Polypropylene Silo Capacity

One of the most important questions that a resin processor faces on a daily basis is: "How much resin is left in my silo?" If the diameter of a resin storage silo and the height of the resin in the silo from the top of the cone are known, it is possible to estimate the amount of resin stored in the silo with a fair degree of accuracy using simple mathematical relationships.

In order to simplify this process even further, INEOS Olefins & Polymers USA, has constructed the attached chart for common resin silo diameters. If the diameter of the silo is known and the height of the resin in the silo is measured, the amount of resin left in the silo (in pounds) can be read from the intersecting lines. For silos with different diameters, the calculations required to estimate the amount of resin remaining or to construct a similar chart for internal use are presented below.

The following variables affect the accuracy of the chart and the calculations shown below:

1. Actual resin bulk density;
2. Pellet count (number of pellets per gram);
3. Bulk density gradient due to compaction;
4. The angle of repose (37^o) is not considered
5. In order to simplify the calculations, the cone angle is assumed to be 45^o. This may not be true in all silos. (Note that the height of a 45^o degree cone is generally half of the cylinder diameter)

Formulas:

Volume of a Cylinder = (height) x (0.7854) x $(\text{diameter})^2$

Volume of a 45^o Cone = 1/3(height) x (0.7854) x $(\text{diameter})^2$

Average Bulk Density of PP = 32 - 38 lbs. / ft^3; Long term storage in silos can lead to compaction that will affectively raise the bulk density. For conservative estimates use an average of 35 lb. /ft^3; for compacted silos, use an average of 37 lb. /ft^3 or consult an INEOS O&P Technical Service professional.

Examples:

9' Diameter, 45^o Cone Silo

Cone volume = 1/3(4.5) x (0.7854) x (81) = 95.4 ft^3

Weight of resin in cone = 95.4 ft^3 x 35 lbs. / ft^3 = 3,339 lbs.

Per foot cylinder volume = (0.7854) x (81) = 63.6 ft^3

Weight of resin per foot of cylinder volume =63.6 ft^3 x 35 lbs. / ft^3 = 2,226 lbs.

Total Silo capacity = cone weight + weight per foot above cone.

If there is 24 feet of resin above the cone then the silo contains how much resin?

3,339 + (24 x 2,226) = 56,763 lb.

12' Diameter, 45^o Cone Silo

Cone volume = 1/3(6) x (0.7854) x (144) = 226 ft^3

Weight of resin in cone = 226 ft^3 x 35 lbs. / ft^3 = 7,910 lbs.

Per foot cylinder volume = (0.7854) x (144) = 113 ft^3

Weight of resin per foot of cylinder volume =113 ft^3 x 35 lbs. / ft^3 = 3,955 lbs.

Total Silo capacity = cone weight + weight per foot above cone.

If there is 32 feet of resin above the cone then the silo contains how much resin?

7,910 + (36 x 3,955) = 150,290 lbs.

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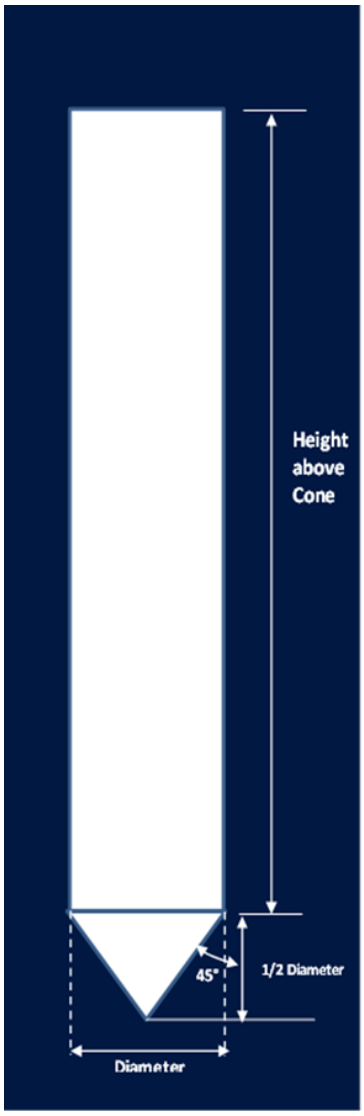

