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Content Based
Chemical Engineering

12/16/11

VENTILATION - requirements for accumulated flammable vapors

SYSTEM : Flammable Liquid Hold Tanks; vapor liberation

fluid =	Ethanol		Area :	19.6	sq ft or 1.821 sq meter
FORMULA :	C2H6O		M :	46.069	mol. weight
Temp :	80	°F	L.E.L. :	3.30%	lower explosive limit
or:	299.8167	°K	K, ft/min:	1.195	mass transfer coefficent

- **determine vapor pressure at temperature**

Coefficient A : 18.9119
Coefficient B : 3803.98
Coefficient C : -41.68

$$P_{SAT} := \exp\left[\frac{-(-A\cdot T - A\cdot C + B)}{(T + C)}\right] = 65.079 \text{ mmHg}$$

or: 0.086 atm

- **determine rate of evaporation**

$$Q_M := \frac{M\cdot K\cdot A\cdot P_{stat}}{(R_g\cdot T_L)} = 0.234424 \text{ lbm/min}$$

or : 1.963498 ft^3/min

and : 0.100178 ft^3/min air per $foot^2$

- **ventilation necessary below 25% LEL**

$$V_{25\%} := \frac{(Q_M\cdot 4\cdot 100)}{LEL} = 12.14 \text{ } ft^3\text{/min air per } foot^2$$

or : 222.0683 m^3/hr air per $meter^2$

Ventilation Required for this 20 sq. ft. Area = 238 ft^3 min

or : 404 m^3 hour

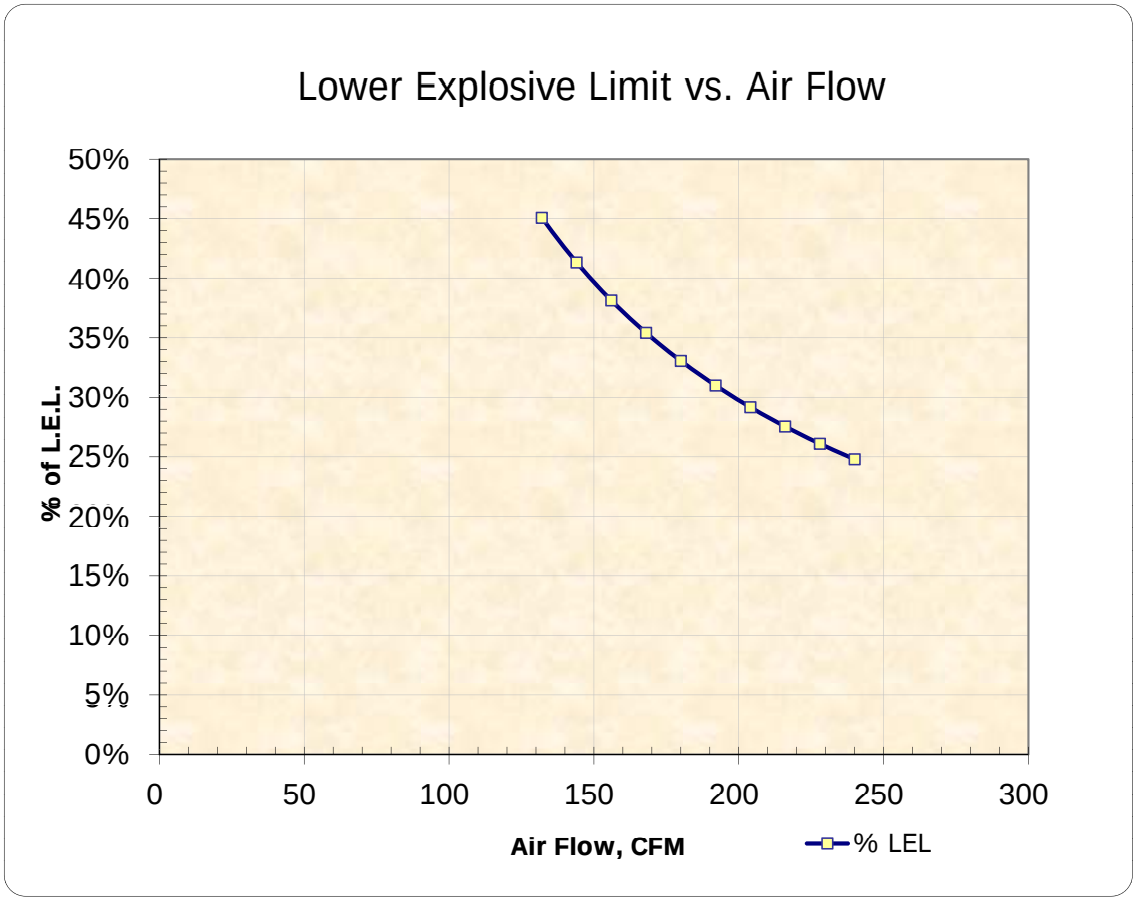
12/16/11

VENTILATION - Design @ 25% Lower Explosive Limit

SYSTEM : Flammable Liquid Hold Tanks; vapor liberation
AREA : 19.6 sq feet or 1.8209 sq meter

