

ASAE EP413.2 FEB2010 (R2014)

Procedure for Establishing Volumetric Capacities of Cylindrical Grain Bins



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Procedure for Establishing Volumetric Capacities of Cylindrical Grain Bins

Proposed by the Grain Bin Manufacturers Council of the Farm and Industrial Equipment Institute; approved by the ASAE Structures Group; approved by the ASAE Structures and Environment Division Standards Committee; adopted by ASAE March 1982; equation in paragraph 3.4.1 corrected September 1982; reconfirmed December 1986, December 1987, December 1988, December 1989, December 1990; revised February 1992; reaffirmed December 1996, December 1997, February 2003, February 2008; revised and reclassified as an Engineering Practice February 2010; reaffirmed December 2014.

Keywords: Bins, Capacities, Grain

1 Purpose and Scope

1.1 The purpose of this Standard is to define the method for determining the volumetric capacity and the calculated storage capacity of cylindrical grain bins. This method assumes that the bins are centrically filled.

1.2 The purpose is also to establish an industry standard for the estimation of compaction factors for all cylindrical bins.

2 Definitions and Nomenclature

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

2.2 open eave bins: Bins in which free passage of air between the sidewall and the roof is possible. These bins should be filled only to a height which is 25 mm (1 in.) below the eave height because of the likelihood of small grain passing through this space.

2.3 tight eave bins: Bins in which free passage of air between the sidewall and the roof is restricted. Although not airtight, the seal between the sidewall and roof prevents small grains from passing through this space.

2.4 roof slope: Slope or inclination of the bin roof measured in degrees from horizontal.

2.5 maximum angle of fill (α): Maximum angle that may be used for calculating the capacity of the roof area. This angle is measured from horizontal and shall be assumed as 28 deg.

2.6 eave height (EH): For the purpose of volume calculations, eave height is defined in Figure 1, along with other conditions described in this section.

2.6.1 bins with roof slopes greater than 28 deg: For these bins the eave height is defined as the distance from the top of the permanent structural floor to the top of the bin sidewall for tight eave bins or 25 mm (1 in.) less than the top of the sidewall for open eave bins (see Figs. 1a and 1b).

2.6.2 bins with roof slopes less than 28 deg: For these bins the eave height is defined as the distance from the top of the permanent structural floor to the height at which the grain intersects the bin sidewall (see Figure 1c).

2.6.3 bins filled using a spreader: Special consideration should be given to those bins filled using a spreader or other fill device which alters the natural angle of fill. For these bins, the maximum angle of fill shall be considered to be the angle, measured from horizontal, of the granular surface (see Figure 1d).

2.6.4 bins with elevated floors: For bins with an elevated floor, the height of the manufacturer's standard floor shall be deducted from the eave height of the bin. The average height of the floor shall be used if the top of the floor is not flat.

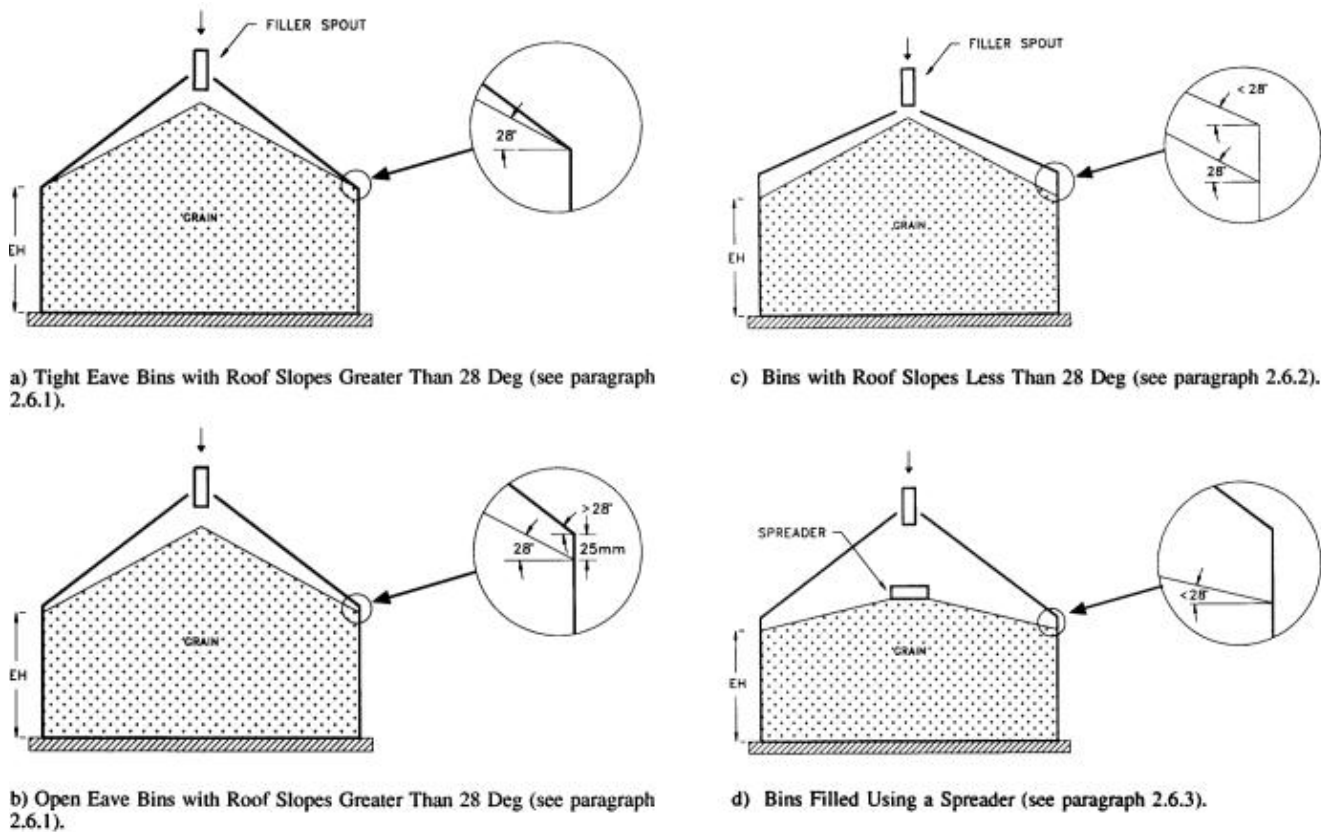


Figure 1 – Definition of eave height

2.7 hopper slope: Slope or inclination of the hopper measured from horizontal.

2.8 standard US bushel: Equivalent to 0.0352 m³ (1.244 ft³).

2.9 hopper bin: A bin equipped with a conical hopper having a center discharge opening.

2.10 level full storage capacity (C_L): Rated capacity of a bin, based on a uniform grain depth equal to the appropriate eave height of the bin (see paragraph 2.6).

2.11 peaked storage capacity (C_P): Rated capacity of a bin, based on the appropriate level full storage capacity plus the capacity of the conical space within the roof area of the bin calculated using the maximum angle of fill (see paragraph 2.5).

2.12 hopper bin storage capacity: Rated peaked storage capacity (see paragraph 2.11) of a bin plus the capacity of the conical hopper.

2.13 compaction factor (f_c): Reduction in volume of grain stored in bulk in a bin from the same amount of grain in an unconfined condition, expressed as a percentage of the unconfined volume.