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Content Based
Chemical Engineering

Tank/Vessel Overflow Line Sizing

NOTE: The program has two parts: the first is for sizing the overflow, and second is for calculating the capacity of an overflow.

Always begin a new case by retrieving the original file. Direct entry of data in cells that originally contain table lookups could cause functions to be lost, or incorrect calculations. I format cells requiring entry colored **RED**; calculated values are black.

1.) Enter identification at [C4].
2.) Enter total liquid inflow at [C7].
3.) Enter fluid at [G7], use [=], then go to fluid name in table (A44.... D92) eg. [=A92] is WATER. The Specific Gravity at G8 will be automatically looked up in the table, if the fluid is in table. If not, enter directly in [G8].
4.) Enter liquid head (inches) at [C9].
5.) Select the pipe schedule "10" or "40" with the drop-down at [F13].
6.) The required overflow inside diameter is shown at [F18].
7.) The recommended size overflow is given at row 22 and is based on the schedule previously selected. The look-up tables follow schedule 40 pipe through 12 inch and standard (STD) weight above 12 inch.

This latter part of the program is set up to automatically calculate the capacity of the overflow prviously chosen. By comparing capacities to the inflow, the area for future inflow increase can be determined.

To use this part separately:

8.) Enter identification at [C27].
9.) Enter specific gravity at [D29].
10.) Enter liquid head (inches) at [D30].
11.) Enter overflow ID at [D33], use pipe table if appropriate.

Calculated overflow capacity is indicated at [E38].

Print out using direct Excel commands. This application is provided by Chemical Engineers Resource Website, vischeresources.com for additional selections.

Print out using direct EXCEL commands.

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4/24/2004

Tank/Vessel Overflow Line Sizing

DEVICE : Tank #2501; Overflow Tag: 03000

Vessel			Fluid		
Vessel Inflow:	7000	gpm	Liquid:	WATER	
W:	3500000	lb/hr	Specific Gravity:	1.000	
Δ P:	4	inch	Density:	62.4	lb/cu. ft.
or	0.1443001	psig	Frictional Loss, N:	1.5	(simple overflow)

Select Overflow Pipe Schedule : Schedule 10

$$dia := \left[\left(2.79 \cdot 10^{-7}\right) \cdot N \cdot \frac{W^2}{(\Delta P \cdot D)} \right]^{0.25} = 27.469139 \text{ inch}$$

-- A 30-inch overflow is recommended --

Selected Overflow Capacity

DEVICE : Tank #2501; Overflow Tag: 03000

sp.gr. =	1.000			
ΔP=	4.000	inch =	0.1443001	psi
D =	1.000	× 62.4 =	62.4	lb/cu.ft.
N =	1.5	(for simple o'flow)		
d =	29.376	inch (overflow ID)		

$$W := \sqrt{\left[\frac{\Delta P \cdot D \cdot d^4}{N \cdot \left(2.79 \cdot 10^{-7}\right)} \right]} = 4002794.2 \text{ lb/hr or } 8{,}005.6 \text{ gpm}$$

4/24/2004

Tank/Vessel Overflow Line Sizing

DEVICE : Tank #2501; Overflow Tag: 03000

Vessel			Fluid		
Vessel Inflow:	78.358024	m^3/hr	Liquid:	WATER	
W:	21.766118	kg/sec	Specific Gravity:	1.000	
Δ P:	0.1016	meter	Density:	1000	kg/cu. meter
or	996.35564	Pa	Frictional Loss, N:	1.5	(simple overflow)

Select Overflow Pipe Schedule : Schedule 40

$$dia := \left[\left(808 \cdot 10^{-3}\right) \cdot N \cdot \frac{W^2}{(\Delta P \cdot D)} \right]^{0.25} = 154.93964 \text{ mm}$$

-- A 200 mm overflow is recommended --

Selected Overflow Capacity

DEVICE : Tank #2501; Overflow Tag: 03000

sp.gr. =	1.000			
ΔP=	0.1016	meter =	0.9962896	kPa
D =	1.000	× 1000 =	1000	kg/cu. meter
N =	1.5	(for simple o'flow)		
d =	202.74	millimeter (overflow ID)		

$$W := \sqrt{\left[\frac{\Delta P \cdot D \cdot d^4}{N \cdot \left(808 \cdot 10^{-3}\right)} \right]} = 37.266652 \text{ kg/sec or } 134.2 \text{ cu. meter/hr}$$

