



TankSheet



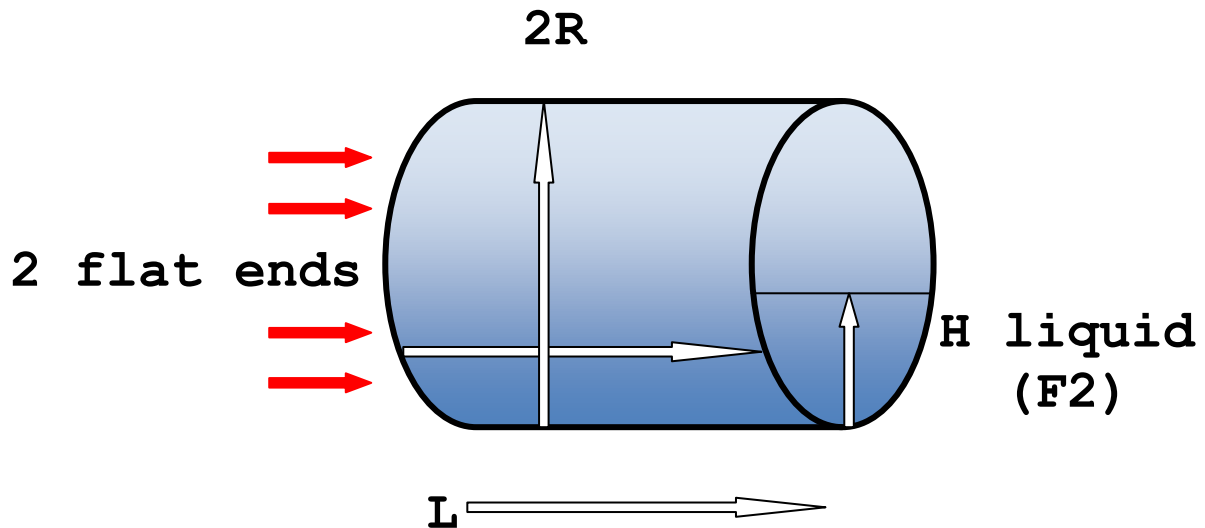
Documentation TankSheet



Please be sure to read the disclaimer on the last page.

Volume horizontal cylindrical tank

Case 1



In your calculation minor radius (**r**) must be set to zero.

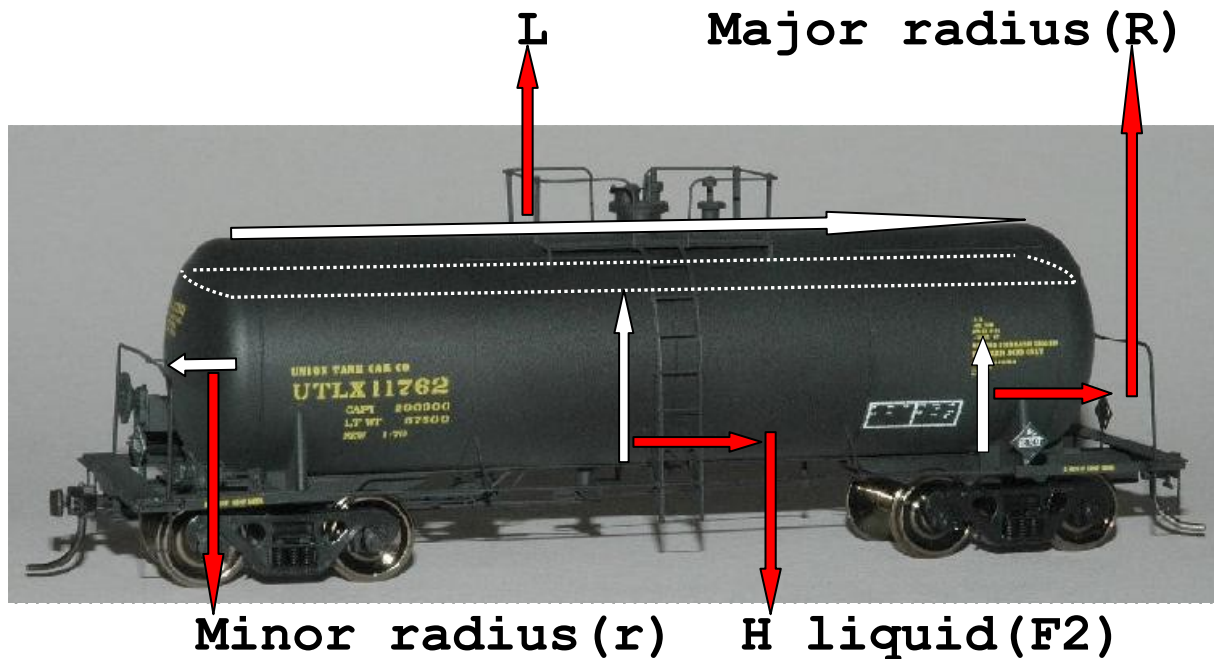
Sheet:

