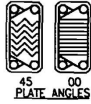
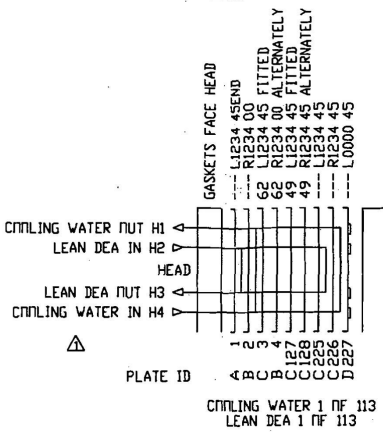


MATERIALS OF CONSTRUCTION		
ITEM NO.	DESCRIPTION	MATERIAL
1	HEAD	SAS16 GR70
2	FOLLOWER	SAS16 GR70
3	END SUPPORT	A36
4	TOP BAR	A36 W/304 SS STRIP
5	BOTTOM BAR	A36 W/304 SS COVER
6	M36 DIA. TIE BAR	SA193 GRB7
7	M42 DIA. TIE BAR	SA193 GRB7
8	TIE BAR HEX NUTS	SA194 GR2H ZINC PLATED
9	HEAT TRANSFER PLATES	SA240 GR316
10	STUDS	SA193 GRB7 ZINC PLATED
11	LINERS	316L STAINLESS STEEL
12	GROUNDING LUGS	A36

APV
FACTORY SERVICE
 FOR PARTS AND SERVICE
 CALL OUR CUSTOMER
 SERVICE DEPARTMENT
 1-888-278-4321

F_x (KN)	12.2
F_y (KN)	7.213
F_z (KN)	7.213
M_x (KNm)	7.157
M_y (KNm)	7.157
M_z (KNm)	7.157

NOTE: MOMENTS AND FORCES MAY ACT IN ANY COMBINATION IN ANY SENSE (i.e. +/-).



NOTES

- THE INSTALLATION, OPERATION AND MAINTENANCE OF THIS HEAT EXCHANGER SHALL BE IN ACCORDANCE WITH THE APV PARAFLOW PLATE HEAT EXCHANGER INSTRUCTION MANUAL.
- THIS MODEL HEAT EXCHANGER IS TIGHTENED USING A WRENCH ON THE TIE BAR HEX NUTS AT THE HEAD (FIXED COVER) END ONLY. CLEAN AND LUBRICATE THE THREADS BEFORE OPENING OR CLOSING USING A LUBRICANT COMPATIBLE WITH CARBON STEEL. APV RECOMMENDS NEVER SEEZ REGULAR GRADE. DO NOT USE COMMON GREASE. THE PLATE PACK IS TO BE TIGHTENED IN ACCORDANCE WITH THE INSTRUCTION MANUAL SUPPLIED. DO NOT TIGHTEN BELOW THE MINIMUM DIMENSION SHOWN. THE CUSTOMER IS RESPONSIBLE FOR PROVIDING:
 - ANCHOR BOLTS PER ASTM A36 MINIMUM WITH A RECOMMENDED DIAMETER OF 1 1/8".
 - PROTECTION AGAINST START UP OR OPERATING PRESSURES EXCEEDING THE MAXIMUM ALLOWABLE WORKING PRESSURE.
 - PIPING TO THE FOLLOWER OR CONNECTOR GRIDS THAT ALLOWS FOR FREE MOVEMENT WHEN THE UNIT IS OPENED FOR SERVICE AND PROVIDES FLEXIBILITY FOR THE VARIATION OF THE COMPRESSED PLATAE DIMENSIONS.
- UNED STUDDED PORTS ARE PROVIDED WITH A SMOOTH RASSED FACE FINISH.
- BOLT HOLES STRADDLE CENTERLINES SHOWN.
- DIMENSIONS ARE SHOWN IN INCHES. DIMENSIONS IN BRACKETS [] ARE IN MILLIMETERS.
- STANDARD TOLERANCES:
 FRAME AND FOUNDATION BOLT LOCATIONS: ±1/4 INCH [±6mm]
 NOZZLE CENTERLINE AND FACE DIMENSIONS: ±1/8 INCH [±3mm]

