Formulas for Calculating Capacities of Cylindrical Grain Bins*

Definitions and Symbols

Bin diameter (D): The diameter of the bin measured from the centerline or neutral axis of the corrugated sidewalls, or the inside diameter of a smooth-walled bin.

Open eave: The spaced relationship at the intersection of the bin sidewall and the bin roof that allows free passage of air between the sidewall and the roof.

Tight eave: The sealed condition at the intersection of the bin sidewall and the bin roof. This seal, although not airtight, is sufficient to restrict the flow of air substantially and will prevent small grains from passing through this space.

Eave height (EH): The distance from the top of the permanent structural floor to the top of the bin sidewall. (Drying floors are not considered a permanent structural floor.)

Roof slope (ϕ): The slope or inclination of the bin roof measured in degrees from horizontal.

Hopper slope (γ): The slope or inclination of the hopper measured from horizontal.

Maximum angle of fill (ϕ): The maximum angle used for calculating the capacity of the roof area. This angle is measured from horizontal and is assumed to be 28° or the roof slope, whichever is less.

Drying floor height (DFH): Average height of drying floor.

Drying Bin Capacity

Calculated on the basis of level full within K distance (25 mm or 1 in.) of the eave height:

$$\text{Volume} = \frac{\pi D^2}{4}[(EH - K) - DFH]$$

Storage Bin Capacity (open eaves)

Calculated on the basis of level full within K distance (25 mm or 1 in.) of the eave height:

$$\text{Volume} = \frac{\pi D^2}{4}(EH - K)$$

Storage Bin Capacity (open eaves)

Calculated on the basis of peaked fill from K distance (25 mm or 1 in.) of the eave height.

$$\text{Volume} = \frac{\pi D^2}{4}(EH - K) + \frac{\pi D^2}{4}\left[\frac{1}{3}\left(\frac{D}{2}\tan\phi\right)\right]$$

Storage Bin Capacity (tight eaves)

Level full.

$$\text{Volume} = \frac{\pi D^2}{4}EH$$

Storage Bin Capacity (tight eaves)

Peaked full.

$$\text{Volume} = \frac{\pi D^2}{4}EH + \frac{\pi D^2}{4}\left[\frac{1}{3}\left(\frac{D}{2}\tan\phi\right)\right]$$

Hopper Bin Capacity (open eaves)

Calculated on the basis of peaked fill from K distance (25 mm or 1 in.) of the eave height.

$$\text{Volume} = \frac{\pi D^2}{4}(EH - K) + \frac{\pi D^2}{4}\left[\frac{1}{3}\left(\frac{D}{2}\tan\phi\right)\right] + \frac{\pi D^2}{4}\left[\frac{1}{3}\left(\frac{D}{2}\tan\gamma\right)\right]$$

Hopper Bin Capacity (tight eaves)

Peaked fill.

$$\text{Volume} = \frac{\pi D^2}{4}EH + \frac{\pi D^2}{4}\left[\frac{1}{3}\left(\frac{D}{2}\tan\phi\right)\right] + \frac{\pi D^2}{4}\left[\frac{1}{3}\left(\frac{D}{2}\tan\gamma\right)\right]$$

* Adapted from *ASAE Standards*. Am. Soc. Agric. Eng., St. Joseph, MI, 1988.