

LAMPIRAN 2 ADMINISTRASI PENELITIAN

1. Surat Permohonan Data Penelitian



KEMENTERIAN PENDIDIKAN, KEBUDAYAAN,
RISET, DAN TEKNOLOGI
POLITEKNIK NEGERI SRIWIJAYA
Jalan Srijaya Negara Bukit Besar – Palembang 30139 Telepon 0711-353414
Laman : <http://polsri.ac.id>, Pos El : info@polsri.ac.id

Nomor : 11837/PL6.3.1/SP/2022
Perihal : Izin Pengambilan Data Penelitian

27 Desember 2022

Yth. Human Resource Development
PT. Wiratama Indotect
Jalan Komodo Blok D No.60 Komplek AL Jati Bening
Pondok Gede Bekasi

Dengan hormat,

Sesuai dengan kurikulum Program Sarjana Terapan (D-IV) Teknik Mesin Produksi dan Perawatan Jurusan Teknik Mesin Politeknik Negeri Sriwijaya, Tugas Akhir merupakan mata kuliah wajib pada semester 8 (delapan). Untuk itu mahasiswa kami memerlukan data untuk Tugas Akhir tersebut.

Sehubungan dengan hal tersebut di atas, kami mohon Bapak/Ibu dapat memberikan izin dan membantu mahasiswa kami ini untuk pengambilan data penelitian.

Mahasiswa kami yang akan melakukan pengambilan data penelitian tersebut adalah :

No	Nama	NPM	Kelas	Jurusan/ Program Studi
1	Devita Dinda Fitriani	0619 4021 0230	7 PP.B	Teknik Mesin / Teknik Mesin Produksi dan Perawatan

Atas perhatian dan bantuannya diucapkan terima kasih.

Direktur
Wakil Direktur I,

Carlos K., S.T., M.T.
NIP 196403011989031003

Tembusan:
1. Ketua Jurusan Teknik Mesin
2. Yang bersangkutan



2. Surat Jawaban Izin Pengambilan Data Penelitian



No. : 001/SK-WI/I/2023
Lamp : -
Hal : Kesiediaan Memberikan Izin Pengambilan
Data Penelitian

Bekasi, 04 Januari 2023

Kepada Ykh,
Wakil Direktur I
Politeknik Negeri Sriwijaya
DI
Palembang

Sesuai dengan Surat Permohonan Izin Pengambilan Data Penelitian mahasiswa D-IV Teknik Mesin Produksi dan Perawatan Jurusan Teknik Mesin Politeknik Negeri Sriwijaya, Palembang Tanggal : 22 Desember 2022 perihal Permohonan Izin Pengambilan Data Penelitian mahasiswa, maka dengan ini PT. Wiratama Indotech memberikan izin untuk melakukan penelitian dan bersedia memberikan data penelitian yang dibutuhkan di workshop PT Wiratama Indotech dengan perincian data sebagai berikut :

No.	NPM	Kelas	NAMA MAHASISWA	JURUSAN / PROGRAM STUDI
1	0619 4021 0230	7 PP.B	Devita Dinda Fitriani	Teknik Mesin/ Teknik Mesin Produksi & Perawatan

Adapun materi yang akan diberikan dan diterima mahasiswa sebagai berikut :

- Dataheet desain produk
- P&id drawing chiller
- P&id drawing heat exchanger
- Dasar fabrikasi unit heat exchanger
- Penguasaan software kalkulasi perencanaan heat exchanger
- Referensi perencanaan dan perancangan heat exchanger
- Studi virtual terkait heat exchanger khusus POME

Demikian Surat ini dibuat dengan harapan kerjasama yang sudah terjalin bisa bermanfaat bagi ilmu pengetahuan dan pengembangan keterampilan mahasiswa yang dimaksud. Atas perhatiannya kami ucapkan terima kasih.

PT WIRATAMA INDOTECH


IRIANSYAH PUTRA, ST
HRD

PT WIRATAMA INDOTECH
workshop
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General Supplier | Trading | Heat Exchanger Equipment

3. Surat Izin Penggunaan Data Perusahaan Menjadi Karya Ilmiah (Skripsi)



No. : 002/SK-WI/III/2023
Lamp : -
Hal : Kesediaan Memberikan Izin Pengambilan
Data Penelitian Data Perusahaan

Bekasi, 08 Maret 2023

Kepada Ykh,
Wakil Direktur I
Politeknik Negeri Sriwijaya
Di
Palembang

Sesuai dengan Surat Permohonan Izin Pengambilan Data Penelitian mahasiswa D-IV Teknik Mesin Produksi dan Perawatan Jurusan Teknik Mesin Politeknik Negeri Sriwijaya, Palembang Tanggal : 22 Desember 2022 perihal Permohonan Izin Pengambilan Data Penelitian mahasiswa, maka dengan ini PT. Wiratama Indotech memberikan surat izin penggunaan data perusahaan untuk dijadikan karya ilmiah perincian data sebagai berikut :

A. Data Mahasiswa

No.	NPM	Kelas	NAMA MAHASISWA	JURUSAN / PROGRAM STUDI
1	0619 4021 0230	7 PP.B	Devita Dinda Fitriani	Teknik Mesin/ Teknik Mesin Produksi & Perawatan

B. Data Karya Ilmiah

No.	JUDUL TA / KARYA ILMIAH
1	Perancangan Shell and Tube Heat Exchanger Pendingin Gas POME Menggunakan Chilled Water dengan Studi Kasus di PT Wiratama Indotech

Demikian Surat Ini dibuat dengan harapan kerjasama yang sudah terjalin bisa bermanfaat bagi ilmu pengetahuan dan pengembangan keterampilan mahasiswa yang dimaksud. Atas perhatiannya kami ucapkan terima kasih.

PT WIRATAMA INDOTECH

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General Supplier | Trading | Heat Exchanger Equipment

LAMPIRAN 3 DATA DAN STANDAR

1. Origin TEMA Data Sheet PT Wiratama Indotech

Project	: Proyek Pembangunan PLT Bogas Limbah Cair Sesi 1 (PORS)							
Client	: DIREKTORAT JENDERAL ENERGI BARU TERBARUKAN DAN KONSERVASI ENERGI (EBTNE) - Kementerian Energi Dan Sumber Daya Mineral							
Location	: [REDACTED]							
Service	: Bogas Dehumidifier HE							
Item No.	: HE-301		Qty : 1					
Reference PMD	: [REDACTED]							
Vendor	:							
Serial No.	:							
Purchase Order No.	:							
No. Required	: 1 (GHE)							
Design Process Information								
TEMA Classification Head	: B E M			Orientation : Horizontal				
Surf/Unit (Gross/Elf)	: 14.69 / 14.12 m ²			HE Configuration : 1 Parallel				
No. Shell / Unit	: 1			Series				
Process Performance Information								
Fluid Allocation			Shell Side		Tube Side			
			Inlet		Outlet	Inlet		Outlet
Fluid Name			Bogas in		Cooling Water in			
Fluid Quantity, Total	kg/hr		673.002		1532.16			
Liquid (In/Out)				4.8727	1532.16			
Vapor (In/Out)			673.002	668.129			1532.16	
Temperature (In/Out)	°C		35	12	7		12	
Specific Gravity (In/Out)				1.0176	1.0234		1.0153	
Viscosity (In/Out)	mN-s/m ²		0.0131	0.0122 V/L 1.2319	1.5713		1.2219	
Specific Heat (In/Out)	kJ/kg-C		1.36	1.3287 V/L 4.316	4.3237		4.3234	
Thermal Conductivity (In/Out)	W/m-C		0.027	0.0244	0.5762		0.5951	
Velocity	m/s		3.15		5.87E-03			
Inlet Pressure	kPa		105.002		105.002			
Pressure Drop, Allow/Calc	kPa			0.832			0.517	
Heat Exchanged KW	:	9.2	MTD (corrected) : 9.5		°C	Flow Rate	m ³ /hr : 1.51	
Transfer Rate, Service	:	67.58	W/m ² -K	Clean	:	68.5	W/m ² -K Actual	
Design Information								
Code	: ASME Section VIII Division 1			Dimension				
	: TEMA 8'th Ed' - '99			Nom. Diameter (ID Shell) : 380 mm				
Operating Temperature	: 35 °C			Length (s / s) : 2 m				
Design Temperature	: 60 °C			Nom. Volume (New) Shell : TBD t(s)				
Operating Pressure	: 101.3 kPa			Tube : TBD t(s)				
Design Pressure	: 1034.2 kPa			Thickness				
Corr Allowance	Inside	: 1.5 mm		Shell, Front&Rear Ch. : TBD mm				
	Outside			Front/Rear Head : TBD mm				
Joint Efficiency	: 70%			Tubes : TBD mm				
Hydrotest Pressure	:			Tubesheet : TBD mm				
Wind Velocity	: - mph							
Seismic Factor	: N/A							
Fabrication/Construction Information								
Head Type								
Orientation	<input checked="" type="checkbox"/> Horizontal		<input type="checkbox"/> Vertical					
Support Type	<input checked="" type="checkbox"/> Saddle		<input type="checkbox"/> Lug		<input type="checkbox"/> Leg		<input type="checkbox"/> Skirt	
Platform & Ladder	<input type="checkbox"/> Yes		<input checked="" type="checkbox"/> No					
A	027011	ISSUED FOR APPROVAL	SM	APF	ARY			
REV	TGL	URWAH	DIBAT	DPERKSA	DDETJAJ	DPERKSA	DDETJAJ	
				PT WIRATAMA KARYA		SI	IBTHE	



DATASHEET FOR DEHUMIDIFIER HE



SURVEYOR INDONESIA



PT WILKA KARYA (Persero) Tbk

Revisi

Nomor Dokumen

Nomor Halaman :

2 dari 2

Material Specifications

Shell, Head, Pad	: ASTM SA - 53 E/B	Nozzle Neck	: Pipe	ASTM SA - 53 E/B
Saddle / Skirt	: ASTM SA - 36		: Flange	SA-105
Lug / Leg	: N/A			
Structural	: N/A	Gasket	: N/A	
Internal Bolt/ Nut	: N/A			
Flange Bolt/Nut	: N/A			
Internal	: ASTM SA - 36			
Mist Pad & Frame	: N/A			

Personal Protection	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
Nameplate	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
Lifting Lugs	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
PWHT (As per Code)	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
Radiography	<input type="checkbox"/> Full	<input type="checkbox"/> Spot
Insulation	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
Painting	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No

Personal Protection Type : NA
Nameplate Bracket : YES

Refer to Specification

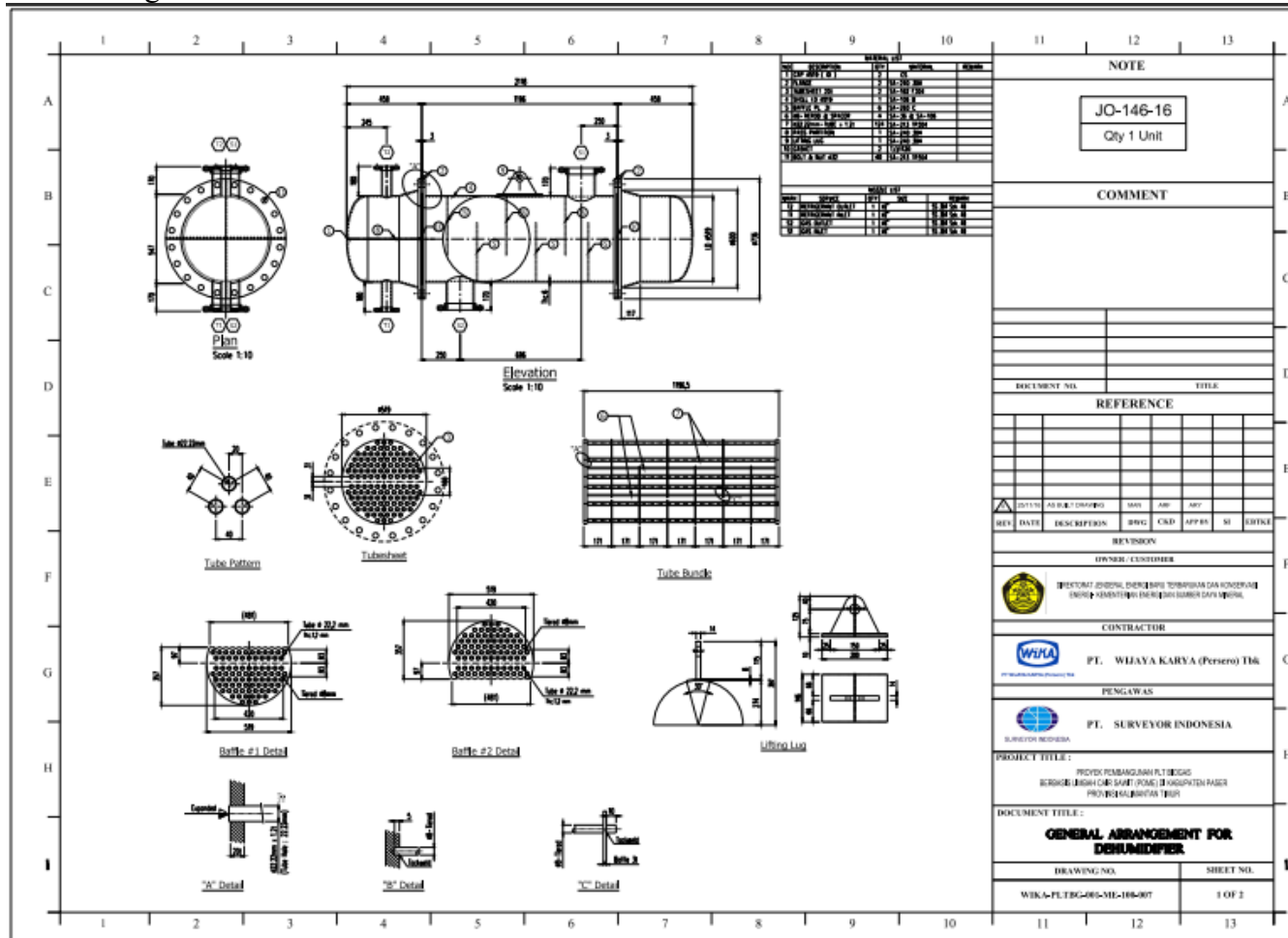
Weight (Approx.)

