





 $\overline{v2.0}$

SEPARATOR DESIGN

TWO PHASE THREE PHASE

A computer approach based on Wayne D.Monnery and William Y.Svrcek's articles

By:

Ali Farrokhzad

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Overview:

Sw provides simple macro-based Excel files which can size Two and Three Phase separators.

These files have been developed based on the well-known articles of **W.D.Monnery** and **W.Y.Svrcek's**.

There are 2 methods to get outputs from these files:

- Shortcut
- Detailed

The advantages of each method will be explained later.

Below abbreviations have been considered for mentioned files:

- **2pH:** Sizing of 2 phase HORIZONTAL separators. (vapor/liquid)
- ➤ 2pV: Sizing of 2 phase VERTICAL separators. (vapor/liquid)
- ➤ **3pHw:** Sizing of 3 phase HORIZONTAL separators with Weir. (vapor/liquid/liquid)
- ➤ 3pHb: Sizing of 3 phase HORIZONTAL separators with Boot. (vapor/liquid/liquid)
- ➤ 3pV: Sizing of 3 phase VERTICAL separators. (vapor/liquid/liquid)





> Shortcut Mode:

This method calculates vessel size based on minimum requirements. So it assumes some assumption to find the optimum result.

User should only enter process parameters (holdup and surge times, vapor/liquid rates, operating pressure, viscosities and densities of fluids and also the particle sizes in 3-phase cases) to evaluate the drum size.

Program will set some default values to obtain minimum vessel weight. Therefore, the Dimensions (Diameter, Length and level heights) are exact, but the total weight and nozzles size are estimated.

These are some of the default values where are fixed in this method:

- . Max. Allowable Tensile Stress for the Alloy = 17500 psi (1207 Bar)
- . Joint Efficiency = 0.85
- . Corrosion Allowance = 1/16 inch (1.6 mm)
- . Alloy Density = $490 \text{ lb/ft}^3 (7850 \text{ kg/m}^3)$

Total weight will be calculated as below:

 $W_T = 1.1 \times Alloy \ thickness \times Surface \ Area \times Alloy \ density$

Where Alloy thickness= Max (Head thickness, Shell thickness)

10% overhead is considered as the weight of nozzles, joints and other accessories.

User shall fill all **red bordered** cells. But during fill-up, some cells will be recolored to **green**, **gray** or **pale-red**, because these are depended on some other cells and by entering that parameters, these cells will be deactivated.

After filling the essential red-bordered cells, the first estimation of vessel sizing will be shown, but it isn't an optimum case and maybe some design constraints have not been satisfied. So by pressing *Optimize* button, the best result will be recalculated by program.



One of the design constraints is L/D that sets to be between $1.5\sim6^{\circ}$. Users are able to change this range.

Nozzle sizing are based on minimum fluid velocity.

Note: In horizontal separators, final dimension is optimum for selected default values such as corrosion allowance. By changing default values, the solution will converge to a different dimension as an optimum case. (Some inputs such as corrosion allowance, joint efficiency and design pressure effect on the shell and head thickness and therefore on the final vessel weight.)

¹ L/D is based on operating pressure. For details refer to Table.5 of reference 1 (Table 7 of reference 2).



> Detailed Mode:

This method is similar to shortcut, but users have more options to customize their design such as selecting the alloy type, changing the corrosion allowance, updating design pressure and temperature, introducing slug volume and customizing holdup volume and exact nozzle sizing by selecting standards flanges, introduce nozzle sizing criteria, etc.

So by these options, we will have some more exact data for the vessel weight.

In addition, in this mode, user can press **Show Detailed Calculation Steps** to view internal calculations.

Notes:

- For more information, view Help sheet of each file.
- A Reset button considered to undo Optimized case to the first estimated data.
- There is a *Reset All* button, which undo all calculations and clear input fields to original blank one. **It's important to be informed that this action is not undo-able**.

