Lampiran 1. Data *sheet* Bejana Tekan 2nd *Stage Compressor Suction KOD*

Data Sheet for Unfired Pressure Vessels

Equipment Name:	2nd Stage Compressor Suction KOD	**Location:**	Arabian Gulf
Tag No.:	603-11V-04	**Plant Location:**	PS-3K
No.of Units:	1	**Manufacturer/Model:**	

DESIGN DATA

1	Orientation		Vertical	**CONSTRUCTION MATERIAL**	
2	Contents		HC, H_2S, Water, CO_2	Part	Material Specification
3	Criticality Rating		3	Shell	SA537Cl.1 (note 4, 5, 6)
4	Service		Lethal, Sour	Cladding/Lining of shell △1	See Note 4
5	Design Code		ASME Sec.VIII DIV.1	Heads	SA537Cl.1 (note 4, 5, 6)
6	Code Stamp		Yes	Cladding/Lining of heads	See Note 4
7				Supp. Skirt (Top/Bottom Section)	SA537Cl.1/SA283GR.C (note 9)
8	Temperature			Self Reinforced Nozzles/Forged Flg. on CS	SA105
9	Design - Upper/Lower	°C	150/-15	Self Reinforced Noz.above 3" on weld dep	SA105 (note 4)
10	Operating - Max./Normal / Min.	°C	45/35/35	Nozzle neck on weld deposit	SB444Gr.1 UNS N06625 △1
11	Pressure			Forged Flanges above 3"NB on weld depos	SA105 (note 4)
12	Design (Internal)	barg	62 (note 10) △1	Forged Flanges 3"NB and below on weld d	SB564Gr.1 UNS N06625
13	Design External	barg	Full Vacuum	Welding elbow	SB 366 UNS N06625
14	Operating - Max/Norm/Min	barg	-/34/-	Demister	Solution Treated SS316L
15	Corrosion Allowance	mm	3 mm on CS △1	Self Reinforcing Nozzles 3" NB	SB564Gr.1 UNS N06625
16	Specific Gravity Liquid(HC/W)		Refer Sheet 2	and below on weld deposit	
17	Gross Capacity	m^3	10.4	Skirt Base ring/stiffeners	SA 283 GR C
18	Vessel Dia (ID)	mm	1550	Nozzle neck on CS	SA106Gr.B -
19	Vessel Length (T/L TO T/L)	mm	5000	Vortex Breakers	SB443 UNS N06625
20	Shop Hydrotest Pressure (N&C)		Per code	Internal attachments on CS	SA 537Cl.1 -
21	Wind		BS CP3, Chapter V, PART 2	Internal attachments on weld deposit	Inconel 625
22	Design Wind Speed	m/s	45	External attachments	SA 283 GR C
23	Seismic		See note 9	External Bolts	SA 193 GR B7(note 2)
24	Shell Thickness (NOM)	△1 mm	42/(39+3) mm weld deposit (V	Nuts	SA 194 GR 2H (note 2)
25	Min.Head Thickness(Top/Bot)	mm	42/(38+3) mm weld deposit (V	Gaskets External	Spiral Wound (note 1)
26	SkirtThickness/Height	mm	8/1500 VTC	Gaskets Internal	
27	Weld Joint Efficiencies:			Internal Bolts	Solution Treated SS 316 △1
28	Shell		1.0	Nuts	Solution Treated SS 316
29	Head		1.0		
30	Inspection and Testing				
31	Third Party Inspection		Yes	**CONSTRUCTION**	
32	Non Destructive Testing:			Type of Heads	2:1 Ellipsoidal
33	Radiography		100%	Type of support	Skirt
34	Ultrasonic		Yes, Per Code/Spec	Platform/Ladder/Pipe Clip	Required
35	Magnetic Particle		100%	Insulation supports	Not Required
36	Dye Penetrant		Per Code/Spec	Manway Davit	Required
37	Post Weld Heat Treatment		Yes	Earthing Boss	Required
38	Material Impact Test Required		Per code/spec	Lifting Lugs/Eyes/Trunions	Required
39	Certified Elevated Temp.Test Required		No	Name plate	Required, SS316
40	Insulation (By others)	mm	No	**ESTIMATED WEIGHTS**	
41	Fireproofing (By others)	mm	No	Empty Kg	14,500 VTC
42	Painting (External)		ES-Q-12	Shipping Kg	VTA
43	Painting (Internal)		No	Operating Kg	20,400 VTC
44				Field Test Kg	25,000 VTC

NOTES:

1. Gaskets shall be SS316L spiral wound graphite filled with SS316L internal and external rings. Gaskets shall be as per API-601.
2. External bolting shall be hot dip galvanised as per BS 729 (BS EN ISO 1461:1999).
3. Indicated thickness of shell, head and skirt are minimum and vendor to confirm the thicknesses.
4. Inside surfaces of bottom half of the vessel upto 3200 mm height from bottom T/L, bottom head, nozzle sizes above 3" NB including gasket faces of flanges attached to the above section shall be weld deposited with minimum 3 mm thick Inconel 625 before PWHT.
5. △1 Iron content in Inconel 625 weld deposition shall not be more than 7%.
6. Vessel shall meet all the requirements of NACE MR 0175 and the material shall be HIC tested as per NACE TM 0284.
7. Material for shell and heads shall be of normalised steel, vacuum degassed and secondary calcium treated during manufacture. Max.carbon, sulphur content and CE shall not be more than 0.16%, 0.003% and 0.41% respectively.
8. Nozzles shall be self reinforced (Integrally Reinforced) type wherever reinforcement is required.
9. Inside diameter of 20"NB manway shall be 457 mm.
10. Top 610 mm of skirt section welded to bottom dished head shall be of the same material as bottom dished head.
11. Refer Environmental data:1535-0-56-0001.
12. △1 Indicated design pressure is based on settle-out pressure and shall be confirmed during detail design.

VTC: Vendor to confirm, VTA: Vendor to advise.

REV	DATE	ISSUE DESCRIPTION	ORIG	CHKD	APPRD.	PRIJECT	CLIENT APPR.
1	30-Jul-01	APPROVED FOR DETAILED DESIGN	NVR	CPS	CPS	IDB	
0	24-06-2001	ISSUED FOR COMMENTS	NVR	GMP	CPS	IDB	

Worley

Qatar Petroleum

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Bul Hanine Arab "C" Gas Cap Recycling

Project No:	**022/00705**	Rev:
Document No:	**00705-MEC-DTS-210**	1

Data Sheet for Unfired Pressure Vessel

Equipment Name :	2nd Stage Compressor Suction KOD	**Location:**	Arabian Gulf
Tag No. :	603-11V-04	**Plant Location :**	PS-3K
No. of Units :	1	**Manufacturer/Model :**	

DESIGN DATA

Process Guarantees

Max liquid in Gas outlet shall not exceed 0.1 Usgal/MMSCF

Max liquid particle size 20 micron in gas.

PROCESS DATA

Fluid Name		Wet Sour Gas			
Case		Rich Summer	Rich Winter	Lean Summer	
Vapour Flow rate	m3/h	1540	1653	884	
Vapour Density @ Oper T/P	kg/m3	51	52	53	
Vapour Viscosity @ Oper. T/P	cP	0.013	0.013	0.013	
Vapour Molecular Weight		30	29	31	
Liquid HC Flow Rate	m3/h	9.8	12	38	
Liquid HC Density @ Oper. T/P	kg/m3	549	547	512	
Liquid HC Viscosity @ Oper. T/P	cP	0.12	0.12	0.1	
Liquid HC Surface Tension	dyne/cm	8.1	8.1	6.8	
Slug Holding Liquid Volume	m3/h	-	-	-	
Water Flow Rate	m3/h	0.04	0.04	0.01	
Water Density @ Oper. T/P	kg/m3	999	1000	992	
Water Viscosity @ Oper. T/P	cP	0.7	0.7	0.6	
Design Margin on Flow Rates	%	0	0	0	
Corrosive Compounds		H_2S, CO_2, Water			
VESSEL INTERNALS					
Gas Demister/Vane Pack		Mist Mat			
Vortex Breakers		N3 & N4			

NOZZLE SCHEDULE

Mark No	Size	Qty.	Flange		Service	Standout (mm)		Reinf Pad (mm)	
	NPS	Nos.	Rating	Type/Face		Ext	Int	Thick	Diam
N1	16"	1	600#	SR / RF	Fluid Inlet				
N2	10"	1	600#	SR / RF	Vapour Outlet				
N3	2"	1	600#	WN / RF	Water Outlet				
N4	6"	1	600#	SR / RF	Hydrocarbon Outlet (1)				
N5	2"	1	600#	WN / RF	Vent				
N6	4"	1	600#	SR / RF	PSV (1)				
N7	3"	1	600#	SR / RF	Drain				
N8	2"	1	600#	WN / RF	Utility Connection (1)				
K1A/B	4"	2	600#	SR / RF	Condensate Level Bridle				
K2A/B	4"	2	600#	SR / RF	Condensate Level Bridle				
K3	2"	1	600#	WN / RF	Pressure Transmitter				
K4A/B	4"	2	600#	SR / RF	Water Level Bridle				
K5A/B	4"	2	600#	SR / RF	Water Level Bridle				
M1	20"	1	600#	SR / RF	Manway				
S_A	ID.610	1	-	-	Skirt Access				
Sv	2"	4	-	-	Skirt Vent				
Ss	6"	1	-	-	Skirt Sleeve				

REMARKS

1. Nozzle sizes and elevations shall be confirmed during detailed engineering.
2. SR RF - Self Reinforced (Integrally Reinforced) nozzle with Raised Face Flange.
3. Vendor to provide details of mist mat.