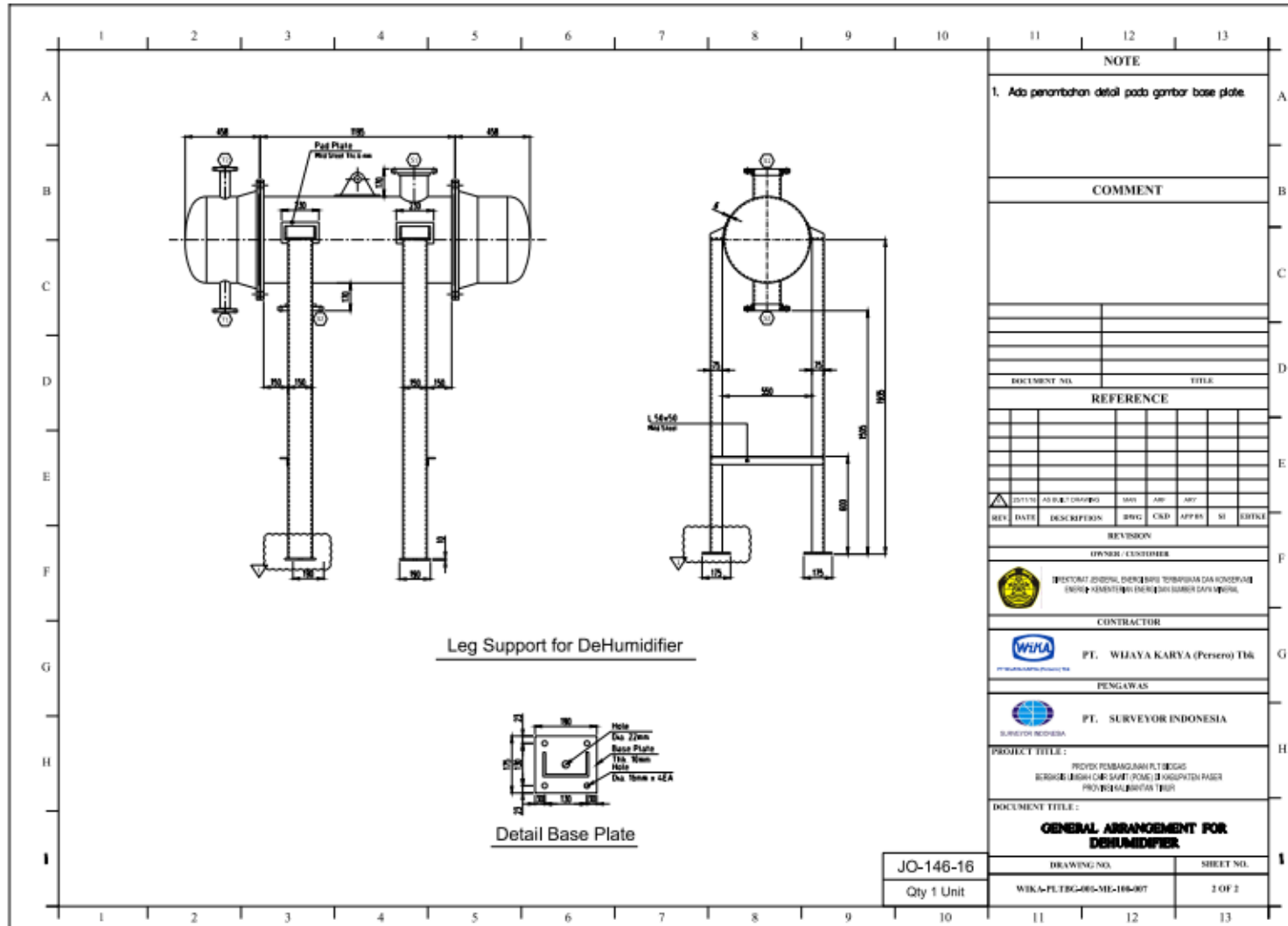
Empty Vessel (New)	: TBD kg	Empty Vessel (Corroded)	: TBD kg
Instrumentation at Vessel	: TBD kg		
Operating Vessel (New)	: TBD kg	Operating Vessel (Corroded)	: TBD kg
Hydrotest	: TBD kg		

NOTE : TBD: To Be Determined

A	02/2016	ISSUED FOR APPROVAL	BM	ARF	ARY		
REV	TGL	URA RI	DIBAT	DIPERIKSA	DISETUIJ	DIPERIKSA	DISETUIJ
PT. WILKA KARYA						SI	BTHE

2. Origin Technical Drawing PT Wiratama Indotech





3. Standar Tube Count pada Layout Segitiga

TABLE 9. TUBE-SHEET LAYOUTS (TUBE COUNTS).—(Continued)
Triangular Pitch

$\frac{3}{4}$ in. OD tubes on $1\frac{1}{8}$ -in. triangular pitch						$\frac{3}{4}$ in. OD tubes on 1-in. triangular pitch					
Shell ID, in.	1-P	2-P	4-P	6-P	8-P	Shell ID, in.	1-P	2-P	4-P	6-P	8-P
8	36	32	26	24	18	8	37	30	24	24	
10	62	56	47	42	36	10	61	52	40	36	
12	109	98	86	82	78	12	92	82	76	74	70
13 $\frac{1}{4}$	127	114	96	90	86	13 $\frac{1}{4}$	109	106	86	82	74
15 $\frac{1}{4}$	170	150	140	136	128	15 $\frac{1}{4}$	151	138	122	118	110
17 $\frac{1}{4}$	239	224	194	188	178	17 $\frac{1}{4}$	203	196	178	172	166
19 $\frac{1}{4}$	301	282	252	244	234	19 $\frac{1}{4}$	262	250	226	216	210
21 $\frac{1}{4}$	361	342	314	306	290	21 $\frac{1}{4}$	316	302	278	272	260
23 $\frac{1}{4}$	442	420	386	378	364	23 $\frac{1}{4}$	384	376	352	342	328
25	532	506	468	466	434	25	470	452	422	394	382
27	637	602	550	536	524	27	559	534	488	474	464
29	721	692	640	620	594	29	630	604	556	538	508
31	847	822	766	722	720	31	745	728	678	666	640
33	974	938	878	852	826	33	856	830	774	760	732
35	1102	1068	1004	988	958	35	970	938	882	864	848
37	1240	1200	1144	1104	1072	37	1074	1044	1012	986	870
39	1377	1330	1258	1248	1212	39	1206	1176	1128	1100	1078
1 in. OD tubes on $1\frac{1}{4}$ -in. triangular pitch						$1\frac{1}{4}$ in. OD tubes on $1\frac{3}{8}$ -in. triangular pitch					
8	21	16	16	14		10	20	18	14		
10	32	32	26	24		12	32	30	26	22	20
12	55	52	48	46	44	13 $\frac{1}{4}$	38	36	32	28	26
13 $\frac{1}{4}$	68	66	58	54	50	15 $\frac{1}{4}$	54	51	45	42	38
15 $\frac{1}{4}$	91	86	80	74	72	17 $\frac{1}{4}$	69	66	62	58	54
17 $\frac{1}{4}$	131	118	106	104	94	19 $\frac{1}{4}$	95	91	86	78	69
19 $\frac{1}{4}$	163	152	140	136	128	21 $\frac{1}{4}$	117	112	106	101	95
21 $\frac{1}{4}$	199	188	170	164	160	23 $\frac{1}{4}$	140	136	130	123	117
23 $\frac{1}{4}$	241	232	212	212	202	25	170	164	155	150	140
25	294	282	256	252	242	27	202	196	185	179	170
27	349	334	302	296	286	29	235	228	217	212	202
29	397	376	338	334	316	31	275	270	255	245	235
31	472	454	430	424	400	33	315	306	297	288	275
33	538	522	486	470	454	35	357	348	335	327	315
35	608	592	562	546	532	37	407	390	380	374	357
37	674	664	632	614	598	39	449	436	425	419	407
39	766	736	700	688	672						
$1\frac{1}{2}$ in. OD tubes on $1\frac{3}{4}$ -in. triangular pitch											
12	18	14	14	12	12						
13 $\frac{1}{4}$	27	22	18	16	14						
15 $\frac{1}{4}$	36	34	32	30	27						
17 $\frac{1}{4}$	48	44	42	38	36						
19 $\frac{1}{4}$	61	58	55	51	48						
21 $\frac{1}{4}$	76	72	70	66	61						
23 $\frac{1}{4}$	95	91	86	80	76						
25	115	110	105	98	95						
27	136	131	125	118	115						
29	160	154	147	141	136						
31	184	177	172	165	160						
33	215	206	200	190	184						
35	246	238	230	220	215						
37	275	268	260	252	246						
39	307	299	290	284	275						

4. Standar Tube

TABLE 10. HEAT EXCHANGER AND CONDENSER TUBE DATA

Tube OD, in.	BWG	Wall thickness, in.	ID, in.	Flow area per tube, in. ²	Surface per lin ft, ft ²		Weight per lin ft, lb steel
					Outside	Inside	
3/4	12	0.100	0.282	0.0625	0.1309	0.0748	0.493
	14	0.083	0.334	0.0876		0.0874	0.403
	16	0.065	0.370	0.1076		0.0669	0.339
	18	0.049	0.402	0.127		0.1053	0.258
	20	0.035	0.430	0.145		0.1125	0.190
1/2	10	0.134	0.482	0.182	0.1963	0.1363	0.965
	11	0.120	0.510	0.204		0.1335	0.884
	12	0.109	0.532	0.223		0.1303	0.817
	13	0.095	0.560	0.247		0.1466	0.727
	14	0.083	0.584	0.268		0.1529	0.647
	15	0.072	0.606	0.289		0.1587	0.571
	16	0.065	0.620	0.302		0.1623	0.520
	17	0.058	0.634	0.314		0.1660	0.469
	18	0.049	0.652	0.334		0.1707	0.401
1	8	0.165	0.670	0.355	0.2618	0.1754	1.61
	9	0.148	0.704	0.389		0.1843	1.47
	10	0.134	0.732	0.421		0.1916	1.36
	11	0.120	0.760	0.455		0.1990	1.23
	12	0.109	0.782	0.479		0.2048	1.14
	13	0.095	0.810	0.515		0.2121	1.00
	14	0.083	0.834	0.546		0.2183	0.890
	15	0.072	0.856	0.576		0.2241	0.781
	16	0.065	0.870	0.594		0.2277	0.710
17	0.058	0.884	0.613	0.2314	0.639		
18	0.049	0.902	0.639	0.2361	0.545		
1 1/4	8	0.165	0.920	0.665	0.3271	0.2409	2.09
	9	0.148	0.954	0.714		0.2498	1.91
	10	0.134	0.982	0.757		0.2572	1.75
	11	0.120	1.01	0.800		0.2644	1.58
	12	0.109	1.03	0.836		0.2701	1.45
	13	0.095	1.06	0.884		0.2775	1.28
	14	0.083	1.08	0.923		0.2839	1.13
	15	0.072	1.11	0.960		0.2896	0.991
	16	0.065	1.12	0.985		0.2932	0.900
17	0.058	1.13	1.01	0.2969	0.808		
18	0.049	1.15	1.04	0.3015	0.688		
1 1/2	8	0.165	1.17	1.075	0.3925	0.3063	2.57
	9	0.148	1.20	1.14		0.3152	2.34
	10	0.134	1.23	1.19		0.3225	2.14
	11	0.120	1.26	1.25		0.3299	1.98
	12	0.109	1.28	1.29		0.3356	1.77
	13	0.095	1.31	1.35		0.3420	1.56
	14	0.083	1.33	1.40		0.3482	1.37
	15	0.072	1.36	1.44		0.3555	1.20
	16	0.065	1.37	1.47		0.3587	1.09
17	0.058	1.38	1.50	0.3623	0.978		
18	0.049	1.40	1.54	0.3670	0.831		

5. Lmtd Correction Factor

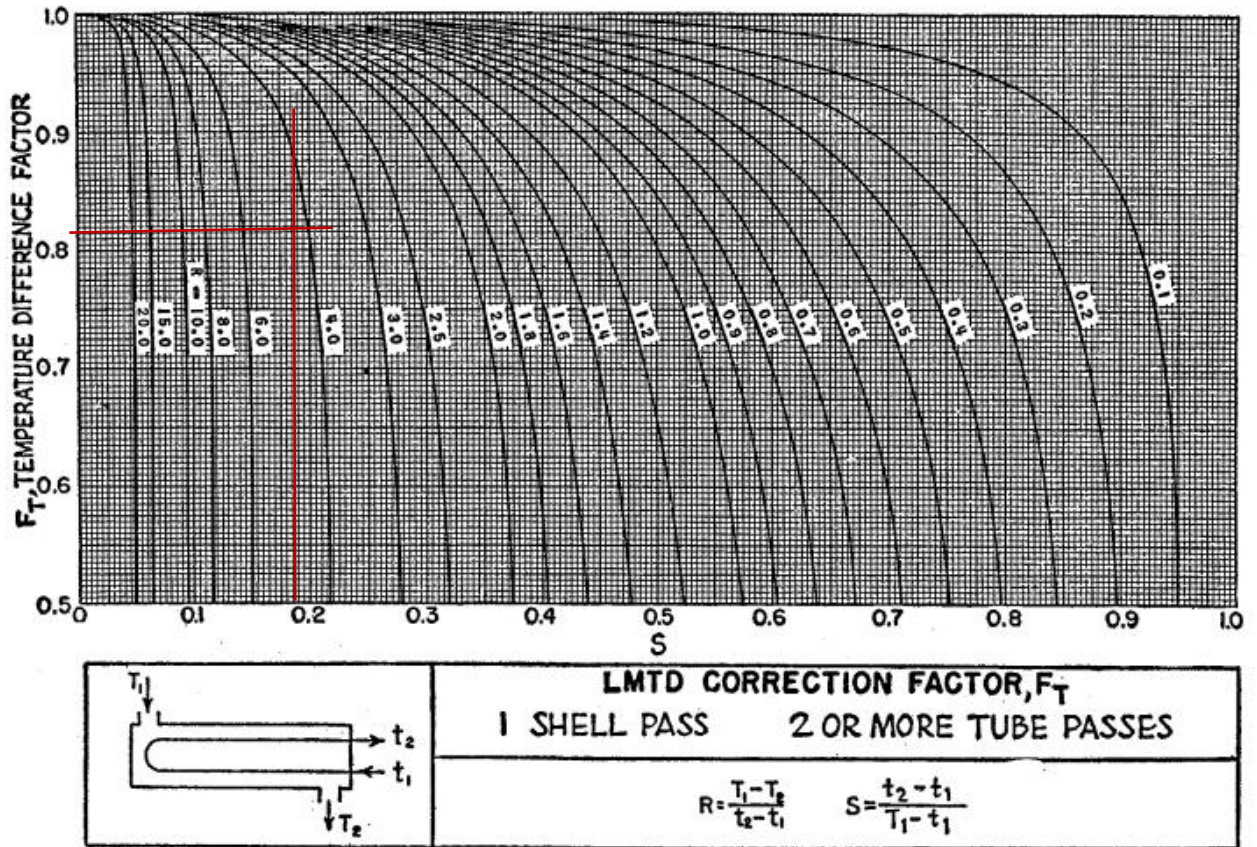



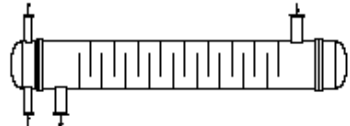
FIG. 18. LMTD correction factors for 1-2 exchangers. (Standards of Tubular Exchanger Manufacturers Association, 2d ed., New York, 1949)

