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Online Chemical Engineering Information

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Content Based Chemical Engineering

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Storage Bin Sizing

Use this calculation procedure to perform preliminary sizing of storage bins for bulk solids.

With minimal inputs, the volume of the final bin will be calculated. A preliminary drawing of the bin will also be included in the output along with a chart showing volume versus height of the bin for future measurement correlations.

Both english and metric units of measure are available.

Do not rename sheets in this workbook

Sheets are protected, but protection may be turned off.

Revision History :

The Chemical Engineers' Resource Page
www.cheresources.com

Storage Bin Sizing

Applicable to: Preliminary design of bulk solid storage bins

Assumptions of Method:
- Bin will have a cone bottom
- Bin will have straight sides
- Bin will have one of the following types of heads:
  2:1 Elliptical, ASME flanged and dished, or flat

References:
Steve, Edward H., "Sizing Up the Storage Bin", Chem. Eng., p. 84, July 2000

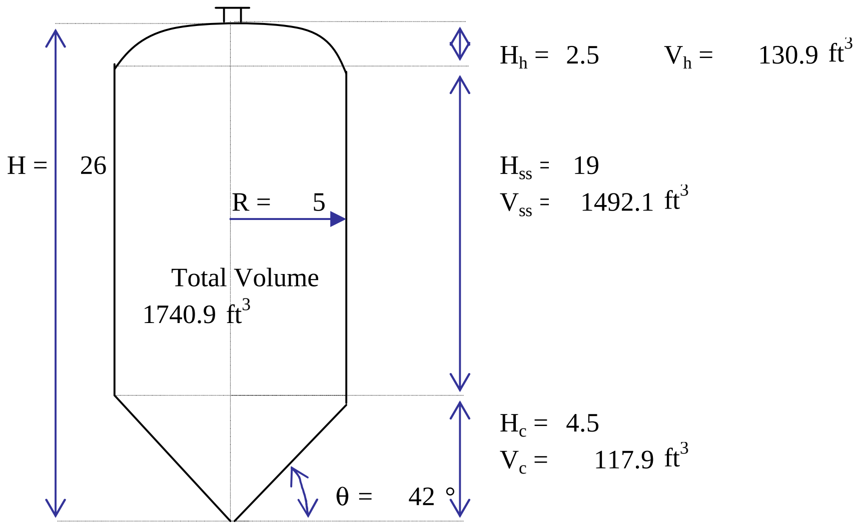
Precision Stainless Website, www.precisionstainless.com

Walas, Stanley M., *Chemical Process Equipment: Selection and Design*, McGraw-Hill, 1990.

Calculation Details:

Begin by choosing your preferred head style:
2:1 Elliptical   ASME Flanged & Dished   Flat

2:1 Elliptical Head Storage Bin (dimensions in feet)



Nomenclature:
θ_R = angle of repose or slide angle, degrees
θ = bottom cone angle, degrees
R = maximum vessel radius, ft
H = heights as labeled on diagram, ft
V = volumes as labeled on diagram, ft^3

Define the material's angle of repose (slide angle):

θ_R = 37 °   Slide Angle Lookup Chart

Design angle for bottom of cone is taken as:

$\theta = \theta_R + 5° = 42°$

Choose a radius for the bin (check local shop standards for 2:1 Elliptical head standards):

R = 5 ft   Elliptical Head Details

$H_c = R \tan \theta =$ 4.5 ft

$H_h = 2Rd$, for 2:1 Elliptical head, d=0.25 (depth is 25% of diameter),

$H_h = 0.50R =$ 2.5 ft

Choose an overall height for the bin:

H = 26 ft

$H_{ss} = H - H_c - H_h =$ 19 ft

Calculate the volume of each portion of the bin:

$V_h = a\,(2R)^3$, for 2:1 Elliptical head, a=0.1309 (see Note 1)

$V_h = 0.1309(2R)^3 =$ 130.9 ft^3

$V_{ss} = \pi R^2 H_{ss} =$ 1492.1 ft^3

$V_c = (\pi R^2 H_c)/3 =$ 117.9 ft^3

Sum to find the total volume of the bin:

$V = V_h + V_{ss} + V_c =$ 1740.9 ft^3

x 40.0 lb/ft^3 (bulk density, if available)

69,634 lb

Adjust bin geometry to meet your volume requirements.

Formulate a convenient Height versus Volume Chart :

Each bin section is divided into ten sections for chart formulation

Height (ft)	Volume (ft^3)
0.45	11.79
0.90	23.57
1.35	35.36
1.80	47.15
2.25	58.93
2.70	70.72
3.15	82.50
3.60	94.29
4.05	106.08
4.50	117.86
6.40	267.07
8.30	416.28
10.20	565.49
12.10	714.70
14.00	863.91
15.90	1013.12
17.80	1162.33
19.70	1311.54
21.60	1460.75
23.50	1609.96
23.75	1623.05
24.00	1636.14
24.25	1649.23
24.50	1662.32
24.75	1675.41
25.00	1688.50
25.25	1701.59
25.50	1714.68
25.75	1727.77
26.00	1740.86