time, such as for inspection, service or pump stoppage, proceed as follows:

- Slowly close the feed valves, starting with the most severe circuit
- Switch off the pumps.
- Close the valves at the outlet nozzles.

3.3.2 PROLONGED STOPPAGES

For long term stoppages of one month or longer, proceed as above and follow the additional recommendations below:

- Vent and drain Viexplate®
- Flush the plate pack and perform the appropriate cleaning procedure. Beware of any residual chlorine, either from the process fluids or the rinse water, since this can cause pitting of the plates.
- Slacken the plate pack by 10 to 20% of the existing dimension 'a': ($a + 10$ to 20%).
- Refer to section 2.4 of this manual, Storing Viexplate®.

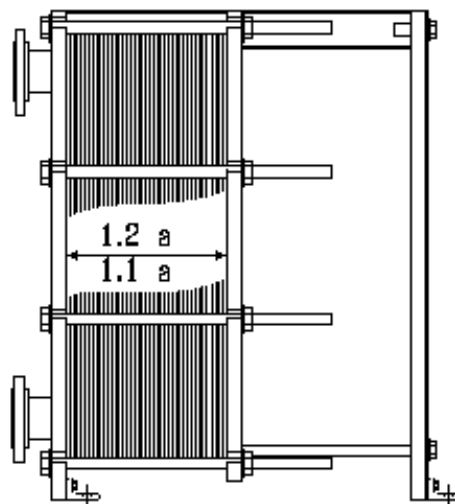


Figure 3.2 Slackening the Plate Pack for Storage

CAUTION

When re-starting Viexplate®, make sure to re-tighten the plate pack to the 'a'-dimension and proceed as per INITIAL OPERATION, and START-UP.

4

MAINTENANCE

4.1 OPENING VIEXPLATE®

Prior to opening Viexplate®, proceed as follows

- Shut-down as per instructions in 3.3
- Disconnect any nozzles on the mobile head.
- Clean the exposed section of the upper guide bar, to allow easy movement of the plates
- Clean the mobile head roller so that it can move easily
- Clean and lubricate the tightening rod threads
- Record the current tightening dimension 'a'.
- Paint a diagonal line across the side of the plate pack to facilitate the correct sequencing on re-assembly.

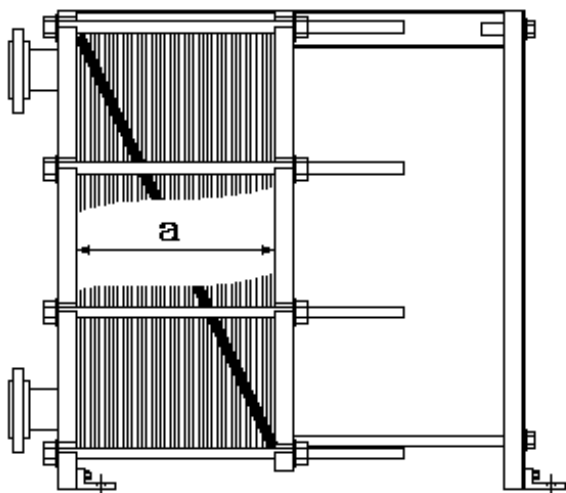


Figure 4.1 Paint a diagonal line across the Plate Pack

4.1.1 MANUAL OPENING

- Release the tension on the tie rods in a diagonal pattern, alternating sides (e.g. top right followed by bottom left). Loosen each nut by only 1/4" to 1/2", and no more. It's important that the heads remain parallel to avoid damaging (crushing) the plates between them.
- When all tie rods have been fully loosened, they may be removed. Push the Mobile Head fully away from the plate pack, up against the end post.
- Remove the plates one by one and place on a flat surface.

4.1.2 HYDRAULIC OPENING

- With a wrench, loosen the hexagonal nuts (Item J, Figure 4.2) from the two pairs of tie rods (Item O) in positions 2 & 5 (also shown in Figure 4.2)
- Loosen the four nuts (Item J) to a length corresponding to the opened length of the hydraulic cylinder.
- Push the four tie rods (Item O) forward toward the fixed head.
- Mount the four hydraulic cylinders with rams extended to 6 mm (1/4") less than their full length of travel.
- Put all cylinders under pressure. This will tighten the plate pack slightly, by about 6 mm (1/4").
- Hold cylinders under pressure and remove the pair of tie rods in positions 3 & 4.
- Loosen the nuts (Item J), by ('Y' minus 6 mm (1/4")) on the remaining pair of tie rods in positions 1 & 6. The Y dimension represents the hydraulic ram travel distance (typically either 100 mm (4") or 150 mm (6")).
- Release the pressure from the cylinders and allow the plate pack to expand against tie rod pairs in positions 1 & 6.
- Repeat the above operations until the plate pack is fully opened
- The gaskets sometimes stick to the adjacent plate. In this case use a plastic or wooden wedge to carefully pry the plates apart.

