



## Cycletime Tips - General

### Volume 48: Handling Bulk Powders

By: Rich DeMair

#### **Prevention of particle size segregation in silos**

Particles of varying size can segregate within a silo causing handling, processing, and safety issues if not controlled. Very fine particles of polyethylene can be explosive under certain conditions. Accumulations of fines should be avoided both by controlling the incoming particle size distribution and by preventing segregation by particle size.

The most common mechanism of powder particle segregation in a silo is called “Air Entrainment/Dynamic Fluidization”. As the silo is filled, the falling product entrains air; the bed remains fluid-like until the air escapes up to the surface. As the air travels upward, it carries very fine particles with it, thus segregating them to the surface layer. These fine particles can accumulate from several loads. Regularly emptying the silo can help prevent their accumulation.

This same mechanism of segregation, as well as affects from sifting and angle of repose may occur with blended materials, such as natural powder and pigment masterbatches. This can be very difficult to prevent and it is advised to handle blended materials in small batches.

Bottom cone angles should be steep enough to promote mass flow or funnel flow (rat holing) will occur, absolutely greater than 45°, typically 60° from horizontal.

#### **Line Velocity**

Most plastics are friable, which means they are susceptible to damage during handling. Evidence of damage in a pneumatic conveying system is seen as “angle hair”, “streamers”, or lumps. These can be avoided by controlling the line velocity below limits recommended by the material manufacturer. Generally, softer products, such as LDPE or LLDPE, should be conveyed below 5500 ft/min.

It is important to size the blower to the line size and recommended product conveying velocity, and to remain within the designed operating parameters.

#### **Line Layout**

Careful consideration should be given to line layouts to prevent any unnecessary direction change that causes the product to impact the pipe walls. This increases pressure losses in the system. A 90° bend results in line losses equivalent to 20' of conveying line, 45°s are equal to 10'. It is obvious that a few bends can reduce the system capacity to half. For the same reason, use of flex lines should be kept to a minimum. Long radius (12 times the diameter) bends should be used for all products, except for those that are very

free flowing. PE powders are not considered free flowing. Bends should be at least 12' apart to allow the product to re-accelerate between them. Failure of the product to re-accelerate can result in line plugging or low transfer rates. All lines should be installed vertically or horizontally as slopes over  $10^\circ$  may result in product reflux in the line, which greatly reduces system capacity.

Product to air ratio should be kept as high as possible (greater than 8:1). This reduces the relative number of particles impinging on the pipe walls and lowers the average velocity in the system.