Worley

Qatar Petroleum

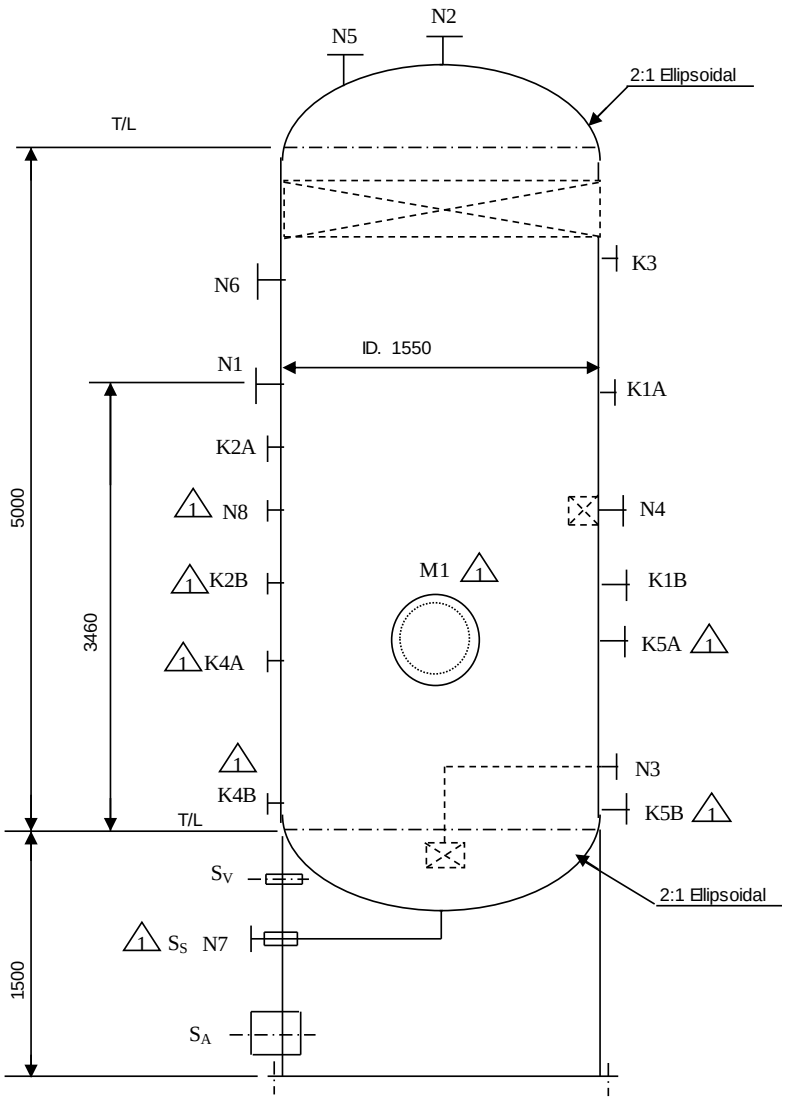
Qatar Petroleum

Bul Hanine Arab "C" Gas Cap Recycling

Project No:	**022/00705**	**Rev:**
Document No:	**00705-MEC-DTS-210**	**1**

Data Sheet for Unfired Pressure Vessel

Equipment Name :	2nd Stage Compressor Suction KOD	**Location:**	Arabian Gulf
Tag No. :	603-11V-04	**Plant Location :**	PS-3K
No. of Units :	1	**Manufacturer/Model :**	



LIQUID LEVELS		HC LIQUID	WATER
LLHH	mm	2850	750
LAH	mm	2450	600
NLL	mm	1970	450
LAL	mm	1490	300
LALL	mm	1170	150

Note: Vessel tan line = '0' Datum

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Qatar Petroleum

Qatar Petroleum

Bul Hanine Arab "C" Gas Cap Recycling

Project No:	**022/00705**	**Rev:**
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Lampiran 2. ASME B3.13 untuk Material SA 537 Cl

TABLE A-1 (CONT'D)
BASIC ALLOWABLE STRESSES IN TENSION FOR METALS[1]
Numbers in Parentheses Refer to Notes for Appendix A Tables; Specifications Are ASTM Unless Otherwise Indicated

Material	Spec. No.	P-No. or S-No. (5)	Grade	Notes	Min. Temp., °F (6)	Specified Min. Strength, ksi		Min. Temp. to 100	200	300
						Tensile	Yield			
Carbon Steel (Cont'd) Pipes and Tubes (2) (Cont'd)										
...	A 53	1	B	(57)(59)	B	60	35	20.0	20.0	20.0
...	A 106	1	B	(57)	B	60	35	20.0	20.0	20.0
...	A 333									
...	A 334	1	6	(57)	−50	60	35	20.0	20.0	20.0
...	A 369	1	FPB	(57)	−20	60	35	20.0	20.0	20.0
...	A 381	S-1	Y35	...	A	60	35	20.0	20.0	20.0
...	API 5L	S-1	B	(57)(59)(77)	B	60	35	20.0	20.0	20.0
...	A 139	S-1	C	(8b)	A	60	42			
...	A 139	S-1	D	(8b)	A	60	46	20.0	20.0	20.0
...	API 5L	S-1	X42	(55)(77)	A	60	42	20.0	20.0	20.0
...	A 381	S-1	Y42	...	A	60	42	20.0	20.0	20.0
...	A 381	S-1	Y48	...	A	62	48	20.6	19.7	18.7
...	API 5L	S-1	X46	(55)(77)	A	63	46	21.0	21.0	21.0
...	A 381	S-1	Y46	...	A	63	46	21.0	21.0	21.0
...	A 381	S-1	Y50	...	A	64	50	21.3	20.3	19.3
A 516 Gr. 65	A 671	1	CC65	(57)(67)	B	65	35	21.7	21.3	20.7
A 515 Gr. 65	A 671	1	CB65							
A 515 Gr. 65	A 672	1	B65	(57)(67)	A	65	35	21.7	21.3	20.7
A 516 Gr. 65	A 672	1	C65	(57)(67)	B	65	35	21.7	21.3	20.7
...	A 139	S-1	E	(8b)	A	66	52	22.0	22.0	22.0
...	API 5L	S-1	X52	(55)(77)	A	66	52	22.0	22.0	22.0
...	A 381	S-1	Y52	...	A	66	52	22.0	22.0	22.0
A 516 Gr. 70	A 671	1	CC70	(57)(67)	B	70	38	23.3	23.1	22.5
A 515 Gr. 70	A 671	1	CB70							
A 515 Gr. 70	A 672	1	B70	(57)(67)	A	70	38	23.3	23.1	22.5
A 516 Gr. 70	A 672	1	C70	(57)(67)	B	70	38	23.3	23.1	22.5
...	A 106	1	C	(57)	B	70	40	23.3	23.3	23.3
A 537 Cl. 1 (≤ 2½ in. thick)	A 671	1	CD70							
A 537 Cl. 1 (≤ 2½ in. thick)	A 672	1	D70	(67)	D	70	50	23.3	23.3	22.9
A 537 Cl. 1 (≤ 2½ in. thick)	A 691	1	CMSH70							
...	API 5L	S-1	X56	(51)(55)(71)(77)	A	71	56	23.7	23.7	23.7
...	A 381	S-1	Y56	(51)(55)(71)	A	71	56	23.7	23.7	23.7

TABLE A-1 (CONT'D)
BASIC ALLOWABLE STRESSES IN TENSION FOR METALS[1]

Numbers in Parentheses Refer to Notes for Appendix A Tables; Specifications Are ASTM Unless Otherwise Indicated

Basic Allowable Stress *S*, ksi (1), at Metal Temperature, °F (7)														
400	500	600	650	700	750	800	850	900	950	1000	1050	1100	Grade	Spec. No.
													Carbon Steel (Cont'd) Pipes and Tubes (2) (Cont'd)	
20.0	18.9	17.3	17.0	16.5	13.0	10.8	8.7	6.5	4.5	2.5	1.6	1.0	B	A 53
													B	A 106
													6	A 333
													6	A 334
													PPB	A 369
													Y35	A 381
													B	API 5L
...	...	...	...	...	...	...	...	...	...	...	...	...	C	A 139
...	...	...	...	...	...	...	...	...	...	...	...	...	D	A 139
20.0	...	...	...	...	...	...	...	...	...	...	...	...	X42	API 5L
20.0	...	...	...	...	...	...	...	...	...	...	...	...	Y42	A 381
17.8	16.9	16.0	15.5	...	...	...	...	...	...	...	...	...	Y48	A 381
21.0	...	...	...	...	...	...	...	...	...	...	...	...	X46	API 5L
21.0	...	...	...	...	...	...	...	...	...	...	...	...	Y46	A 381
18.4	17.4	16.5	16.0	...	...	...	...	...	...	...	...	...	Y50	A 381
20.0	18.9	17.3	17.0	16.8	13.9	11.4	9.0	6.5	4.5	2.5	...	...	CC65	A 671
													CB65	A 671
20.0	18.9	17.3	17.0	16.8	13.9	11.4	9.0	6.5	4.5	2.5	1.6	1.0	B65	A 672
													C65	A 672
...	...	...	...	...	...	...	...	...	...	...	...	...	E	A 139
22.0	...	...	...	...	...	...	...	...	...	...	...	...	X52	API 5L
22.0	...	...	...	...	...	...	...	...	...	...	...	...	Y52	A 381
21.7	20.5	18.7	18.4	18.3	14.8	12.0	9.3	6.5	4.5	2.5	...	...	CC70	A 671
													CB70	A 671
21.7	20.5	18.7	18.4	18.3	14.8	12.0	9.3	6.5	4.5	2.5	1.6	1.0	B70	A 672
													C70	A 672
22.9	21.6	19.7	19.4	19.2	14.8	12.0	...	...	...	...	...	...	C	A 106
													CD70	A 671
22.9	22.9	22.6	22.0	21.4	...	...	...	...	...	...	...	...	D70	A 672
													CMSH70	A 691
23.7	...	...	...	...	...	...	...	...	...	...	...	...	X56	API 5L
23.7	...	...	...	...	...	...	...	...	...	...	...	...	Y56	A 381

Lampiran 3. ASME B3.13 untuk Material SA 105

TABLE A-1 (CONT'D)
BASIC ALLOWABLE STRESSES IN TENSION FOR METALS[1]
Numbers in Parentheses Refer to Notes for Appendix A Tables; Specifications Are ASTM Unless Otherwise Indicated