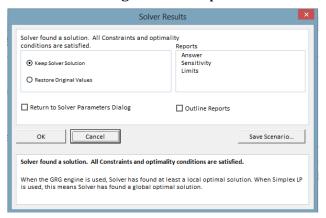
Limits and Inabilities:

- 1. The horizontal vessels cannot calculate pure single phase feeds. (Typically more than 99.99% vapor quality). So in these cases, assume a bit liquid volume instead of ZERO to avoid uncertain "divided by zero" in the program.
- 2. These files could evaluate K factor¹ for a wide pressure range as 0~5500 Pisa (379 Bara). Also for high pressure conditions, the vapor viscosity and particle size will be asked to evaluate theoretical **K**.
 - After v2.0 a *Kalculator* button has been considered to evaluate theoretical K based on physical properties of vapor and liquid. K will be calculated according to Table 1 of Ref.1

¹ Calculation of **K** is based on two methods: GPSA and York Demister.



- (Table 2 of Ref.2) and dose not included process modification factors where mentioned in that tables.
- 3. In this version, we have not considered "Round It" button. So the output dimensions are exact and user should round it manually as we have shown in the **finalization** section of the **Sample Case**.
- 4. Optimization procedure is provided by **SOLVER**¹. So final result is depending on solvers algorithm. Read its conversation dialog box after optimization:



 \bigstar According to Ref.2 Examples, we added a modification factor (α) for vapor disengagement area height (H_v) in horizontal drums with high vapor load. I could not found any reference for this factor, so I have considered it as below (in my own judge):

Hv=Max {
$$\alpha$$
D, 2 (1)} ; ft where $\begin{cases} \alpha = 0.2 & ; q \leq 0.353 \\ \alpha = 0.85 & ; q > 0.353 \end{cases}$

q is feed quality (mass fraction of vapor in the feed)

- In v2.0 we provided a built-in macro to install Solver add-in automatically by opening of $S\omega^2$ Launcher.xlsm. If it won't work properly, please refer to Startup sheet in each Excel file and follow instruction to install it manually.
- ❖ A movie has been provided that shows you running of a sample case step by step. <u>Click</u> <u>here</u> to watch it.

Ali Farrokhzad

Process Department Petrogas Jahan LTD, Co. 05 June 2016; Version **2.0**; R20160605

¹ Frontline Systems Inc.



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We are looking forward to your advice: Email: Sizing.Wizard@gmail.com

Discussion & Comments:

26 Website: https://sites.google.com/site/sizingwizards/Version-2-0

in LinkedIn: https://www.linkedin.com/groups/8243915

Find The Last Version on the website: https://sites.google.com/site/sizingwizards/what-s-new



Revision History:

Version	Updated Items	Note	Release Date
1.0	First Release.	All files	R20140513
1.1	Modify initial guess of vessel diameter for high load vapors.(To run solver in the right way)	2pH,2pHs	R20150520
2.0	 - Modify L/D optimization range based on Operating Pressure. - Velocity criteria effects modified in Inlet Nozzle Sizing. - Nozzle sizing tips and visualization modified. - Modify Surge/Holdup calculation - Adding User input option for K factor. - Modify Boot weight calculation on 3pHb & 3pHb_s 	All files	R20160605

References:

- **1.** Wayne D. Monnery and William Y. Svrcek. "**Design Two-Phase Separators Within The Right Limits**"; University of Calgary; October 1993. Chemical Engineering Progress (CEP).
- **2.** Wayne D. Monnery and William Y. Svrcek. "**Successfully Specify Three-Phase Separators**"; University of Calgary; September 1994. Chemical Engineering Progress(CEP).
- 3. Eugene F. Megyesy. "Pressure Vessel Handbook", 10th Edition, University of Tulsa, 1997.
- 4. Stanley M. Walas, "Chemical Process Equipment Selection and Design", University of Kansas, 1990.
- **5.** "Process Engineering Design Manual", TOTAL, 1985.

Note: There are some typos in the referenced articles. We have provided a marked / corrected files. You can download them from the <u>website</u>.



A Sample Case:

A mixture of petroleum feed flows at 146.2 Pisa and 63 °C and should pre-separate for further treating.

So we desired to use a drum to reach this propose. The downstream operation condition does not let us to have more liquid droplets in vapor phase.

