Tips

# How to analyze bid differences in blower package horsepower requirements

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**How do you explain the variation in blower horsepower requirements in bids you receive for the same pneumatic conveying system? This article describes how suppliers determine the horsepower requirements for the blower packages in their bids and explains how you can evaluate these differences.**

When you solicit bids from various equipment suppliers for your pneumatic conveying system, there may be some obvious differences — like conveying line diameters and construction materials — among the proposals you receive. But aside from these, the one difference that's likely to jump out at you is the variation in the motor horsepower requirements for the blower packages. (Besides the rotary-lobe positive-displacement blower and motor, a typical standard blower package includes a drive assembly, inlet and outlet silencers, switches, and gauges, all mounted on a base.)

While these variations in horsepower requirements may seem small in terms of capital costs, they can have a huge impact on operational costs down the road. The blower's required horsepower determines the motor's size, so if the horsepower requirement is larger than it has to be, you're going to spend more money on electrical power than necessary because you'll be running a larger-than-necessary motor every minute your pneumatic conveying system is running. If the motor is smaller than it has to be, your conveying system won't achieve its design transfer rate and the motor will keep tripping out. As a result, you'll not only have to pay for a larger motor to replace the existing model, you'll also have to cover the costs of installing new larger-gauge wiring, bigger motor starters, and larger circuit breakers, plus put up with the downtime and hassle involved in making these changes.

So how can the blower package horsepower requirement vary widely among the bids for the same conveying system? Equipment suppliers have different approaches to sizing the blower motor based on what *safety factor* (that is, extra capability over the minimum required) they elect to build into the blower package and its components. Some suppliers are more liberal with this safety factor, and some are more conservative. Examining how blower horsepower requirements for a pneumatic conveying system are calculated will help explain why.

## Some calculations

Consider this example: We want the blower in our proposed conveying system to produce a 400-cfm air volume at 8-psig pressure. We can use this air volume and pressure information with a blower horsepower chart or software program to calculate how much horsepower (here called *brake horsepower*[1]) the blower will require at its shaft for this air volume and pressure combination. (Blower horsepower charts and software programs are available on many blower supplier Web sites.) In this case, the blower requires 18 brake horsepower. Because most blowers are belt-driven, we also need to figure in the blower's belt and sheave horsepower losses. These losses run at about 10 percent (in this case 2 horsepower), so now we're looking at a 20-horsepower requirement.

Sounds simple, doesn't it? But a supplier *never* sizes a blower package based on the exact air volume and pressure your conveying system is expected to run at. The risk is that if your conveying conditions change or the conveying system is altered at or after installation, such as with additional bends or line sections, the blower won't have enough power to run the system. That's why the blower package and its components need to have some built-in safety factor — and how a supplier applies this safety factor is where the huge differences in motor horsepower requirements can come in during the bidding process.

## How safety factors affect blower motor size

For instance, some suppliers would add a safety factor from 2 psig to as much as 4 psig to your conveying system's expected 8-psig pressure before sizing the blower motor. Other suppliers may maximize the motor size to achieve the maximum pressure level the conveying system can handle.

With factoring in belt and sheave losses of 10 percent, this means the supplier's safety factor for sizing the blower motor can run from 12 psig to 15 psig.

So here's the motor size we started at, without any safety factor:

- 8 psig = 18 brake horsepower + 10 percent = 20 horsepower, so we'd use a 20-horsepower motor.

And here's how adding different safety factors increases the motor size:

- 8 psig + 4 psig safety factor = 12 psig = 26 brake horsepower + 10 percent = 29 horsepower, requiring a 30-horsepower motor.
- 8 psig + 7 psig safety factor = 15 psig = 37 brake horsepower + 10 percent = 41 horsepower, requiring a 40- or 50-horsepower motor.

Moving from the 30-horsepower motor to the 50-horsepower unit involves not only a huge difference in the motor's initial cost, but also in the size of the blower package's electrical components and the package's potential electrical power use. Of course, you want to ensure that the blower motor supplies enough power to successfully run your conveying system. So which motor is right for this system?

It all depends on your confidence in the supplier's motor sizing accuracy for your system's pressure requirement. To be comfortable with the blower motor size in a bid, ask how the supplier arrived at this size. What safety factor did the supplier use? Why? What experience does the supplier have with systems like yours that makes this safety factor reasonable?

***The 40-horsepower motor for this blower package has been sized to run a dilute-phase pneumatic conveying system that transfers plastic pellets to a silo and two in-plant day bins.***

You can get further assurance that the motor size in the bid is right for your conveying system by observing pilot-plant tests of the proposed system in the supplier's test lab. While no pilot-plant setup can exactly match your proposed system, you need to reach a comfort level with how close the pilot-plant setup can get. Most pilot plants have more elbows and horizontal conveying line for the same distance than a "real-world" system has, but as long as the pilot-plant setup's line diameter and line length are fairly close to those of your proposed system, the pilot-plant results will be "worst-case" results compared to those for your system. This isn't true, however, when the pilot-plant setup has a line diameter 3 or 4 times smaller or a line length 3 or 4 times shorter than your proposed system: In such a case, it's extremely difficult to extrapolate the test data to accurately size the proposed system's blower motor, and so your confidence in the recommended motor size should be more conservative.

### Some selection advice

Bear in mind that blower packages come in a wide range of types and sizes, and this can complicate a clear apples-to-apples comparison among the blower horsepower requirements in the bids you receive. Some blower package types are more efficient than so-called "standard" types, sometimes even shaving a few horsepower off the package's requirement. And for the same air volume and pressure, a larger blower turning slowly will eat up more horsepower than a smaller blower turning fast. Before you go with any supplier's bid, be sure that you understand what safety factor the supplier applied to arrive at the horsepower number — and make sure that you've got good reason to believe in it. **PBE**

### Reference

1. Brake horsepower is the actual power required at the blower shaft, including all the loads imposed on the blower by the downstream process as well as by the blower itself. This brake horsepower is then corrected for the motor's efficiency and the type of drive arrangement to come up with the necessary motor horsepower.

### For further reading

Find more information on blower packages and other pneumatic conveying system components in articles listed under "Pneumatic conveying" in *Powder and Bulk Engineering*'s comprehensive article index (in the December 2008 issue and at *PBE*'s Web site, www.powderbulk.com) and in books available on the Web site at the *PBE* Bookstore. You can also purchase copies of past *PBE* articles at www.powderbulk.com.

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