LAMPIRAN 4 HASIL PERHITUNGAN MANUAL

HASIL HITUNG							
NAMA	NOTASI	TUBE OD					SATUAN
		0,5	0,75	1	1,25	1,5	inch
Heat Duty	Q	30400,5					btu/hr
LMTD	Tlmtd	21,2					F
Faktor Koreksi LMTD	Ft	0,8					
MTD	Tmtd	17,6					F
Koefisien Perpindahan Panas Asumsi	U asumsi	18,0					btu/ft ² .hr.F
Luas Area Perpindahan Panas Estimasi	Ae	95,8					ft ²
Bilangan Reynold Tube	Nre tube	651,1	558,1	501,3	508,8	484,4	
Kecepatan Aliran	V	1077,7	569,6	369,7	294,4	230,2	ft/sec
Faktor Panas Tube	Jh	3,0	3,3	3,9	3,8	3,9	
	hi	63,1	42,8	36,5	27,9	23,5	btu/ft ² .hr.F
	hio	50,7	37,2	33,0	25,7	22,0	btu/ft ² .hr.F
Luas Area Perpindahan Panas Shell	As	0,1	0,1	0,1	0,1	0,1	ft ²
Kecepatan Aliran Massa di Shell	Gs	10528,2	23739,4	24339,5	20080,1	17232,4	lb/hr.ft ²
Diameter Ekuivalen	De	1,4	0,7	0,7	0,8	0,9	Inch
		0,1	0,1	0,1	0,1	0,1	ft
Bilangan Reynold Shell	Nre Shell	38596,5	44321,4	45501,4	42274,6	42901,6	
Faktor Panas di Shell	Jh	125,0	131,0	132,0	128,0	132,0	
	Ho	16,8	34,5	34,8	29,9	26,1	btu/ft ² .hr.F
Koefisien Perpindahan Panas Bersih	Uc	12,6	17,9	16,9	13,8	11,9	btu/ft ² .hr.F
Koefisien Perpindahan Panas Required	Ureq	17,6	16,3	15,2	15,8	15,2	btu/ft ² .hr.F
Persentase Over Design	%	-28,4	9,7	11,2	-12,2	-21,6	%

LAMPIRAN 5 DATA OUTPUT HTRI

1. Final Result Data Sheet Model Tube 0.5inch

		Final Results Released to the following organization: POLITEKNIK NEGERI SRIBIJAYA DEVITA DINDA FITRIANI		Page 1	
		Xist E 9.1 (64 bit) 31/07/2023 2:35 SN: 18380-466159599		US Units	
STHE OD 0,5inch 2 Meter Rating - Horizontal Multipass Flow TEMA BEM Shell With Single-Segmental Baffles					
Process Data		Hot Shellside		Cold Tubeside	
Fluid name Fluid condition Total flow rate Weight fraction vapor, In/Out Temperature, In/Out Skin temperature, Min/Max Wall temperature, Min/Max Pressure, In/Average Pressure drop, Total/Allowed Velocity, Mid/Max allow Mole fraction inert Average film coef. Heat transfer safety factor Fouling resistance		POME GAS Sens. Gas 1,4837 1,0000 95,00 46,96 46,96 29,925 1,32e-3 3,69e-2 0,0000 28,18 1,0000 0,00000		CHILLED WATER Sens. Liquid 3,3778 0,0000 44,60 63,27 46,90 63,27 29,925 29,911 0,027 0,000 0,32 62,73 1,0000 0,00000	
Overall Performance Data					
Overall coef., Req'd/Clean/Actual Heat duty, Calculated/Specified Effective overall temperature difference EMTD - (MTD) * (DELTA) * (F/G/H)		(Btu/ft ² -hr-F) 18,80 / 17,92 / 17,92 (MM Btu/hr) 0,0304 / 0,0304 (Deg F) 16,9 (Deg F) 17,4 * 0,9735 * 1,0000			
See Runtime Messages Report for warnings.					
Exchanger Fluid Volumes					
Approximate shellside (ft ³) 5,205 Approximate tubeside (ft ³) 2,137					
Shell Construction Information					
TEMA shell type BEM Shells Series 1 Parallel Passes Shell 1 Tube 2 Shell orientation angle (deg) 0,00 Impingement present No Pairs seal strips 0 Shell expansion joint No Weight estimation WeV/Dry/Bundle 1257,8 / 799,62 / 268,08 (lb/shell)		Shell ID (inch) 13,250 Total area (ft ²) 97,917 Eff. area (ft ² /shell) 95,741 Passlane seal rods (inch) 0,0000 No. 0			
Baffle Information					
Type Perpend. Single-Seg. Crosspasses/shellpass 19 Central spacing (inch) 3,3125 Inlet spacing (inch) 10,339 Outlet spacing (inch) 10,339 Baffle thickness (inch) 0,1875 Number of deresonating baffles 0		Baffle cut (% dia) 25 No. (Pct Area) (inch) to C.L. 1 20,00 3,3125 2 0,00 0,0000			
Tube Information					
Tube type Plain Overall length (ft) 6,562 Effective length (ft) 6,416 Total tubesheet (inch) 1,7500 Area ratio (out/in) 1,2438 Tube metal 304 Stainless steel (18 Cr, 8 Ni)		Tubecount per shell 114 Pct tubes removed (both) 0,87 Outside diameter (inch) 0,5000 Wall thickness (inch) 0,0490 Pitch (inch) 0,9750 Ratio 1,9500 Tube pattern (deg) 60			
Bundle Information					
Outer tube limit (inch) 12,717 Bundle entrance rho-V2 (lb/ft-sec ²) 9,25e-2 Fins on U-bends No Parallel passlane width (inch) 0,0000		Bundle exit rho-V2 (lb/ft-sec ²) 9,25e-2 Allow crossed U-bends No Perpend. passlane width (inch) 1,4500			
Support Information			Inlet Outlet		
Distance, support to tubesheet/support plate (inch) Number of rows supported Rear head support plate Support plates/baffle space		No			


Unit: STHE OD 0,5inch 2 Meter

D:\Kuliah\MY FINAL\FD\0,5 INCH 2 METER.htri

2. Rating Data Sheet Model Tube 0.5inch

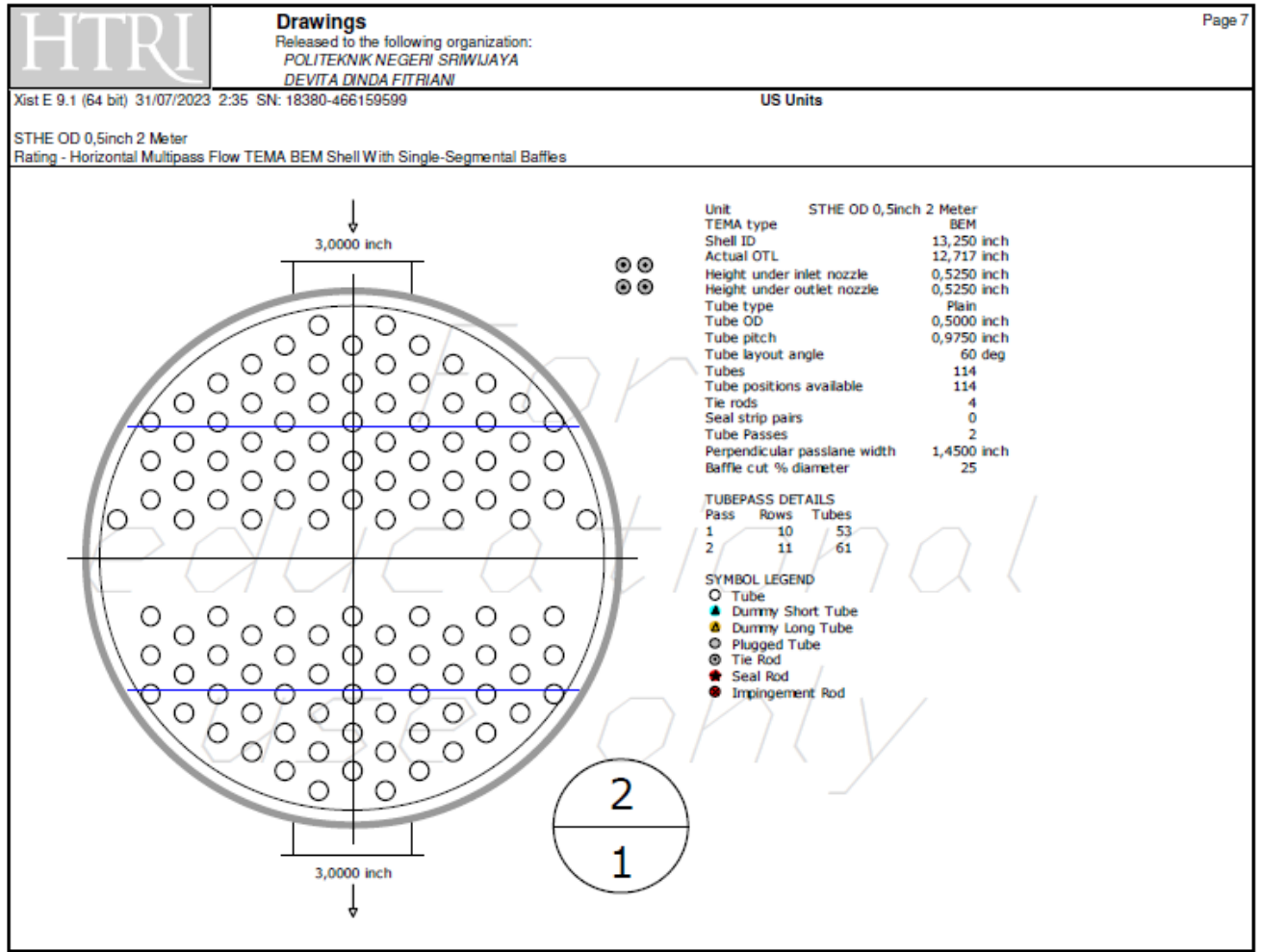
HTRI		HEAT EXCHANGER RATING DATA SHEET					Page 4									
		Released to the following organization: POLITEKNIK NEGERI SRIWIJAYA DEVITA DINDA FITRIANI					US Units									
Service of Unit			Item No.													
Type	BEM		Orientation	Horizontal		Connected In	1 Parallel 1 Series									
Surf/Unit (Gross/Eff)			97,917 / 95,741 ft2		Shell/Unit	1 Surf/Shell (Gross/Eff) 97,917 / 95,741 ft2										
PERFORMANCE OF ONE UNIT																
Fluid Allocation			Shell Side			Tube Side										
Fluid Name			POME GAS			CHILLED WATER										
Fluid Quantity, Total			1,4837			3,3778										
Vapor (In/Out)			wt%		100,00	100,00		0,00 0,00								
Liquid			wt%		0,00	0,00		100,00 100,00								
Temperature (In/Out)			F		95,00	53,60		44,60 53,60								
Density			lb/ft3		54,687	54,687		62,425 62,400								
Viscosity			cP		0,0131	0,0131		1,4269 1,2340								
Specific Heat			Btu/lb-F		0,4949	0,4949		1,0039 1,0020								
Thermal Conductivity			Btu/hr-ft-F		0,0156	0,0156		0,3307 0,3368								
Critical Pressure			psia													
Inlet Pressure			psia		29,925	29,925										
Velocity			ft/sec			3,69e-2		0,32								
Pressure Drop, Allow/Calc			psi			1,32e-3		0,027								
Average Film Coefficient			Btu/ft2-hr-F		28,18	62,73										
Fouling Resistance (min)			ft2-hr-F/Btu													
Heat Exchanged			0,0304 MM Btu/hr		MTD (Corrected)	16,9 F		Overdesign -4,67 %								
Transfer Rate, Service			18,80 Btu/ft2-hr-F		Calculated	17,92 Btu/ft2-hr-F		Clean 17,92 Btu/ft2-hr-F								
CONSTRUCTION OF ONE SHELL					Sketch (Bundle/Nozzle Orientation)											
Design Pressure			psig		150,04	150,04										
Design Temperature			F		140,00	140,00										
No Passes per Shell					1	2										
Flow Direction					Downward	Upward										
Connections			In Inch		1 @ 3,0000	1 @ 2,0000										
Size & Rating			Out Inch		1 @ 3,0000	1 @ 2,0000										
Liq. Out Inch					@											
Tube No.	114,00	OD	0,5000	Inch	Thk(Avg)	0,0490	Inch	Length	6,562	ft	Pitch	0,9750	Inch	Tube pattern	60	
Tube Type	Plain		Material		304 Stainless steel (18 Cr, 8 Ni)		Pairs seal strips		0							
Shell ID	13,250		Inch		Kettle ID		Inch		Passlane Seal Rod No.		0					
Cross Baffle Type	Perpend.		Single-Seq.		%Cut (Diam)		25		Impingement Plate		None					
Spacing(c/c)	3,3125		Inch		Inlet		10,339		Inch		No. of Crosspasses		19			
Rho-V2-Inlet Nozzle	1,29		lb/ft-sec2		Shell Entrance		0,98		lb/ft-sec2		Shell Exit		0,98		lb/ft-sec2	
			Bundle Entrance		9,25e-2		lb/ft-sec2		Bundle Exit		9,25e-2		lb/ft-sec2			
Weight/Shell	799,62		lb		Filled with Water		1257,8		lb		Bundle		268,08		lb	
Notes:					Thermal Resistance, %		Velocities, ft/sec		Flow Fractions							
Shell lining material - SA-53 B Pipe (S) K03005					Shell		63,60		Shellside		3,69e-2		A		0,119	
Tubesheet (tubeside) lining material - SA-53 B Pipe (S)					Tube		35,53		Tubeside		0,32		B		0,694	
K03005					Fouling		0,00		Crossflow		4,69e-2		C		0,041	
					Metal		0,87		Window		4,70e-2		E		0,147	
													F		0,000	

