Interstitial Velocity
(Can Velocity)

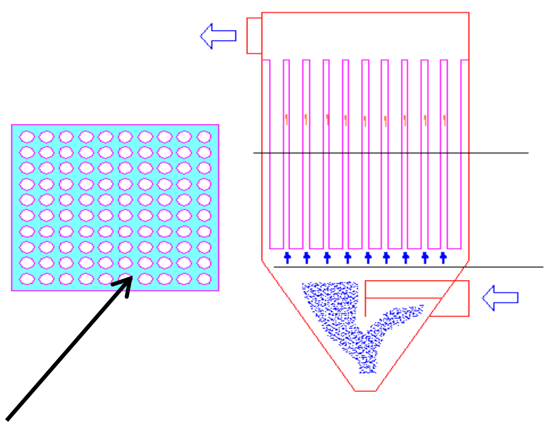
Guidelines

When sizing a pulse-jet dust collector, it is important to consider not just air-to-cloth ratio but also interstitial velocity. Interstitial velocity is defined as the upward velocity of the air through the open area between the filter bags inside a dust collector. Upward velocity occurs when a hopper inlet is used on a pulse-jet baghouse. Dusty air is introduced into the hopper and travels upward into the filter housing where cleaned gas passes through the filter bags and dust is deposited on the exterior of the bags.

Sometimes the term "can velocity" is incorrectly used to refer to interstitial velocity. The distinction is that can velocity is the upward velocity through the entire housing without taking into consideration the cross sectional area taken up by the filter bags; it may also be seen as the upward velocity just below the bags. If the interstitial velocity of the upward air flow is too high, then the dust pulsed off the bags during cleaning will not migrate downward to the hopper. Instead it will be re-entrained and carried back onto the bag surface. The results can be high pressure drop, excessive use of compressed air, and shortened bag life.

Interstitial velocity is calculated as:

$$\frac{\text{Air Volume}}{(\text{Cross-Sectional area of collector} - \text{Cross Sectional area of bags})}$$



Interstitial area (blue)

The optimal interstitial velocity is a function of several variables. They include bulk density, particle size distribution, agglomerating/non-agglomerating tendencies of the dust and inlet loadings.

Bulk Density –

Generally expressed in pounds per cubic foot (PCF), the higher the bulk density of a dust, the greater its tendency to settle downward against the rising air. Therefore, higher interstitial velocities may be used for higher bulk density dusts.

Particle size –

The smaller the particle, the slower it settles or falls, and the greater the effect of upward air flow that keeps the dust in suspension. Generally, smaller particle sizes should indicate the use of lower interstitial velocities.

Agglomerating/non-agglomerating-

Material that has a tendency to agglomerate (stick together) generally will be pulsed off more in "mass" than in discrete particles. Agglomerating particles may allow for the use of higher interstitial velocities.

Inlet Loading –

Inlet loading is the rate of the mass of solid material being introduced into the dust collector. Extremes of high and low loadings might allow slightly higher interstitial velocities.

Normally the baghouse selection process involves dividing the incoming air volume by the desired or specified air-to-cloth ratio. The number of filter bags is then selected by choosing the maximum length bag and minimum quantity which allows for the required cloth area. 10 ft. is generally the longest bag length chosen for most applications (8 ft. for side removal.) If these selection procedures are followed and interstitial velocity is higher than the recommended range, there are some optional considerations to explore. Pricing impact should be considered as an implication of the design options.

1. **Change the length of the filter bags**. Resize the dust collector using 8 ft. bags instead of 10 ft. bags or change from 8 ft. to 6 ft., etc.
2. **Change the diameter of the bags**. Use a 4-1/2" dia. bag instead of a 5-3/4" dia. bag to make a dramatic reduction in interstitial velocity. Bag-to-bag spacing increases from 2" to 3-1/2".
3. **Use a high inlet**. High inlets introduce the dusty air into the upper filter housing instead of the hopper, which essentially eliminates the upward velocity issue.
4. **Use wider bag row spacing**. Changing the distance between rows of bags from the standard of 8" centers to something greater will also reduce upward velocity. Keep in mind that it may be necessary to consider not only row to row spacing, but also the spacing between the bags in the row.
5. You may have to **use a combination** of these to achieve the required results. For example, to reduce upward velocity to <100 fpm, it may be necessary to use bag lengths of less than 10 ft. and also change the pulse row spacing to more than 8".