Material	Spec. No.	P-No. or S-No. (5)	Grade	Notes	Min. Temp., °F (6)	Specified Min. Strength, ksi		Min. Temp. to 100	200	300
						Tensile	Yield			
Carbon Steel (Cont'd) Forgings and Fittings (2)										
...	A 350	1	LF-1	(9)(57)(59)	-20	60	30	20.0	18.3	17.7
...	A 181	1	Cl. 60	(9)(57)(59)	A	60	30	20.0	18.3	17.7
...	A 420	1	WPL-6	(57)	-50	60	35	20.0	20.0	20.0
...	A 234	1	WPB	(57)(59)	B	60	35	20.0	20.0	20.0
...	A 350	1	LF-2	(9)(57)	-50	70	36	23.3	21.9	21.3
...	A 105	1	...	(9)(57)(59)	-20					
...	A 181	1	Cl. 70	(9)(57)(59)	A	70	36	23.3	21.9	21.3
...	A 234	1	WPC	(57)(59)	B	70	40	23.3	23.3	23.3
Castings (2)										
...	A 216	1	WCA	(57)	-20	60	30	20.0	18.3	17.7
...	A 352	1	LCB	(9)(57)	-50	65	35	21.7	21.3	20.7
...	A 216	1	WCB	(9)(57)	-20	70	36	23.3	21.9	21.3
...	A 216	1	WCC	(9)(57)	-20	70	40	23.3	23.3	23.3

TABLE A-1 (CONT'D)
BASIC ALLOWABLE STRESSES IN TENSION FOR METALS[1]

Numbers in Parentheses Refer to Notes for Appendix A Tables; Specifications Are ASTM Unless Otherwise Indicated

Basic Allowable Stress S, ksi (1), at Metal Temperature, °F (7)														
400	500	600	650	700	750	800	850	900	950	1000	1050	1100	Grade	Spec. No.
														Carbon Steel (Cont'd) Forgings and Fittings (2)
17.2	16.2	14.8	14.5	14.4	13.0	10.8	7.8	5.0	3.0	1.5	...	...	LF-1	A 350
17.2	16.2	14.8	14.5	14.4	13.0	10.8	8.7	6.5	4.5	2.5	1.6	1.0	Cl. 60	A 181
20.0	18.9	17.3	17.0	16.8	13.0	10.8	7.8	5.0	3.0	1.5	...	...	WPL-6	A 420
20.0	18.9	17.3	17.0	16.8	13.0	10.8	8.7	6.5	4.5	2.5	1.6	1.0	WPB	A 234
20.6	19.4	17.8	17.4	17.3	14.8	12.0	7.8	5.0	3.0	1.5	...	...	LF-2	A 350
20.6	19.4	17.8	17.4	17.3	14.8	12.0	9.3	6.5	4.5	2.5	1.6	1.0	...	A 105
													Cl. 70	A 181
22.9	21.6	19.7	19.4	19.2	14.8	12.0	...	...	...	...	...	...	WPC	A 234
														Castings (2)
17.2	16.2	14.8	14.5	14.4	13.0	10.8	8.6	6.5	4.5	2.5	1.6	1.0	WCA	A 216
20.0	18.9	17.3	17.0	16.8	13.8	11.4	8.9	6.5	4.5	2.5	1.6	1.0	LCB	A 352
20.6	19.4	17.8	17.4	17.3	14.8	12.0	9.3	6.5	4.5	2.5	1.6	1.0	WCB	A 216
22.9	21.6	19.7	19.4	19.2	14.8	12.0	9.3	6.5	4.5	2.5	...	...	WCC	A 216

Lampiran 4. ASME B16.5 untuk material SA 105

TABLES 2
PRESSURE–TEMPERATURE RATINGS FOR GROUPS 1.1 THROUGH 3.16 MATERIALS

TABLE 2-1.1 RATINGS FOR GROUP 1.1 MATERIALS

Nominal Designation	Forgings	Castings	Plates
C–Si	A 105 (1)	A 216 Gr. WCB (1)	A 515 Gr. 70 (1)
C–Mn–Si	A 350 Gr. LF2 (1)		A 516 Gr. 70 (1)(2) A 537 Cl. 1 (3)

NOTES:
(1) Upon prolonged exposure to temperatures above 800°F, the carbide phase of steel may be converted to graphite. Permissible, but not recommended for prolonged use above 800°F.
(2) Not to be used over 850°F.
(3) Not to be used over 700°F.

WORKING PRESSURES BY CLASSES, psig

Class Temp., °F	150	300	400	600	900	1500	2500
−20 to 100	285	740	990	1480	2220	3705	6170
200	260	675	900	1350	2025	3375	5625
300	230	655	875	1315	1970	3280	5470
400	200	635	845	1270	1900	3170	5280
500	170	600	800	1200	1795	2995	4990
600	140	550	730	1095	1640	2735	4560
650	125	535	715	1075	1610	2685	4475
700	110	535	710	1065	1600	2665	4440
750	95	505	670	1010	1510	2520	4200
800	80	410	550	825	1235	2060	3430
850	65	270	355	535	805	1340	2230
900	50	170	230	345	515	860	1430
950	35	105	140	205	310	515	860
1000	20	50	70	105	155	260	430

Lampiran 5. ASME B16.5 untuk Material SB 564 Gr.1 UNS No 6625

TABLE 2-3.8 RATINGS FOR GROUP 3.8 MATERIALS

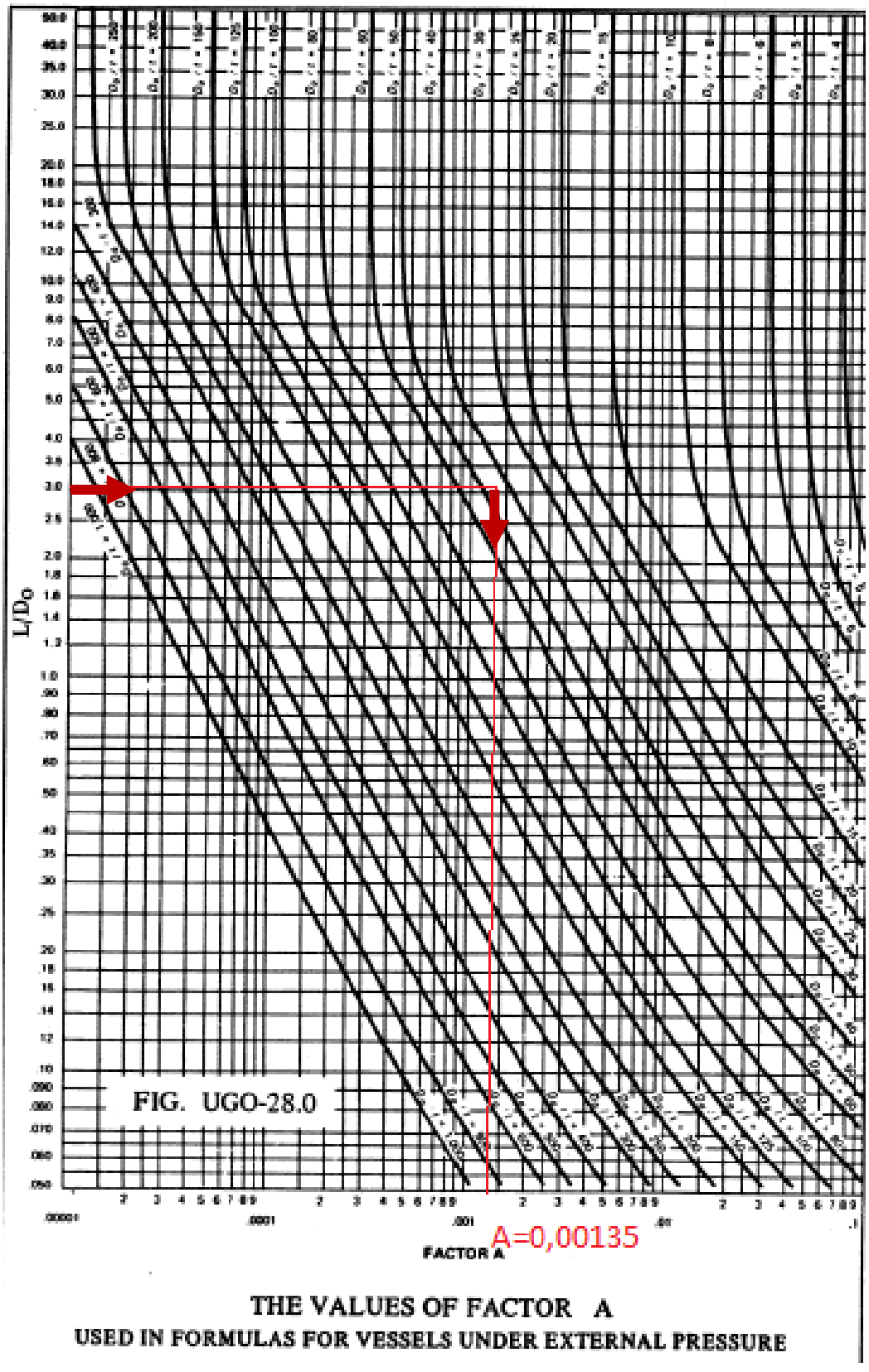
Nominal Designation	Forgings	Castings	Plates
54Ni–16Mo–15Cr	B 564 Gr. N10276 (1)(4)		B 575 Gr. N10276 (1)(4)
60Ni–22Cr–9Mo–3.5Cb	B 564 Gr. N06625 (3)(5)		B 443 Gr. N06625 (3)(5)
62Ni–28Mo–5Fe	B 335 Gr. N10001 (1)(2)(6)		B 333 Gr. N10001 (1)(6)
70Ni–16Mo–7Cr–5Fe	B 573 Gr. N10003 (2)(3)		B 434 Gr. N10003 (3)
61Ni–16Mo–16Cr	B 574 Gr. N06455 (1)(2)(6)		B 575 Gr. N06455 (1)(6)
42Ni–21.5Fe–3Cr–2.3Cu	B 564 Gr. N08825 (3)(7)		B 424 Gr. N08825 (3)(7)

NOTES:
(1) Use solution annealed material only.
(2) The chemical composition, mechanical properties, heat treating requirements, and grain size requirements shall conform to the applicable ASTM specification. The manufacturing procedures, tolerances, tests, certification, and markings shall be in accordance with ASTM B 564.
(3) Use annealed material only.
(4) Not to be used over 1250°F.
(5) Not to be used over 1200°F. Alloy N06625 in the annealed condition is subject to severe loss of impact strength at room temperatures after exposure in the range of 1000°F to 1400°F.
(6) Not to be used over 800°F.
(7) Not to be used over 1000°F.