3. TEMA Specification Data Sheet 0.5inch

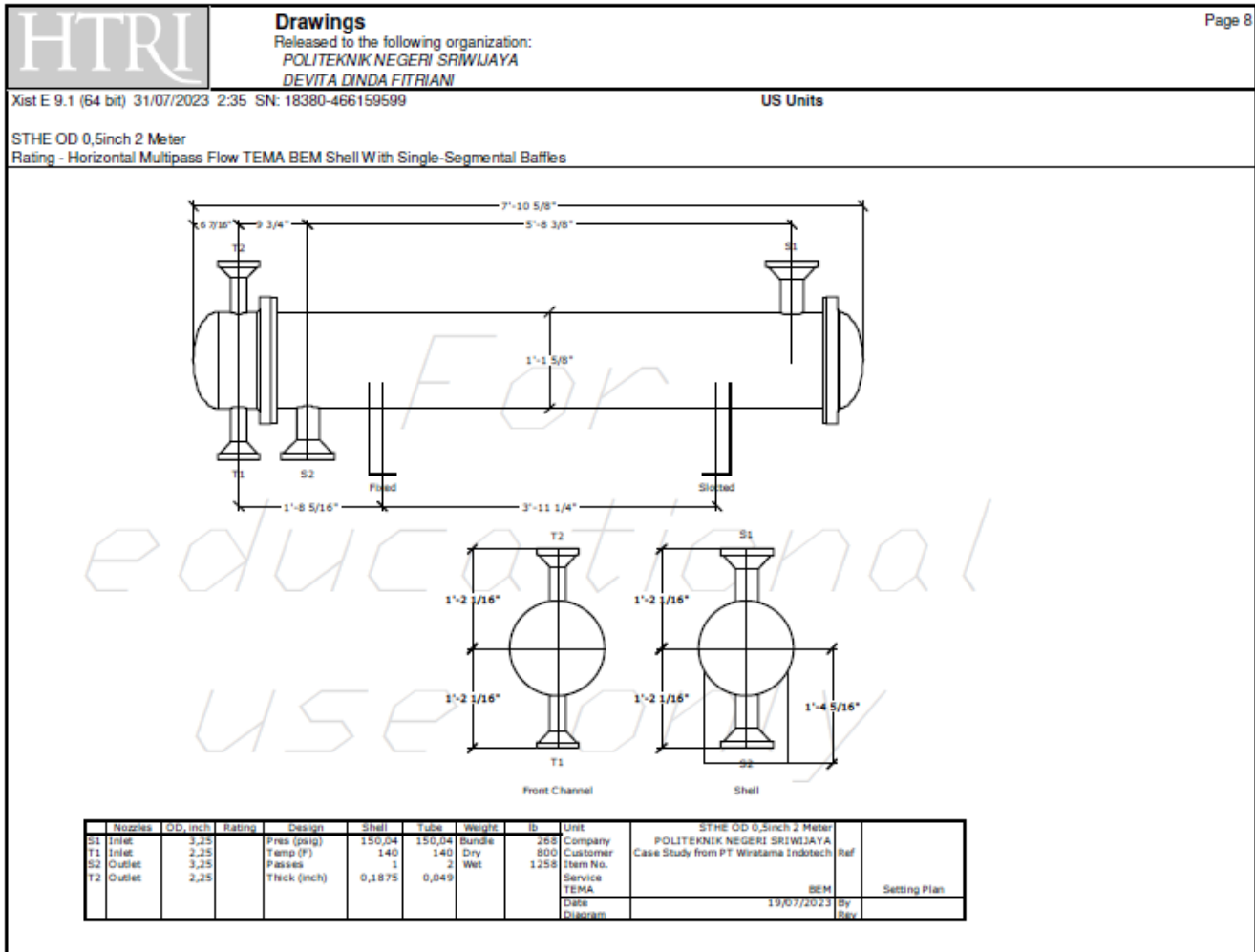
		HEAT EXCHANGER SPECIFICATION SHEET				Page 5	
		Released to the following organization: POLITEKNIK NEGERI SRWIJAJAYA DEVITA DINDA FITRIANI				US Units	
Customer	Case Study from PT Wiratama Indotech			Job No.	1		
Address	JL. Srijaya Negara - Palembang			Reference No.			
Plant Location	State Polytechnic of Sriwijaya			Proposal No.			
Service of Unit				Date	19/07/2023	Rev	
Size	13.25 x 78.74	inch	Type	BEM	Horizontal	Connected In 1 Parallel 1 Series	
Surf./Unit (Gross/Eff)	97,917 / 95,741	#/2	Shell/Unit	1	Surf/Shell (Gross/Eff)	97,917 / 95,741 #/2	
PERFORMANCE OF ONE UNIT							
Fluid Allocation		Shell Side		Tube Side			
Fluid Name		POME GAS		CHILLED WATER			
Fluid Quantity, Total		1483,7		3377,8			
Vapor (In/Out)		1483,7					
Liquid				3377,8			
Steam				3377,8			
Water				3377,8			
Noncondensables							
Temperature (In/Out)		F 95,00 53,60		F 44,60 53,60			
Specific Gravity				1,0004 1,0000			
Viscosity		cP 0,0131 0,0131		1,4269 1,2340			
Molecular Weight				18,02 18,02			
Molecular Weight, Noncondensables							
Specific Heat		Btu/lb-F 0,4949 0,4949		1,0039 1,0020			
Thermal Conductivity		Btu/hr-ft-F 0,0156 0,0156		0,3307 0,3368			
Latent Heat		Btu/lb					
Inlet Pressure		psia 29,925		29,925			
Velocity		ft/sec 3,69e-2		0,32			
Pressure Drop, Allow/Calc		psi 1,32e-3		0,027			
Fouling Resistance (min)		ft ² -hr-F/Btu					
Heat Exchanged		30400 Btu/hr		MTD (Corrected) 16,9 F			
Transfer Rate, Service		18,80 Btu/ft ² -hr-F		Clean	17,92 Btu/ft ² -hr-F	Actual 17,92 Btu/ft ² -hr-F	
CONSTRUCTION OF ONE SHELL				Sketch (Bundle/Nozzle Orientation)			
		Shell Side		Tube Side			
Design/Test Pressure		psig 150,04 / 140,00		150,04 / 140,00			
Design Temperature		F		F			
No Passes per Shell		1		2			
Corrosion Allowance		inch 0,0591		0,0591			
Connections		In 1 @ 3,0000		1 @ 2,0000			
Size & Rating		Out 1 @ 3,0000		1 @ 2,0000			
		@		@			
Tube No. 114		OD 0,5000	inch	Thk(Avg) 0,0490	inch	Length 6,562	
Tube Type Plain		Material 304 Stainless steel (18 Cr, 8 Ni)			Pitch 0,9750		
Shell 304 Stainless steel (18 Cr, 8 Ni)		ID 13,250	OD 13,625	inch	Tube pattern 60		
Channel or Bonnet 304 Stainless steel (18 Cr, 8 Ni)		Shell Cover			Channel Cover		
Tubesheet-Stationary 304 Stainless steel (18 Cr, 8 Ni)		Tubesheet-Floating			Impingement Plate None		
Floating Head Cover							
Baffles-Cross 304 Stainless steel (18 Cr, 8 Ni) Type Single-Seg.		%Cut (Diam) 25	Spacing(c/c) 3,3125	Inlet 10,339			
Baffles-Long		Seal Type None			Type None		
Supports-Tube		U-Bend			Type None		
Distance, support to tubesheet		Inlet		Outlet			
Number of rows supported		Inlet		Outlet			
Bypass Seal Arrangement		pairs seal strips		Tube-Tubesheet Joint Expanded (2 grooves)			
Expansion Joint		Type None					
Rho-V2-Inlet Nozzle 1,29		lb/ft-sec ²		Bundle Entrance 9,25e-2 Bundle Exit 9,25e-2			
Gaskets-Shell Side Mach. Mt. (Kammprofil/Flex. Face)		Tube Side Mach. Mt. (Kammprofil/Flex. Face)					
- Floating Head							
Code Requirements		TEMA Class R					
Weight/Shell 799,62		lb Filled with Water 1257,8		lb Bundle 268,08			
Remarks:							
Shell lining material - SA-53 B Pipe (S) K03005							
Tubesheet (tubeside) lining material - SA-53 B Pipe (S) K03005							

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4. Tube Layout Model 0.5inch



5. Heat Exchanger 2D Drawing 0.5inch

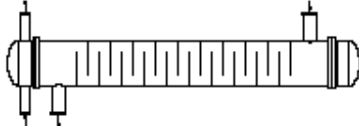


HTRI Drawings Page 8
 Released to the following organization:
 POLITEKNIK NEGERI SRIWIJAYA
 DEVITA DINDA FITRIANI

Xist E 9.1 (64 bit) 31/07/2023 2:35 SN: 18380-466159599 US Units

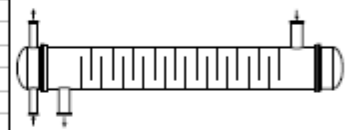
STHE OD 0,5inch 2 Meter
 Rating - Horizontal Multipass Flow TEMA BEM Shell With Single-Segmental Baffles

6. Final Result Data Sheet 0.75inch


HTRI		Final Results		Page 1
Xist E 9.1 (64 bit) 31/07/2023 2:44 SN: 18380-466159599			Released to the following organization: POLITEKNIK NEGERI SRWIJAYA DEVITA DINDA FITRANI	
STHE 0,75inch 2 Meter			US Units	
Rating - Horizontal Multipass Flow TEMA BEM Shell With Single-Segmental Baffles				
Process Data		Hot Shellside		Cold Tubeside
Fluid name		POME GAS		CHILLED WATER
Fluid condition		Sens. Gas		Sens. Liquid
Total flow rate	(1000-lb/hr)	1,4837		3,3778
Weight fraction vapor, In/Out	(-)	1,0000	1,0000	0,0000
Temperature, In/Out	(Deg F)	95,00	53,60	44,60
Skin temperature, Min/Max	(Deg F)	47,97	64,41	47,90
Wall temperature, Min/Max	(Deg F)	47,97	64,41	47,90
Pressure, In/Average	(psia)	29,925	29,923	29,925
Pressure drop, Total/Allowed	(psi)	3,09e-3	0,000	0,010
Velocity, Mid/Max allow	(ft/sec)	6,69e-2		0,17
Mole fraction inert	(-)		0,0000	
Average film coef.	(Btu/ft2-hr-F)		33,19	50,31
Heat transfer safety factor	(-)		1,0000	1,0000
Fouling resistance	(ft2-hr-F/Btu)		0,00000	0,00000
Overall Performance Data				
Overall coef., Req'd/Clean/Actual	(Btu/ft2-hr-F)	17,57 /	18,70 /	18,70
Heat duty, Calculated/Specified	(MM Btu/hr)	0,0304 /	0,0304	
Effective overall temperature difference	(Deg F)	16,8		
EMTD - (MTD) * (DELTA) * (F/G/H)	(Deg F)	17,4 *	0,9670 *	1,0000
See Runtime Messages Report for warnings.				
Exchanger Fluid Volumes				
Approximate shellside	(ft3)	3,474		
Approximate tubeside	(ft3)	2,371		
Shell Construction Information				
TEMA shell type	BEM		Shell ID	(inch) 12,000
Shells Series	1 Parallel	1	Total area	(ft2) 105,65
Passes Shell	1 Tube	2	Eff. area	(ft2/shell) 102,96
Shell orientation angle (deg)	0,00			
Impingement present	No			
Pairs seal strips	0			
Shell expansion joint	No			
Weight estimation Wet/Dry/Bundle	1104,3 /	739,55 /	267,63 (lb/shell)	
Baffle Information				
Type	Perpend. Single-Seg.		Baffle cut (% dia)	25
Crosspasses/shellpass	21		No. (Pct Area)	(inch) to C.L. 3,0000
Central spacing	(inch)	3,0000	1	20,94
Inlet spacing	(inch)	9,8701	2	0,00
Outlet spacing	(inch)	9,8701		
Baffle thickness	(inch)	0,1875		
Number of deresonating baffles	0			
Tube Information				
Tube type	Plain		Tubecount per shell	82
Overall length	(ft)	6,562	Pct tubes removed (both)	2,38
Effective length	(ft)	6,395	Outside diameter	(inch) 0,7500
Total tubesheet	(inch)	2,0000	Wall thickness	(inch) 0,0490
Area ratio	(out/in)	1,1503	Pitch (inch)	1,0000 Ratio 1,3333
Tube metal	304 Stainless steel (18 Cr, 8 Ni)		Tube pattern (deg)	60
Bundle Information				
Outer tube limit	(inch)	11,566	Bundle exit rho-V2	(lb/ft-sec2) 0,24
Bundle entrance rho-V2	(lb/ft-sec2)	0,24	Allow crossed U-bends	No
Fins on U-bends	No			
Parallel passlane width	(inch)	0,0000	Perpend. passlane width	(inch) 1,2499
Support Information		Inlet	Outlet	
Distance, support to tubesheet/support plate	(inch)			
Number of rows supported				
Rear head support plate				No
Support plates/baffle space				

7. Rating Data Sheet 0.75inch

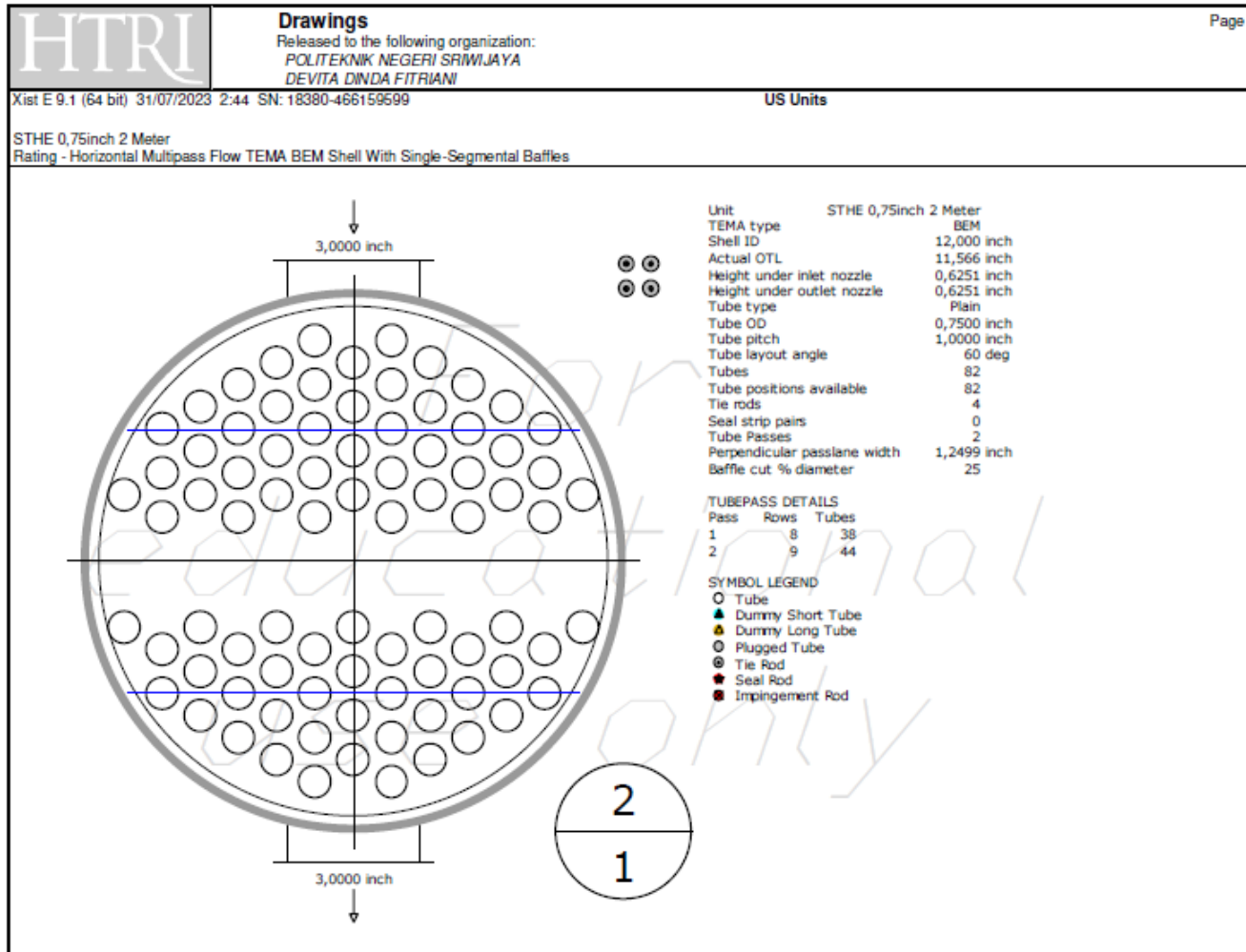
HTRI		HEAT EXCHANGER RATING DATA SHEET				Page 4		
		Released to the following organization: POLITEKNIK NEGERI SRIWIJAYA DEVITA DINDA FITRIANI				US Units		
Service of Unit				Item No.				
Type	BEM		Orientation	Horizontal		Connected In	1 Parallel 1 Series	
Surf/Unit (Gross/Err)	105,65 / 102,96	ft2	Shell/Unit	1		Surf/Shell (Gross/Err)	105,65 / 102,96 ft2	
PERFORMANCE OF ONE UNIT								
Fluid Allocation		Shell Side			Tube Side			
Fluid Name		POME GAS			CHILLED WATER			
Fluid Quantity, Total		1,4837			3,3778			
Vapor (In/Out)	wt%	100,00		100,00		0,00 0,00		
Liquid	wt%	0,00		0,00		100,00 100,00		
Temperature (In/Out)	F	95,00		53,60		44,60 53,60		
Density	lb/ft3	54,687		54,687		62,425 62,400		
Viscosity	cP	0,0131		0,0131		1,4269 1,2340		
Specific Heat	Btu/lb-F	0,4949		0,4949		1,0039 1,0020		
Thermal Conductivity	Btu/hr-ft-F	0,0156		0,0156		0,3307 0,3368		
Critical Pressure	psia							
Inlet Pressure	psia	29,925			29,925			
Velocity	ft/sec				6,69e-2		0,17	
Pressure Drop, Allow/Calc	psi				3,09e-3		0,010	
Average Film Coefficient	Btu/ft2-hr-F	33,19			50,31			
Fouling Resistance (min)	ft2-hr-F/Btu							
Heat Exchanged	0,0304 MM Btu/hr	MTD (Corrected)	16,8 F		Overdesign	6,48 %		
Transfer Rate, Service	17,57 Btu/ft2-hr-F	Calculated	18,70 Btu/ft2-hr-F		Clean	18,70 Btu/ft2-hr-F		
CONSTRUCTION OF ONE SHELL					Sketch (Bundle/Nozzle Orientation)			
Design Pressure		Shell Side		Tube Side				
Design Temperature		150,11		150,11				
No Passes per Shell		1		2				
Flow Direction		Downward		Upward				
Connections	In Inch	1 @ 3,0000		1 @ 2,0000				
Size & Rating	Out Inch	1 @ 3,0000		1 @ 2,0000				
	Liq. Out Inch	@		1 @				
Tube No.	82,000	OD	0,7500 Inch	Thk(Avg)	0,0490 Inch	Length	6,562 ft	
Tube Type	Plain	Material	304 Stainless steel (18 Cr, 8 Ni)				Pitch	1,0000 Inch
Shell ID	12,000 Inch	Kettle ID	Inch				Tube pattern	60
Cross Baffle Type	Perpend. Single-Seq.	%Cut (Diam)	25		Impingement Plate	None		
Spacing(c/c)	3,0000 Inch	Inlet	9,8701 Inch		No. of Crosspasses	21		
Rho-V2-Inlet Nozzle	1,29 lb/ft-sec2	Shell Entrance	1,30 lb/ft-sec2		Shell Exit	1,30 lb/ft-sec2		
		Bundle Entrance	0,24 lb/ft-sec2		Bundle Exit	0,24 lb/ft-sec2		
Weight/Shell	739,55 lb	Filled with Water	1104,3 lb		Bundle	267,63 lb		
Notes:				Thermal Resistance, %	Velocities, ft/sec	Flow Fractions		
Shell lining material - SA-53 B Pipe (S) K03005				Shell	56,36	Shellside	6,69e-2 A 0,213	
Tubesheet (tubeside) lining material - SA-53 B Pipe (S) K03005				Tube	42,77	Tubeside	0,17 B 0,514	
				Fouling	0,00	Crossflow	0,11 C 0,061	
				Metal	0,87	Window	6,74e-2 E 0,212	
							F 0,000	