Feed properties are as the below table. 10% oversize in nozzles shall be considered. All fluids are non-corrosive.

The products will be fed to another drum with pump.

Assume a SA-515_60 alloy for the material with examined joints.

	Flow Rate (kg/hr)	Density (kg/m³)	Viscosity (cp)
Vapor phase	7,000	10.3	-
Light Liquid (HC)	37,650	400.0	0.7
Heavy Liquid (Water)	4,510	1,020.0	0.5

Particle sizes:

Heavy liquid in the light liquid = 89 micron.

Light liquid in the heavy liquid = 127 micron.



Fluids properties input page:

Specify Input Units and Required Values:

		Quantity	Symbol	Unit	,	Value
		Pressure	P	Psia		146.2
IZ Duti		Vapor Density	$\rho_{\rm V}$	Kg/m3		10.3
Vapor Properties	Vapor N	Mass Flow Rate	$\mathbf{W}_{\mathbf{v}}$	kg/hr		7,000
Light Liquid Properties	Ligh	t Liquid Density	$\rho_{\rm L}$	Kg/m3		400.0
0 1	Light I	iquid Viscosity	$\mu_{\mathtt{L}}$	сР		0.7
(Usually Hydrocarbon)	Light I	iquid Flow Rate	$\mathbf{W}_{\mathtt{LL}}$	kg/hr		37,650
Hamm Liquid Dyanartics	Heavy	Liquid Density	$\rho_{\mathbf{H}}$	Kg/m3		1020.0
Heavy Liquid Properties	Heavy I	iquid Viscosity	$\mu_{\mathbf{H}}$	сР		0.5
(Usually Water)	Heavy I	iquid Flow Rate	$\mathbf{W}_{\mathbf{HL}}$	kg/hr	T	4,510
	Warning	gs & Errors:	,	kg/hr kg/min kg/s lb/hr lb/min lb/s ton/hr		

It seems everything is OK; jump to calculation tab:)

Press Here

It is recommended to use a 3-phase Horizontal drum with Boot; [because of $W(Heavy\ Liquid)/W(Total\ liquid) < 0.2]$

Warning: By clicking on "Reset ALL"; All Input Data will be deleted permanently!

Reset All

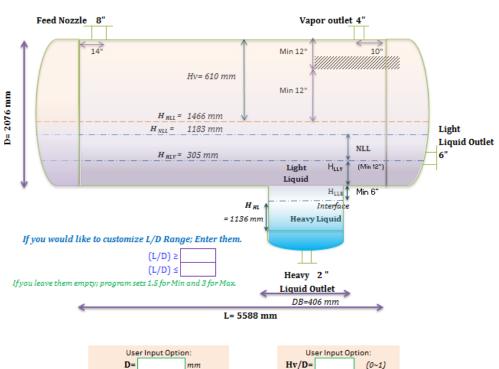


Additional Customization Options:

	Status: Optimized	Opi	imize	Reset	Show Detailed Calculation Steps	Reset All
Quantity	Symbol	Unit	Value			
Nozzle Sizing			☑ Inlet	Diverter		
Oversizing factor	% (Typically	0~1)		10%		
The inlet nozzle size should be between 6 & 8.2 inches (Velocity Basis).Also dF> 10" (Rho.V2 Basis)	7 2" (CED	Mathad) Sala		NDS from hele	_	
Inlet Nozzle size snould be between 0 dc 6.2 inches (velocity blass). Also dr 9 10 (10/0.02 blass)	d _F	inch	O Proper	8 8	u=7.3 m/s	
	,			_		
The heavy liquid outlet nozzle size should be between $0.8 \ \& 1.2$ inches. Select proper NPS from below	w.					
Heavy Liquid Outlet Nozzle size	d_{HL}	inch	¥	2	$u=0.7 \ m/s$	
The light liquid outlet nozzle size should be between 4.3 & 7.5 inches. Select proper NPS from below				•		
Light Liquid Outlet Nozzle size	d_{II}	inch	lacksquare	6	u=1.6 m/s	
m	י ממז ומיי		ATDC C			
The vapor outlet nozzle size should be between 3.7 & 5.2 inches (Velocity Basis) or greater than 4.6 Vapor Outlet Nozzle size	d.	s). Seiect prop inch	er NPS jr	om oslow.	u=25.6 m/s	
- Vapor Odriot Nozzio dizo		111011		•	a 25.0 m2	
Extra Process Condition for K value modification						
(Vapor velocity Modification):	V Me	shPad				
Vapor Under Vacuum?	OY= C) No				
Glycol or Amine Solution?	Oves C) No				
Compressor suction saubbers/mole sieve saubbers/expander inlet separator	OY= C) No				
As per Table.1 of Article, Calculated K is equal to 0.16 ft/s; Otherwise Enter Here:	K	ft/s			Kalculator	
Select a case to evaluate Holdup and Surge Time. Also you canenter them manually or enter slug	volume instea	d of surge tim	e.			
	Bla. Feed to d	ther drum or	ankage v	eith numn or		
	through excha		arrage n	ini panip oi		
Program's default value for your selected case is: TH=5min &Ts=2min.						
if you wish to enter Holdup time and Surge time manually, check this checkbox and enter them.				Use my own va	lue for TH &Ts	
Personal factor	 Experienced 	Trained	Or	nexperienced	multiply holdup time by 1;1.2 or 1.5 respe	ctively. By default=1.
Instrument factor	® Well	() Standard	O Po	porly	multiply holdup time by 1;1.2 or 1.5 respe	
				,	muniply notaup time by 1,1.2 or 1.3 respe	cuvely. By aejaun-1.
Surge volume based on Ts=2 min. is equal to 3.14 cub. If you desire another one or needed to add extra volumes such as slug, enter Total Surge.		0.8 cubic feet	1		1	
tj you destre another one or needed to dad extra volumes such as slug, enter 10tdi Surge	voiume nere:				J	
Or Enter the particle size [HL in LL]; [LL in HL] (micron)						
	$\mathbf{D}_{\mathbf{p}}$	89		127		
				127		
tier Operating or Design Temperature and Material grade to evaluate Max. Stress and Density	of alloy or En	iter them man	ually.			
tter Operating or Design Temperature and Material grade to evaluate Max. Stress and Density Operating Temperature			ually.	127		
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Output:

			7	mmary	Sizing Su						•	•
1	2076	nm		D	Diameter of Drum							
L/D= 2.7		mm		L	sel Tan-Tan Length		١					
Hv/D = 0.29					_							
Feed quality= (19	mm	1	t _s	Shell Thickness							
	30	mm	1	t _H	Head thickness							
	7773	kg		$\mathbf{W}_{\mathtt{D}}$	sel (without boot)	of Ves	Weight of					
	564	kg		$W_{\mathtt{B}}$	nt of Boot (approx.)	Weigh	W					
	8337	kg		W	of Vessel (approx.)	eight (Total Weig					
					Nozzle Sizing:							
	8	nch	i	$\mathbf{d}_{\mathtt{F}}$	Inlet Nozzle size							
	2	nch	i	$\mathbf{d}_{\mathtt{HL}}$	Outlet Nozzle size	Liquid	Heavy Liq					
	6	nch		d _{LL}	Outlet Nozzle size	•						
	4	nch	i	\mathbf{d}_{v}	Outlet Nozzle size	Vapor	Va					
	10%				e Oversizing Factor	Nozzle	No					
					Boot:			2	itioi	iiza	Before Optim	
	406	mm	1	DB	Diameter of Boot						•	
	1136	mm	1	H_{HL}	liquid in the Boot	heavy	Height he		uess	ai g	(Based on Initia	
	2.00	min	1	T _B	Boot Holdup Time			2502		_	Diameter of Drum	
						А	L/D= 1.4 Hv/D =0.24	3506	mm	L	Vessel Tan-Tan Length	V
	6.0	min	1	T _H	Holdup Time		Feed quality=	22	mm	t.	Shell Thickness	
	2.0	min	1	Ts	Surge Time	-	L/D is not OI			-	Head thickness	
								8409	kg	W _D	Vessel (without boot)	Weight of \
				Yes	MeshPad			665	kg	W_{B}	eight of Boot (approx.)	We
			liptical	2:1 Eli	Head Type			9075	kg	W	ght of Vessel (approx.)	Total Weig
	Steel	arbon S	5_60; C	SA-515	oy grade and type:	ial/All	Material					
	10.66	Barg	E	MOP	Operating Pressure	Max. C	Ma					
	12.36	Barg	E	DP	Design Pressure							
	90.78	°C		DT	esign Temperature	De						
	3.81	nm	1	C	rrosion Allowance	Со						
╝	(Examined Joints)	0.85	(E	Joint Efficiency				_			