DO NOT USE A SCREW DRIVER OR ANY METAL OBJECT.

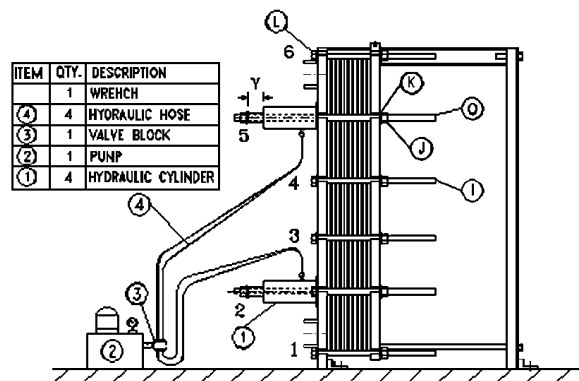
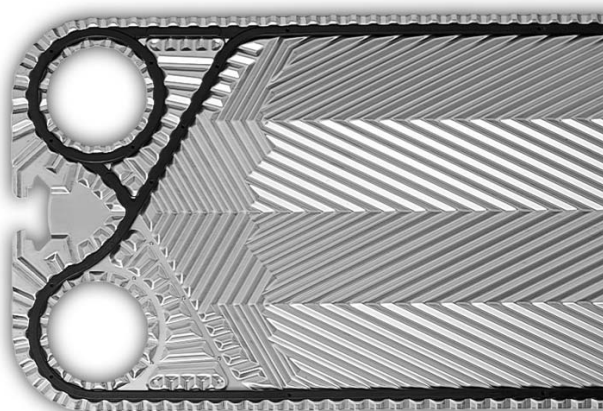


Figure 4.2 - Hydraulic Opening of Viexplate®



CAUTION

The plates have sharp edges.
Wear safety gloves when handling plates.

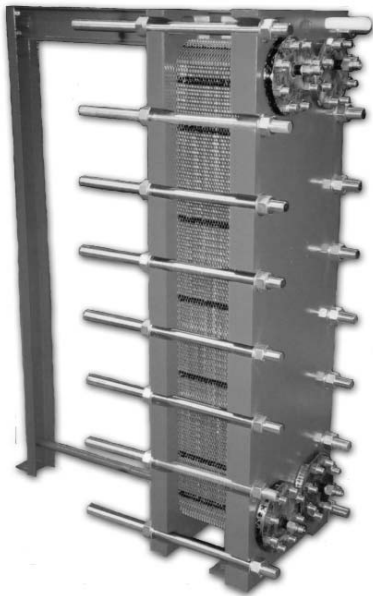
4.2 CLOSING VIEXPLATE®

Prior to closing Viexplate®

- Make sure that the plates and gaskets are free of foreign matter or contaminants. If necessary clean with a soft cloth or brush.
- Clean the guide bars to ensure easy movement of the plates when installing and tightening.
- Install all plates in the correct sequence in accordance with the general assembly drawing. The diagonal line painted on the plate pack side must reappear unbroken.

NOTE:

- When closing plate packs with a very large number of plates (300+), allow the plate pack to relax for at least one hour after every 4 to 6 inches of displacement for the last 12" of tightening. This will help to prevent deformation of the plates closest to the covers by distributing the thrust force more evenly along the plates and gaskets. This is particularly important for plates made of softer metals.
- If Viexplate® does not seal at the recorded tightening dimension 'a', further tightening is allowed. However, the following rule must be observed:



4.2.1 MANUAL CLOSING

- Push the mobile head into contact with the plate pack.
- For large units select and install a minimum of 50% of the tie rods, evenly distributed in the frame.
- Tighten the plate pack using diagonally opposite tie rod pairs, in a sequence similar to that given in Figure 4.3 below. Ensure during closing that the fixed and mobile heads are kept parallel to each other to within 1/4" to 1/2".
- Install and tighten the remaining tie rods and ensure that all tie rods are under tension.