LIQUID	sp. gr.
ACETIC ACID 100%	1.050
ACETIC ACID 70%	1.010
ACETONE	0.789
AMINE OXIDE	0.950
AMMONIA 26%	0.905
AMMONIA 100%	0.682
BENZENE 26%	0.844
BLACK LIQUOR 50%	1.250
BLACK LIQUOR 63%	1.330
BLACK LIQUOR 68%	1.360
BRINE, CALCIUM CHLORIDE 25	1.230
BRINE, SODIUM CHLORIDE 25%	1.190
CARBON DIOXIDE	1.102
CAUSTIC 20%	1.223
CAUSTIC 50%	1.530
CHLORINE LIQUID	1.467
DOWTHERM A	0.995
ETHANOL 100%	0.789
ETHANOL 40%	0.935
ETHANOL 95%	0.804
ETHYL CHLORIDE	0.923
ETHYLENE GLYCOL	1.110
FREON, R11	1.410
FREON, R12	1.170
FREON, R22	1.440
FUEL OIL #2	0.876
FUEL OIL #6	0.993
GASOLINE	0.751
GLYCEROL, 100%	1.260
HYDROCHLORIC 31.5%	1.159
ISOPROPYL ALCOHOL	0.785
KEROSENE	0.811
LUBE OIL MOBIL 634	0.884
METHANOL 100%	0.796
METHANOL 40%	0.937
METHANOL 90%	0.824
METHYL CHLORIDE	0.998
MULTITHERM PG-1	0.875
NITRIC ACID 60%	1.370
NITRIC ACID 95%	1.500
OIL, VEGETABLE HARDENED	0.920
OIL, VEGETABLE UNHARDENED	0.880
SULPHUR DIOXIDE	1.434
SULPHURIC 110%, FUMING	1.840
SULPHURIC ACID 60%	1.500
SULPHURIC ACID 98%	1.830
TOLUENE	0.862
TURPENTINE	0.864
WATER	1.000

Overflow Selection Information

Case	Selection	Test	- A 30-inch overflow is recommended -
Schedule 1	Schedule 1	1	
Schedule 40			

Piping	Schedule 10 Lookup Table			Schedule 40 Lookup Table		
Size	schd 10S	next nom	next i.d.	nominal	schd 40	next nom
1/2	0.001	1/2	0.674	0.001	1/2	0.622
1/2	0.674	3/4	0.884	0.622	3/4	0.824
3/4	0.884	1	1.097	0.824	1	1.049
1	1.097	1 1/4	1.422	1.049	1 1/4	1.38
1 1/4	1.422	1 1/2	1.682	1.380	1 1/2	1.61
1 1/2	1.682	2	2.157	1.610	2	2.067
2	2.157	2 1/2	2.635	2.067	2 1/2	2.469
2 1/2	2.635	3	3.26	2.469	3	3.068
3	3.260	3 1/2	3.76	3.068	3 1/2	3.548
3 1/2	3.760	4	4.26	3.548	4	4.026
4	4.260	6	6.357	4.026	6	6.065
6	6.357	8	8.329	6.065	8	7.981
8	8.329	10	10.42	7.981	10	10.02
10	10.420	12	12.39	10.020	12	11.938
12	12.390	14	13.624	11.938	14	13.25
14	13.624	16	15.624	13.250	16	15.25
16	15.624	18	17.624	15.250	18	17.25
18	17.624	20	19.564	17.250	20	19.25
20	19.564	22	21.564	19.250	22	21.25
22	21.564	24	23.5	21.250	24	23.25
24	23.500	26	25.376	23.250	26	25.25
26	25.376	28	27.376	25.250	28	27.25
28	27.376	30	29.376	27.250	30	29.25
30	29.376	32	31.376	29.250	32	31.25
32	31.376	34	33.312	31.250	34	33.25
34	33.312	36	35.376	33.250	36	35.25
36	35.376			35.250	36+	