In an <u>existing</u> collector installation, too high interstitial velocity can be a difficult condition and expensive to remedy. Possible modifications to reduce interstitial velocity include:

1. Increase the open area in the filter housing by changing to smaller diameter bags. This requires installing a new tubesheet. An increase of the air-to-cloth ratio would result, but lowering the interstitial velocity may still improve the operation.

2. Change to smaller diameter bags with increased length to maintain required air-to-cloth ratio. In addition to changing the tubesheet, the filter housing must be modified to accept the longer bags.

3. Re-engineer the ventilation system to reduce air volume (CFM) entering the collector.

4. Install pleated bags. A pleated element has considerably more filter area than conventional bags, substantially increasing the potential cloth area. Rows of bags could be eliminated, reducing the can velocity while maintaining or even lowering air-to-cloth ratio.

5. Modify the filter housing with a high inlet section to eliminate upward velocity.

Careful thought during the design stage can provide the customer with a sound design and trouble free operation.

Please refer to the below graph which shows Sly's recommended interstitial velocity as a function of only bulk density for the following examples.

Example A –

Nuisance ventilation at air flow rate of 6,500 CFM @ 6:1 A/C. Material is ground phosphate weighing 50 PCF. From the graph we see the recommended interstitial velocity range is around 340 FPM.

Consider a STJ-108-10

A/C ratio:

(80) bags x 15 sq. ft. = 1,200 SF

6,500 CFM/1200 SF = 5:4:1 A/C

Interstitial Velocity:

Cross sectional area of housing: 80" x 64" = 35.6 SF

Cross sectional area of Sly's 5-3/4" diameter bag = $\frac{(5.75/12)^2 \times \pi}{4}$ = 0.18 SF

Interstitial (open) area= housing cross section less bags cross section:

35.6 - (80 x 0.18) = 35.6-14.4 SF = 21.2 SF interstitial area

Then 6,500 CFM / 21.2 SF = 307 FPM interstitial velocity

Select a **STJ-108-10** at 5.42:1 A/C and 307 FPM interstitial velocity as the most economical choice.

Example B –

Expanded perlite weighing 15 PCF. Air flow rate is 17,250 ACFM @ 4:1 A/C. Recommended interstitial velocity is approximately 135 FPM. With so light a bulk density it is likely to need a special design to achieve an acceptable interstitial velocity. If we want to use 10 ft. bags, the next thing to try is using 4-1/2" diameter bags.

Consider a STJ-2317-10 (4.5)

A/C ratio: (391) bags x 12 SF = 4,692 SF

17,250 CFM / 4692 SF = 3.7:1 A/C

Interstitial Velocity:

Cross sectional area of housing: 184" x 136" = 173.8 SF

Cross sectional area of Sly's 4-1/2" diameter bag = $\frac{(4.5/12)^2 \times \pi}{4}$ = 0.11 SF

Interstitial (open) area= housing cross section less bags cross section:

173.8 - (391 x 0.11) = 173.8 - 43 SF = 130.7 SF interstitial area

Then 17,250 CFM / 130.7 SF = 132 FPM interstitial velocity

Select a **STJ-2317-10 (4.5)** at 3.7:1 A/C and 132 FPM interstitial velocity as the most economical choice.

Example C –

Pigment weighing 25 PCF. Air flow is 20,500 CFM @ 5:1 A/C. Interstitial velocity recommendation is approximately 225 FPM.

Consider a STJ-1717-10

A/C ratio: (289) bags x 15 SF = 4,335 SF

20,500 CFM / 4,335 SF = 4.7:1 A/C

Interstitial Velocity:

Cross sectional area of housing: 136" x 136" = 128.4 SF

Cross sectional area of Sly's 5-3/4" diameter bag = $\underline{(5.75/12)^2 \times \pi}$ = 0.18 SF

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Interstitial (open) area= housing cross section less bags cross section:

128.4 - (289 x 0.18) = 128.4 - 43 SF = 85.4 SF interstitial area

Then 20,500 CFM / 8.54 SF = 240 FPM interstitial velocity—too high!

The next thing to try in this case is to change the bag length to 8 ft.