Notice: Initial guess for D=2502 mm
After Using solver; Should Reset to recalculation all values!

Hv/D= (0~1)

Before Enteing D & Hv/D; First Press RESET

First enter Diameter and then fill Hv/D.



Detailed Steps. Pg. 1 of 2.

Status: Optimize Reset Optimized	Show D	etailed Cal	culation Steps	Reset All
Quantity	Symbol	Unit	Value	
Pressure	P	psig	131.7	
Vapor Density	ρv	lb/ft*	0.64	
Vapor Mass Flow Rate	W _v	lb/hr	15432	
Light Liquid Density Light Liquid Viscosity	ρι	lb/ft³ cP	25.0 0.70	
: Light Liquid Viscosity Light liquid Flow Rate	μ _ι W _{ιι}	lb/hr	83004	
Heavy Liquid Density	Рн	lb/ft3	63.7	
Heavy Liquid Viscosity	μн	cР	0.50	
Heavy liquid Flow Rate	$\mathbf{W}_{\mathtt{HL}}$	lb/hr	9943	
Vapor Volumetric Flow Rate	\mathbf{Q}_{v}	ft3/s	6.67	
Light Liquid Volumetric Flow Rate	QLL	ft3/min	55.40	
Heavy Liquid Volumetric Flow Rate	Q_{HL}	ft3/min	2.60 ✓ Inlet Diverter	
Nozzle Sizing Oversizing factor	94 (Tunically	(0.1)	10%	
Oversizing factor	76 (Typicuii)	0~1)	10%	
The inlet nozzle size should be between 6 & 8.2 inches (Velocity Basis).Also dF> 10" (Rho.V2 B		-		
Inlet Nozzle size	d_F	inch	⊘ 8	u=7.3 m/s
The heavy liquid outlet nozzle size should be between 0.8 & 1.2 inches. Select proper NPS from	m below.			
Heavy Liquid Outlet Nozzle size	d_{HL}	inch	2	u=0.7 m/s
!				
The light liquid outlet nozzle size should be between 4.3 & 7.5 inches. Select proper NPS from	below.			_
Light Liquid Outlet Nozzle size	d_{LL}	inch		u=1.6 m/s
The vapor outlet nozzle size should be between 3.7 & 5.2 inches (Velocity Basis) or greater the		-	ct proper NPS from 4	u below. u=25.6 m/s
Vapor Outlet Nozzle size	d _v	inch lb/ft ³	29.1	u=25.6 m/s
Mean Liq Density Min Flow	ρ_L Q_M	ft³/s	7.63	
Lambda Factor	λ	-	0.1266	
Mean density	$\rho_{\scriptscriptstyle M}$	lb/ft³	4.25	
Min_Inlet Nozzle Size	\mathbf{d}_{N}	ft	0.606	
!		0.7		
: K_York Demister K_GPSA	K K	ft/s	0.3153	
		ft/s	U.3468	
K_GF3A Min-K	K	ft/s ft/s	0.3468 0.3153	
-				
-				
-			0.3153 #DIV/0!	
·		ft/s X= Y=	0.3153 #DIV/0! #DIV/0!	
-		ft/s X= Y= CD=	0.3153 #DIV/0! #DIV/0! #DIV/0!	
-		ft/s X= Y=	0.3153 #DIV/0! #DIV/0!	
Min-K K_Min Extra Process Condition for K value modification	K K	ft/s X= Y= CD= K=	0.3153 #DIV/0! #DIV/0! #DIV/0! #DIV/0!	
Min-K K_Min Extra Process Condition for K value modification (Vaporvelocity Modification):	K K	Tt/s X	0.3153 #DIV/0! #DIV/0! #DIV/0! #DIV/0!	
Min-K K_Min Extra Process Condition for K value modification (Vaporvelocity Modification): Vapor Under Vacuum?	K K V Ves	Tt/s X	0.3153 #DIV/0! #DIV/0! #DIV/0! #DIV/0!	
Min-K K_Min Extra Process Condition for K value modification (Vaporvelocity Modification):	K K	Tt/s X	0.3153 #DIV/0! #DIV/0! #DIV/0! #DIV/0!	
Min-K K_Min Extra Process Condition for K value modification (Vaporvelocity Modification): Vapor Under Vacuum?	K K V Ves	Tt/s X	0.3153 #DIV/0! #DIV/0! #DIV/0! #DIV/0!	
Min-K K_Min Extra Process Condition for K value modification (Vaporvelocity Modification): Vapor Under Vacuum? Glycol or Amine Solution?	K K V Yes Yes	ft/s X	0.3153 #DIV/0! #DIV/0! #DIV/0! #DIV/0!	Kolcyiator
Min-K K_Min Extra Process Condition for K value modification (Vapor velocity Modification): Vapor Under Vacuum? Glycol or Amine Solution? Compressor suction scrubbers/mole sieve scrubbers/expander inlet separator	K K V Yes Yes Yes K K	ft/s X=	0.3153 #DIV/0! #DIV/0! #DIV/0! #DIV/0!	Kalculator
K_Min Extra Process Condition for K value modification (Vapor velocity Modification): Vapor Under Vacuum? Glycol or Amine Solution? Compressor suction scrubbers/mole sieve scrubbers/expander inlet separator As per Table.1 of Article, Calculated K is equal to 0.16 ft/s; Otherwise Enter Here: Final K Value Vertical Terminal Vapor Velocity	K K Ves Yes Yes Ves K K U _T	$\begin{array}{c} x = \\ Y = \\ CD = \\ K = \\ ft/s \end{array}$ MeshPad \bigcirc No \bigcirc No \bigcirc No \bigcirc ft/s \bigcirc ft/s \bigcirc ft/s	0.3153 #DIV/0! #DIV/0! #DIV/0! #DIV/0! 0.3153	Kolculator
K_Min Extra Process Condition for K value modification (Vaporvelocity Modification): Vapor Under Vacuum? Glycol or Amine Solution? Compressor suction scrubbers/mole sieve scrubbers/expander inlet separator As per Table.1 of Article, Calculated K is equal to 0.16 ft/s; Otherwise Enter Here: Final K Value	K K V Yes Yes Yes K K	ft/s $X = Y = CD = K = ft/s$ MeshPad \(\text{No} \) \(\text{No} \) \(ft/s \) ft/s	0.3153 #DIV/0! #DIV/0! #DIV/0! #DIV/0! 0.3153	Kaiculator
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Detailed Steps. Pg 2 of 2.