Fluid :	Ethanol	Q_M :	0.1001785	evaporation rate, CFM/sq. ft.
Formula :	C2H6O	$V_{25\%}$:	12.14	cu ft air/sq. ft. @ 25% LEL
Mol. Weight :	46.069	or :	1.832064	m^3/hr air per $meter^2$
L.E.L. :	3.30%	V_{req} :	238	CFM, Ventilation Req'd for this Area
		or :	404.3642	m^3 hour

Current Rate, CFM : 250.0 equates to 425 cubic meter/hour, resulting in 23.8 % of LEL.



VENTILATION - requirements for accumulated flammable vapors

BASIS: Chemical Process Safety: Fundamentals with Applications by Daniel A. Crowl & Joseph F. Louvar , and database properties from The Properties of Gases and Liquids, 3rd Edition", 'by Reid, Prausnitz and Sherwood, McGraw Hill, 1977.

NOTE: 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.

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			Antoine Vapor Pressure Equation LN(P)=A-B/(T+C) P as mmHg and T as °K			
Component	Chemical Formula	Mole Wt	A	B	C	LEL
Acetone	C3H6O	58.08	16.6513	2940.46	-35.93	0.025
Benzene	C6H6	78.114	15.9008	2788.51	-52.36	0.012
Carbon Disu	CS2	76.131	15.9844	2690.83	-31.62	0.013
Chlorobenze	C6H5CL	112.559	16.0676	3295.12	-55.6	0.013
Cyclohexane	C6H12	84.162	15.7527	2766.63	-50.5	0.013
Cyclohexanc	C6H10O	95.145	NA	NA	NA	0.011
Dibutyl-O-Pl	C16H22O4	278.35	336.24	NA	NA	0.005
Diethyl Keto	C5H10O	86.134	16.8138	3410.51	-40.15	0.016
Ethanol	C2H6O	46.069	18.9119	3803.98	-41.68	0.033
Ethyl Acetat	C4H8O2	88.107	16.1516	2790.5	-57.15	0.020
Ethyl Ether	C4H10O	74.123	16.0828	2511.29	-41.95	0.019
Ethyl Propio	C5H10O2	102.134	16.162	2935.11	-64.17	0.019
Ethylbenzen	C8H10	106.168	16.0195	3279.47	-59.95	0.008
Isopropyl Al	CH3CHOHC	60.096	18.6929	3640.2	-53.54	0.022
Methanol	CH4O	32.042	18.5875	3626.55	-34.29	0.060
Methyl Aceta	C3H6O2	74.08	16.1295	2601.92	-56.15	0.031
Methyl Ethyl	C4H8O	72.107	16.5986	3150.42	-36.65	0.014
Naphthalene	C10H8	128.174	16.1426	3992.01	-71.29	0.009
N-Butyl-Acet	C6H12O2	116.161	16.1836	3151.09	-69.15	0.017
N-Heptane	C7H16	100.205	15.8737	2911.32	-56.51	0.010
N-Hexane	C6H14	86.178	15.8366	2697.55	-48.78	0.011
Nitromethan	CH3NO2	61.041	16.2193	2972.64	-64.15	0.073
N-Propyl Ac	C5H10O2	102.134	16.2291	2980.47	-64.15	0.017
O-Dichlorob	C6H4CL2	147.004	16.2799	3798.23	-59.84	0.022
O-Xylene	C8H10	106.168	16.1156	3395.57	-59.46	0.009
P-Cresol	C7H8O	108.14	16.1989	3479.39	-111.3	0.011
Propyl Alcol	C3H8O	60.096	17.5439	3166.38	-80.15	0.020
Pyridine	C5H5N	79.102	16.091	3095.13	-61.15	0.018
sec-Butyl Al	C4H10O	74.123	17.2102	3026.03	-86.65	0.017
Tetrahydrof	C4H8O	72.107	16.1069	2768.38	-46.9	0.020
Toluene	C7H8	92.141	16.0137	3096.52	-53.67	0.011
Vinyl Acetat	C4H6O2	86.091	16.1003	2744.68	-56.15	0.026