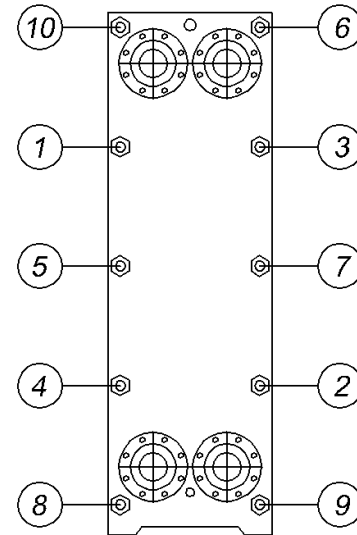


Figure 4.3 Example of Manual Tightening Sequence

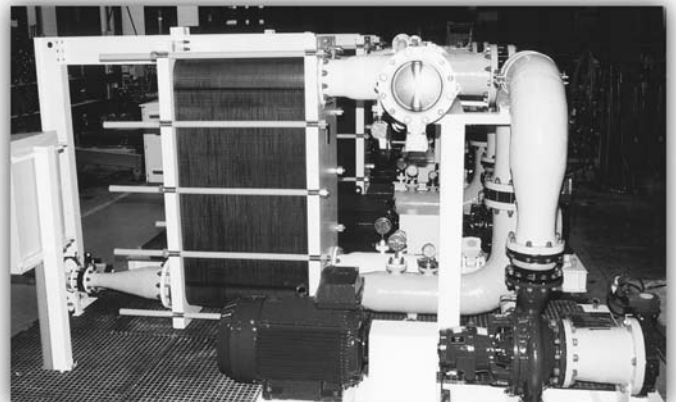
- If old gaskets are still used, the tightening dimension should be between the recorded dimension 'a' and the minimum tightening dimension indicated in the General Assembly Drawing (provided that the number of plates remains as per the original design). If new gaskets have been applied, then the tightening dimension should be between the minimum and maximum values specified on the General Assembly Drawing.
- After final tightening, the fixed and mobile heads must be parallel to within 1/16" in all directions, to ensure proper plate pack alignment.
- The unit is now ready for hydrotest.

CAUTION

Never tighten Viexplate® while it is under pressure.

CAUTION

Never tighten the plate pack to a dimension smaller than the minimum indicated in the General Assembly Drawing (or as advised by ViEX when the number of plates has been modified.) Failure to observe this rule could result in permanent damage to the plates.



4.2.2 HYDRAULIC CLOSING

1. Push the mobile head into contact with the plate pack.
2. Install the four tie rods (Item 0, Figure 4.2) and adjust them so that they project at least 18" out from the face of the fixed head, to allow installation of the hydraulic cylinders.
3. Mount the four hydraulic cylinders (fully closed) at the fixed-head end.
4. Install the nuts (Item L, Figure 4.2).
5. Activate the hydraulic pump and allow the cylinders to tighten the plate pack.
6. Shut off the hydraulic pump, maintaining the cylinders under pressure.
7. Install the remaining tie rods and tighten them by hand.
8. Release the pressure from the hydraulic cylinders. When rams have fully retracted from the nuts, tighten the nuts against the mobile head.
9. Re-activate the hydraulic pump and repeat the procedure until the required tightening dimension is reached. If old gaskets are still used, the tightening dimension should be between the recorded dimension 'a' and the minimum tightening dimension indicated in the General Assembly Drawing (provided that the number of plates remains as per the original design). If new gaskets have been applied, then the tightening dimension should be no larger than the maximum specified on the General Assembly Drawing, and no smaller than the minimum specified.
10. Finish tightening the tie rod nuts (Items L or J) with a wrench. The fixed and mobile heads must be parallel to within 1/16" in all directions, to ensure proper plate pack alignment.
11. Remove the hydraulic cylinders and tighten the four remaining tie rods.
12. The unit is ready for hydrotest.

4.3 RE-GASKETING

ViEX gasketed plate heat exchangers, depending on model and materials of construction, are available with glued or glueless gasketing systems. Please consult the general assembly drawing of your unit to verify the gasketing system used.

NOTE:

When replacing a significant number of gaskets, consider replacing the entire set. The sealing properties of gaskets under compression diminish over time, and this determines the amount of tightening that will need to be applied to the plate pack when closing the exchanger. Mixing of old and new gaskets, therefore, will cause over-compression of the new gaskets, severely reducing their service life.

4.3.1 GASKET GLUING

When gaskets are supplied loose for on-site installation, the plates must be properly cleaned and prepared, and the gaskets attached to the plates according to the following instructions:

a) PLATE PREPARATION:

Old gaskets and glue must be completely removed. If the removal of the gasket proves difficult, use a hot air gun to heat the gasket groove from the back of the plate. As the adhesive softens, pull the gasket off with pliers. As an alternative, the plates may be dipped in liquid nitrogen and then knocked; the gaskets should crumble off.

The gasket groove must be completely clean. Any remaining traces of old adhesive should be removed by rubbing with a non-abrasive cloth. If solid particles remain in the gasket groove, remove them carefully with an abrasive cloth.

b) GLUING THE GASKETS

We recommend for cold gluing, the use of 3M's 3MEC1099 adhesive or its equivalent (glue can be 1 or 2 parts).

CAUTION

Care must be taken not to scratch the gasket groove or leaks may develop underneath the gasket.

NOTE:

For best results, carefully follow the manufacturer's instructions for the glue that you select.

- Prior to gluing, review section 1.4.3 of this manual for a good understanding of the ViEX gasket terminology, e.g. 4 corner gasket (4 Cr), and the standard gasket in odd or even position.
- Perform a visual inspection and make sure that the gasket grooves are clean, and dry, and that there is no visible damage to the gasket groove.
- Roughen the side of the gasket to be glued with an emery cloth or sand paper. Do not roughen the reverse side of the gasket.