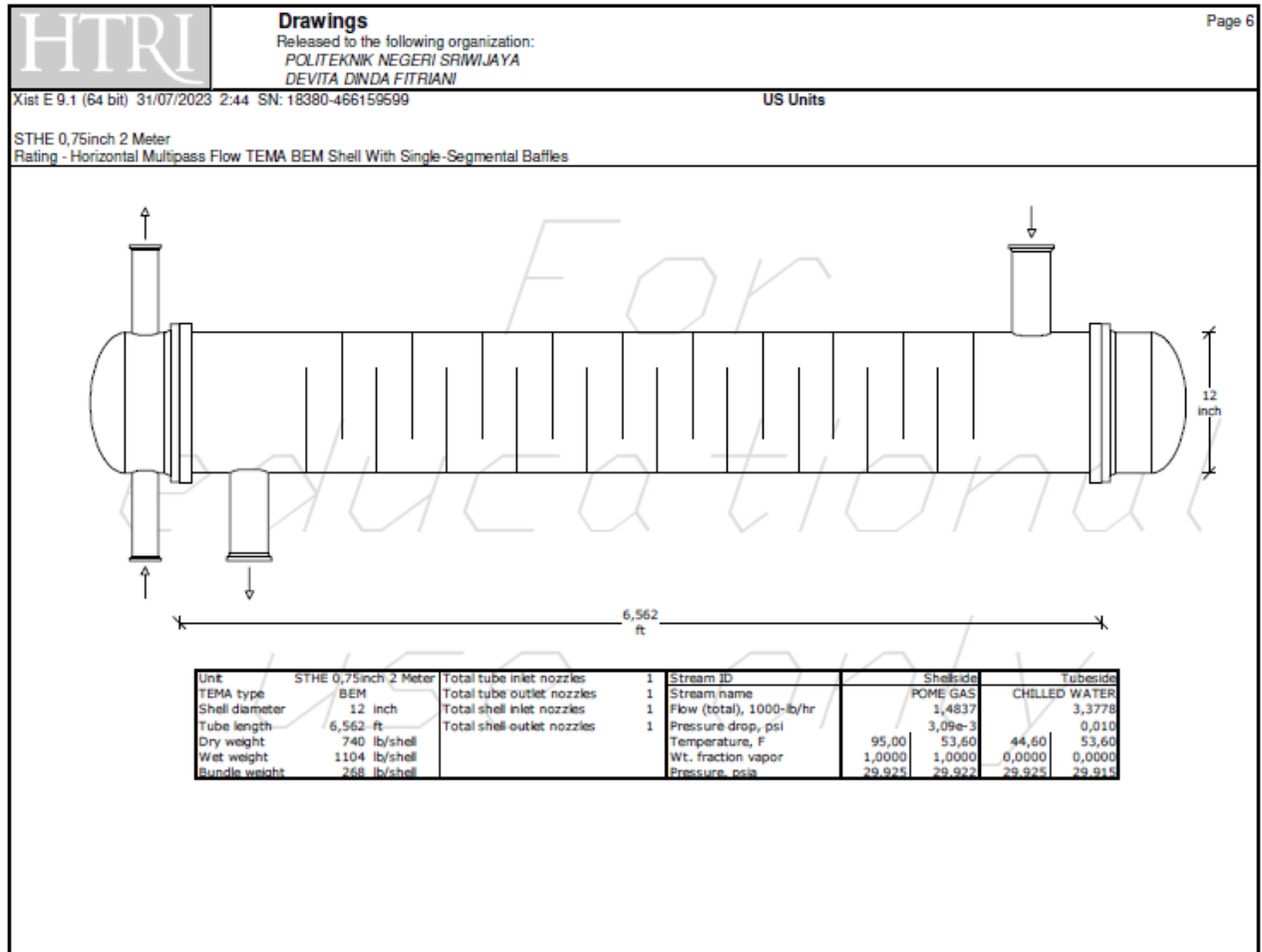
8. TEMA Specification Data Sheet 0.75inch

		HEAT EXCHANGER SPECIFICATION SHEET				Page 5	
		Released to the following organization: POLITEKNIK NEGERI SRWIJAYA DEVITA DINDA FITRIANI				US Units	
Customer		JL. Srijaya Negara - Palembang		Job No.			
Address		State Polytechnic of Sriwijaya		Reference No.			
Plant Location		Service of Unit		Proposal No.			
Size		12 x 78,74 inch		Date		19/07/2023 Rev	
Surf/Unit (Gross/Elf)		105,65 / 102,96 #2		Item No.			
Type		BEM Horizontal		Connected In		1 Parallel 1 Series	
Shell/Unit		1		Surf/Shell (Gross/Elf)		105,65 / 102,96 #2	
PERFORMANCE OF ONE UNIT							
Fluid Allocation		Shell Side		Tube Side			
Fluid Name		POME GAS		CHILLED WATER			
Fluid Quantity, Total lb/hr		1483,7		3377,8			
Vapor (In/Out)		1483,7					
Liquid				3377,8			
Steam				3377,8			
Water				3377,8			
Noncondensables							
Temperature (In/Out) F		95,00 53,60		44,60 53,60			
Specific Gravity				1,0004 1,0000			
Viscosity cP		0,0131 0,0131		1,4269 1,2340			
Molecular Weight				18,02 18,02			
Molecular Weight, Noncondensables							
Specific Heat Btu/lb-F		0,4949 0,4949		1,0039 1,0020			
Thermal Conductivity Btu/hr-ft-F		0,0156 0,0156		0,3307 0,3368			
Latent Heat Btu/lb							
Inlet Pressure psia		29,925		29,925			
Velocity ft/sec		6,69e-2		0,17			
Pressure Drop, Allow/Calc psi				3,09e-3 0,010			
Fouling Resistance (min) #2-hr-F/Btu							
Heat Exchanged		30400 Btu/hr		MTD (Corrected) 16,8 F			
Transfer Rate, Service		17,57 Btu/#2-hr-F		Clean 18,70 Btu/#2-hr-F Actual 18,70 Btu/#2-hr-F			
CONSTRUCTION OF ONE SHELL				Sketch (Bundle/Nozzle Orientation)			
Design/Test Pressure psig		150,11 /		150,11 /			
Design Temperature F		140,00		140,00			
No Passes per Shell		1		2			
Corrosion Allowance inch		0,0591		0,0591			
Connections		1 @ 3,0000		1 @ 2,0000			
Size & Rating		Intermediate		Intermediate			
Tube No. 82		OD 0,7500 inch		Thk(Avg) 0,0490 inch		Length 6,562 ft Pitch 1,0000 inch	
Tube Type Plain		Material 304 Stainless steel (18 Cr, 8 Ni)		Tube pattern 60			
Shell 304 Stainless steel (18 Cr, 8 Ni)		ID 12,000 OD 12,375 inch		Shell Cover			
Channel or Bonnet 304 Stainless steel (18 Cr, 8 Ni)				Channel Cover			
Tubesheet-Stationary 304 Stainless steel (18 Cr, 8 Ni)				Tubesheet-Floating			
Floating Head Cover				Impingement Plate None			
Baffles-Cross 304 Stainless steel (18 Cr, 8 Type Single-Seg.		%Cut (Diam) 25		Spacing (c/c) 3,0000		Inlet 9,8701 inch	
Baffles-Long		Seal Type None					
Supports-Tube		U-Bend		Type None			
Distance, support to tubesheet		Inlet		Outlet inch			
Number of rows supported		Inlet		Outlet			
Bypass Seal Arrangement		pairs seal strips		Tube-Tubesheet Joint Expanded (2 grooves)			
Expansion Joint		Type None					
Rho-V2-Inlet Nozzle 1,29 lb/ft-sec2		Bundle Entrance 0,24		Bundle Exit 0,24		lb/ft-sec2	
Gaskets-Shell Side Mach. Mtl. (Kammprofile/Flex. Face)		Tube Side Mach. Mtl. (Kammprofile/Flex. Face)					
- Floating Head							
Code Requirements		TEMA Class R					
Weight/Shell 739,55 lb		Filled with Water 1104,3 lb		Bundle 267,63 lb			
Remarks:							
Shell lining material - SA-53 B Pipe (S) K03005							
Tubesheet (tubeside) lining material - SA-53 B Pipe (S) K03005							
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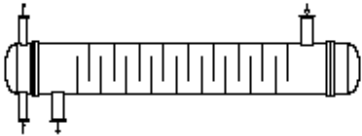
9. Tube Layout 0.75inch



10. Heat Exchanger 0.75inch




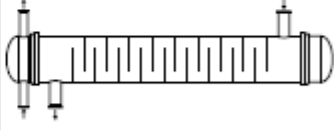
11. Final Result Datasheet 1 inch

HTRI		Final Results		Page 1	
Released to the following organization: POLITEKNIK NEGERI SRWIJAYA DEVITA DINDA FITRIANI					
Xist E 9.1 (64 bit) 31/07/2023 2:42 SN: 18380-466159599				US Units	
STHE OD 1inch 2 Meter Rating - Horizontal Multipass Flow TEMA BEM Shell With Single-Segmental Baffles					
Process Data			Hot Shellside		Cold Tubeside
Fluid name			POME GAS		CHILLED WATER
Fluid condition			Sens. Gas		Sens. Liquid
Total flow rate	(1000-lb/hr)		1,4837		3,3778
Weight fraction vapor, In/Out	(--)	1,0000	1,0000	0,0000	0,0000
Temperature, In/Out	(Deg F)	95,00	53,60	44,60	53,60
Skin temperature, Min/Max	(Deg F)	47,79	64,77	47,73	64,46
Wall temperature, Min/Max	(Deg F)	47,79	64,77	47,73	64,46
Pressure, In/Average	(psia)	29,925	29,924	29,925	29,921
Pressure drop, Total/Allowed	(psi)	2,57e-3	0,000	7,35e-3	0,000
Velocity, Mid/Max allow	(ft/sec)	6,67e-2		0,10	
Mole fraction inert	(--)		0,0000		
Average film coef.	(Btu/ft2-hr-F)		31,26		44,39
Heat transfer safety factor	(--)		1,0000		1,0000
Fouling resistance	(ft2-hr-F/Btu)		0,00000		0,00000
Overall Performance Data					
Overall coef., Req'd/Clean/Actual			(Btu/ft2-hr-F)	16,13 /	17,41 /
Heat duty, Calculated/Specified			(MM Btu/hr)	0,0304 /	0,0304
Effective overall temperature difference			(Deg F)	17,1	
EMTD - (MTD) * (DELTA) * (F/G/H)			(Deg F)	17,7 *	0,9661 * 1,0000
See Runtime Messages Report for warnings.					
Exchanger Fluid Volumes					
Approximate shellside	(ft3)	3,881			
Approximate tubeside	(ft3)	3,400			
Shell Construction Information					
TEMA shell type		BEM	Shell ID	(inch)	13,250
Shells Series	1 Parallel	1	Total area	(ft2)	113,38
Passes Shell	1 Tube	2	Eff. area	(ft2/shell)	110,32
Shell orientation angle (deg)		0,00			
Impingement present		No			
Pairs seal strips		2	Passlane seal rods (inch)	0,0000	No. 0
Shell expansion joint		No			
Weight estimation Wet/Dry/Bundle			1281,8 /	827,49 /	295,95 (lb/shell)
Baffle Information					
Type		Perpend. Single-Seg.	Baffle cut (% dia)	25	
Crosspasses/shellpass		19	No. (Pct Area)	(inch) to C.L.	
Central spacing	(inch)	3,3125	1	24,54	3,3125
Inlet spacing	(inch)	10,151	2	0,00	0,0000
Outlet spacing	(inch)	10,151			
Baffle thickness	(inch)	0,1875			
Number of de-resonating baffles		0			
Tube Information					
Tube type		Plain	Tubecount per shell		66
Overall length	(ft)	6,562	Pct tubes removed (both)		16,46
Effective length	(ft)	6,385	Outside diameter	(inch)	1,0000
Total tubesheet	(inch)	2,1250	Wall thickness	(inch)	0,0490
Area ratio	(out/in)	1,1086	Pitch (inch)	1,2500	Ratio 1,2500
Tube metal	304 Stainless steel (18 Cr, 8 Ni)		Tube pattern (deg)		60
Bundle Information					
Outer tube limit	(inch)	12,702	Bundle exit rho-V2	(lb-ft-sec2)	0,41
Bundle entrance rho-V2	(lb-ft-sec2)	7,35e-2	Allow crossed U-bends		No
Fins on U-bends		No	Perpend. passlane width	(inch)	0,5000
Parallel passlane width	(inch)	0,0000			
Support Information			Inlet		Outlet
Distance, support to tubesheet/support plate	(inch)				
Number of rows supported					
Rear head support plate					No
Support plates/baffle space					


