

Reactor Vessel Design & Cost Estimation
Excel Program

PVtools
pvtools.weebly.com

Details

Release Date : 15 Jun, 2021

Software : Excel **Size :** 0.5 MB

Design Type : Mechanical

Design Code : ASME Sec. VIII Div. 1

Options :

Nozzle Flange Cons. : Solid and Lined

Nozzle Flange : Slip On and Weld Neck

Baffle : With and without

Material : SS304, SS304L, SS316, SS316L, SA516
and Custom to add

Calculations available :

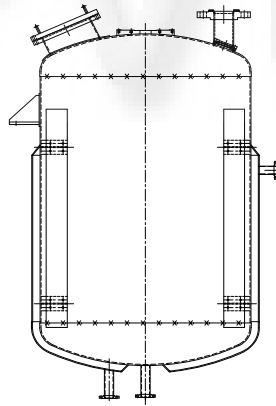
Shell Thickness

Dish End Thickness

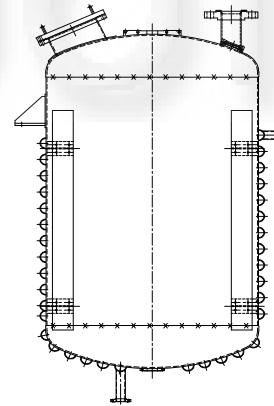
Limpet coil & Jacket Thickness

Nozzle

Output : BOQ with Costing.



Jacketed Vessel



Limpet Coiled Vessel

Screenshots

INPUTS

DESIGN DATA		Shell Side	Jacket Side
Design Pressure	kgf/cm ² g	3	2
Design Temperature	C	100	20
Material	SS304L	CS 60	
Corrosion Allowance	mm	0	3
Radiography		Nil	Nil

NOZZLES		Nozz. Flg. Type	SORF
Shell Side			
Service	Size	Qty	
50 NB	1	Inlet	40 NB
80 NB	1	Outlet	40 NB
25 NB	1	Vent	25 NB
25 NB	1	Drain	25 NB
MH	500 NB	1	

Pad Type		Nozz. Flg.	Solid
Drain	25 NB	1	Pad Type
	25 NB	1	Pad Type
	25 NB	1	Glass Type
Slight	25 NB	1	Aglt. Pad
Light	25 NB	1	

Description	Material	Thing Allowance	Min. Thk Req. In Internal Pressure	Thk Assume	External Pressure Design Result
Shell	SA 240 GR 304L		1.83	6	Safe
Top Dish	SA 240 GR 304L	2	3.28	8	
Bottom Dish	SA 240 GR 304L	2	3.28	8	Safe
Jkt Shell	SA 516 GR 60		4.43	6	
Jkt Dish	SA 516 GR 60	2	8	6	

Nozz. Flange (FS)	SA 182 F 304L	150W	150W
Nozz. Neck (SS)	SA 312 TP 304L	SCH 40	SCH 40
Nozz. Flange (FS)	SA 105	150W	150W
Nozz. Neck (FS)	SA 100 GR B	SCH 160	SCH 160
Gasket	PTFE	3	3
Fastner	SA193 Gr.87	---	---

PVtools
 DESIGN CODE : ASME
 VENDOR : PVTOOLS.WEBSITE.COM
 CREATED BY : PRADEEP NAYAK
 FROM DAMBUI, INDIA

CALCULATION

JACKET AND SHELL DESIGN CALCULATION

SHELL SIDE

Cylinder Inside Diameter	D	3000	mm
Cylinder Length	L	3500	mm
Cylinder Thickness Assume	th	6	mm
Cylinder Internal Design Pressure	P	3	kgf/cm ²
Design Temperature		100	°C
Cylinder Material		SA 240 GR 304L	
Allowable Stress	S	1175	kgf/cm ²
Corrosion Allowance	ca	0	mm
Cylinder Outer Corrosion Allowance	co	0	mm
Cylinder Joint Efficiency	E	0.7	

JACKET SIDE

Jacket Inside Diameter	JD	1200	
Jacket Thickness	JT	6	mm
Design Pressure	Pj	2	kgf/cm ²
Design Temperature		20	°C
Jacket Material		SA 516 GR 60	
Allowable Stress	Sj	1203	kgf/cm ²
Corrosion Allowance	caj	3	mm
Jacket Joint Efficiency	Ej	0.7	
External Pressure		0	kgf/cm ²

CALCULATION

Shell Thickness Calculation under Internal Pressure:
 Required Thickness of Shell per UG-27 Eq(3) (Includes CA) [T]:
 $t = P \cdot R / (S \cdot E \cdot 0.8 \cdot P) + ca + co$
 ID = 3000, IDT = 2994

ELIPSOIDAL (2:1) BOTTOM & JACKET DISH THICKNESS

BOTTOM DISH	
MDC	SA 240 GR 304L
Diameter	D = 1000 mm
Thickness Assume (Minimum)	th = 8 mm

