What you need to know to select an automatic sampler

Richard Bassett Sentry Equipment Corp

This article will discuss three basic modes and types of automatic samplers and explore the factors that should be considered before selecting a model for your application.

Let's say you've got a big order for a dry powdered food product and you need to be sure the product fits the customer's specifications before it's shipped. Or maybe you need to keep tabs on the moisture content of your material throughout a processing run. Or perhaps you need to ensure that your chemical material doesn't move above a certain level of volatility. To accomplish these tasks, you'll need to sample and test the material. This requires using some type of sampler — a device that will enter the flowing material stream, capture a quantity of that material, and extract a sample for quality control or other analysis.

For some purposes, a simple manual sampler will work: You might periodically thrust an empty cup into the material stream and bring out a sample. But many applications require a more sophisticated method that allows precise samples to be taken at regular intervals, leaving no room for human error. In such a case, you need an automatic sampler.

Some sampler basics

Automatic samplers in today's market are available in three basic sampling modes and three common operating types. *Sampling mode* refers to how the sampler collects the sample: The *spot sampler* enters the material stream and takes a sample only at the point where it stops; the *strip sampler* enters the material stream and takes a sample from a narrow portion of the stream all the way across the stream and back; and the *cross-cut sampler* takes a sample from the stream's entire cross-section. The cross-cut sampler will give the most representative sample of your material. Figure 1 illustrates these sampling modes.

Operating type describes the automatic sampler's material-collecting mechanics. The *tube* or *tube probe sampler* (Figure 2a) is the simplest and most common. Basically, it's a tube with a hole near one end. (There are variations, such as the *cup sampler,* in which a sampling cup, rather than a tube enters the material stream.) The hole-end of the tube moves into the material stream, material flows into the hole, and the tube retracts from the material stream. The *tube-and-auger sampler* (Figure 2b) is the second most common type. It, too, is a tube with a hole in it, but in this sampler an auger inhabits the tube and helps direct the flowing material into the sampler.

The third type is the *pelican diverter* or *pelican sampler,* (Figure 2c), called this because of the vague similarity between the sample *cutter* (the component of the sampler that passes through the material stream and cuts out a sample) and a pelican's beak: Both have an opening at the top with a "container" hanging down from the opening. The pelican diverter is a three-dimensional box, somewhat narrower at the top, with the bottom edge angled at 45 degrees and with an opening on the top edge and a discharge on the bottom. The box fits inside a rectangular housing that's wide enough to cross the entire material stream and allow room for the pelican diverter outside the stream on each side. The pelican diverter resides on one side of the stream. Then, when activated, it cuts across the entire material stream and ends up on the other side.

In all three operating types, a motor or pneumatic device activates the sampler, causing it to enter and withdraw from the material stream. The material flows into the sampler and then is released either mechanically or by gravity into a sample container that's manually or automatically removed to your analysis device (such as a particle analyzer) or quality control laboratory.

The tube and the tube-and-auger types take either strip or spot samples. The pelican diverter takes a cross-cut sample.

In some cases, two or more sampler options are appropriate. In a case like this, you'll probably choose the smallest and most economical unit.

All three types of automatic samplers can be used in any number of processes and on many types of equipment. The challenge is to decide which sampler is right for your needs. It's a good idea to discuss your needs, both in terms of your application requirements and practical considera-