NOTE:

- a) Do not roughen fibre gaskets.
 - b) For models using gaskets that have one side flat and one curved, the flat side is to be glued against the plate.
- Glue should be applied evenly in the plate's gasket groove with a tube, glue gun or small, round pure bristle brush.
 - Use a minimum amount of glue, evenly applied over the entire gasket groove and roughened side of the gasket.
 - Allow the glue to dry for about 5 to 10 minutes (refer to manufacturer's instructions). When the glue is tacky, carefully line up the gasket with the groove and press the gasket into place.
 - Do not force or stretch the gaskets.
 - To ensure proper seating, tap the gasket lightly into place with a soft faced mallet.
 - Glue must be completely dry before the plate pack is placed into service.
 - Stack the plates horizontally on a support that assures that the plates are centered. Ensure that the gaskets remain in the grooves.
 - Place a uniform weight on the top plate and allow the pack to sit and dry per the manufacturer's instructions.

CAUTION

Glue must be compatible with both the plate material and the gasket material. If in doubt, consult the glue manufacturer

4.3.2 GLUELESS GASKET REPLACEMENT

ViEX glueless gasket systems allows gasket to be snapped in place in the grooves on the plate perimeter.

Please contact your nearest ViEX office or representative for additional instructions, if required.

4.3.3 STORING SPARE GASKETS AND GLUE

It is recommended that spare gaskets be readily available for each heat exchanger. As a guideline for two years of operation, stock 10% of the total number of gaskets. Stock a complete set of gaskets if they are of special materials with long lead times.

Gaskets should be stored in an area sheltered from any sources of ultra violet light, such as fluorescent lights, or ozone generating equipment such as electric motors. Normal shelf-life for gaskets is about three years, but exposure can lead to premature deterioration. When storing in exposed areas, wrapping the gaskets in dark plastic is recommended.

Storage temperature should be maintained between 32 °F (0 °C) and room temperature to ensure ease of handling the gaskets. Whenever gaskets have been exposed to temperatures lower than recommended, they should be warmed to room temperature before handling.

Whenever practical, the gaskets should be stored flat. Large gaskets may be stored lightly folded in half, as long as any sharp bends are avoided, since these will cause the gaskets to crack.

It is advisable to stock glue for emergency repairs. The glue should be stored as per the glue manufacturer's instructions. (The average shelf life of glue is 6 months.)

4.4 PLATE MOUNTING

Refer to the General Assembly Drawing provided with your unit for the proper sequencing of the plates. The diagonal line in Figure 4.1 (if painted prior to disassembly) must reappear at the side of the plate pack as the plates are hung on the frame.

4.5 HANGING THE PLATES ON THE FRAME

Proper handling during hanging of the plates on the frame is very important to protect the integrity of the plates. Proceed with the following steps, referring to Figure 4.4:

- a) Put plate in position 1 and hook it onto upper guide bar.



- b) Hold up the bottom of the plate so that it will clear the lower guide bar, and rotate the plate around the upper guide bar into position 2.
- c) Lower the bottom of the plate over the lower guide bar, to a vertical position 3.
- d) Slide plate toward the stationary head, against plates already installed.

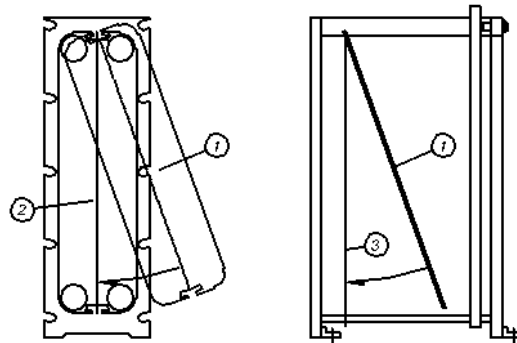


Figure 4.4 - Hanging the Plates

The plates must be correctly positioned on the guide bars in order to achieve proper alignment of the plate pack (See figure 4.5 below).

If before or during tightening the plate-pack appears misaligned at the sides or in the port holes, re-check and correct the positioning of each plate.

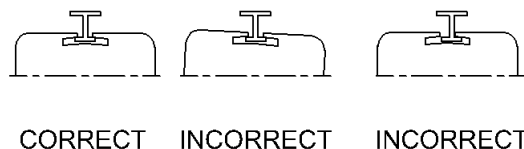


Figure 4.5- Correct position of plates

4.6 HYDROSTATIC TESTING

After each disassembly, it is necessary to perform a hydrostatic test to the pressures indicated on the nameplate.

New units are hydrostatically tested separately on each circuit to the pressures indicated on the nameplate. (i.e., 1 circuit under pressure and the other open to the atmosphere).