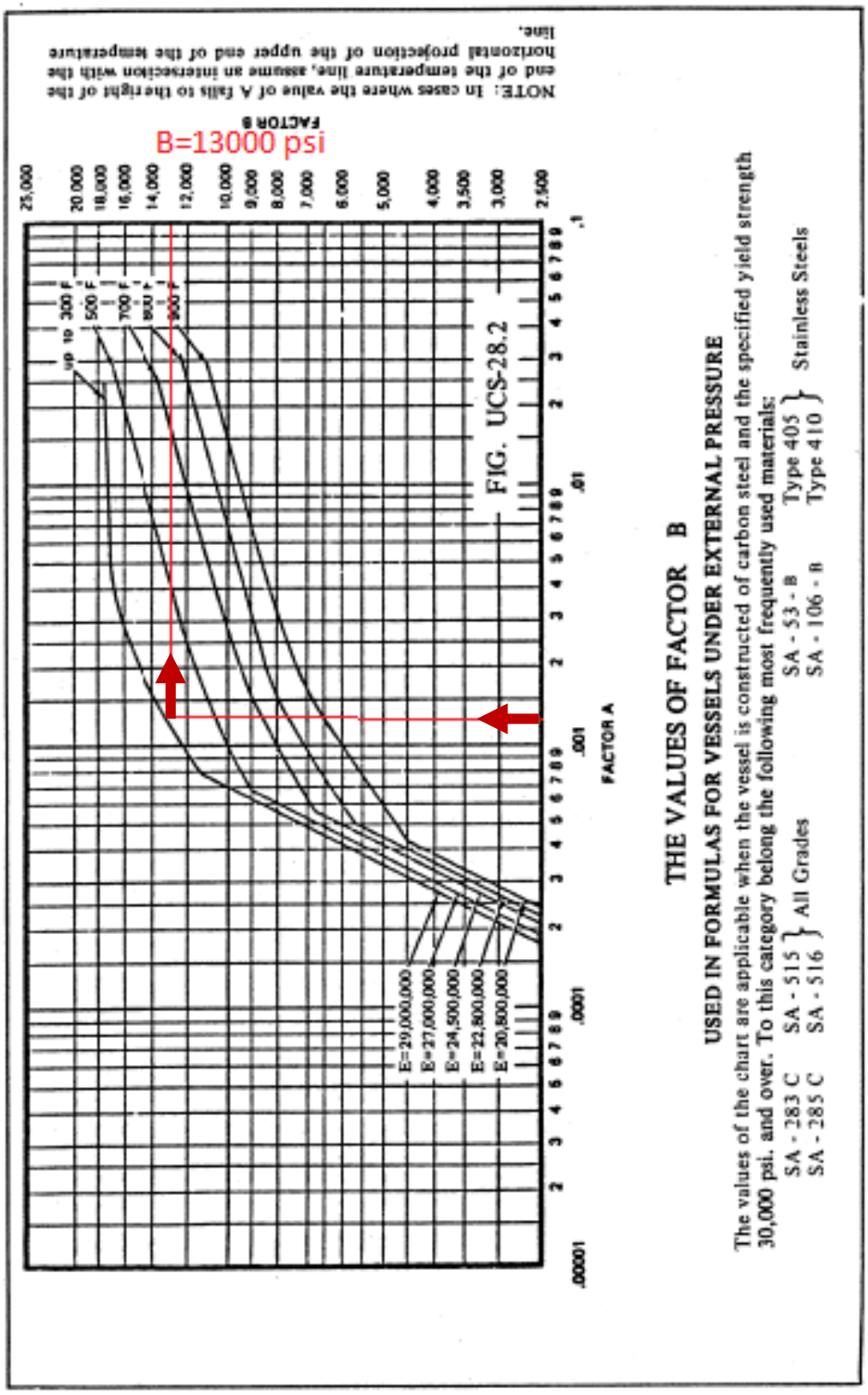
WORKING PRESSURES BY CLASSES, psig

Class Temp., °F	150	300	400	600	900	1500	2500
−20 to 100	290	750	1000	1500	2250	3750	6250
200	260	750	1000	1500	2250	3750	6250
300	230	730	970	1455	2185	3640	6070
400	200	705	940	1410	2115	3530	5880
500	170	665	885	1330	1995	3325	5540
600	140	605	805	1210	1815	3025	5040
650	125	590	785	1175	1765	2940	4905
700	110	570	755	1135	1705	2840	4730
750	95	530	710	1065	1595	2660	4430
800	80	510	675	1015	1525	2540	4230
850	65	485	650	975	1460	2435	4060
900	50	450	600	900	1350	2245	3745
950	35	385	515	775	1160	1930	3220
1000	20	365	485	725	1090	1820	3030
1050	. . .	360	480	720	1080	1800	3000
1100	. . .	325	430	645	965	1610	2685
1150	. . .	275	365	550	825	1370	2285
1200	. . .	185	245	370	555	925	1545
1250	. . .	145	195	295	440	735	1220
1300	. . .	110	145	215	325	540	900

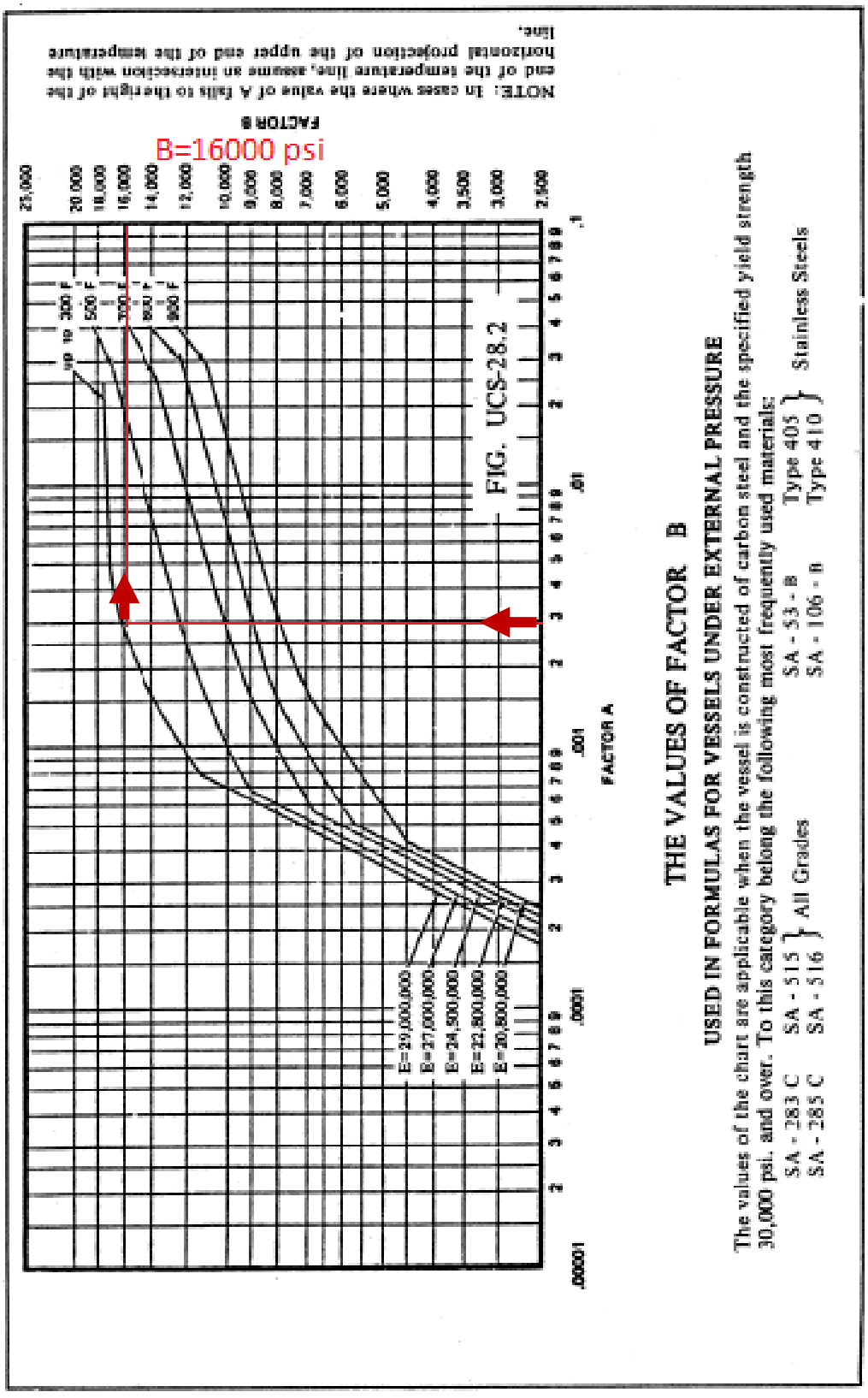
Lampiran 6. Nilai Faktor A untuk *Shell*