DESIGN SPECIFICATIONS	
DESIGN CODE	ASME SECTION VIII DIV 1, 2004 EDITION 88D-68DITION
MAX. ALLOWABLE WORKING PRESSURE	380 PSIG. (2750 kPa) FV
MINIMUM DESIGN METAL TEMPERATURE	-20 F. @ 380 PSIG. (-29C @ 2750 kPa)
HYDROTEST PRESSURE	320 PSIG. (2575 kPa) FV
MINIMUM OPERATING TEMPERATURE	-20F. (-29C)
MAXIMUM OPERATING TEMPERATURE	285F (95C)
SERIAL NUMBER	2007300300609
HEAT TRANSFER AREA	1298.6TSQ.FT. (120.6 SQ.M.)
FRAME SIZE	NB.3
MAXIMUM FRAME CAPACITY	3000PALLETS
DRY WEIGHT	6895 LBS. (3163 KG)
FLOODED (OPERATING) WEIGHT	7895 LBS. (3571 KG)
TOTAL LIQUID VOLUME	108LBS.GALS. (408.1 LITERS)
FINISH	APV STANDARD PAINT 3196
ACCESSORIES SUPPLIED	304 SS SHROUD GROUNDING LUGS

OPERATING CONDITIONS			
LIQUID	FLOW RATE	TEMP. °C	ΔP (kPa)
LEAN DEA	152.04 KG/S	46.1° - 37.9°	70.0
COOLING WATER	69.31 KG/S	24° - 40°	15.0

Plates (Total: 222)
 ID Qty Part Number Description

A	1	4614KAXX7BEEA	P&G ASY TR9GL (45) END 316 0.7 STK EPDM RC (BL/WH)
B	63	4610FAXX7BEEA	P&G ASY TR9GL (00) FLOW 316 0.7 STK EPDM RC (BL/WH)
C	162	4614FAXX7BEEA	P&G ASY TR9GL (45) FLOW 316 0.7 STK EPDM RC (BL/WH)
D	1	4614FOXAX7BEEA	P&G ASY TR9GL (45) FLOW 316 0.7 STK EPDM RC (BL/WH)

Frame Qty Part Number Description

1	TR9GLXC2500C31B	TR9GL M-25c (C:SS T:CS) Size 3, Max 368 Plates
1	GB506365G2G2G202	Head
1	GB506365AXXAXX	Follower

Fitting Qty Part Number Position Description

4	GB506370	H1,H2,H3,H4	NPS 8.0 Studded SS 316L ANSI B16.5 CL.300
---	----------	-------------	---

Qty Part Number Accessory Description

1	500534	SS Shroud, FS3
1	ASME U STAMP	ASME INSPECTION AND U STAMP
1	501255	GROUNDING LUG HEAD
1	501252	GROUNDING LUG END SUPPORT

PROJECT NO. 103933
 COMPANY NO. 383-1296
 Kiewit APEC
 0032
 52-E-7B

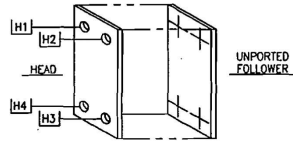
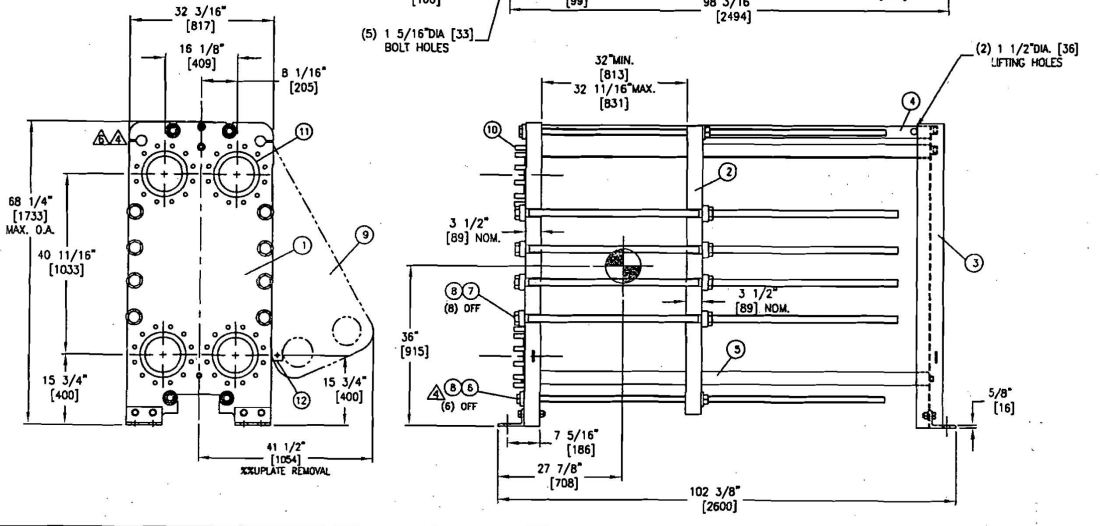
REVISIONS