Figure 1

Sampling modes

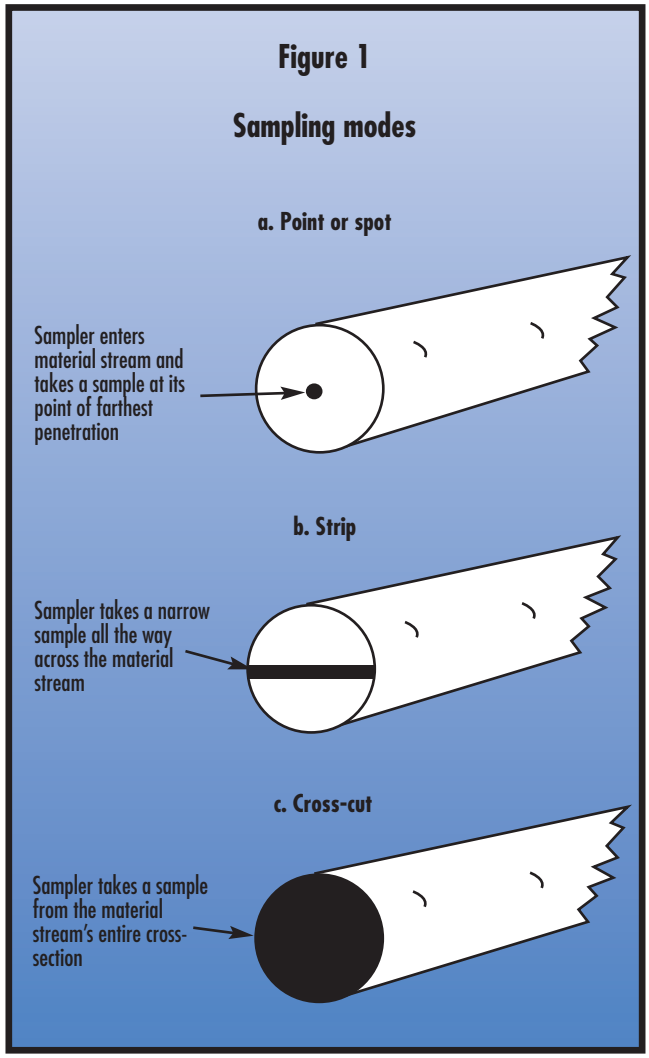
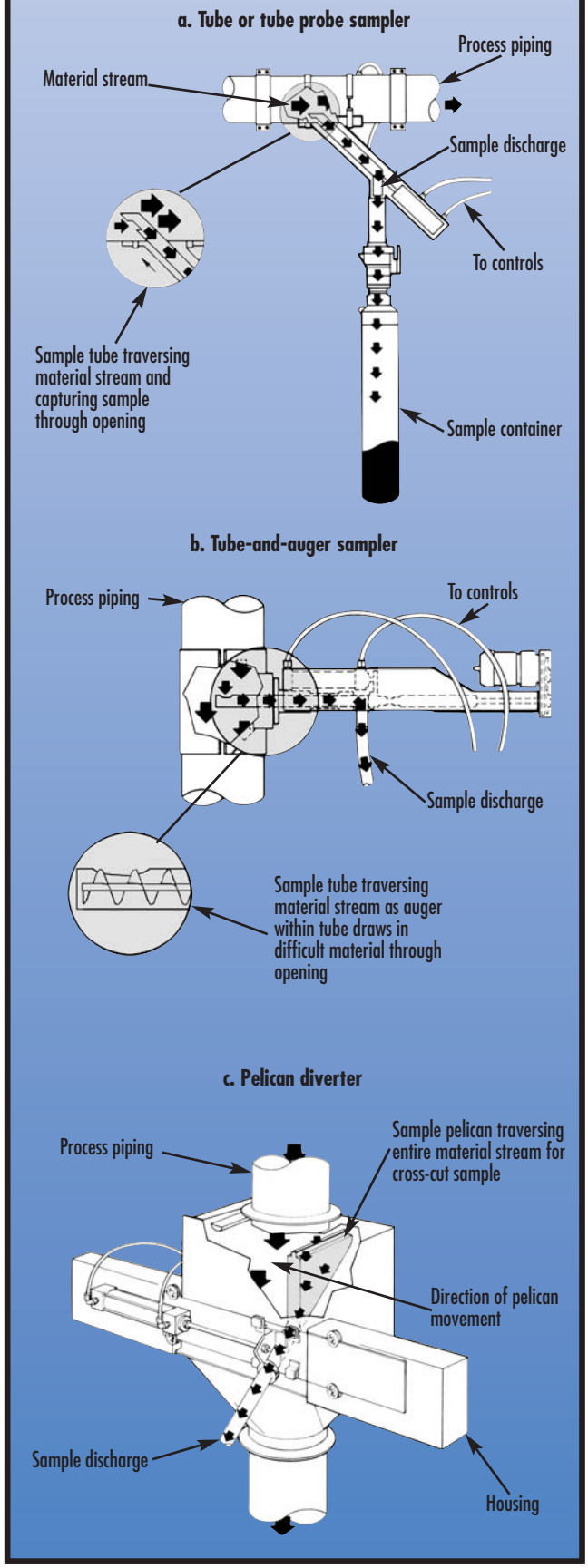


Figure 2

Sampler operating types



tions like size and cost, with a reputable sampler manufacturers' representative. Together, you can determine the important factors and select a sampler model.

To get started, here are some key questions to consider when choosing a sampling mode and operating type: Why am I taking the sample? What are my material's physical properties? Where will I locate the sampler? Your representative may ask you to detail the answers to these questions by filling out an application data sheet similar to that in Figure 3.