Lampiran 7. Nilai B untuk *Shell*



Lampiran 8. Nilai B untuk *Head*

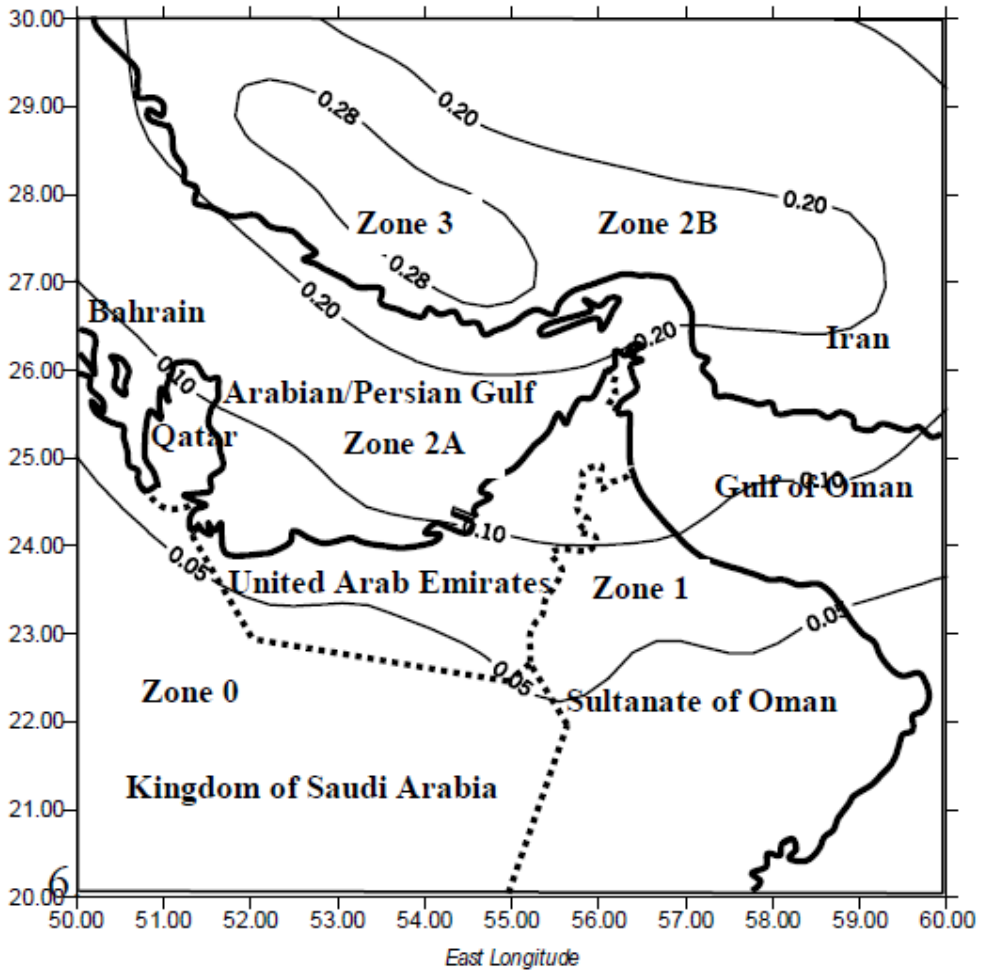


Lampiran 9. Ukuran Tebal Dinding Standar

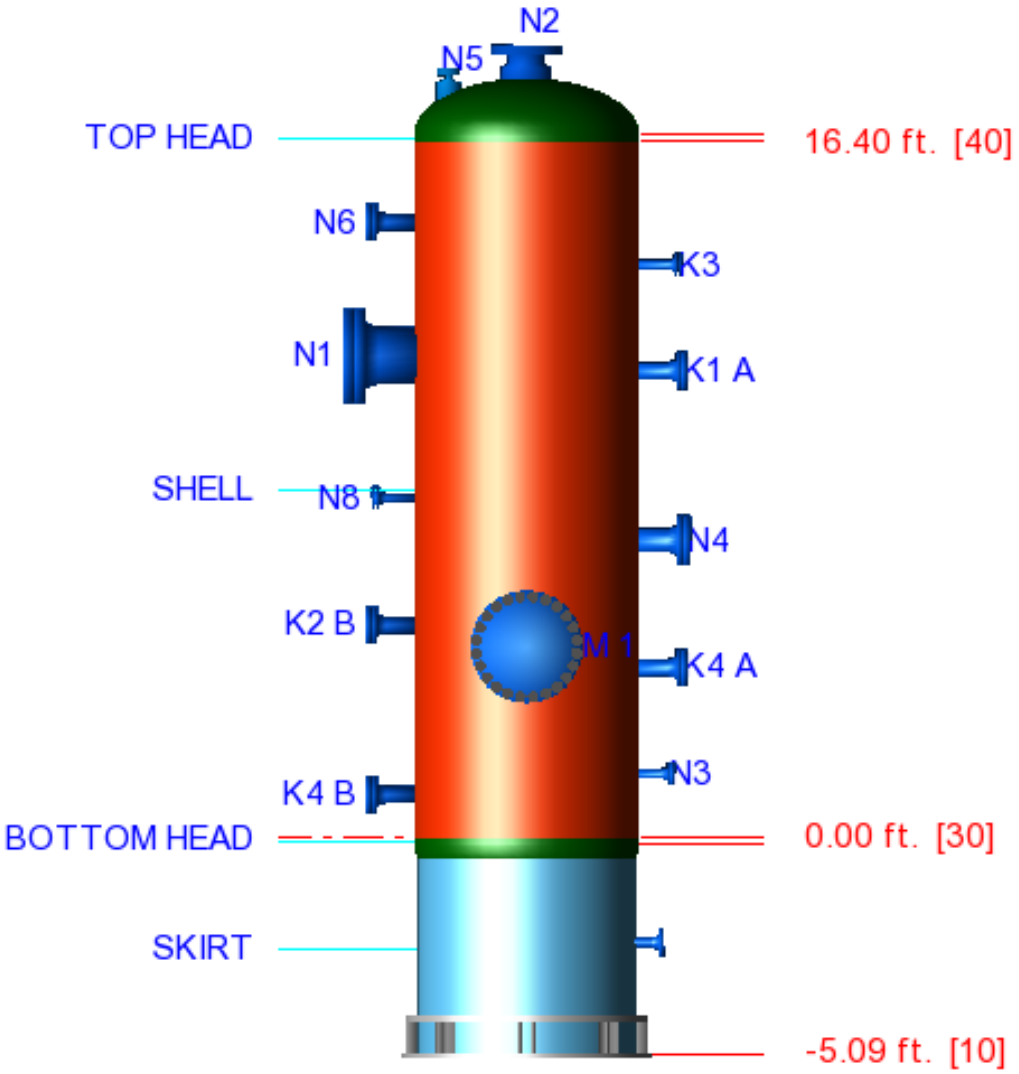
Ukuran Tebal Dinding Shell & Head Standar (in):

- 1/4 = 0,25	- 7/8 = 0,875	- 1-1/2 = 1,5
- 5/16 = 0,3125	- 15/16 = 0,9375	- 1-9/16 = 1,5625
- 3/8 = 0,375	- 1 = 1,0	- 1-5/8 = 1,625
- 7/16 = 0,4375	- 1-1/16 = 1,0625	- 1-11/16 = 0,6875
- 1/2 = 0,5	- 1-1/8 = 1,125	- 1-3/4 = 1,75
- 9/16 = 0,5625	- 1-3/16 = 1,1875	- 1-13/16 = 1,8125
- 5/8 = 0,625	- 1-1/4 = 1,25	- 1-7/8 = 1,875
- 11/16 = 0,6875	- 1-5/16 = 1,3125	- 1-15/16 = 1,9375
- 3/4 = 0,75	- 1-3/8 = 1,375	- 2 = 2,0
- 13/16 = 0,8125	- 1-7/16 = 1,4375	- 2-1/4 = 2,25

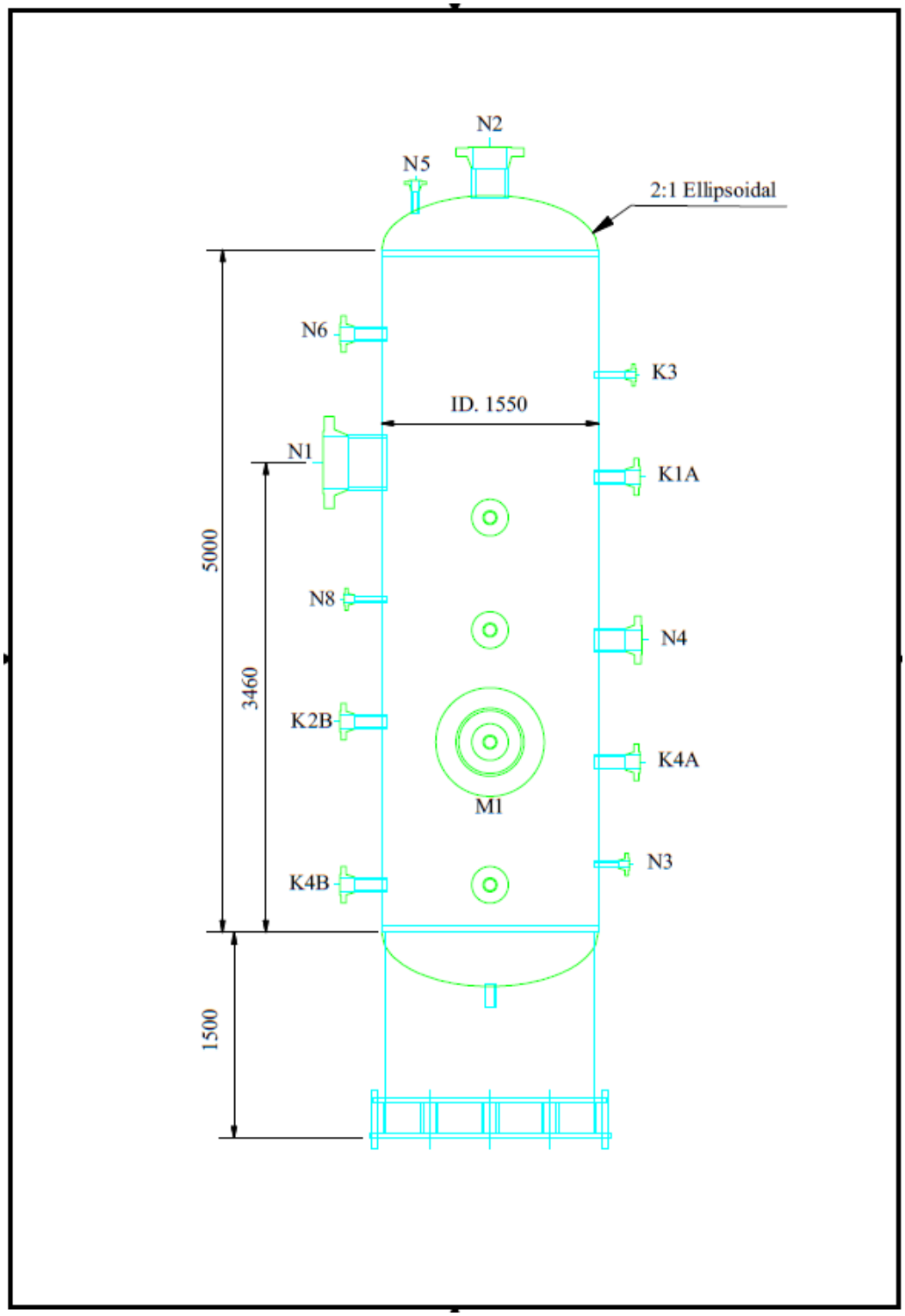
Lampiran 10. ***Seismic Zone Map*** **UAE**