NO.	DATE	DESCRIPTION
01	8-14-07	REMOVED SSP NOTE - PER REQUIREMENT PER ASME & ENC.
02	8-17-07	REMOVED (2) H2H3 BOLTS - UPDATED FRAME P/N
03	GAL SAFETY?	CHANGED GASKETS TO STICK
04	8-17-08	ADDED (2) H2H3 BOLTS - UPDATED FRAME P/N
05	9-14-08	CHANGED GASKET MATERIAL
06	12-12-08	INCORPORATED CUSTOMER COMMENTS
07	9-28-08	APPROVED - INCORPORATED COMMENTS
08	BY / DATE	CL. BY / DATE

Checked: Date: Supervisor: Scaled: Sheet: 1 OF 1

Approved: Date: Drawn: Date: Drawing No.: 0500608 Rev: 07

CAT9M25903 CAD File: 0500608 A



REV.	BY / DATE	CHK. BY / DATE	DESCRIPTION AND LOCATION
07	KWR 8-14-07		REMOVED SSP NOTE - PER REQUIREMENT PER ASME & ENC.
08	KWR 8-17-07		REMOVED (2) H2H3 BOLTS - UPDATED FRAME P/N
09	GAL SAFETY?		CHANGED GASKETS TO STICK
10	8-17-08		ADDED (2) H2H3 BOLTS - UPDATED FRAME P/N
11	9-14-08		CHANGED GASKET MATERIAL
12	12-12-08		INCORPORATED CUSTOMER COMMENTS
13	9-28-08		APPROVED - INCORPORATED COMMENTS
14	BY / DATE		CL. BY / DATE

APV Products
 1200 W. Ash Street
 Goldsboro, NC 27530
 Tel: (919) 735-4570/Fax: (919) 581-1134

DESCRIPTION: TR9GL M-25SPEC PLATE HEAT EXCHANGER

Scale: N.T.S. Sheet: 1 OF 1

Approved: Date: Drawn: Date: Drawing No.: 0500608 Rev: 07

CAT9M25903 CAD File: 0500608 A

Dean W. S. Shuman
 04/18/2007

Plate Heat Exchanger Data Sheet

Ref.: EJW60169/1 (O)



Duty:	Lean Amine Trim Cooler	REV:05
Item No:		52-E-7A/B
PHE Type:	TR9GL	Engineer: EJW
Quotation No:	C5EW189WS	Date: 2006.Mar.14

Process Data	Hot	Cold
Fluid	Lean DEA	Cooling water
Mass Flow Rate	Kg/s 149.06	69.50
Volume Flow Rate	l/s 146.14	69.69
Inlet Temperature	°C 46.1	24.0
Outlet Temperature, Duty	°C 37.9	40.0
Pressure Drop, calculated	kPa 70	15
Heat Exchange Rate, Duty	kW 4642.22	
Design (Duty) HTC	W/°C m ² 4068.0	
Clean HTC	W/°C m ² 4508.6	
% Difference in HTC	10.8%	
Fluid Volume in PHE	l 222.0	222.0

Fluid Properties	Hot	Cold
Density	kg/(m ³) 1023.0	995.0
Specific Heat Capacity	kJ/kg °C 3.738	4.178
Thermal Conductivity	W/m °C 0.456	0.617
Inlet Viscosity	mPa s 1.57	0.91
Outlet Viscosity	mPa s 1.95	0.65

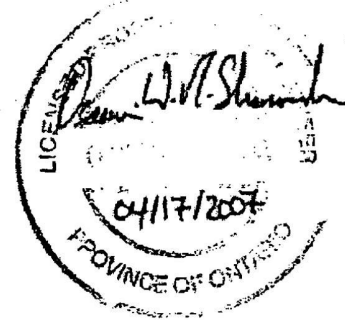
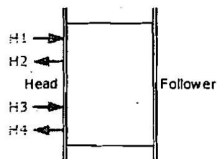