$$= ((\text{PI}()) * \text{D2} * (3 * \text{C2} - \text{F2}) * \text{F2} * \text{F2}) / (3 * \text{C2}) + \text{A2} * (2 * \text{ATAN2}(\text{SQRT}((2 * \text{C2} / \text{F2}) - 1); 1) * \text{C2} * \text{C2} + \text{SQRT}((2 * \text{C2} - \text{F2}) * \text{F2}) * (\text{F2} - \text{C2})) / 1000$$

$$= ((\text{PI}()) * \mathbf{r} * (3 * \mathbf{R} - \mathbf{H}) * \mathbf{H} * \mathbf{H}) / (3 * \mathbf{R}) + \mathbf{L} * (2 * \text{ATAN2}(\text{SQRT}((2 * \mathbf{R} / \mathbf{H}) - 1); 1) * \mathbf{R} * \mathbf{R} + \text{SQRT}((2 * \mathbf{R} - \mathbf{H}) * \mathbf{H}) * (\mathbf{H} - \mathbf{R})) / 1000$$

Volume horizontal cylindrical tank

Case 2



Train tank above has elliptical end caps so $r < R$!

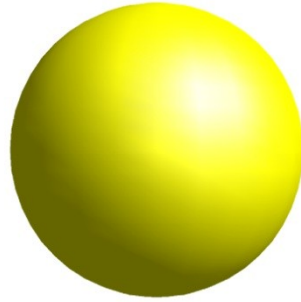
If the tank has spherical end caps:
 $r = R$!

Sheet:

$$= ((\text{PI}()) * D^2 * (3 * C^2 - F^2) * F^2 * F^2) / (3 * C^2) + A^2 * (2 * \text{ATAN}2(\text{SQRT}((2 * C^2 / F^2) - 1); 1) * C^2 * C^2 + \text{SQRT}((2 * C^2 - F^2) * F^2) * (F^2 - C^2))) / 1000$$

$$= ((\text{PI}()) * r * (3 * R - H) * H * H) / (3 * R) + L * (2 * \text{ATAN}2(\text{SQRT}((2 * R / H) - 1); 1) * R * R + \text{SQRT}((2 * R - H) * H) * (H - R)) / 1000$$

Volume spherical tank



The tank is spherical: $r = R$ and in your calculation L is set to zero (no cylindrical part).

Sheet:

$$=((PI()*D2*(3*C2-F2)*F2*F2)/(3*C2)+A2*(2*ATAN2(SQRT((2*C2/F2)-1);1)*C2*C2+SQRT((2*C2-F2)*F2)*(F2-C2)))/1000$$

$$= ((PI() * r * (3 * R - H) * H * H) / (3 * R) + L * (2 * ATAN2 (SQRT ((2 * R / H) - 1) ; 1) * R * R + SQRT ((2 * R - H) * H) * (H - R))) / 1000$$

Variable info

The results of your calculations depend on the accuracy of your measurements. It's imperative that you have the inside dimensions of the tank!