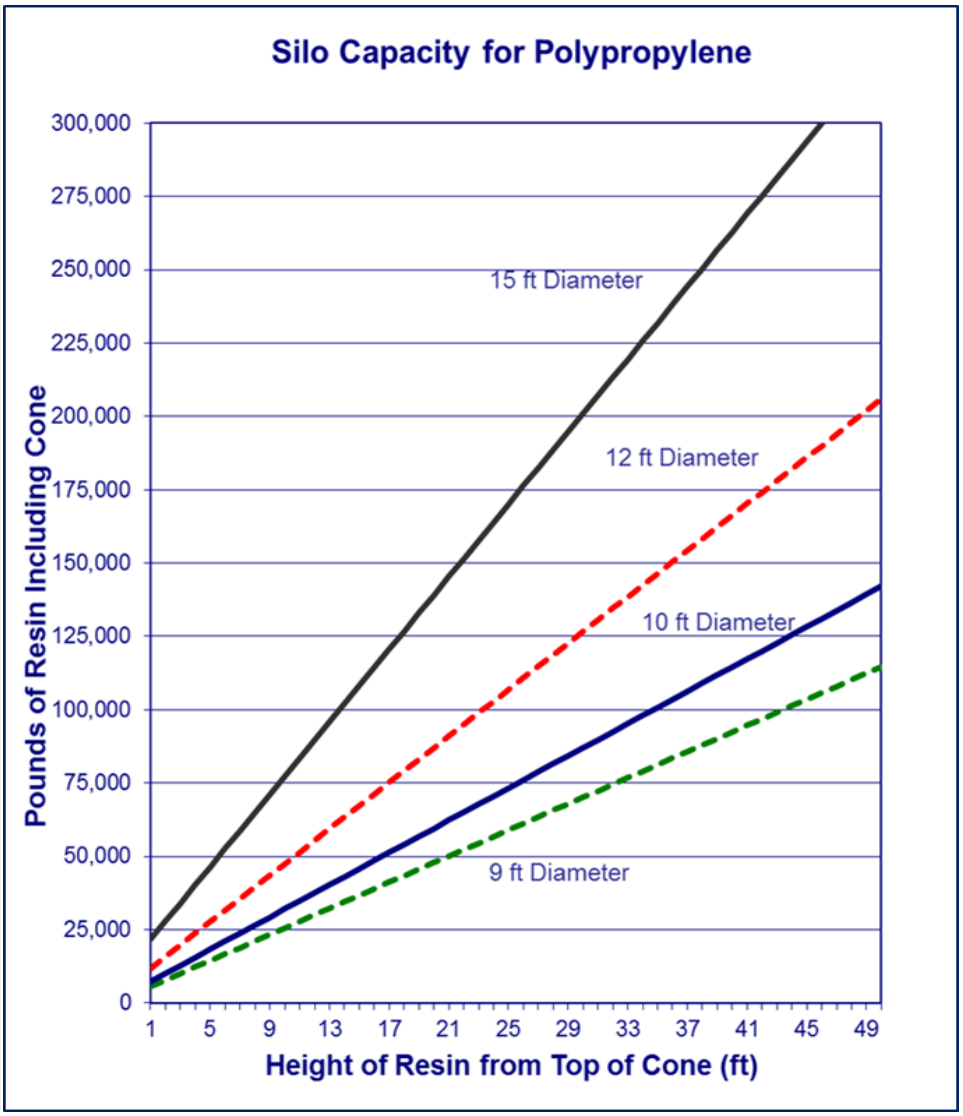

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