Plate Heat Exchanger Specifications			
PHE Type	TR9GL		
Frame Type / Size	M-25/3. Painted Floor Mount Tie:CS, Carry:SS, max. 368 plates		
Dimensions (H*W*L)	mm	1733x820x2594	
Total Number of Plates	227		
Total Active Area	m ²	120.61	
Hot Side Flow Arrangement	1*113		
Cold Side Flow Arrangement	1*113		
Plate Material	0.7 mm SS 316 SA240 Paracip		
Gasket Material	EPDM RC (Paratemp) Glue In		
Hot Side Connection - Inlet	H1	NPS 8.0 Studded SS 316L Class 300 (Mates With) ANSI B16.5	
Hot Side Connection - Outlet	H4	NPS 8.0 Studded SS 316L Class 300 (Mates With) ANSI B16.5	
Cold Side Connection - Inlet	H3	NPS 8.0 Flange (RFWN) SS 316L Class 300 (Mates With) ANSI B16.5	
Cold Side Connection - Outlet	H2	NPS 8.0 Flange (RFWN) SS 316L Class 300 (Mates With) ANSI B16.5	
Design Code	A.S.M.E. VIII Div. 1		
Certificate			
Design Temperature	°C	Max. 95	Min. -29
Design Pressure	kPa	2750	
Test Pressure	kPa	Balanced 3575	Differential 3575
Mass	kg	Flooded 3618	Empty 3170
Approx. Shipping Mass & Volume		Std Packing	kg m ³

Accessories
AutoCAD Drawing w/ Frame Dimensions (1); ASME Inspection and U Stamp (1); Standard Paint APV Blue (APV3196) (1); Spray Deflector (1)

Connection Placement



Remarks

CRN & API662. Shear stress, hot/cold, is 103/21 Pa. Plate gap is 3.0 mm.

Reviewed By

APV 30 2007

Tim Scott

Plate and Frame Exchanger				DATA SHEET NO.		REV	
				52-E-7-DS-1		2	
NO.	BY	DATE	REVISION	SHEET	OF	DATE	
0	GQW	31-Jul-05	ISSUED FOR PURCHASE	1	2	17-Apr-06	
1	GQW	17-Apr-06	AS BUILT	BY	CHK'D	PROC	APPR
2	GQW	15-May-07	AS BUILT - revised gaskets	GQW			
				P.O.	383-1296-0032		
				REQ	HT-1300-005		

TAG NO:	52-E-7A/B		Spec No:		r e v
Asset No:	P&ID:	52-PID-PR-0015			
Service Description:	Lean Amine Trim Cooler			Manufacturer:	APV
				Model:	TR9GL
User 1:		User 3:			
User 2:		User 4:			

Job No.:	103933		Process Unit:	52 Amine Unit	
Item No.:	52-E-7A/B		Fabricator:	APV	
Location:	Fort McMurray		No. of Units:	Two (1 operating & 1 spare) (Note 7.)	
Size:	M-25/3	mm	Type:	No. Connected in:	1 Parallel 1 Series
Surface area/Unit (Eff.)	120.6	m ²	Shells/Unit	1	Surface area/Shell (Eff.) 120.6 m ²

		HOT SIDE		COLD SIDE	
Fluid Allocation:		Lean DEA		Cooling Water	
Fluid Name:		Lean DEA		Cooling Water	
Fluid Quantity, Total:	kg/hr	536,626		250,196	
		IN	OUT	IN	OUT
Fluid Quantity, Vapor (In/Out):	kg/hr				
Fluid Quantity, Liquid:	kg/hr	536,626	536,626		
Fluid Quantity, Steam:	kg/hr				
Fluid Quantity, Water:	kg/hr			250,196	250,196
Fluid Quantity, Noncondensable (MW):	kg/hr				
Temperature (In/Out):	°C	46.1	37.9	24	40
Density (Vapor/Liquid):	kg/m ³	1,020	1,026	997	992
Viscosity (Vapor/Liquid):	mPa-s	1.571	1.953	0.911	0.651
Molecular Weight, Vapor:					
Specific Heat (Vapor/Liquid):	kJ/(kg °C)	3.742	3.733	4.180	4.179
Thermal Conductivity (Vapor/Liquid):	W/(m °C)	0.459	0.453	0.610	0.632
Dew Point:	°C				
Bubble Point:	°C				
Critical Pressure:	kPa(g)				
Critical Temperature:	°C				
Latent Heat:	KJ/kg@°C				
Surface Tension:	Dyne/cm	58.19	59.44	72.27	69.49
Inlet Pressure:	kPa(g)	1,615		845	
Velocity:	m/s	4.6 (port) , 0.57 (passages)		2.2 (Port) ; 0.27 (passages)	
Pressure Drop (Allowable/Calculated):	kPa	70	70	70	15
Overall Fouling Allowance:	% Excess Area	10		10	
Wall Shear Stress:	kPa	103		21	
Heat Exchanged per Unit:	4,642,220 Watts	LMTD (Corrected) (Weighted):		9.46 °C	
Transfer Rate (Service/Clean):	4,068	4,509		W/(m ² °C)	

