vapor flow area (Equation 16).

5. Select appropriate design surge time from Tables 1 or 2 and calculate full liquid volume by Equations 11 and 12.

The remainder of the sizing procedure is carried out by trial and error as follows:

6. When the vessel is full, the separator-vapor area can be assumed to occupy only 15-25% of the total cross sectional area. Here, a value of 20% is used and the total cross sectional area is calculated by Equation 17 and the minimum vessel diameter by Equation 18.

7. Assume a length-to-diameter ratio of 3 (L/D = 3). Calculate the vessel length using Equation 19.

8. Because the vapor is assumed to occupy 20% of the total cross sectional area, liquid will occupy 80% of that area (Equation 20).

9. Calculate the vessel volume (Equation 21).

10. Calculate liquid surge time (Equation 22).

Liquid hold-up

The dimensions of both vertical and horizontal separators are based on rules designed to provide adequate liquid holdup and vapor disengaging space.

For instance, the desired vapor space in a vertical separator is at least 1½ times the diameter, with 6 in. minimum above the top of the inlet nozzle. In addition, a 6-in. minimum is required between the maximum liquid level and the bottom of the inlet nozzle.

For a horizontal separator, the minimum vapor space is equal to 20% of the diameter, or 12 in., whichever is greater.

Wire-mesh pad

Pads of fine wire mesh induce coalescence of impinging droplets into larger ones, which then separate freely from the gas phase. No standard equations have been developed for the pressure drop across wire mesh because there are no standardized mesh pads.

As a rule of thumb, however, the pressure drop (ΔP) of a wire mesh is 1.0 in. water. Every manufacturer makes a standard high-efficiency, very high-efficiency, or high-throughput mesh under various trade names, each for a specific requirement.

Table 1

Reflux distillate accumulator design criteria

	Recommended design surge times, min				
	F_1 (Instrument factor)		F_2 (Labor factor)		
Operation	w/alarm	w/o alarm	Good	Fair	Poor
FRC*	0.5	1	1	1.5	2
LRC*	1	1.5	1	1.5	2
TRC*	1.5	2	1	1.5	2

* Flow, level, and temperature controls.

Table 2

Operation factors for external units

Operating characteristic:	Factor F_3
Under good control	2
Under fair control	3
Under poor control	4
Feed to or from storage	1.251
	Factor F_4
Board-mounted level recorder	1.0
Level indicator on board	2.5
Gauge glass at equipment only	2.0

Table 3

Separator sizing specifications

	Factor
Vertical separator sizing:	
Liquid flowrate, lb/hr	50,000
Vapor flowrate, lb/hr	47,000
Liquid density, lb/cu ft	61.870
Vapor density, lb/cu ft	0.374
Surge time, min	5.0
Separation factor	0.0827
Vapor velocity factor	0.439
Maximum vapor velocity, fps	5.627
Vessel diameter, ft	2.810
Minimum vapor-liquid nozzle velocity, fps	68.513
Maximum vapor-liquid nozzle velocity, fps	114.188
Required vessel volume, cu ft	67.346
Liquid height, ft	10.856
Horizontal separator sizing:	
Liquid flowrate, lb/hr	56,150
Vapor flowrate, lb/hr	40,000
Liquid density, lb/cu ft	60.000
Vapor density, lb/cu ft	1.470
Length-to-diameter ratio (L/D)	3.0
Separation factor	0.220
Vapor velocity factor	0.447
Vapor volumetric rate, cfs	7.559
Maximum vapor velocity, fps	2.823
Vessel diameter, ft	4.129
Vessel length, ft	12.386
Vessel volume, cu ft	165.817
Surge time, min	8.505

Standard specs

The following specifications are generally standard for the design of horizontal separators:[4]

1. The maximum liquid level shall provide a minimum vapor space height of 15 in. but not be below the center line of the separator.

2. The volume of dished heads is not considered in vessel-sizing calculations.

3. The inlet and outlet nozzles shall be located as closely as practical to the vessel tangent lines.

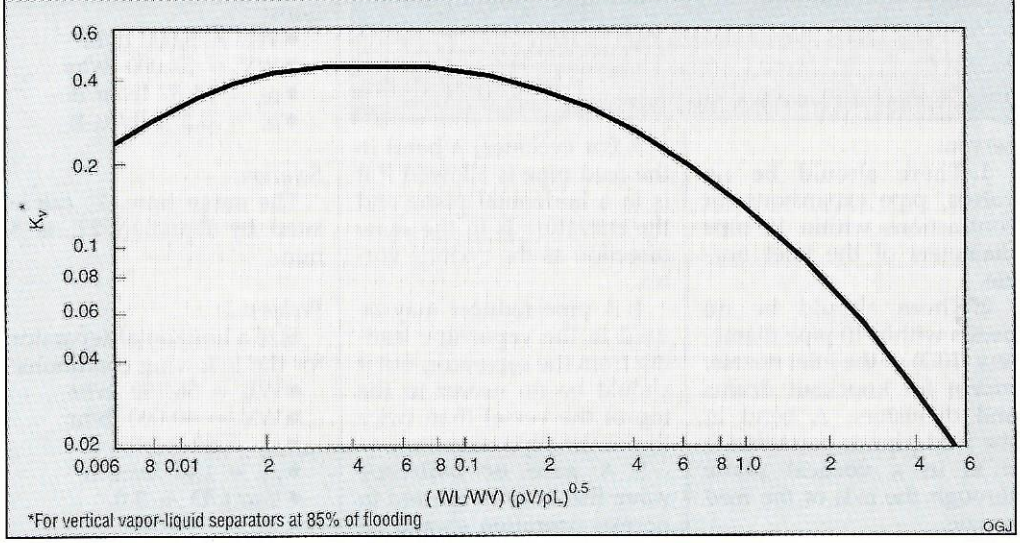
4. Liquid outlets shall have antivortex baffles.

Piping requirements

Pipes connected to and from the process vessels must not interfere with the proper working of the vessels. Therefore, the following guidelines should be ob-

Fig. 3

Design vapor-velocity factor



*For vertical vapor-liquid separators at 85% of flooding

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