Lampiran 11. Gambar Hasil Perancangan *Software* PV Elite 2014



Lampiran 12. Gambar Hasil Perancangan



Lampiran 13. Analisa PV Elite *Element Thickness*

Element Thickness, Pressure, Diameter and Allowable Stress :

From	To	Int. Press + Liq. Hd psig	Nominal Thickness in.	Total Corr Allowance in.	Element Diameter in.	Allowable Stress(SE) psi
SKIRT	...	...	0.31496	0.11811	61.0235	...
BOTTOM HEA		903.139	1.37500	0.11811	61.0235	22900.0
SHELL		903.139	1.37500	0.11811	61.0235	22900.0
TOP HEAD		899.235	1.37500	0.11811	61.0235	22594.0

Element Required Thickness and MAWP :

From	To	Design Pressure psig	M.A.W.P. Corroded psig	M.A.P. New & Cold psig	Minimum Thickness in.	Required Thickness in.
SKIRT	...	No Calc	No Calc	0.31496	No Calc	
BOTTOM HEA		899.235	913.212	1027.35	1.37500	1.32469
SHELL		899.235	913.212	1004.81	1.37500	1.35538
TOP HEAD		899.235	904.862	1027.35	1.37500	1.33578
Minimum			904.862	1004.810		

Lampiran 14. Analisa PV Elite *Internal Pressure*

Internal Pressure Calculation Results :

ASME Code, Section VIII, Division 1, 2013

Elliptical Head From 20 To 30 SA-537 , UCS-66 Crv. D at 302 °F

BOTTOM HEAD

Longitudinal Joint: Full Radiography per UW-11(a) Type 1
Circumferential Joint: Full Radiography per UW-11(a) Type 1

Material UNS Number: K12437

Required Thickness due to Internal Pressure [tr]:
= (P*D*Kcor)/(2*S*E-0.2*P) Appendix 1-4(c)
= (903.139*61.2597*0.995)/(2*22900.00*1.00-0.2*903.139)
= 1.2066 + 0.1181 = 1.3247 in.

Max. Allowable Working Pressure at given Thickness, corroded [MAWP]:
Less Operating Hydrostatic Head Pressure of 3.904 psig
= (2*S*E*t)/(Kcor*D+0.2*t) per Appendix 1-4 (c)
= (2*22900.00*1.00*1.2569)/(0.995*61.2597+0.2*1.2569)
= 940.645 - 3.904 = 936.741 psig

Maximum Allowable Pressure, New and Cold [MAPNC]:
= (2*S*E*t)/(K*D+0.2*t) per Appendix 1-4 (c)
= (2*22900.00*1.00*1.3750)/(1.000*61.0235+0.2*1.3750)
= 1027.350 psig

Actual stress at given pressure and thickness, corroded [Sact]:
= (P*(Kcor*D+0.2*t))/(2*E*t)
= (903.139*(0.995*61.2597+0.2*1.2569))/(2*1.00*1.2569)
= 21986.916 psi

Straight Flange Required Thickness:
= (P*R)/(S*E-0.6*P) + c per UG-27 (c)(1)
= (903.139*30.6299)/(22900.00*1.00-0.6*903.139)+0.118
= 1.355 in.

Straight Flange Maximum Allowable Working Pressure:
Less Operating Hydrostatic Head Pressure of 3.904 psig
= (S*E*t)/(R+0.6*t) per UG-27 (c)(1)
= (22900.00 * 1.00 * 1.2569)/(30.6299 + 0.6 * 1.2569)
= 917.117 - 3.904 = 913.212 psig

Factor K, corroded condition [Kcor]:
= (2 + (Inside Diameter/(2 * Inside Head Depth))^(2))/6
= (2 + (61.260/(2 * 15.374))^(2))/6
= 0.994888

Percent Elong. per UCS-79, VIII-1-01-57 (75*tnom/Rf)*(1-Rf/Ro) 9.323 %
Note: Please Check Requirements of UCS-79 as Elongation is > 5%.

MDMT Calculations in the Knuckle Portion:

Govrn. thk, tg = 1.375 , tr = 1.214 , c = 0.1181 in. , E* = 1.00
Stress Ratio = tr * (E*)/(tg - c) = 0.966 , Temp. Reduction = 3 °F

```
Min Metal Temp. w/o impact per UCS-66, Curve D            -17 °F
Min Metal Temp. at Required thickness (UCS 66.1)          -20 °F
```

MDMT Calculations in the Head Straight Flange:

Govrn. thk, tg = 1.375 , tr = 1.245 , c = 0.1181 in. , E* = 1.00
Stress Ratio = tr * (E*)/(tg - c) = 0.991 , Temp. Reduction = 1 °F

```
Min Metal Temp. w/o impact per UCS-66, Curve D            -17 °F
Min Metal Temp. at Required thickness (UCS 66.1)          -18 °F
```

Note: Post Weld Heat Treatment is required for this Element/Joint.

Cylindrical Shell From 30 To 40 SA-537 , UCS-66 Crv. D at 302 °F

SHELL

Longitudinal Joint: Full Radiography per UW-11(a) Type 1
Circumferential Joint: Full Radiography per UW-11(a) Type 1

Material UNS Number: K12437

Required Thickness due to Internal Pressure [tr]:

```
 = (P*R)/(S*E-0.6*P) per UG-27 (c)(1)
 = (903.139*30.6299)/(22900.00*1.00-0.6*903.139)
 = 1.2373 + 0.1181 = 1.3554 in.
```

Max. Allowable Working Pressure at given Thickness, corroded [MAWP]:
Less Operating Hydrostatic Head Pressure of 3.904 psig

```
 = (S*E*t)/(R+0.6*t) per UG-27 (c)(1)
 = (22900.00*1.00*1.2569)/(30.6299+0.6*1.2569)
 = 917.117 - 3.904 = 913.212  psig
```

Maximum Allowable Pressure, New and Cold [MAPNC]:

```
 = (S*E*t)/(R+0.6*t) per UG-27 (c)(1)
 = (22900.00*1.00*1.3750)/(30.5117+0.6*1.3750)
 = 1004.811 psig
```

Actual stress at given pressure and thickness, corroded [Sact]:

```
 = (P*(R+0.6*t))/(E*t)
 = (903.139*(30.6299+0.6*1.2569))/(1.00*1.2569)
 = 22550.992 psi
```

```
Percent Elongation per UCS-79  (50*tnom/Rf)*(1-Rf/Ro)  2.204 %
```

Minimum Design Metal Temperature Results:

Govrn. thk, tg = 1.375 , tr = 1.245 , c = 0.1181 in. , E* = 1.00

Stress Ratio = tr * (E*)/(tg - c) = 0.991 , Temp. Reduction = 1 °F

```
Min Metal Temp. w/o impact per UCS-66, Curve D            -17 °F
Min Metal Temp. at Required thickness (UCS 66.1)          -18 °F
```

Note: Post Weld Heat Treatment is required for this Element/Joint.

Elliptical Head From 40 To 50 SA-537 , UCS-66 Crv. D at 302 °F

TOP HEAD

Longitudinal Joint: Full Radiography per UW-11(a) Type 1
Circumferential Joint: Full Radiography per UW-11(a) Type 1

Material UNS Number: K12437

Required Thickness due to Internal Pressure [tr]:

```
 = (P*D*Kcor)/(2*S*E-0.2*P) Appendix 1-4(c)
 = (899.235*61.2597*0.995)/(2*22594.00*1.00-0.2*899.235)
 = 1.2177 + 0.1181 = 1.3358 in.
```

Max. Allowable Working Pressure at given Thickness, corroded [MAWP]:

```
 = (2*S*E*t)/(Kcor*D+0.2*t) per Appendix 1-4 (c)
 = (2*22594.00*1.00*1.2569)/(0.995*61.2597+0.2*1.2569)
 = 928.076 psig
```

Maximum Allowable Pressure, New and Cold [MAPNC]:

```
 = (2*S*E*t)/(K*D+0.2*t) per Appendix 1-4 (c)
 = (2*22900.00*1.00*1.3750)/(1.000*61.0235+0.2*1.3750)
 = 1027.350 psig
```

Actual stress at given pressure and thickness, corroded [Sact]:

```
 = (P*(Kcor*D+0.2*t))/(2*E*t)
 = (899.235*(0.995*61.2597+0.2*1.2569))/(2*1.00*1.2569)
 = 21891.867 psi
```

Straight Flange Required Thickness:

```
 = (P*R)/(S*E-0.6*P) + c    per UG-27 (c)(1)
 = (899.235*30.6299)/(22594.00*1.00-0.6*899.235)+0.118
 = 1.367 in.
```

Straight Flange Maximum Allowable Working Pressure:

```
 = (S*E*t)/(R+0.6*t) per UG-27 (c)(1)
 = (22594.00 * 1.00 * 1.2569 )/(30.6299 + 0.6 * 1.2569 )
 = 904.862 psig
```

Factor K, corroded condition [Kcor]:

```
 = ( 2 + ( Inside Diameter/( 2 * Inside Head Depth ))^(2))/6
 = ( 2 + ( 61.260/( 2 * 15.374 ))^(2))/6
 = 0.994888
```

```
Percent Elong. per UCS-79, VIII-1-01-57 (75*tnom/Rf)*(1-Rf/Ro)  9.323 %
```
Note: Please Check Requirements of UCS-79 as Elongation is > 5%.