Remarks:	* Information to be supplied by Manufacturer
Notes:	<ol style="list-style-type: none"> Design case: Napthenic Solvent design case flow, composition and conditions. Nozzles shall be designed for the loads shown in Attachment 1, Nozzle Loads for Plate & Frame Heat Exchangers, Rev. 0. All materials and components in contact with process fluid to meet 00-STD-ME-0034 requirement, Category 1. CRN/ ABSA registration required. Structural design shall be per 00-STD-ST-0001, Rev. 4. Saddles shall be designed for -45 °C minimum ambient temperature. Provide loads (weight and forces) at the bottoms of the base plates. Two 100% units are to be installed in Phase 1. The exchanger design shall prevent process fluids from contacting carbon steel surfaces. Structural supports shall have 1.6 mm corrosion allowance.

		HOT SIDE				COLD SIDE					
Design Press / Test Press	kPa(g)	2,750 & FV	/	per code	2,750 & FV	/	per code				
Design / MDMT Temperature	°C	95	/	-29	95	/	-29				
Corrosion Allowance (wetted Carbon Steel only)	mm	(Note 8)				(Note 8)					
No. of Passes / No. Channels per pass		1	/	113	1	/	113				
Passages Per Pass											
Number of Plates per Frame		227		368 (Max.)	Plate Thickness	0.7	mm				
Connections Size, Rating & Type	In:	8" 300# RF				8" 300# RF					
	Out:	8" 300# RF				8" 300# RF					
	Intermed:										
Weights: Plates	kg	1,005	kg	2,158	kg	Total Flooded	3,571	kg	Empty	3,163	kg
Frame Material	SA-516-70N				Tie Bars Material	SA-193 B7					
Plate Material	SA-240-316				Shroud Material	304 SS					
Gasket Material	EPDM RC (Paratemp) Glue In Δ				Gasket Type	Clipon					
Nozzle Material	N/A				Nozzle Lining Material	316 SS					
Bolts/Nuts Material	Internal	SA-193-B7M / SA-194-2HM				External	SA-193-B7 / SA-194-2H				
	Pass No.		1		2		3		4		
No. of Channels per Fluid		113									
No. of Plates		227									
Plate Model		Dura Flow									
Chevron Angle		0, 45									
Surface Area Enhancement Factor		N/A									
Plate Materials		SA-240-316									
Plate Thickness	mm	0.7									
Plate Spacing	mm	3									
Area per Plate	m ²	0.531 (Effective)									
Port Diameter	in	8"									
Vertical Distance between Port Centres	mm	1033									
Horizontal Distance between Port Centres	mm	817									
Frame Size: L x W x H	mm	2594 x 817 x 1733	mm	Plate Size	1292 x 674	mm					
Code Requirement	ASME Sect. VIII, Div. 1	Stamp	YES	API 662	YES	CRN / ABSA Registration		YES			
Remarks:											

User 5		User 9	
User 6		User 10	
User 7		User 11	
User 8		User 12	

Notes	



ENGINEER: PETE MATKOVICS
DATE: 18-Oct-06
CALC NO.: 0500608-609 ASME

REV NO.: 03

PRESSURE VESSEL CALCULATIONS
FOR AN
APV PLATE HEAT EXCHANGER
IN ACCORDANCE WITH THE
ASME BOILER AND PRESSURE VESSEL CODE
SECTION VIII, DIVISION 1
2004 EDITION

HEAT EXCHANGER MODEL:	TR9GL MGS-25SPEC
REFERENCE DRAWING NUMBER:	0500608 & 0500609
MATERIAL NUMBER(S):	20053003000608 20053003000609
DESIGN PRESSURE:	398.75 (27.50) psi (bar)
TEST PRESSURE:	519.00 (35.79) psi (bar)
MAXIMUM DESIGN TEMPERATURE:	203.00 (95.00) F (C)
MINIMUM DESIGN METAL TEMPERATURE:	-20.00 (-28.89) F (C)
P.O. NO:	383-1296-0032
TAG / ITEM NO.:	52-E-7A/B LEAN AMINE TRIM COOLER