Consider a STJ-2117-8

A/C ratio: (357) bags x 12 SF = 4,284 SF

20,500 CFM / 4,284 SF = 4.8:1 A/C

Interstitial Velocity:

Cross sectional area of housing: 168” x 136” = 158.7 SF

Cross sectional area of Sly’s 5-3/4” diameter bag = $\frac{(5.75/12)^2 \times \pi}{4}$ = 0.18 SF

Interstitial (open) area= housing cross section less bags cross section:

158.7 - (357 x 0.18) = 158.7 – 64.3 SF = 94.4 SF interstitial area

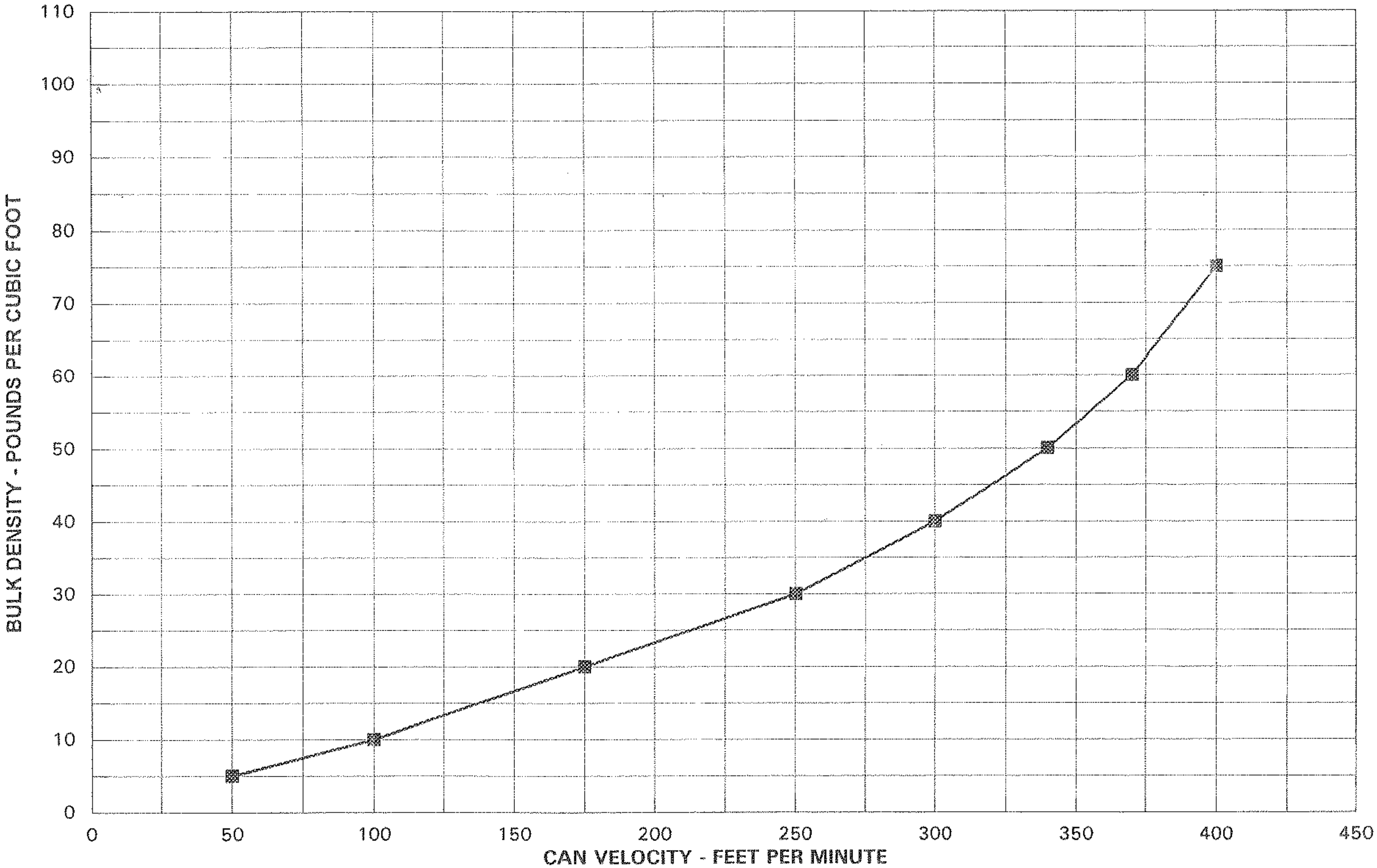
Then 20,500 CFM / 94.4 SF = 217 FPM interstitial velocity

Select a **STJ-2117-8** at 4.79:1 A/C and interstitial velocity of 217 FPM.

(Note, in this case it is also important to consider whether changing from a single pyramid hopper to two hoppers or a trough is desirable.)

INTERSTITIAL VELOCITY CHART

Recommended Guidelines for Sly TubeJet Dust Collectors



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