Unit: STHE OD 1inch 2 Meter

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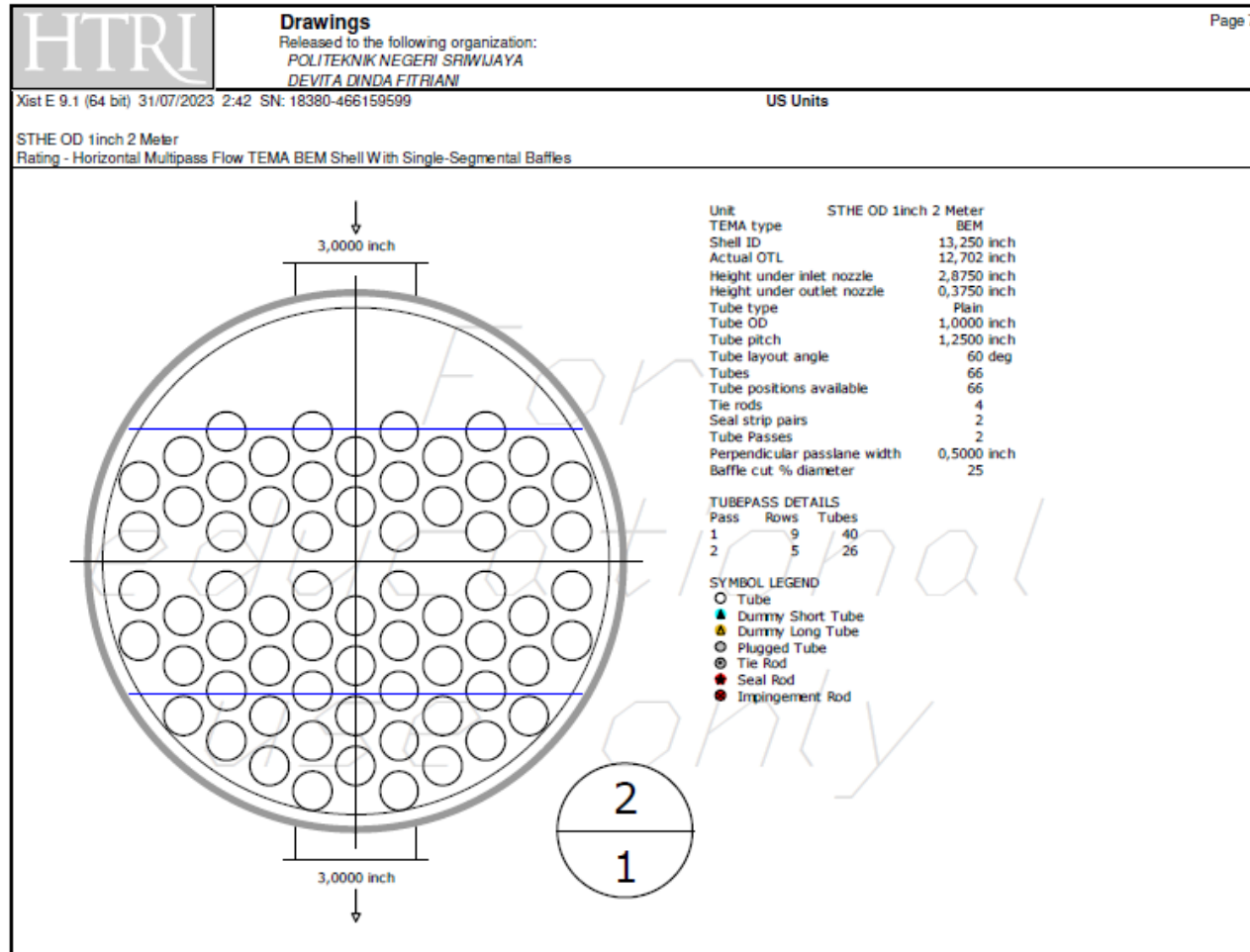
12. Rating Datasheet 1inch

		HEAT EXCHANGER RATING DATA SHEET				Page 4									
		Released to the following organization: POLITEKNIK NEGERI SRIWIJAYA DEVITA DINDA FITRIANI				US Units									
Service of Unit		Item No.													
Type	BEM	Orientation	Horizontal	Connected In	1 Parallel	1 Series									
Surf/Unit (Gross/Eff)	113,38 / 110,32	ft2	Shell/Unit	1	Surf/Shell (Gross/Eff)	113,38 / 110,32	ft2								
PERFORMANCE OF ONE UNIT															
Fluid Allocation		Shell Side			Tube Side										
Fluid Name		POME GAS			CHILLED WATER										
Fluid Quantity, Total		1,4837			3,3778										
Vapor (In/Out)		wt%			wt%										
		100,00			100,00										
Liquid		wt%			wt%										
		0,00			0,00										
Temperature (In/Out)		F			F										
		95,00			53,60										
Density		lb/ft3			lb/ft3										
		54,687			54,687										
Viscosity		cP			cP										
		0,0131			0,0131										
Specific Heat		Btu/lb-F			Btu/lb-F										
		0,4949			0,4949										
Thermal Conductivity		Btu/hr-ft-F			Btu/hr-ft-F										
		0,0156			0,0156										
Critical Pressure		psia			psia										
Inlet Pressure		psia			psia										
		29,925			29,925										
Velocity		ft/sec			ft/sec										
		6,67e-2			0,10										
Pressure Drop, Allow/Calc		psi			psi										
		2,57e-3			7,35e-3										
Average Film Coefficient		Btu/ft2-hr-F			Btu/ft2-hr-F										
		31,26			44,39										
Fouling Resistance (min)		ft2-hr-F/Btu			ft2-hr-F/Btu										
Heat Exchanged		0,0304 MM Btu/hr		MTD (Corrected)	17,1	F	Overdesign	7,94	%						
Transfer Rate, Service		16,13 Btu/ft2-hr-F		Calculated	17,41	Btu/ft2-hr-F	Clean	17,41	Btu/ft2-hr-F						
CONSTRUCTION OF ONE SHELL															
		Shell Side			Tube Side			Sketch (Bundle/Nozzle Orientation)							
Design Pressure		psig			psig										
Design Temperature		F			F										
No Passes per Shell		1			2										
Flow Direction		Downward			Upward										
Connections		In	Inch	@	In	Inch	@								
Size & Rating		Out	Inch	@	Out	Inch	@								
		Liq. Out	Inch	@											
Tube No.	66,000	OD	1,0000	Inch	Thk(Avg)	0,0490	Inch	Length	6,562	ft	Pitch	1,2500	Inch	Tube pattern	60
Tube Type	Plain	Material		304 Stainless steel (18 Cr, 8 Ni)		Pairs seal strips		2							
Shell ID	13,250	Kettle ID		Inch		Passlane Seal Rod No.		0							
Cross Baffle Type	Perpend.	Single-Seq.		%Cut (Diam)		Impingement Plate		None							
Spacing(c/c)	3,3125	Inlet		10,151		No. of Crosspasses		19							
Rho-V2-Inlet Nozzle	1,29	lb/ft-sec2		Shell Entrance		8,26e-2		lb/ft-sec2							
		Bundle Entrance		7,35e-2		lb/ft-sec2		Bundle Exit							
								0,41							
Weight/Shell	827,49	lb		Filled with Water		1281,8		lb							
								Bundle							
								295,95							
Notes:		Thermal Resistance, %			Velocities; ft/sec		Flow Fractions								
Shell lining material - SA-53 B Pipe (S) K03005		Shell			55,71		Shellside		6,67e-2		A		0,222		
Tubesheet (tubeside) lining material - SA-53 B Pipe (S) K03005		Tube			43,49		Tubeside		0,10		B		0,492		
		Fouling			0,00		Crossflow		0,11		C		0,072		
		Metal			0,80		Window		5,14e-2		E		0,214		
											F		0,000		

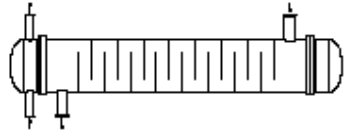
13. TEMA Specification Datasheet 1inch

		HEAT EXCHANGER SPECIFICATION SHEET				Page 5
		Released to the following organization: POLITEKNIK NEGERI SRWIJAYA DEVITA DINDA FITRIANI				US Units
Customer	Case Study from PT Wiratama Indotech			Job No.	1	
Address	JL. Srijaya Negara - Palembang			Reference No.		
Plant Location	State Polytechnic of Sriwijaya			Proposal No.		
Service of Unit				Date	19/07/2023	Rev
Size	13.25 x 78.74	inch	Type	BEM	Horizontal	Connected In 1 Parallel 1 Series
Surf/Unit (Gross/Eff)	113,38 / 110,32	ft ²	Shell/Unit	1	Surf/Shell (Gross/Eff)	113,38 / 110,32 ft ²
PERFORMANCE OF ONE UNIT						
Fluid Allocation		Shell Side		Tube Side		
Fluid Name		POME GAS		CHILLED WATER		
Fluid Quantity, Total	lb/hr	1483,7		3377,8		
Vapor (In/Out)		1483,7	1483,7			
Liquid				3377,8	3377,8	
Steam						
Water				3377,8	3377,8	
Noncondensables						
Temperature (In/Out)	F	95,00	53,60	44,60	53,60	
Specific Gravity				1,0004	1,0000	
Viscosity	cP	0,0131	0,0131	1,4269	1,2340	
Molecular Weight				18,02	18,02	
Molecular Weight, Noncondensables						
Specific Heat	Btu/lb-F	0,4949	0,4949	1,0039	1,0020	
Thermal Conductivity	Btu/hr-ft-F	0,0156	0,0156	0,3307	0,3368	
Latent Heat	Btu/lb					
Inlet Pressure	psia		29,925		29,925	
Velocity	ft/sec		6,67e-2		0,10	
Pressure Drop, Allow/Calc	psi		2,57e-3		7,35e-3	
Fouling Resistance (min)	ft ² -hr-F/Btu					
Heat Exchanged	30400	Btu/hr		MTD (Corrected)	17,1	F
Transfer Rate, Service	16,13	Btu/ft ² -hr-F	Clean	17,41	Btu/ft ² -hr-F	Actual 17,41 Btu/ft ² -hr-F
CONSTRUCTION OF ONE SHELL				Sketch (Bundle/Nozzle Orientation)		
		Shell Side		Tube Side		
Design/Test Pressure	psig	150,04	/	150,04	/	
Design Temperature	F	140,00		140,00		
No Passes per Shell		1		2		
Corrosion Allowance	inch	0,0591		0,0591		
Connections	In	1 @ 3,0000		1 @ 2,0000		
	Out	1 @ 3,0000		1 @ 2,0000		
Size & Rating	Intermediate	@		@		
Tube No.	66	OD	1,0000	inch	Trk(Avg)	0,0490
					inch	Length
Tube Type	Plain				Material	304 Stainless steel (18 Cr, 8 Ni)
						Pitch
Shell	304 Stainless steel (18 Cr, 8 Ni)	ID	13,250	OD	13,625	inch
Channel or Bonnet	304 Stainless steel (18 Cr, 8 Ni)					Tube pattern
Tubesheet-Stationary	304 Stainless steel (18 Cr, 8 Ni)					60
Floating Head Cover						Shell Cover
						Channel Cover
						Tubesheet-Floating
						Impingement Plate
						None
Baffles-Cross	304 Stainless steel (18 Cr, 8 Type	Single-Seg.		%Cut (Diam)	25	Spacing(c/c)
						3,3125
						Inlet
						10,151
Baffles-Long						inch
Supports-Tube						Seal Type
						None
						U-Bend
						Type
						None
Distance, support to tubesheet	Inlet			Outlet		inch
Number of rows supported	Inlet			Outlet		
Bypass Seal Arrangement	2	pairs seal strips		Tube-Tubesheet Joint		Expanded (2 grooves)
Expansion Joint				Type		None
Rho-V2-Inlet Nozzle	1,29	lb/ft-sec ²		Bundle Entrance	7,35e-2	Bundle Exit
						0,41
						lb/ft-sec ²
Gaskets-Shell Side	Mach. Mtl. (Kammprofile/Flex. Face)			Tube Side	Mach. Mtl. (Kammprofile/Flex. Face)	
- Floating Head						
Code Requirements						TEMA Class
						R
Weight/Shell	827,49	lb	Filled with Water	1281,8	lb	Bundle
						295,95
						lb
Remarks:						
Shell lining material - SA-53 B Pipe (S) K03005						
Tubesheet (tubeside) lining material - SA-53 B Pipe (S) K03005						
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14. Tube Layout 1inch




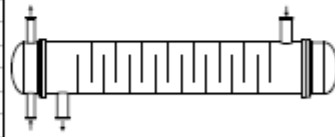
16. Final Result Datasheet 1.25inch

HTRI		Final Results		Page 1	
Released to the following organization: POLITEKNIK NEGERI SRIWIJAYA DEVITA DINDA FITRIANI					
Xist E 9.1 (64 bit) 31/07/2023 2:38 SN: 18380-466159599				US Units	
STHE OD 1,25inch 2 Meter					
Rating - Horizontal Multipass Flow TEMA BEM Shell With Single-Segmental Baffles					
Process Data		Hot Shellside		Cold Tubeside	
Fluid name		POME GAS		CHILLED WATER	
Fluid condition		Sens. Gas		Sens. Liquid	
Total flow rate	(1000-lb/hr)	1,4837		3,3778	
Weight fraction vapor, In/Out	(-)	1,0000	1,0000	0,0000	0,0000
Temperature, In/Out	(Deg F)	95,00	53,60	44,60	53,60
Skin temperature, Min/Max	(Deg F)	47,69	63,39	47,64	63,13
Wall temperature, Min/Max	(Deg F)	47,69	63,39	47,64	63,13
Pressure, In/Average	(psia)	29,925	29,924	29,925	29,922
Pressure drop, Total/Allowed	(psi)	1,78e-3	0,000	6,59e-3	0,000
Velocity, Mid/Max allow	(ft/sec)	5,89e-2		8,14e-2	
Mole fraction inert	(-)		0,0000		
Average film coef.	(Btu/ft ² -hr-F)		24,48		40,01
Heat transfer safety factor	(-)		1,0000		1,0000
Fouling resistance	(ft ² -hr-F/Btu)		0,00000		0,00000
Overall Performance Data					
Overall coef., Req'd/Clean/Actual		(Btu/ft ² -hr-F)	16,84 /	14,61 /	14,61
Heat duty, Calculated/Specified		(MM Btu/hr)	0,0304 /	0,0304	
Effective overall temperature difference		(Deg F)	17,0		
EMTD - (MTD) * (DELTA) * (F/G/H)		(Deg F)	17,7 *	0,9636 *	1,0000
See Runtime Messages Report for warnings.					
Exchanger Fluid Volumes					
Approximate shellside	(ft ³)	5,368			
Approximate tubeside	(ft ³)	4,476			
Shell Construction Information					
TEMA shell type	BEM		Shell ID	(inch)	15,250
Shells Series	1 Parallel	1	Total area	(ft ²)	109,51
Passes Shell	1 Tube	2	Eff. area	(ft ² /shell)	106,04
Shell orientation angle (deg)	0,00				
Impingement present	No				
Pairs seal strips	0		Passlane seal rods (inch)	0,0000	No. 0
Shell expansion joint	No				
Weight estimation Wet/Dry/Bundle	1562,0 /		947,79 /		337,90 (lb/shell)
Baffle Information					
Type	Perpend.	Single-Seg.	Baffle cut (% dia) 25		
Crosspasses/shell/pass	17		No. (Pct Area)	(inch) to C.L	
Central spacing	(inch)	3,8125	1	21,23	3,8125
Inlet spacing	(inch)	9,5263	2	0,00	0,0000
Outlet spacing	(inch)	9,5263			
Baffle thickness	(inch)	0,2500			
Number of deresonating baffles	0				
Tube Information					
Tube type	Plain		Tubecount per shell		
Overall length	(ft)	6,562	Pct tubes removed (both)		
Effective length	(ft)	6,353	1,92		
Total tubesheet	(inch)	2,5000	Outside diameter (inch)		
Area ratio	(out/in)	1,0851	1,2500		
Tube metal	304 Stainless steel (18 Cr, 8 Ni)		Wall thickness (inch)		
			0,0490		
			Pitch (inch)		
			1,5625 Ratio		
			1,2500		
			Tube pattern (deg)		
			60		
Bundle Information					
Outer tube limit	(inch)	14,872		Bundle exit rho-V2 (lb/ft-sec ²)	
Bundle entrance rho-V2	(lb/ft-sec ²)	0,25		0,25	
Fins on U-bends	No				
Parallel passlane width	(inch)	0,0000		Perpend. passlane width (inch)	
					1,8750
Support Information			Inlet Outlet		
Distance, support to tubesheet/support plate	(inch)				
Number of rows supported					
Rear head support plate					
Support plates/baffle space	No				