MDMT Calculations in the Knuckle Portion:

Govrn. thk, tg = 1.375 , tr = 1.209 , c = 0.1181 in. , E* = 1.00
Stress Ratio = tr * (E*)/(tg - c) = 0.962 , Temp. Reduction = 4 °F

Min Metal Temp. w/o impact per UCS-66, Curve D	-17 °F
Min Metal Temp. at Required thickness (UCS 66.1)	-21 °F

MDMT Calculations in the Head Straight Flange:

Govrn. thk, tg = 1.375 , tr = 1.240 , c = 0.1181 in. , E* = 1.00
Stress Ratio = tr * (E*)/(tg - c) = 0.986 , Temp. Reduction = 1 °F

Min Metal Temp. w/o impact per UCS-66, Curve D	-17 °F
Min Metal Temp. at Required thickness (UCS 66.1)	-18 °F

Note: Post Weld Heat Treatment is required for this Element/Joint.

Lampiran 15. Analisa PV Elite *External Pressure*

External Pressure Calculation Results :

ASME Code, Section VIII, Division 1, 2013

Elliptical Head From 20 to 30 Ext. Chart: CS-5 at 86 °F

BOTTOM HEAD

Elastic Modulus from Chart: CS-5 at 86 °F : 0.302E+08 psi

Results for Maximum Allowable External Pressure (MAEP):

Tca	OD	D/t	Factor A	B
1.257	63.77	50.74	0.0027373	24773.69

EMAP = B/(K0*D/t) = 24773.6875/(0.9000 *50.7391) = 542.5068 psig

Results for Required Thickness (Tca):

Tca	OD	D/t	Factor A	B
0.160	63.77	398.19	0.0003488	5266.88

EMAP = B/(K0*D/t) = 5266.8784/(0.9000 *398.1908) = 14.6967 psig

*Check the requirements of UG-33(a)(1) using P = 1.67 * External Design pressure for this head.*

Material UNS Number: K12437

Required Thickness due to Internal Pressure [tr]:
= (P*D*Kcor)/(2*S*E-0.2*P) Appendix 1-4(c)
= (24.541*61.2597*0.995)/(2*22900.00*1.00-0.2*24.541)
= 0.0327 + 0.1181 = 0.1508 in.

Max. Allowable Working Pressure at given Thickness, corroded [MAWP]:
= ((2*S*E*t)/(Kcor*D+0.2*t))/1.67 per Appendix 1-4 (c)
= ((2*22900.00*1.00*1.2569)/(0.995*61.2597+0.2*1.2569))/1.67
= 563.261 psig

Maximum Allowable External Pressure [MAEP]:
= min(MAEP, MAWP)
= min(542.51 , 563.2607)
= 542.507 psig

Thickness requirements per UG-33(a)(1) do not govern the required thickness of this head.

Cylindrical Shell From 30 to 40 Ext. Chart: CS-5 at 86 °F

SHELL

Elastic Modulus from Chart: CS-5 at 86 °F : 0.302E+08 psi

Results for Maximum Allowable External Pressure (MAEP):

Tca	OD	SLEN	D/t	L/D	Factor A	B
1.257	63.77	211.02	50.74	3.3089	0.0010182	15374.11

```
EMAP = (4*B)/(3*(D/t)) = (4*15374.1074)/(3*50.7391 ) = 404.0040 psig
```

Results for Required Thickness (Tca):

```
    Tca          OD       SLEN        D/t        L/D    Factor A         B
  0.329       63.77     211.02     193.93     3.3089  0.0001416   2137.51
EMAP = (4*B)/(3*(D/t)) = (4*2137.5088 )/(3*193.9326 ) = 14.6959 psig
```

Results for Maximum Stiffened Length (Slen):

```
    Tca          OD       SLEN        D/t        L/D    Factor A         B
  1.257       63.77   12861.87      50.74    50.0000  0.0004287   6473.52
EMAP = (4*B)/(3*(D/t)) = (4*6473.5190 )/(3*50.7391 ) = 170.1125 psig
```

Elliptical Head From 40 to 50 Ext. Chart: CS-5 at 86 °F

TOP HEAD

Elastic Modulus from Chart: CS-5 at 86 °F : 0.302E+08 psi

Results for Maximum Allowable External Pressure (MAEP):

```
    Tca          OD        D/t     Factor A           B
  1.257       63.77      50.74    0.0027373     24773.69
EMAP = B/(K0*D/t) = 24773.6875/(0.9000 *50.7391 ) = 542.5068 psig
```

Results for Required Thickness (Tca):

```
    Tca          OD        D/t     Factor A           B
  0.160       63.77     398.19    0.0003488      5266.88
EMAP = B/(K0*D/t) = 5266.8784/(0.9000 *398.1908 ) = 14.6967 psig
```

*Check the requirements of UG-33(a)(1) using P = 1.67 * External Design pressure for this head.*

Material UNS Number: K12437

Required Thickness due to Internal Pressure [tr]:

```
 = (P*D*Kcor)/(2*S*E-0.2*P) Appendix 1-4(c)
 = (24.541*61.2597*0.995)/(2*22594.00*1.00-0.2*24.541)
 = 0.0331 + 0.1181 = 0.1512 in.
```

Max. Allowable Working Pressure at given Thickness, corroded [MAWP]:

```
 = ((2*S*E*t)/(Kcor*D+0.2*t))/1.67 per Appendix 1-4 (c)
 = ((2*22594.00*1.00*1.2569)/(0.995*61.2597+0.2*1.2569))/1.67
 = 555.734 psig
```

Maximum Allowable External Pressure [MAEP]:

```
 = min( MAEP, MAWP )
 = min( 542.51 , 555.7341 )
 = 542.507 psig
```

Thickness requirements per UG-33(a)(1) do not govern the required thickness of this head.

External Pressure Calculations

From	To	Section Length ft.	Outside Diameter in.	Corroded Thickness in.	Factor A	Factor B psi
10	20	4.92125	...	...	No Calc	No Calc
20	30	No Calc	63.7735	1.25689	0.0027373	24773.7
30	40	17.5851	63.7735	1.25689	0.0010182	15374.1
40	50	No Calc	63.7735	1.25689	0.0027373	24773.7

External Pressure Calculations

From	To	External Actual T. in.	External Required T. in.	External Des. Press. psig	External M.A.W.P. psig
10	20	...	No Calc	...	No Calc
20	30	1.37500	0.27827	14.6954	542.507
30	40	1.37500	0.44695	14.6954	404.004
40	50	1.37500	0.27827	14.6954	542.507
Minimum					404.004

External Pressure Calculations

From	To	Actual Len. Bet. Stiff. ft.	Allow. Len. Bet. Stiff. ft.	Ring Inertia Required in**4	Ring Inertia Available in**4
10	20	4.92125	No Calc	No Calc	No Calc
20	30	No Calc	No Calc	No Calc	No Calc
30	40	17.5851	1071.82	No Calc	No Calc
40	50	No Calc	No Calc	No Calc	No Calc

Elements Suitable for External Pressure.

Lampiran 16. Analisa PV Elite *Hidrostatic Pressure*

Hydrostatic Test Pressure Results:

```
   Pressure per UG99b     = 1.3 * M.A.W.P. * Sa/S        1176.320  psig
   Pressure per UG99b[34] = 1.3 * Design Pres * Sa/S      1169.005  psig
   Pressure per UG99c     = 1.3 * M.A.P. - Head(Hyd)      1298.521  psig
   Pressure per UG100     = 1.1 * M.A.W.P. * Sa/S          995.348  psig
   Pressure per PED       = 1.43 * MAWP                   1293.952  psig
```

UG-99(b), Test Pressure Calculation:

```
 = Test Factor * MAWP * Stress Ratio
 = 1.3 * 904.862 * 1.000
 = 1176.320 psig
```

Vertical Test performed per: UG-99b

Please note that Nozzle, Shell, Head, Flange, etc MAWPs are all considered when determining the hydrotest pressure for those test types that are based on the MAWP of the vessel.

Stresses on Elements due to Test Pressure:

From To	Stress	Allowable	Ratio	Pressure
BOTTOM HEAD	26406.8	29770.0	0.887	1184.67
SHELL	26985.0	29770.0	0.906	1184.05
TOP HEAD	26234.5	29770.0	0.881	1176.94

Elements Suitable for Internal Pressure.

Lampiran 17. Analisa PV Elite *Wind Load*

```
  Wind Design Code                                    ASCE-7 95
      Basic Wind Speed                    [V]            100.66
mile/hr
      Surface Roughness Category                 C: Open Terrain
      Importance Factor                                      1.0
      Type of Surface                          Moderately Smooth
      Base Elevation                                    0.0000  ft.
      Percent Wind for Hydrotest                          33.0
      Using User defined Wind Press. Vs Elev.                N
      Height of Hill or Escarpment     H or Hh           0.0000  ft.
      Distance Upwind of Crest             Lh            0.0000  ft.
      Distance from Crest to the Vessel     x            0.0000  ft.
      Type of Terrain ( Hill, Escarpment )                 Flat
      Damping Factor (Beta) for Wind (Ope)              0.0100
      Damping Factor (Beta) for Wind (Empty)            0.0000
      Damping Factor (Beta) for Wind (Filled)           0.0000
```

Wind Analysis Results

Dynamic Gust-Effect Factor, Operating Case [Gf]:

```
 = ( 1 + 2 * G * Zbar * sqrt( Q2 + R2 ))/( 1 + 7 * Zbar )
 = (1+2*3.500*0.228*sqrt(0.898+0.022))/(1+7*0.228)
 = 0.975
```

```
Natural Frequency of Vessel (Operating)          8.570 Hz
Natural Frequency of Vessel (Empty)              10.403 Hz
Natural Frequency of Vessel (Test)               9.258 Hz
```

Note: Per Section 1609 of IBC 2003/06/09 these results are also applicable for the determination of Wind Loads on structures (1609.1.1).

```
User Entered Importance Factor is                1.000
Force Coefficient                          [Cf]  0.558
Structure Height to Diameter ratio               4.458
Height to top of Structure                       23.045 ft.
```

This is classified as a flexible structure. Dynamic analysis performed.