L = The length of the cylindrical section. As shown above, this is the linear (straight line) distance between the two end caps. Your measurement should begin/stop where the tank surface starts bending.

Range: $0 \leq L$ (greater than or equal to zero).

R = The radius of the cylinder and the major radius of the spherical/elliptical end caps. If you don't know the radius you can do this: measure the tank's circumference and divide by [6,283185307179](#).... Don't forget to subtract the tank's wall thickness from your measured value!

Example: you measure the circumference of a tank: **408,40** cm.

$$408,40 / 6,283185307179 = 64,99887875873613 \text{ (radius outside cylinder)}$$

Let's say the tank's wall thickness is **5** mm, so the radius of the inside cylinder is:

$$64,99887875873613 \text{ cm} - 0,5 \text{ cm} = 64,49887875873613 \text{ cm} \approx 64,5 \text{ cm}$$

Range: $0 < R$ (greater than zero).

r = The minor radius of the elliptical end caps. This is a more difficult measurement to perform. My suggestion: use a plumb line to make marks on the ground. This gives you the overall length of the tank. Subtract **L** and **2 * wall thickness** and then divide by **2**.

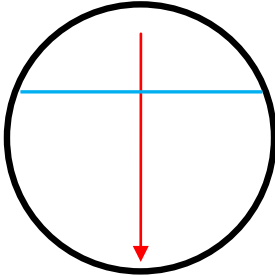
Example: tank overall length = **460** cm; **L** = **340** cm; wall thickness = **0,5** cm

$$[460 - 340 - (2 * 0,5)] / 2 = 59,5 \text{ cm} = \text{the minor radius of the end caps of your tank.}$$

Range: $0 \leq r \leq R$ (equal or greater than **0** not exceeding **R**).

H = The height (level) of the liquid in your tank. This value can be acquired with electronic measurement equipment or dipstick.

Dipstick measuring point liquid level



Range: $0 < H \leq 2R$ (greater than 0 not exceeding 2R).

Sheet

Cells A1-V1: **title** of the column

Column A: **length (L)** of the cylindrical section in cm

Column B: cm

Column C: **major radius (R)**, constant, in cm

Column D: **minor radius (r)**, constant, in cm

Column E: cm

Column F: **height (H)** liquid (maximum: 2R), decreasing, in cm

Column G: cm

Column H: $=((\pi) * D^2 * (3 * C^2 - F^2) * F^2 * F^2) / (3 * C^2) + A^2 * (2 * \text{ATAN2}(\text{SQRT}((2 * C^2 / F^2) - 1); 1) * C^2 * C^2 + \text{SQRT}((2 * C^2 - F^2) * F^2 * (F^2 - C^2))) / 1000$ (row numbers increasing), value decreasing, **volume liquid** in litre (**blue**)*

Column I: $H_n / (H_2 / 100)$; H_n = value corresponding to the n-th row; H_2 = total tank volume, **% of total tank volume**

Column J: %

Column K: $H_2 - H_n$; H_2 = total tank volume; H_n = value corresponding to the n-th row; value increasing, **volume air** in litre (**red**)

Column L: 0 (check off)

Column M: M (month)

Column N: M (month)

Column O: D (day)

Column P: D (day)

Column Q: H (hour)

Column R: H (hour)

Column S: M (minute)

Column T: M (minute)

Column U: S (second)

Column V: S (second)