Unit: STHE OD 1,25inch 2 Meter

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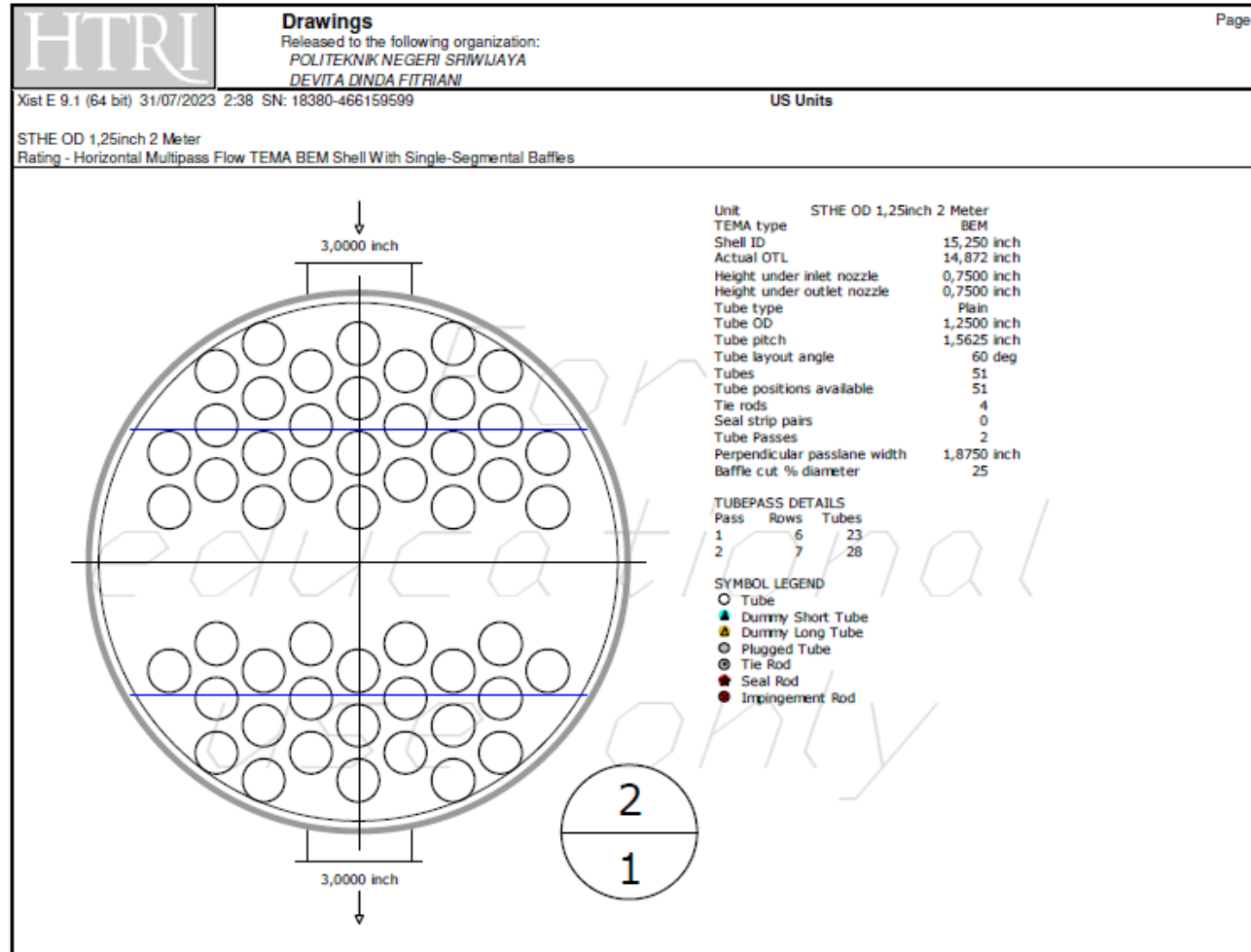
17. Rating Datasheet 1.25inch

		HEAT EXCHANGER RATING DATA SHEET				Page 4									
		Released to the following organization: POLITEKNIK NEGERI SRIWIJAYA DEVITA DINDA FITRIANI				US Units									
Service of Unit		Item No.													
Type	BEM	Orientation	Horizontal	Connected In	1 Parallel	1 Series									
Surt/Unit (Gross/Eff)	109,51 / 106,04	ft2	Shell/Unit	1	Surt/Shell (Gross/Eff)	109,51 / 106,04	ft2								
PERFORMANCE OF ONE UNIT															
Fluid Allocation		Shell Side			Tube Side										
Fluid Name		POME GAS			CHILLED WATER										
Fluid Quantity, Total		1,4837			3,3778										
Vapor (In/Out)		wt%			wt%										
		100,00			100,00										
Liquid		wt%			wt%										
		0,00			0,00										
Temperature (In/Out)		F			F										
		95,00			53,60										
Density		lb/ft3			lb/ft3										
		54,687			54,687										
Viscosity		cP			cP										
		0,0131			0,0131										
Specific Heat		Btu/lb-F			Btu/lb-F										
		0,4949			0,4949										
Thermal Conductivity		Btu/hr-ft-F			Btu/hr-ft-F										
		0,0156			0,0156										
Critical Pressure		psia			psia										
Inlet Pressure		psia			psia										
		29,925			29,925										
Velocity		ft/sec			ft/sec										
		5,89e-2			8,14e-2										
Pressure Drop, Allow/Calc		psi			psi										
		1,78e-3			6,59e-3										
Average Film Coefficient		Btu/ft2-hr-F			Btu/ft2-hr-F										
		24,48			40,01										
Fouling Resistance (min)		ft2-hr-F/Btu			ft2-hr-F/Btu										
Heat Exchanged		0,0304 MM Btu/hr		MTD (Corrected)	17,0	F	Overdesign -13,21 %								
Transfer Rate, Service		16,84 Btu/ft2-hr-F		Calculated	14,61	Btu/ft2-hr-F	Clean 14,61 Btu/ft2-hr-F								
CONSTRUCTION OF ONE SHELL				Sketch (Bundle/Nozzle Orientation)											
Design Pressure		psig		Shell Side		Tube Side									
		150,04		150,04		150,04									
Design Temperature		F		140,00		140,00									
No Passes per Shell		1		2											
Flow Direction		Downward		Upward											
Connections		In Inch		1 @ 3,0000		1 @ 2,0000									
Size & Rating		Out Inch		1 @ 3,0000		1 @ 2,0000									
		Liq. Out Inch		@		1 @									
															
Tube No.	51,000	OD	1,2500	Inch	Thk(Avg)	0,0490	Inch	Length	6,562	ft	Pitch	1,5625	Inch	Tube pattern	60
Tube Type	Plain	Material		304 Stainless steel (18 Cr, 8 Ni)		Pairs seal strips		0							
Shell ID	15,250	Inch	Kettle ID	Inch		Passlane Seal Rod No.		0							
Cross Baffle Type	Perpend.	Single-Seg.	%Cut (Diam)		25		Impingement Plate		None						
Spacing(c/c)	3,6125	Inch	Inlet	9,5263		No. of Crosspasses		17							
Rho-V2-Inlet Nozzle	1,29	lb/ft-sec2	Shell Entrance	1,01		lb/ft-sec2	Shell Exit	1,01		lb/ft-sec2					
			Bundle Entrance	0,25		lb/ft-sec2	Bundle Exit	0,25		lb/ft-sec2					
Weight/Shell	947,79	lb	Filled with Water	1562,0		lb	Bundle	337,90		lb					
Notes:				Thermal Resistance, %		Velocities; ft/sec		Flow Fractions							
Shell lining material - SA-53 B Pipe (S) K03005				Shell		59,70		Shellside		5,89e-2		A		0,162	
Tubesheet (tubeside) lining material - SA-53 B Pipe (S) K03005				Tube		39,64		Tubeside		8,14e-2		B		0,578	
				Fouling		0,00		Crossflow		8,64e-2		C		0,057	
				Metal		0,66		Window		4,26e-2		E		0,203	
												F		0,000	

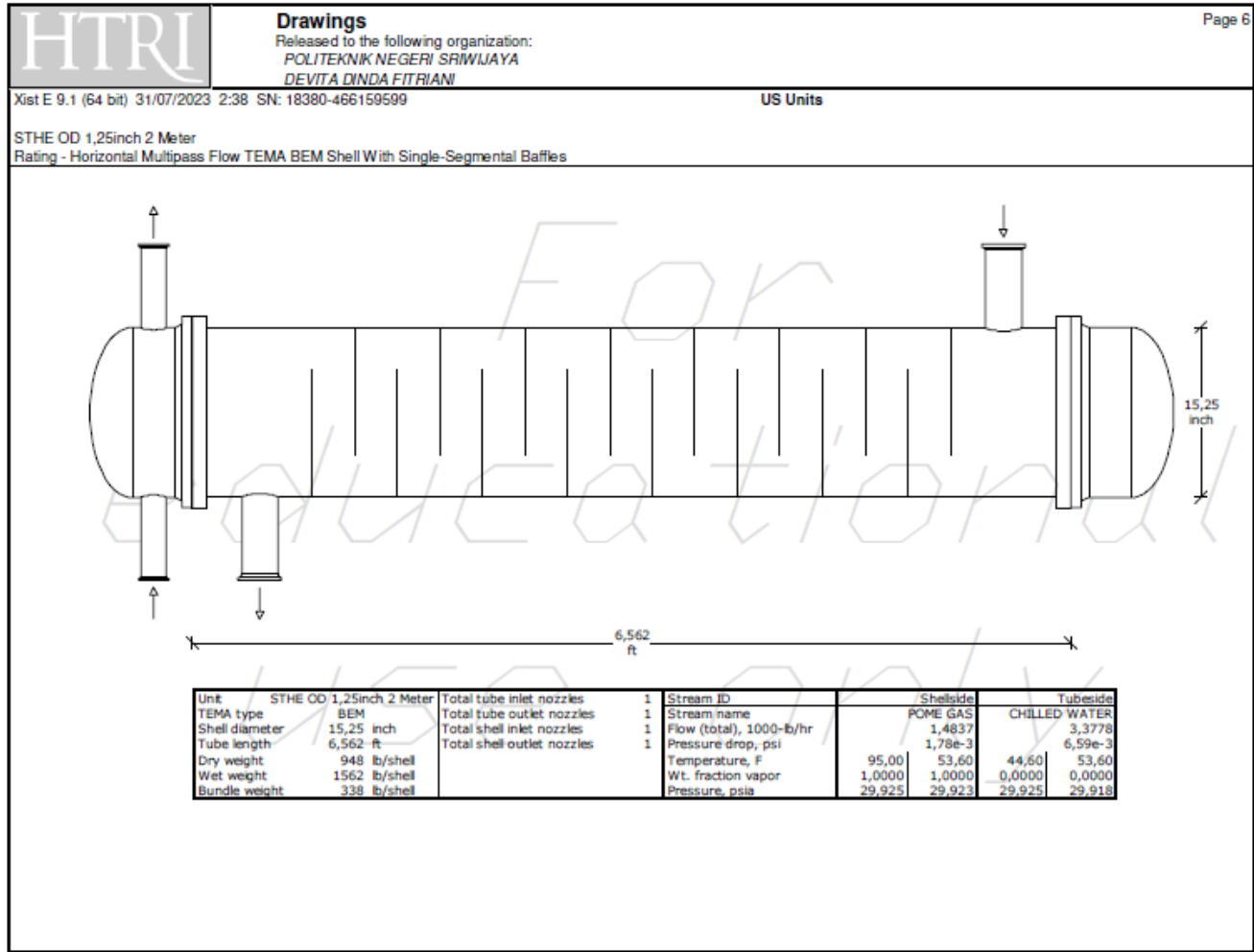
18. TEMA Specification Datasheet 1.25inch

HTRI		HEAT EXCHANGER SPECIFICATION SHEET				Page 5	
		Released to the following organization: POLITEKNIK NEGERI SRIWIJAYA DEVITA DINDA FITRIANI				US Units	
Customer	Case Study from PT Wiratama Indotech			Job No.	1		
Address	JL. Srijaya Negara - Palembang			Reference No.			
Plant Location	State Polytechnic of Sriwijaya			Proposal No.			
Service of Unit				Date	19/07/2023	Rev	
Size	15,25 x 78,74	inch	Type	BEM	Horizontal	Connected In	1 Parallel 1 Series
Surf/Unit (Gross/Eff)	109,51 / 106,04	ft2	Shell/Unit	1		Surf/Shell (Gross/Eff)	109,51 / 106,04 ft2
PERFORMANCE OF ONE UNIT							
Fluid Allocation		Shell Side			Tube Side		
Fluid Name		POME GAS			CHILLED WATER		
Fluid Quantity, Total		1483,7			3377,8		
Vapor (In/Out)		1483,7					
Liquid					3377,8		
Steam							
Water					3377,8		
Noncondensables					3377,8		
Temperature (In/Out)		95,00			44,60		
Specific Gravity					1,0004		
Viscosity		0,0131			1,2340		
Molecular Weight					18,02		
Molecular Weight, Noncondensables					18,02		
Specific Heat		0,4949			1,0039		
Thermal Conductivity		0,0156			0,3307		
Latent Heat					0,3368		
Inlet Pressure		29,925			29,925		
Velocity		5,89e-2			8,14e-2		
Pressure Drop, Allow/Calc					1,78e-3		
Fouling Resistance (min)					6,59e-3		
Heat Exchanged		30400 Btu/hr			MTD (Corrected) 17,0 F		
Transfer Rate, Service		16,84 Btu/ft2-hr-F			Clean	14,61	Btu/ft2-hr-F
					Actual	14,61	Btu/ft2-hr-F
CONSTRUCTION OF ONE SHELL				Sketch (Bundle/Nozzle Orientation)			
Design/Test Pressure		Shell Side		Tube Side			
Design Temperature		150,04 / 140,00		150,04 / 140,00			
No Passes per Shell		1		2			
Corrosion Allowance		0,0591		0,0591			
Connections		1 @ 3,0000		1 @ 2,0000			
Size & Rating		1 @ 3,0000 Intermediate		1 @ 2,0000			
Tube No.	51	OD	1,2500	inch	Thk(Avg)	0,0490	inch
Tube Type	Plain		Length	6,562	ft	Pitch	1,5625
Shell	304 Stainless steel (18 Cr, 8 Ni)		ID	15,250	inch	Material	304 Stainless steel (18 Cr, 8 Ni)
Channel or Bonnet	304 Stainless steel (18 Cr, 8 Ni)		OD	15,625	inch	Shell Cover	Tube pattern 60
Tubesheet-Stationary	304 Stainless steel (18 Cr, 8 Ni)				Channel Cover		
Floating Head Cover					Tubesheet-Floating		
Baffles-Cross	304 Stainless steel (18 Cr, 8 Type Single-Seg.		%Cut (Diam)	25	Spacing(c/c)	3,8125	Inlet 9,5263
Baffles-Long			Impingement Plate	None			
Supports-Tube			Seal Type	None			
Distance, support to tubesheet	Inlet		U-Bend				
Number of rows supported	Inlet		Outlet	inch			
Bypass Seal Arrangement	pairs seal strips		Tube-Tubesheet Joint	Expanded (2 grooves)			
Expansion Joint			Type	None			
Rho-V2-Inlet Nozzle	1,29	lb/ft-sec2	Bundle Entrance	0,25	Bundle Exit	0,25	lb/ft-sec2
Gaskets-Shell Side	Mach. Mtl. (Kammprofile)\Flex. Face)		Tube Side	Mach. Mtl. (Kammprofile)\Flex. Face)			
- Floating Head							
Code Requirements						TEMA Class R	
Weight/Shell	947,79	lb	Filled with Water	1562,0	lb	Bundle	337,90
Remarks:							
Shell lining material - SA-53 B Pipe (S) K03005							
Tubesheet (tubeside) lining material - SA-53 B Pipe (S) K03005							