Sample Calculation for the First Element

The ASCE code performs all calculations in Imperial Units only. The wind pressure is therefore computed in these units.

Value of [Alpha] and [Zg]:

```
 Exposure Category: C from Table C6-2
 Alpha = 9.500 : Zg = 900.000 ft.
```

Effective Height [z]:

```
 = Centroid Height + Vessel Base Elevation
 = 2.461 + 0.000 = 2.461 ft.
```

Velocity Pressure coefficient evaluated at height z [Kz]:

Because z (2.461 ft.) < 15 ft.
= 2.01 * (15 / Zg) ^(2 / Alpha)
= 2.01 * (15/900.000)^(2/9.500)
= 0.849

Type of Hill: No Hill

As there is No Hill Present: [Kzt]:
K1 = 0, K2 = 0, K3 = 0

Topographical Factor [Kzt]:
= (1 + K1 * K2 * K3)²
= (1 + 0.000 * 0.000 * 0.000)²
= 1.0000

Velocity Pressure evaluated at height z, Imperial Units [qz]:
= 0.00256 * Kz * Kzt * Kd * I * Vr(mph)²
= 0.00256 * 0.849 * 1.000 * 1.000 * 1.000 * 100.662²
= 22.0 psf

Force on the first element [F]:
= qz * Gf * Cf * WindArea
= 22.020 * 0.975 * 0.558 * 30.341
= 363.1 lb.

Element	Hgt (z) ft.	K1	K2	K3	Kz	Kzt	qz psf
SKIRT	2.5	0.000	0.000	0.000	0.849	1.000	22.020
BOTTOM HEAD	5.0	0.000	0.000	0.000	0.849	1.000	22.020
SHELL	13.3	0.000	0.000	0.000	0.849	1.000	22.020
TOP HEAD	22.2	0.000	0.000	0.000	0.922	1.000	23.905

Wind Vibration Calculations

This evaluation is based on work by Kanti Mahajan and Ed Zorilla

Nomenclature

Cf - Correction factor for natural frequency
D - Average internal diameter of vessel ft.
Df - Damping Factor < 0.75 Unstable, > 0.95 Stable
Dr - Average internal diameter of top half of vessel ft.
f - Natural frequency of vibration (Hertz)

f1 - Natural frequency of bare vessel based on a unit value of (D/L²)(10^(4))
L - Total height of structure ft.
Lc - Total length of conical section(s) of vessel ft.
tb - Uncorroded plate thickness at bottom of vessel in.
V30 - Design Wind Speed provided by user mile/hr
Vc - Critical wind velocity mile/hr
Vw - Maximum wind speed at top of structure mile/hr
W - Total corroded weight of structure lb.
Ws - Cor. vessel weight excl. weight of parts which do not effect stiff. lb.
Z - Maximum amplitude of vibration at top of vessel in.
Dl - Logarithmic decrement (taken as 0.03 for Welded Structures)
Vp - Vib. Chance, <= 0.200E+02 (High); 0.200E+02 < 0.250E+02 (Probable)
P30 - wind pressure 30 feet above the base

Check other Conditions and Basic Assumptions:

#1 - Total Cone Length / Total Length < 0.5
0.000/21.659 = 0.000

#2 - (D / L²) * 10^(4) < 8.0 (English Units)
- (5.27/21.66²) * 10^(4) = 112.434 [Geometry Violation]

Compute the vibration possibility. If Vp > 0.250E+02 no chance. [Vp]:
= W / (L * Dr²)
= 35167/(21.66 * 5.105²)
= 0.62305E+02

Since Vp is > 0.250E+02 no further vibration analysis is required !

The Natural Frequency for the Vessel (Ope...) is 8.57048 Hz.

Wind Load Calculation

From	To	Wind Height ft.	Wind Diameter ft.	Wind Area sq.in.	Wind Pressure psf	Element Wind Load lb.
10	20	2.46062	6.16534	4369.13	22.0201	363.138
20	30	5.00458	6.37735	153.056	22.0201	12.7212
30	40	13.2900	6.37735	15064.6	22.0201	1252.09
40	50	22.1578	6.37735	1152.66	23.9050	104.003

Lampiran 18. Analisa PV Elite *Seismic Load*

Earthquake Analysis Results

```
The UBC Zone Factor for the Vessel is .............    0.1500
The Importance Factor as Specified by the User is .     1.000
The UBC Frequency and Soil Factor (C)  is .........     2.750
The UBC Force Factor as Specified by the User is ..     3.000
The UBC Total Weight (W) for the Vessel is ........   37127.2  lb.
The UBC Total Shear (V) for the Vessel is .........    5105.0  lb.
The UBC Top Shear (Ft) for the Vessel is ..........       0.0  lb.
```

The Natural Frequency for the Vessel (Ope...) is 8.57048 Hz.

Earthquake Load Calculation

From	To	Earthquake Height ft.	Earthquake Weight lb.	Element Ope Load lb.	Element Emp Load lb.
10	20	2.46062	1913.05	50.5787	51.4594
20	30	5.00458	2033.79	109.363	111.267
30	40	13.2900	30855.6	4406.11	2823.83
40	50	21.5754	2324.82	538.946	548.330
Top Load		22.93		0	0

Lampiran 19. Analisa PV Elite MAWP *Flange*

Nozzle Flange MAWP Results :

Nozzle Description	Flange Rating Operating psig	Ambient psig	Temperature °F	Class	Grade|Group
N1	1309.1	1480.0	302	600	GR 1.1
N3	1453.8	1500.0	302	600	GR 3.8
N4	1309.1	1480.0	302	600	GR 1.1
N6	1309.1	1480.0	302	600	GR 1.1
N8	1453.8	1500.0	302	600	GR 3.8
K1 A	1309.1	1480.0	302	600	GR 1.1
K1 B	1309.1	1480.0	302	600	GR 1.1
K2 A	1309.1	1480.0	302	600	GR 1.1
K2 B	1309.1	1480.0	302	600	GR 1.1
K3	1453.8	1500.0	302	600	GR 3.8
K4 A	1309.1	1480.0	302	600	GR 1.1
K4 B	1309.1	1480.0	302	600	GR 1.1
K5 A	1309.1	1480.0	302	600	GR 1.1
K5 B	1309.1	1480.0	302	600	GR 1.1
M 1	1309.1	1480.0	302	600	GR 1.1
N2	1309.1	1480.0	302	600	GR 1.1
N5	1453.8	1500.0	302	600	GR 3.8
Minimum Rating	1309.100	1480.000	psig	(for Core Elements)	

Note: ANSI Ratings are per ANSI/ASME B16.5 2009 Edition

Lampiran 20. Analisa PV Elite Data *Nozzle*

Nozzle Calculation Summary:

Description	MAWP	Ext	MAPNC	UG45 [tr]	Weld Areas or Stresses
	psig		psig		Path
N7	913.21	OK	...	OK 0.307	OK Passed
N1	913.21	OK	...	OK 0.472	OK Passed
N3	913.21	...	...	OK 0.296	OK NoCalc[*]
N4	913.21	OK	...	OK 0.363	OK Passed
N6	913.21	OK	...	OK 0.344	OK Passed
N8	913.21	...	...	OK 0.296	OK NoCalc[*]
K1 A	913.21	OK	...	OK 0.344	OK Passed
K1 B	913.21	OK	...	OK 0.344	OK Passed
K2 A	913.21	OK	...	OK 0.344	OK Passed
K2 B	913.21	OK	...	OK 0.344	OK Passed
K3	913.21	...	...	OK 0.296	OK NoCalc[*]
K4 A	913.21	OK	...	OK 0.344	OK Passed
K4 B	913.21	OK	...	OK 0.344	OK Passed
K5 A	913.21	OK	...	OK 0.344	OK Passed
K5 B	913.21	OK	...	OK 0.344	OK Passed
M 1	913.21	OK	...	OK 0.561	OK Passed
N2	904.86	OK	...	OK 0.437	OK Passed
N5	904.86	OK	...	OK 0.296	OK Passed
N5	904.86	...	...	OK 0.296	OK NoCalc[*]

[*] - This was a small opening and the areas were not computed or

the MAWP of this connection could not be computed because
the longitudinal bending stress was greater than the hoop stress.

Note: MAWPs (Internal Case) shown above are at the High Point.

Check the Spatial Relationship between the Nozzles

From Node	Nozzle Description	Y Coordinate,	Layout Angle,	Dia. Limit
20	N7	0.000	0.000	6.962
30	N1	138.220	180.000	41.138
30	N3	20.000	0.000	5.114
30	N4	86.000	0.000	26.735
30	N6	176.000	180.000	24.836
30	N8	98.000	180.000	5.114
30	K1 A	134.000	0.000	24.836
30	K1 B	89.000	90.000	24.836
30	K2 A	122.000	90.000	24.836
30	K2 B	62.000	180.000	24.836
30	K3	164.000	0.000	5.114
30	K4 A	50.000	0.000	24.836
30	K4 B	14.000	180.000	24.836
30	K5 A	56.000	90.000	24.836
30	K5 B	14.000	90.000	24.836
30	M 1	56.000	270.000	45.138
40	N2	0.000	0.000	17.472
40	N5	0.000	180.000	7.930

The nozzle spacing is computed by the following:
= Sqrt($ll^2 + lc^2$) where
ll - Arc length along the inside vessel surface in the long. direction.
lc - Arc length along the inside vessel surface in the circ. direction

If any interferences/violations are found, they will be noted below.
No interference violations have been detected !