ESTIMATION

SL. NO.	ITEM	QTY	SIZE	THK	MATERIAL	WT IN KGS	RATE IN RS/KG	AMOUNT IN RS	LABOUR CHARGES	WT IN KGS	RATE IN RS/KG	AMT IN RS			
1	Shell	1	3183 Dia x 1400	6	SA 240 GR 304L	212	185	1.1	35718	SS Labour	728	50	1	36400	
2	Top Dish end	1	1280 Blank Dia	8	SA 240 GR 304L	80	185	1.3	12039	SS Consumption	728	80	1	36400	
4	Bottom Dish end	1	1280 Blank Dia	8	SA 240 GR 304L	80	185	1.3	12039	JS Labour	388	30	1	19200	
5	Jacket shell	1	3183 Dia x 1000	6	SA 516 GR 60	178	90	1.1	9810	JS Consumption	388	30	1	19200	
6	Jacket dish	1	1492 Blank Dia	8	SA 516 GR 60	82	90	1.3	5343	DIE Forming	222	25	1	5540	
7	Jacket closure	1	3183 x 1183	6	SA 240 GR 304L	57	185	1.2	3392	Distorted	0	100	1	0	
8	Jacket support ring	4	84 x 3183 Lt	6	SA 240 GR 304L	57	185	1.1	9727	Distorted	0	100	1	0	
9	SS Nozzle pipes				SA 312 TP 304L	7	360	2283	Transport						
10	SS Nozzle Flanges				SA 182 F 304L	213	490	95760	Transport						
11	SS RF pad				SA 240 GR 304L	32	150	1.8	2902	Document					
12	JS Nozzle pipes				SA 316 GR B	7	160	516	Design - FTA						
13	JS Nozzle Flanges				SA 105	5	250	1150	Final MC						
14	JS RF pad				SA 516 GR 60	0	80	1.5	0	Transport					
15	Agitator pad				SA 240 GR 304L	89.934	185	1.3	16388	Painting	0.5	200	1	0	
16	Blow				SA 240 GR 304L	89.4	185	1.4	8797	Painting	0.5	200	1	0	
19	Pad for lug support				SA 240 GR 304L	52	185	1.1	2048	Hydro test					
20	Lug support				CS 60	64	45	1.3	4500	NG filling					
21	Lifting pad				SA 240 GR 304L	1.92	185	1.1	327	Packing					
22	Lifting lug				SA 35	9.6	45	1.1	475	Transport Saddle					
23	Gasket				PTFE			4900							
24	Fasteners				SA193 B7	32		4887							
25	Manhole neck				SA 240 GR 304L	27	185	4155							
26	Toughened Glass				GRASS			1800	2050						
27	Name plate														
28	Jg material														
						1246	TOTAL	254713							

Aug rate	422 Rs/kg
Material	256713
Labour	181772
Total	438487
20%	87697
Total	526184

DATABASE

Material	Density kg/cm ³	SA 516 GR 60	SA 516 GR 70	SA 105	SA 240 GR 304	SA 312 TP 304	SA 312 TP 304L	SA 316	SA 316 TP 316	SA 316 TP 316L	SA 304	SA 304 TP 304	SA 108 GR B	CS 20	CS 20 F.85	CS 20 F.88
		7.85	7.85	7.85	7.85	7.85	7.85	7.85	7.85	7.85	7.85	7.85	7.85	7.85	7.85	7.85

Rates per kg														
SA 516 GR 60	20	SA 240 GR 2	250	SA 312 TP 304	250	CS	20							
SA 516 GR 70	20	SA 105	350	SA 312 TP 304L	350	CS	20							
SA 240 GR 304	200	SA 182 F 304	450	SA 312 TP 316	550	SA304	155							
SA 240 GR 316	200	SA 182 F 304L	450	SA 312 TP 316L	550	SA304L	200							
SA 240 GR 304	155	SA 182 F 316	600	SA 108 GR B	100	SS304L	135							
SA 240 GR 304	350	SA 182 F 316L	600											

Maximum Allowable Stress, Kg/cm ² for Metal Temperature, °C																	
SS316	Plate	SA 240 GR 316	1408	1408	1408	1408	1408	1387	1285	1214	1183	1163	1142	1132	1122	1101	1091
	Forging	SA 182 F 316	1457	1457	1457	1387	1366	1356	1285	1213	1183	1162	1142	1132	1122	1101	1091
	Tube	SA 213 TP 316															
	Noz. Pipe	SA 312 TP 316	1407	1407	1407	1366	1366	1285	1213	1183	1162	1142	1132	1122	1101	1101	1091
	Noz. Flg	SA 182 F 316	1407	1407	1407	1387	1366	1356	1285	1213	1183	1162	1142	1132	1122	1101	1101
	Others	SS316															

Input Sheet

Vessel Type	Jacketed
Baffle	Required

Shell ID	1000
Shell Length TL to TL	1500

	80 NB
	1000
	66

Jacket	
Jkt Shell ID	1200
Jkt Length	1000

Baffle	
Width	150
Length	1000
Qty	4
Thk	8

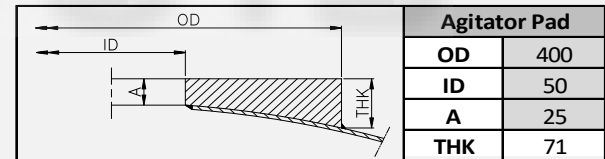
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Radiography	Nil	Nil

NOZZLES			Nozz. Flg. Type	SORF
Shell Side			Jacket Side	
Service	Size	Qty	Service	Size
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	80 NB	1	Outlet	40 NB
	25 NB	1	Vent	25 NB
	25 NB	1	Drain	25 NB
MH	500 NB	1		

Pad Type			Nozz. Flg.	Solid
Glass Type			Pad Type	Solid
			Glass Type	Solid
			Agit. Pad	Solid
Drain	25 NB	1		
	25 NB	1		
Slight	25 NB	1		
Light	25 NB	1		

Description	Material	Thining Allowance	Min. Thk Req. in Internal Pressure	Thk Assume	External Pressure Design Result
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		Min.	Consider
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Nozz. Neck (SS)	SA 312 TP 304L	SCH 40	SCH 40
Nozz. Flange (JS)	SA 105	150#	150#
Nozz. Neck (JS)	SA 106 GR B	SCH 160	SCH 160
Gasket	PTFE	3	3
Fastner	SA193 Gr.B7	--	--




Agitator Pad	
OD	400
ID	50
A	25
THK	71

Demo Video

	<p>Watch Online Link http://tiny.cc/om62uz</p>
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