Hydrostatic tests are performed to detect gasket leaks. Leaks from gaskets would appear either at the side of a plate pack or at drainage points (near nozzle). Gasket leaks always drain to the outside. It is not possible for one fluid to enter the opposite circuit due to gasket failure. To simplify repairs, the location of a leak should be marked prior to disassembly of the plate pack.

Hydrostatic testing of one circuit (i.e. A) enables detection of defective plates. A hole in a plate would allow leakage between circuits. This is visible by water draining into the open circuit (B). When the plate pack is opened, the defective plate would be 1 of the 2 which are wet on circuit B, which was open to the atmosphere.

Note: All tie rods must be in place and properly tightened before a hydrostatic test is made.

The need to clean the heat exchanger and the method to be employed will depend on the type of fouling associated with each particular application.

Accumulation of deposits inside the plate pack will reduce the heat transfer rate and may cause excessive pressure drops through the system. Therefore it is extremely important to establish:

- a) the appropriate cleaning frequency
- b) the method of cleaning, and
- c) the suitable cleaning chemical solution (if required) to dissolve the hard deposits but not damage the plates or gaskets.

5.1 HOW TO MINIMIZE FOULING

5.1.1 PERIODIC FLOW-RATE INCREASES

One of the factors that determine the rate of fouling of the plates is the velocity of the fluids through the plate pack. It is recommended, especially for low fluid velocities, to increase the velocity at regular intervals, if possible. This will slow down the fouling process since the increased turbulence will remove some of the loose scale deposits from the heat transfer surfaces.

Typical intervals and duration of this preventive cleaning practice is four to six hours, every two to three weeks.

5.1.2 FILTRATION

Viexplate's® should not be used as a filter for process fluids. Viexplate® design is specifically suited to clean fluids, and can become clogged by fibers or particulate matter. Filtration is advisable when solids are present in the fluids. Two options are available, the use of external filters connected in series with Viexplate®, and also integral filters fitted within the ports of Viexplate®.

For more information on filters, consult your nearest ViEX office.

CAUTION

Ensure that the cleaning fluid is compatible with the plate and gasket materials. Your cleaning solution supplier should be contacted for recommendations.

5.2 CLEANING WITHOUT OPENING VIEXPLATE®

5.2.1 BACK-FLUSHING METHOD

This method is recommended for fluids containing coarse particles such as fibres and debris that might accumulate in the port areas and distribution zones on the plates.

By briefly reversing the flow direction of the fluid these particles can be removed and carried away from the exchanger. A special piping configuration is required for this method. (Contact your nearest ViEX office for advice.)

5.2.2 CLEANING-IN-PLACE (CIP) METHOD

This method is recommended for high fouling processes where frequent cleaning is required. It is especially recommended where highly corrosive fluids are handled.

CIP PROCEDURE:

1. Drain both sides of the exchanger and flush the process circuit with cold water. If the cooling media contains common salt solutions, make sure that both circuits are well flushed with cold water before any cleaning operation.
2. Flush both sides of the exchanger with warm water 100-120 °F, 38-49 °C), until the effluent water is clear and free of process fluids.
3. Optionally, the plate pack tightening may be relaxed to about 3/16" (5 mm) per each 100 plates. This will relieve and allow the cleaning of the gaskets as dripping will occur. Make sure to record the actual distance "a" between heads prior to any loosening of the plate pack.
4. The choice of cleaning solution, the temperature and duration of cleaning procedure will depend on the type of deposits to be removed and must be compatible with the plate and gasket materials. Confirmation of material compatibility should be obtained from the cleaning fluid supplier.
5. When mixing the cleaning solution, use chloride free, or low chloride water, with a low hardness value. Concentrated cleaning solution must be added to the water before circulation begins.

CAUTION

Never inject chemicals while CIP is in process.

6. It is recommended to pump the cleaning solution at flow-rates of up to 1.5 times the normal working flow-rate, where possible, without exceeding reasonable nozzle velocity (e.g. Carbon Steel nozzles: 15 ft/sec, or lined nozzles: 25 ft/sec). If possible, the cleaning solution should be pumped in the opposite direction to the normal flow. This will provide the advantages of back-flushing.
7. For units with high working flow-rates it might be difficult to attain high CIP flow-rates. In such cases, a solution capable of dissolving the deposits at lower circulating flow-rates should be used and/or the duration of the CIP process must be appropriately extended.
8. Centrifugal pumps should be used for circulating the cleaning solution. The flow-rate and operating pressure of the cleaning solution must be reached gradually to avoid pressure shocks that might result in gasket or plate damage.

CAUTION

When mixing acid and water, always add acid to water. Do not use hydrochloric acid for cleaning stainless steel plates. The edges of plates are sharp. Wear safety gloves when handling them. Caustic soda and concentrated nitric acid can cause serious injuries to skin and mucous membrane. When handling these substances, always use protective goggles and rubber gloves.