Qu	antity	Symbol	Unit	Value	
Total Cross-sectiona		A _T	ft²	36.42	
Factor of Vapor		α	-	0.20	
Vapor Space H	Height	Hv	ft	2.00	
	Hv/D	x	-	0.29	
	Av/A _T	У		0.245	
Vapor Space cross-sect		Av	ft²	8.93	
Height of LLL in the V		H _{LLV}	in	12.0	
	H _{LLV} /D	X	-	0.147	
	A _{LLV} /A _T	y		0.091	
cross-sectional area of the LLL in Light liquid @V		A_{LLV}	ft²	3.32	
Height of LL in the		H _{LLB}	in	6.00	
Min Length to accommodate the liq. Holdup/	/Surge	L	ft	18.33	
Surge volume based on Ts=2 min. is equal to 3.	14 cubic n	neter. (110	.8 cubic feet)		
ou desire another one or needed to add extra volumes such as slug, enter Total					
Time weight base on h	oldup	tw		0.750	
Final holdup volume based	on Vs	V_{H}	ft³	332.4	
		$Vs+V_H$	ft³	443.2	
surge volume based	on Ts	V _s	ft³	110.80	
Or Enter the particle size [HL in LL]; [LL in HL] (m	icron)	Dp	89	127	
Final Ks [HL in LL]; [LL	-	ks	0.163	0.333	
Settling velocity of heavy liquid out of the light		U _{HL}	in./min	9	
Rising velocity of light liquid out of the heavy		ULH	in./min	10	
Time of Heavy liquid settling out of the light		t _{HL}	min	7.1	
Residence Time of Light I		θ_{LL}	min	9.1	
Modified Length (When 6		L_Mod	ft	14.22	
Tan. To Tan. L	ength.	L	ft	18.33	
Liquid drop ou		ф	sec	2.75	
Actual Vapor Ve	elocity	\mathbf{U}_{VA}	ft/s	0.75	
Min Length required for vapor/liquid separ	ration	L_{MIN}	ft	2.05	
	Status		_	L>>Lmin	
F	inal L	L	ft	18.33	
		L/D		2.69	
Head	d Type			2:1 Eliptical	
Operating or Design Temperature and Material grade to evaluate Max	. Stress a	nd Density	of alloy or E	nter them manual	ly.
Operating Tempe	rature	OT	С	63	
Design Tempe	rature	DT	°F	195	
The design temperature calculated by			04 C (405 E)		
I ne design temperature calculated by If you desire an			91 G (195 F)		
Design Temperature		DT DT	°F	195	
Normal Operating Pre	_	NOP	psig	132	
Maximum Operating Pre		MOP	psig		
				157	
Design Pre	essure	DP	psig	157 182	
			psig		
The design pressure calculated by program	m is equal	! to 12.5 Bar	psig		٦
	m is equal other one	! to 12.5 Bar	psig rg. (182 Psig)		
The design pressure calculated by progra If you desire an	m is equal other one _Final	to 12.5 Bar enter here: DP	psig rg. (182 Psig) psig	182]
The design pressure calculated by program If you desire an Design Pressure Corrosion (Select Fluid Type or Enter corrosion allow:	m is equal other one _Final ance in b	to 12.5 Bar enter here: DP elow cell)	psig rg. (182 Psig) psig psig Noncorrosive	182	
The design pressure calculated by progra If you desire an Design Pressure,	m is equal other one _Final ance in b ted fluid ty	to 12.5 Bar enter here: DP elow cell)	psig rg. (182 Psig) psig psig Noncorrosive	182]
The design pressure calculated by prograi If you desire an Design Pressure, Corrosion (Select Fluid Type or Enter corrosion allow Corrosion Allowance based on your select	m is equal other one _Final ance in b ted fluid ty Otherwi	to 12.5 Bar enter here: DP elow cell) vpe is 3.81 n ise enter it:	psig rg. (182 Psig) psig Noncorrosive nm. (0.15 in.)	182 182 Streams	