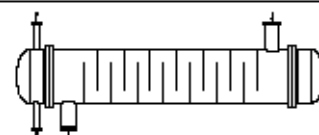
19. Tube Layout 1.25inch



20. Heat Exchanger 1.25inch




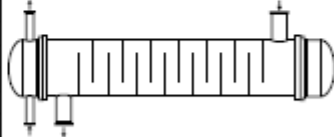
21. Final Result Datasheet 1.5inch

HTRI		Final Results		Page 1
Released to the following organization: <i>POLITEKNIK NEGERI SRWIJAYA DEVITA DINDA FITRIANI</i>				
Xist E 9.1 (64 bit) 31/07/2023 1:59 SN: 18380-466159599			US Units	
STHE OD 1,5inch 2 Meter				
Rating - Horizontal Multipass Flow TEMA BEM Shell With Single-Segmental Baffles				
Process Data		Hot Shellside		Cold Tubeside
		POME GAS		CHILLED WATER
Fluid name		Sens. Gas		Sens. Liquid
Total flow rate	(1000-lb/hr)	1,4837		3,3778
Weight fraction vapor, In/Out	(--)	1,0000		0,0000
Temperature, In/Out	(Deg F)	95,00		44,60
Skin temperature, Min/Max	(Deg F)	47,50		47,46
Wall temperature, Min/Max	(Deg F)	47,50		47,46
Pressure, In/Average	(psia)	29,925		29,925
Pressure drop, Total/Allowed	(psi)	1,05e-3		6,22e-3
Velocity, Mid/Max allow	(ft/sec)	4,99e-2		6,37e-2
Mole fraction inert	(--)	0,0000		0,0000
Average film coef.	(Btu/ft2-hr-F)	21,17		36,94
Heat transfer safety factor	(--)	1,0000		1,0000
Fouling resistance	(ft2-hr-F/Btu)	0,00000		0,00000
Overall Performance Data				
Overall coef., Req'd/Clean/Actual	(Btu/ft2-hr-F)	16,45 /		13,05 / 13,05
Heat duty, Calculated/Specified	(MM Btu/hr)	0,0304 /		0,0304
Effective overall temperature difference	(Deg F)	16,9		
EMTD - (MTD) * (DELTA) * (F/G/H)	(Deg F)	17,6 *		0,9601 * 1,0000
See Runtime Messages Report for warnings.				
Exchanger Fluid Volumes				
Approximate shellside	(ft3)	6,841		
Approximate tubeside	(ft3)	5,945		
Shell Construction Information				
TEMA shell type	BEM	Shell ID	(inch)	17,250
Shells Series	1 Parallel	Total area	(ft2)	113,38
Passes Shell	1 Tube 2	Eff. area	(ft2/shell)	109,06
Shell orientation angle (deg)	0,00			
Impingement present	No			
Pairs seal strips	2	Passlane seal rods (inch)	0,0000	No. 0
Shell expansion joint	No			
Weight estimation Wet/Dry/Bundle		1994,0 /		1196,2 / 481,91 (lb/shell)
Baffle Information				
Type	Perpend. Single-Seg.	Baffle cut (% dia)	25	
Crosspasses/shellpass	15	No. (Pct Area)	(inch) to C.L	
Central spacing	(inch) 4,3125	1	21,49	4,3125
Inlet spacing	(inch) 9,8388	2	0,00	0,0000
Outlet spacing	(inch) 9,8388			
Baffle thickness	(inch) 0,2500			
Number of deresonating baffles	0			
Tube Information				
Tube type	Plain	Tubecount per shell	44	
Overall length	(ft) 6,562	Pct tubes removed (none)		
Effective length	(ft) 6,312	Outside diameter	(inch)	1,5000
Total tubesheet	(inch) 3,0000	Wall thickness	(inch)	0,0490
Area ratio	(out/in) 1,0699	Pitch (inch)	1,8750	Ratio 1,2500
Tube metal	304 Stainless steel (18 Cr, 8 Ni)	Tube pattern (deg)	60	
Bundle Information				
Outer tube limit	(inch) 16,500	Bundle exit rho-V2	(lb/ft-sec2)	0,24
Bundle entrance rho-V2	(lb/ft-sec2) 0,24	Allow crossed U-bends	No	
Fins on U-bends	No	Perpend. passlane width	(inch)	2,2500
Parallel passlane width	(inch) 0,0000			
Support Information		Inlet	Outlet	
Distance, support to tubesheet/support plate	(inch)			
Number of rows supported				
Rear head support plate		No		
Support plate/baffle space				


Unit: STHE OD 1,5inch 2 Meter

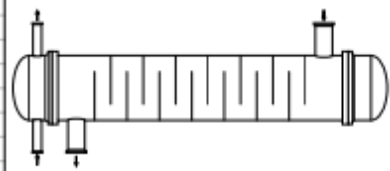
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22. Rating Datasheet 1.5inch

		HEAT EXCHANGER RATING DATA SHEET						Page 4								
		Released to the following organization: POLITEKNIK NEGERI SRIWIJAYA DEVITA DINDA FITRIANI						US Units								
Service of Unit				Item No.												
Type	BEM	Orientation	Horizontal	Connected In	1 Parallel	1 Series										
Surf/Unit (Gross/Elf)	113,38 / 109,06	ft2	Shell/Unit	1	Surf/Shell (Gross/Elf)	113,38 / 109,06	ft2									
PERFORMANCE OF ONE UNIT																
Fluid Allocation		Shell Side				Tube Side										
Fluid Name		POME GAS				CHILLED WATER										
Fluid Quantity, Total		1,4837				3,3778										
Vapor (In/Out)		wt%		100,00	100,00	0,00		0,00								
Liquid		wt%		0,00		100,00		100,00								
Temperature (In/Out)		F		95,00	53,60	44,60		53,60								
Density		lb/ft3		54,687	54,687	62,425		62,400								
Viscosity		cP		0,0131	0,0131	1,4269		1,2340								
Specific Heat		Btu/lb-F		0,4949	0,4949	1,0039		1,0020								
Thermal Conductivity		Btu/hr-ft-F		0,0156	0,0156	0,3307		0,3368								
Critical Pressure		psia														
Inlet Pressure		psia		29,925				29,925								
Velocity		ft/sec		4,99e-2		6,37e-2										
Pressure Drop, Allow/Calc		psi		4,10e-3	1,05e-3	5,90e-3		6,22e-3								
Average Film Coefficient		Btu/ft2-hr-F		21,17				36,94								
Fouling Resistance (min)		ft2-hr-F/Btu														
Heat Exchanged		0,0304 MM Btu/hr		MTD (Corrected)		16,9 F		Overdesign -20,70 %								
Transfer Rate, Service		16,45 Btu/ft2-hr-F		Calculated		13,05 Btu/ft2-hr-F		Clean 13,05 Btu/ft2-hr-F								
CONSTRUCTION OF ONE SHELL						Sketch (Bundle/Nozzle Orientation)										
Design Pressure		psig		150,04		150,04										
Design Temperature		F		140,00		140,00										
No Passes per Shell				1		2										
Flow Direction				Downward		Upward										
Connections		In Inch		1 @ 4,0000		1 @ 2,0000										
Size & Rating		Out Inch		1 @ 4,0000		1 @ 2,0000										
Liq. Out Inch				1 @												
Tube No.	44,000	OD	1,5000	Inch	Thk(Avg)	0,0490	Inch	Length	6,562	ft	Pitch	1,8750	Inch	Tube pattern	60	
Tube Type	Plain	Material		304 Stainless steel (18 Cr, 8 Ni)		Pairs seal strips		2								
Shell ID	17,250	Inch	Kettle ID	Inch		Passlane Seal Rod No.		0								
Cross Baffle Type	Perpend.	Single-Seq.		%Cut (Diam)		Impingement Plate		None								
Spacing(o/c)	4,3125	Inch	Inlet	9,8388		No. of Crosspasses		15								
Rho-V2-Inlet Nozzle	0,41	lb/ft-sec2	Shell Entrance	1,09		lb/ft-sec2	Shell Exit	1,11		lb/ft-sec2						
			Bundle Entrance	0,24		lb/ft-sec2	Bundle Exit	0,24		lb/ft-sec2						
Weight/Shell	1196,2	lb	Filled with Water	1994,0		lb	Bundle	481,91			lb					
Notes:					Thermal Resistance, %		Velocities; ft/sec		Flow Fractions							
Shell lining material - SA-53 B Pipe (S) K03005					Shell		61,62		Shellside		4,99e-2		A		0,126	
Tubesheet (tubeside) lining material - SA-53 B Pipe (S) K03005					Tube		37,79		Tubeside		6,37e-2		B		0,613	
					Fouling		0,00		Crossflow		6,34e-2		C		0,078	
					Metal		0,59		Window		3,20e-2		E		0,183	
													F		0,000	

23. TEMA Specification Datasheet 1.5inch

		HEAT EXCHANGER SPECIFICATION SHEET				Page 5	
		Released to the following organization: POLITEKNIK NEGERI SRWJAYA DEVITA DINDA FITRIANI				US Units	
Customer	Case Study from PT Wiatama Indotech			Job No.	1		
Address	JL. Srijaya Negara - Palembang			Reference No.			
Plant Location	State Polytechnic of Sriwijaya			Proposal No.			
Service of Unit				Date	19/07/2023	Rev	
Size	17,25 x 78,74	inch	Type	BEM	Horizontal	Connected In 1 Parallel 1 Series	
Surf/Unit (Gross/Eff)	113,38 / 109,06	#2	Shell/Unit	1	Surf/Shell (Gross/Eff)	113,38 / 109,06 #2	
PERFORMANCE OF ONE UNIT							
Fluid Allocation		Shell Side		Tube Side			
Fluid Name		POME GAS		CHILLED WATER			
Fluid Quantity, Total	lb/hr	1483,7		3377,8			
Vapor (In/Out)		1483,7	1483,7				
Liquid				3377,8	3377,8		
Steam							
Water				3377,8	3377,8		
Noncondensables							
Temperature (In/Out)	F	95,00	53,60	44,60	53,60		
Specific Gravity				1,0004	1,0000		
Viscosity	cP	0,0131	0,0131	1,4269	1,2340		
Molecular Weight				18,02	18,02		
Molecular Weight, Noncondensables							
Specific Heat	Btu/lb-F	0,4949	0,4949	1,0039	1,0020		
Thermal Conductivity	Btu/hr-ft-F	0,0156	0,0156	0,3307	0,3368		
Latent Heat	Btu/lb						
Inlet Pressure	psia	29,925		29,925			
Velocity	ft/sec	4,99e-2		6,37e-2			
Pressure Drop, Allow/Calc	psi	4,10e-3	1,05e-3	5,90e-3	6,22e-3		
Fouling Resistance (min)	ft ² -hr-F/Btu						
Heat Exchanged	30400	Btu/hr		MTD (Corrected)	16,9	F	
Transfer Rate, Service	16,45	Btu/ft ² -hr-F	Clean 13,05	Btu/ft ² -hr-F	Actual 13,05	Btu/ft ² -hr-F	
CONSTRUCTION OF ONE SHELL							
		Shell Side		Tube Side			
Design/Test Pressure	psig	150,04 /		150,04 /			
Design Temperature	F	140,00		140,00			
No Passes per Shell		1		2			
Corrosion Allowance	inch	0,0591		0,0591			
Connections	In	inch	1 @ 4,0000	1 @ 2,0000			
Size & Rating	Out	inch	1 @ 4,0000	1 @ 2,0000			
	Intermediate		@	@			
Tube No.	44	OD 1,5000	inch	Thk(Avg) 0,0490	inch	Length 6,562 ft Pitch 1,8750 inch	
Tube Type	Plain	Material 304 Stainless steel (18 Cr, 8 Ni)		Tube pattern 60			
Shell	304 Stainless steel (18 Cr, 8 Ni)	ID 17,250	OD 17,625	inch Shell Cover			
Channel or Bonnet	304 Stainless steel (18 Cr, 8 Ni)			Channel Cover			
Tubesheet-Stationary	304 Stainless steel (18 Cr, 8 Ni)			Tubesheet-Floating			
Floating Head Cover				Impingement Plate None			
Baffles-Cross	304 Stainless steel (18 Cr, 8 Type	Single-Seg.	%Cut (Diam) 25	Spacing(c/c) 4,3125	Inlet 9,8388	inch	
Baffles-Long			Seal Type None				
Supports-Tube			U-Bend	Type None			
Distance, support to tubesheet	Inlet		Outlet	inch			
Number of rows supported	Inlet		Outlet				
Bypass Seal Arrangement	2	pairs seal strips	Tube-Tubesheet Joint	Expanded (2 grooves)			
Expansion Joint			Type	None			
Rho-V2-Inlet Nozzle	0,41	lb/ft-sec ²	Bundle Entrance	0,24	Bundle Exit	0,24 lb/ft-sec ²	
Gaskets-Shell Side	Mach. Mil. (Kammprofile/Flex. Face)		Tube Side	Mach. Mil. (Kammprofile/Flex. Face)			
	- Floating Head						
Code Requirements				TEMA Class R			
Weight/Shell	1196,2	lb	Filled with Water	1994,0	lb	Bundle 481,91 lb	
Remarks:							
Shell lining material - SA-53 B Pipe (S) K03005							
Tubesheet (tubeside) lining material - SA-53 B Pipe (S) K03005							
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24. Tube Layout 1.5inch