9. After the cleaning solution has been circulated, the exchanger and the adjacent piping must be flushed with clean water.
10. If the plate pack tightening has been relaxed, re-tighten to the recorded dimension 'a' before bringing the exchanger back on line.

CIP FOR REMOVAL OF LIME SCALE AND SIMILAR DEPOSITS.

One common type of fouling is the precipitation of calcium compound from cooling water and other sources.

- a) Proceed as per the applicable instructions, circulating a solution of 2 to 3% phosphoric acid solution at 70°F (20°C) for two hours.
- b) Flush with cold water until the cleaning solution has been completely removed from the plate pack.

5.3 CLEANING THE OPEN HEAT EXCHANGER

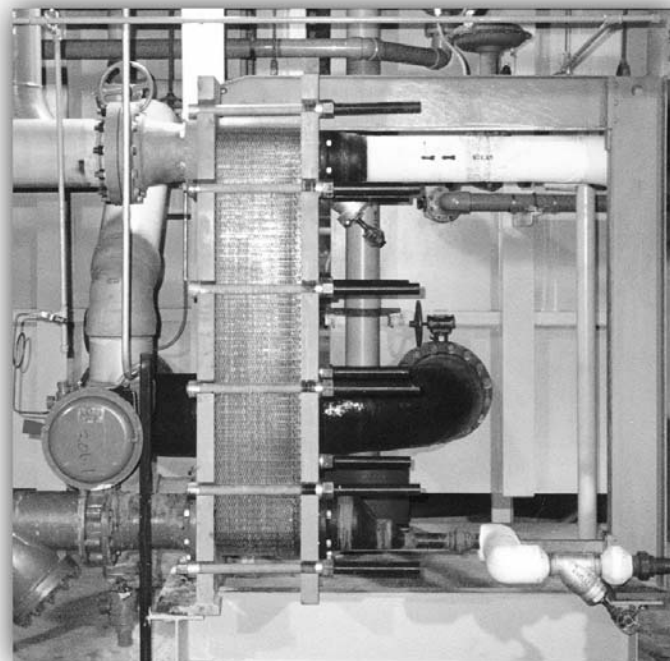
Although CIP is a very efficient way of maintaining the heat exchanger in good operating order, it is sometimes necessary to dismantle the unit for cleaning.

For manual cleaning of the plates proceed as follows:

1. Open Viexplate® as indicated in section 4.1 of this manual.
2. Slide plates apart to allow cleaning by brush or water rinsing.
3. For cleaning with high-pressure water jet, it is recommended to lay the plates flat on a firm surface to avoid damage. To avoid dislodging of gaskets, always direct the water jet at right angles to the gasket face.
4. NEVER use a steel brush or steel wool on the plates. If required, a fibre brush should be used.
5. Be careful not to scratch the gasket surfaces.
6. After brushing rinse well with water and wipe dry.
7. After completion of manual cleaning and careful inspection of all components, proceed to assemble the unit as per section 4.2 of this manual.

TO REMOVE HARD DEPOSITS SUCH AS CALCIUM COMPOUNDS, OXIDE OR CARBONATE DEPOSITS:

- a) Prepare a solution of 10% nitric acid:
1 part volume: 65 % HNO₃ (specific weight 1.4)
9 parts volume: water
- b) Apply the cleaning solution to the plates and let stand for 10 minutes. Brush and rinse with water. If necessary, repeat this operation several times.
- c) Neutralize with a diluted caustic solution followed by a thorough rinse with water.



CAUTION

Closely follow the safety recommendations from the cleaning agent manufacturer.

6 TROUBLE SHOOTING

This section will assist users in trouble shooting problems that arise with the heat exchanger. This table is meant to serve as a guide only. If further assistance is required please contact ViEX.

Symptom 1: **External leakage between plate pack and fixed head or mobile head**

Possible Causes:

- Gasket failure (most common cause)

Finding The Problem:

- Mark the point where the leak occurs.
- Open Viexplate® (see page 8)
- Examine the condition of the gasket and plate alignment

Corrective Action:

- Defective gaskets: Defective gaskets must be replaced.

Remarks:

- When a significant number of gaskets need replacement, it is recommended that a complete new gasket set be installed. This will result in easy sealing and will ensure longest operating life.

Possible Causes (2):

- Nozzle liner failure (rare)

Finding The Problem:

- If the gasket appears to be in good condition, check nozzle liner for any visible cracks or perform a dye penetrant test to locate failure.

Corrective Action:

- Tig weld the crack in the liner if accessible. If not accessible, the liner must be replaced.
- Contact Viex for advice.

Symptom 2: **External leakage between nozzle and fixed or mobile head**

Possible Causes:

- Nozzle liner failure

Finding The Problem:

- Check nozzle bolting tension, piping alignment, etc. to make sure piping loads are not causing the leak.
- If the leak persists, disconnect flange, examine nozzle gasket and replace if necessary.
- If the nozzle gasket is found in good condition, open exchanger and check nozzle liner for any visible cracks or perform a dye-penetrant test to locate failure.