*

$$=((\text{PI}())*\text{D}2*(3*\text{C}2-\text{F}2)*\text{F}2*\text{F}2)/((3*\text{C}2)+\text{A}2*(2*\text{ATAN}2(\text{SQRT}((2*\text{C}2/\text{F}2)-1);1)*\text{C}2*\text{C}2+\text{SQRT}((2*\text{C}2-\text{F}2)*\text{F}2)*(\text{F}2-\text{C}2)))/1000$$

$$=((\text{PI}())*\text{D}3*(3*\text{C}3-\text{F}3)*\text{F}3*\text{F}3)/((3*\text{C}3)+\text{A}3*(2*\text{ATAN}2(\text{SQRT}((2*\text{C}3/\text{F}3)-1);1)*\text{C}3*\text{C}3+\text{SQRT}((2*\text{C}3-\text{F}3)*\text{F}3)*(\text{F}3-\text{C}3)))/1000$$

$$=((\text{PI}())*\text{D}4*(3*\text{C}4-\text{F}4)*\text{F}4*\text{F}4)/((3*\text{C}4)+\text{A}4*(2*\text{ATAN}2(\text{SQRT}((2*\text{C}4/\text{F}4)-1);1)*\text{C}4*\text{C}4+\text{SQRT}((2*\text{C}4-\text{F}4)*\text{F}4)*(\text{F}4-\text{C}4)))/1000$$

$$=((\text{PI}())*\text{Dn}*(3*\text{Cn}-\text{Fn})*\text{Fn}*\text{Fn})/((3*\text{Cn})+\text{An}*(2*\text{ATAN}2(\text{SQRT}((2*\text{Cn}/\text{Fn})-1);1)*\text{Cn}*\text{Cn}+\text{SQRT}((2*\text{Cn}-\text{Fn})*\text{Fn})*(\text{Fn}-\text{Cn}))/1000$$