The design pressure calculated by prograi If you desire an Design Pressure, Corrosion (<i>Select Fluid Type</i> or Enter corrosion allow Corrosion Allowance based on your select Final Corrosion Allow	m is equal other one _Final ance in b ted fluid ty Otherwi	to 12.5 Bar enter here: DP elow cell) vpe is 3.81 n ise enter it: tc	psig g. (182 Psig) psig Noncorrosive nm. (0.15 in.)	182	
The design pressure calculated by prograi If you desire an Design Pressure, Corrosion (Select Fluid Type or Enter corrosion allow Corrosion Allowance based on your select	m is equal other one _Final ance in b ted fluid ty Otherwi	to 12.5 Bar enter here: DP elow cell) vpe is 3.81 n ise enter it:	psig g. (182 Psig) psig Noncorrosive nm. (0.15 in.)	182 182 Streams	(0.85 for examine
The design pressure calculated by prograif you desire an Design Pressure. Corrosion (Select Fluid Type or Enter corrosion allow: Corrosion Allowance based on your select Final Corrosion Alloy Joint Effi	m is equal other one _Final ance in b ted fluid ty Otherwi wance ciency	to 12.5 Bar enter here: DP elow cell) vpe is 3.81 n ise enter it: tc (Typically	psig psig psig Noncorrosive nm. (0.15 in.) in =0.6~1.0)	182 182 Streams	
The design pressure calculated by prograin of you desire an Design Pressure. Corrosion (Select Fluid Type or Enter corrosion allow: Corrosion Allowance based on your select Final Corrosion Allow Joint Effi	m is equal other one _Final ance in b ted fluid ty Otherwi wance ciency perties (S	to 12.5 Bar enter here: DP elow cell) vpe is 3.81 n ise enter it: tc (Typically	psig psig psig Noncorrosive nm. (0.15 in.) in =0.6~1.0)	182 182 Streams	(0.85 for examine
The design pressure calculated by prograin of you desire an Design Pressure. Corrosion (Select Fluid Type or Enter corrosion allow: Corrosion Allowance based on your select Final Corrosion Allow Joint Efficiency Select the Alloy Type from the list or enter Alloy propagation of the select the Alloy Type from the list or enter Alloy propagations.	m is equal other one _Final ance in b ted fluid ty Otherwise ciency perties (\$\footnote{S}\)	to 12.5 Bar enter here: DP elow cell) vpe is 3.81 n ise enter it: tc (Typically 5 & pm) in 1 enter here:	psig rg. (182 Psig) psig Noncorrosive nm. (0.15 in.) in =0.6~1.0) below cells.	182 182 Streams 0.15 SA-515_60	
The design pressure calculated by prograin of you desire an Design Pressure. Corrosion (Select Fluid Type or Enter corrosion allow: Corrosion Allowance based on your select Final Corrosion Allow Joint Effi Select the Alloy Type from the list or enter Alloy program of the stress: S= 1034 Bar (15000 ps). On Shell Thick Shell	m is equal other one _Final ance in b ted fluid ty Otherwi wance ciency perties (S Otherwise ckness	to 12.5 Bar enter here: DP elow cell) vpe is 3.81 n ise enter it: tc (Typically 5 & p _M) in l enter here: t ₂	psig rg. (182 Psig) psig Noncorrosive nm. (0.15 in.) in r=0.6~1.0) below cells.	182 182 Streams 0.15 SA-515_60 0.737	
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Finalization:

After optimization, you can round dimensions manually. (Automatically round mode is not considered yet.)

For this case, we first <u>set</u> D to 2100mm and then tried to round L with changing the H_v/D . In this step, consider the valid range for H_v/D . The result is as below:

				_
Sizing Summary				
Diameter of Drum	D	mm	2100	
Vessel Tan-Tan Length	L	mm	5400	L/D=2
				Hv/D =
Shell Thickness	t _s	mm	19	Feed qu
Head thickness	t _H	mm	30	
Weight of Vessel (without boot)	$\mathbf{W}_{\mathtt{D}}$	kg	7759	
Weight of Boot (approx.)	$\mathbf{W}_{\mathtt{B}}$	kg	570	
Total Weight of Vessel (approx.)	W	kg	8329	
Nozzle Sizing:		_		
Inlet Nozzle size	d_F	inch	8	
Heavy Liquid Outlet Nozzle size	d _{HL}	inch	2	
Heavy Liquid Outlet Nozzle size	$\mathbf{d}_{\mathbf{LL}}$	inch	6	
Vapor Outlet Nozzle size	\mathbf{d}_{v}	inch	4	
Nozzle Oversizing Factor			10%	
Boot:				
Diameter of Boot	$\mathbf{D}_{\mathtt{B}}$	mm	406	
Height heavy liquid in the Boot	H _{HL}	mm	1136	
Boot Holdup Time	T _B	min	2.00	
Holdup Time	T _H	min	6.0	
Surge Time	Ts	min	2.0	
MeshPad	Yes			
Head Type	2:1 Elij	otical		
Material/Alloy grade and type:		_60; Carbon	Steel	
Max. Operating Pressure	MOP	Barg	10.66	
Design Pressure	DP	Barg	12.36	
Design Temperature	DT	°C	90.78	
Corrosion Allowance	C	mm	3.81	
Joint Efficiency	E	0.85	(Examined Joints)	