Corrective Action:

- Tig weld the crack in the liner if accessible. If not accessible, the liner must be replaced.
- Contact ViEX for advice.

Symptom 3: **External leakage between plates**

Possible Causes:

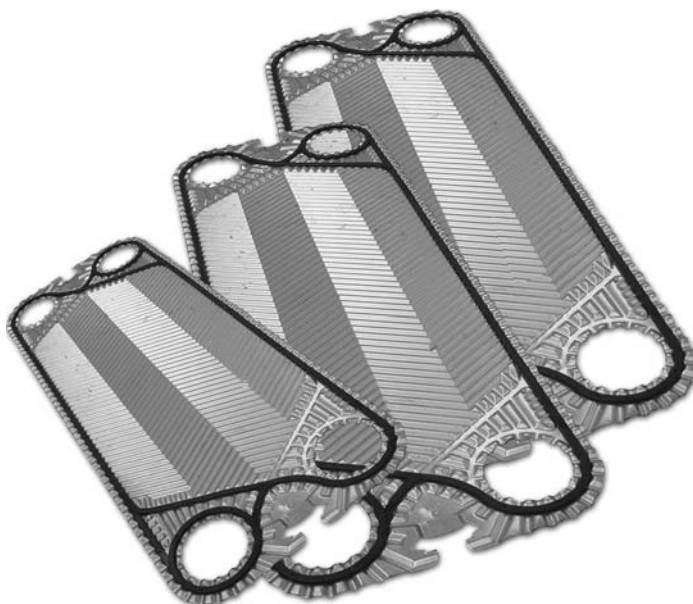
- Extremely high pressure and/or temperature
- Incorrect tightening dimension
- Gasket failure

Finding The Problem:

- Check the operating pressure.
- Check tightening dimension and alignment of heads.
- If pressure is within limits and tightening dimension is correct, leak is due to gasket failure.

Corrective Action:

- Restore pressure and temperature to within acceptable levels.
- Re-tighten plate pack, see page 10 of this manual.
- Open the plate pack, see page 8 of the manual and replace the damaged gaskets.
- Alternatively, remove the plates containing the damaged gasket.
- Close the plate pack. Make sure to obtain the new tightening dimension if any plates have been removed.



Symptom 4:

Internal leakage (Cross Leak)

Possible Causes:

- Hole in plate

Finding The Problem:

- Shut the exchanger down (See page 7) of the manual and drain both sides.
- Disconnect the nozzles of one circuit and apply a slight water pressure to the other circuit.
- By looking into the open circuit, it is possible to locate the approximate location of the leak.
- Open Viexplate® (see page 8)
- Pinpoint the leaking plate(s) by:
 1. Visual inspection of gaskets and plates close to the leak. Look for cracks, pin holes, discoloration of the plate, etc.
 2. Holding the plate against the light might reveal cracks or pin holes in the plate.
 3. Dye penetrant test: Spray the back side of the plate with the dye-penetrant liquid and the other side with the developer. Cracks will be visible after 5-10 minutes.

Corrective Action:

- Replace any defective plates.

Remarks:

- If the failure is due to corrosion, inspect all plates since corrosion will occur normally along the entire plate pack.

Symptom 5:

Extremely low thermal performance and very high pressure drop

Possible Causes:

- Channel throat blocked with debris
- Blocked channels
- Plates installed incorrectly

Finding The Problem:

These conditions typically cause high pressure drops or low flow rates.

- Accurately measure the inlet and pressures as close as possible to the exchanger.
- Compare recorded values to the design values.

Corrective Action:

- If accumulation of debris inside the port and throat areas is suspected, back-flushing at high flow-rate is recommended.
- If back-flushing is not possible or does not solve the problem, the blocking particles might be lodged in the channels. Open the unit and remove debris.

Remarks:

- If problem is not identified, contact ViEX for assistance.

Symptom 6:

Impaired performance associated with heat transfer decline

Possible Causes:

- Fouling
- Actual physical properties of fluids different from those of design
- Lower flow-rates
- Presence of non-condensable gases
- Steam condensate flooding the channels.

Finding The Problem:

- Accurately measure the inlet and outlet temperatures and pressures as close as possible to the exchanger.
- Accurately measure the flow-rates.
- Compare recorded values to the design values.
- Confirm the physical properties of the fluids.

Corrective Action:

- If the heat transfer decline is due to fouling, clean the heat exchanger according to an appropriate method.
- If low performance is due to different physical properties or low operating flow rates, contact ViEX for advice.
- If the problem is caused by flooding of the plates, the steam traps/vacuum pump may need to be repaired or resized and replaced.

Remarks:

- If problem is not identified, contact ViEX for assistance.