DISCLAIMER

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Extensive 1000_500

YEAR: 2009

Length-L	Maj. R	Min. r	Height-H	VOL. IN LITRE	% VOL.	VOL. AIR IN LIT.	M	M	D	D	H	H	M	M	S	S	
1000	CM	500	0	CM	1000,0	CM	785398,1633974	100,0	%	0,0000000	O						
1000	CM	500	0	CM	999,90	CM	785396,8301041	100,00	%	1,3332933	O						
1000	CM	500	0	CM	999,80	CM	785394,3923876	100,00	%	3,7710098	O						
1000	CM	500	0	CM	999,70	CM	785391,2358178	99,999	%	6,9275796	O						
1000	CM	500	0	CM	999,60	CM	785387,4980109	99,999	%	10,6653865	O						
1000	CM	500	0	CM	999,50	CM	785383,2585139	99,998	%	14,9048835	O						
1000	CM	500	0	CM	999,40	CM	785378,5710071	99,998	%	19,5923903	O						
1000	CM	500	0	CM	999,30	CM	785373,4749049	99,997	%	24,6884925	O						
1000	CM	500	0	CM	999,20	CM	785368,0007499	99,996	%	30,1626475	O						
1000	CM	500	0	CM	999,10	CM	785362,1731190	99,995	%	35,9902784	O						
1000	CM	500	0	CM	999,00	CM	785356,0123467	99,995	%	42,1510507	O						
1000	CM	500	0	CM	998,90	CM	785349,5356228	99,994	%	48,6277746	O						
1000	CM	500	0	CM	998,80	CM	785342,7577291	99,993	%	55,4056683	O						
1000	CM	500	0	CM	998,70	CM	785335,6915545	99,992	%	62,4718429	O						
1000	CM	500	0	CM	998,60	CM	785328,3484682	99,991	%	69,8149292	O						
1000	CM	500	0	CM	998,50	CM	785320,7385967	99,990	%	77,4248007	O						
1000	CM	500	0	CM	998,40	CM	785312,8710358	99,989	%	85,2923616	O						
1000	CM	500	0	CM	998,30	CM	785304,7540142	99,988	%	93,4093832	O						
1000	CM	500	0	CM	998,20	CM	785296,3950233	99,987	%	101,7683741	O						
1000	CM	500	0	CM	998,10	CM	785287,8009214	99,986	%	110,3624760	O						
1000	CM	500	0	CM	998,00	CM	785278,9780184	99,985	%	119,1853790	O						
1000	CM	500	0	CM	997,90	CM	785269,9321450	99,984	%	128,2312524	O						
1000	CM	500	0	CM	997,80	CM	785260,6687106	99,982	%	137,4946868	O						
1000	CM	500	0	CM	997,70	CM	785251,1927522	99,981	%	146,9706452	O						
1000	CM	500	0	CM	997,60	CM	785241,5089748	99,980	%	156,6544226	O						
1000	CM	500	0	CM	997,50	CM	785231,6217866	99,979	%	166,5416108	O						
1000	CM	500	0	CM	997,40	CM	785221,5353292	99,978	%	176,6280682	O						
1000	CM	500	0	CM	997,30	CM	785211,2535032	99,976	%	186,9098942	O						
1000	CM	500	0	CM	997,20	CM	785200,7799908	99,975	%	197,3834066	O						
1000	CM	500	0	CM	997,10	CM	785190,1182758	99,974	%	208,0451216	O						
1000	CM	500	0	CM	997,00	CM	785179,2716603	99,972	%	218,8917371	O						
1000	CM	500	0	CM	996,90	CM	785168,2432806	99,971	%	229,9201168	O						
1000	CM	500	0	CM	996,80	CM	785157,0361201	99,969	%	241,1272773	O						
1000	CM	500	0	CM	996,70	CM	785145,6530218	99,968	%	252,5103756	O						
1000	CM	500	0	CM	996,60	CM	785134,0966987	99,966	%	264,0666987	O						
1000	CM	500	0	CM	996,50	CM	785122,3697436	99,965	%	275,7936538	O						
1000	CM	500	0	CM	996,40	CM	785110,4746377	99,963	%	287,6887597	O						
1000	CM	500	0	CM	996,30	CM	785098,4137584	99,962	%	299,7496390	O						
1000	CM	500	0	CM	996,20	CM	785086,1893865	99,960	%	311,9740109	O						
1000	CM	500	0	CM	996,10	CM	785073,8037122	99,959	%	324,3596852	O						
1000	CM	500	0	CM	996,00	CM	785061,2588415	99,957	%	336,9045559	O						
1000	CM	500	0	CM	995,90	CM	785048,5568009	99,955	%	349,6065965	O						
1000	CM	500	0	CM	995,80	CM	785035,6995429	99,954	%	362,4638545	O						
1000	CM	500	0	CM	995,70	CM	785022,6889499	99,952	%	375,4744475	O						
1000	CM	500	0	CM	995,60	CM	785009,5268385	99,951	%	388,6365589	O						
1000	CM	500	0	CM	995,50	CM	784996,2149634	99,949	%	401,9484340	O						
1000	CM	500	0	CM	995,40	CM	784982,7550206	99,947	%	415,4083768	O						
1000	CM	500	0	CM	995,30	CM	784969,1486508	99,945	%	429,0147466	O						
1000	CM	500	0	CM	995,20	CM	784955,3974422	99,944	%	442,7659552	O						
1000	CM	500	0	CM	995,10	CM	784941,5029335	99,942	%	456,6604639	O						
1000	CM	500	0	CM	995,00	CM	784927,4666160	99,940	%	470,6967814	O						
1000	CM	500	0	CM	994,90	CM	784913,2899365	99,938	%	484,8734609	O						
1000	CM	500	0	CM	994,80	CM	784898,9742991	99,936	%	499,1890983	O						
1000	CM	500	0	CM	994,70	CM	784884,5210675	99,935	%	513,6423299	O						
1000	CM	500	0	CM	994,60	CM	784869,9315667	99,933	%	528,2318307	O						
1000	CM	500	0	CM	994,50	CM	784855,2070850	99,931	%	542,9563124	O						
1000	CM	500	0	CM	994,40	CM	784840,3488755	99,929	%	557,8145219	O						