NOTES

[illegible]



SPARE PARTS INQUIRY / ORDER FORM

PO# _____

SHIPPING ADDRESS:

Company Name: _____

Address: _____

City, Province / State: _____

Postal / Zip Code: _____

Purchasing Contact: _____

Phone Number: _____

INVOICING ADDRESS:

Company Name: _____

Address: _____

City, Province / State: _____

Postal / Zip Code: _____

Purchasing Contact: _____

Phone Number: _____

HEAT EXCHANGER MODEL: _____ **SERIAL #:** _____ **WO #:** _____

If the heat exchanger has been modified since installation, please provide the following information:

● Present number of plates:

● Present plate material and thickness:

● Present gasket system (glueless or glued):

● Present gasket material:

MATERIAL REQUESTED:

- Complete Gasketed Plate Pack
- Other (please provide details)

- Complete Set of Gaskets

ITEM	QUANTITY	MATERIAL
gasketed plates		
standard gaskets		
4CR gaskets		
port gaskets		



**ViEX Inc**1201 Nicholson Road
Newmarket, Ontario, Canada, L3Y 7V1

Tel: 905-954-1325 Fax: 905-954-1391

e-mail: info@viex.com • www.viex.com

SPARE PARTS INQUIRY / ORDER FORM

PO# _____

SHIPPING ADDRESS:

Company Name: _____

Address: _____

City, Province / State: _____

Postal / Zip Code: _____

Purchasing Contact: _____

Phone Number: _____

INVOICING ADDRESS:

Company Name: _____

Address: _____

City, Province / State: _____

Postal / Zip Code: _____

Purchasing Contact: _____

Phone Number: _____

HEAT EXCHANGER MODEL: _____ SERIAL #: _____ WO #: _____

If the heat exchanger has been modified since installation, please provide the following information:

● Present number of plates:

● Present plate material and thickness:

● Present gasket system (glueless or glued):

● Present gasket material:

MATERIAL REQUESTED:

● Complete Gasketed Plate Pack

● Other (please provide details)

● Complete Set of Gaskets

ITEM	QUANTITY	MATERIAL
gasketed plates		
standard gaskets		
4CR gaskets		
port gaskets		

_____

ADDITIONAL INFORMATION

ORDERING PARTS

When ordering parts and service, always provide the manufacturer's serial number of the exchanger. This information appears in the General Assembly Drawing and on the exchanger's nameplate.

CERTIFIED BY	ViEX Inc.	
CHANNEL "A"	_____ psig AT _____ °F	
	MDMT _____ °F AT _____ psig	
CHANNEL "B"	_____ psig AT _____ °F	
	MDMT _____ °F AT _____ psig	
SERIAL NUMBER	_____	
YEAR BUILT	_____	
CRN	_____	OIN _____

Figure 7.1 Standard Name Plate

DAMAGED SHIPMENT

Our equipment is carefully packaged and shipped in good condition. Shipments are made at the consignee's risk. Upon receipt of shipments, carefully inspect the packaging and equipment for damage. In the event of loss or damage all claims should be made to the carrier.

RETURNING MATERIALS

Units or parts are not to be returned without first obtaining permission from your nearest ViEX Plant. Parts authorized for return must be properly packaged and labeled and in good condition at the ViEX plant. All credits for returned materials will be subject to restocking and transportation charges.

TECHNICAL INFORMATION AND CUSTOMER SUPPORT

To obtain additional information on the operation, maintenance and care of ViEX equipment you may contact your local ViEX representative or the nearest ViEX facility.

Additional copies of this manual are available at \$10.00 each. Please contact your nearest ViEX representative.

This manual is also available on-line at
www.viex.com



ViEX group Headquarters - Canada



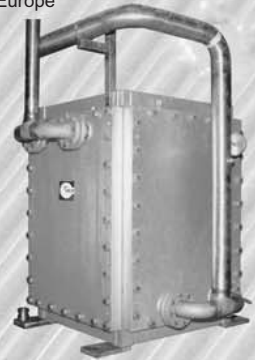
ViEX Asia



ViEX Europe



Viexcoil®
Plate Coil
Heat Exchangers



Viexbloc®
Welded Plate
Heat Exchangers

Compact Heat Exchangers Engineered by ViEX

**ViEX provides all customers with top quality products and services,
intelligent solutions and the most dependable and flexible
heat transfer vendor resource in the world.**

Our business was founded on a long heritage to
design and build the highest quality, most productive
and cost-efficient solutions for our customers.

ViEX has strategic supply and sales alliances around the world.

We invite your inquiry and questions on any
ViEX product or specific project.



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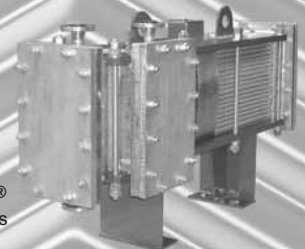


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ViEX Inc.

1201 Nicholson Road,
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www.viex.com