Why am I taking the sample?

First, consider why you're sampling. Reasons include analyzing your material's particle size, chemical, moisture, or volatile content for process and quality control; controlling your material's physical appearance; and retaining a sample for your or your customer's future reference for raw material inspection or shipping authorization.

All of these are valid reasons to sample a material and will affect your choice of sampling mode and operating type. In some cases two or more options are appropriate. For ex-

Figure 3

Automatic sampler application data sheet

Date: _____

Name: _____

Company: _____

Address: _____

_____

Phone: _____

Fax: _____

E-Mail: _____

Product: _____

Bulk Density: _____

Flow Rate: _____

Product Size: _____

Temperature: Min. _____ °F Max. _____ °F

Minimum Chute Slope: _____

Moisture Content: _____

Sample Frequency: _____

Seconds _____ Minutes _____ Hours _____

Type Sample Required:
☐ Individual ☐ Composite

Quantity of Sample Per Incident _____

Total Required Amount _____

Product Description:
☐ Abrasive ☐ Homogeneous
☐ Corrosive ☐ Segregating
☐ Sticky ☐ Hazardous

Sampler Location:
☐ Inside Amb. Temp: Min. _____ °F
☐ Outside Max. _____ °F

Sampling From:
Gravity Line
☐ Vertical Spout ☐ Bagger
☐ Angular Spout ☐ Conveyor Belt
☐ Bin ☐ Screw
☐ Hopper (Include drawing) ☐ Mixer
☐ Air Slide ☐ Other _____

Line Pressure Psi: _____
☐ Pnuematic ☐ Horizontal Left
☐ Liquid ☐ Horizontal Right
☐ Vertical up ☐ Angular
☐ Vertical down ☐ Negative

Reason Sample Needed: _____

_____

Line / Spout Size:
☐ Round ☐ Rectangular ☐ Square

O.D. _____ IN. I.D. _____ IN.

Line / Spout Material:
☐ Stainless Steel ☐ Aluminum
☐ Carbon Steel ☐ Other

Special Systems to Interface:
☐ Partial Size ☐ Color
☐ Moisture Analysis ☐ Density

Sampler Fabricated Of:
☐ Stainless Steel ☐ Other

Electrical Classifications:
☐ Motor Std. Tefc ☐ Explosion Proof

Class _____, Div. _____, Group _____

Voltage:
☐ 115/Ph ☐ 230/Ph ☐ 230/460/3ph

Controller Mode:
☐ Automatic ☐ Manual

Controller Rating:
☐ Nema 4x (Water & Dust Tight - Non Metallic)
☐ Nema 9 (Explosive Dusts)
☐ Nema 7 (Explosive Gasses)

Please enclose a sketch of proposed sampler location.

ample, if you need to do a chemical analysis of a homogeneous material, a spot sampler will work just fine, meaning you could choose either a tube or tube-and-auger sampler. In a case like this, you'll probably choose the smallest and most economical unit. If your homogeneous material is sticky, however, your choice will probably be limited to the tube-and-auger sampler. Sticky material won't readily flow into a plain tube sampler, but the auger will draw it in.

If you're taking the sample for particle size analysis, you'll need a completely representative material sample, so a cross-cut sampler — a pelican type — is probably the best choice.

What are my material's physical properties?

Your material's physical properties will dictate the sampler's particular sampling mode and operating type. You need to know the following properties:

- Material flowability
- Particle size and density
- Material moisture content
- Material temperature
- Ambient temperature
- Distinctive material qualities (Is your material abrasive, corrosive, sticky, friable, or hazardous? Is it homogeneous? Does it tend to segregate?)

In addition to helping you determine the sampler's mode and operating type, knowing these qualities will also help you choose the sampler's materials of construction and any optional equipment needed to make the unit function properly in your application. For example, if your material flows at a 45-degree angle (a standard angle for gravity flow), you could use a tube sampler or pelican diverter. But for a material that won't flow at that angle or is very sticky, you would need to use a tube-and-auger sampler so the auger can help move the material into and out of the sampler. If your material must be kept within a certain temperature range, you'll want to choose a sampler made of material that won't be affected by the material stream's temperature.

Because of the many variables involved, tell your representative as much as possible about your material and perhaps provide a sample of your material as well. The representative is often able to recommend a model based simply on careful examination of your sample but can test the sample if it's an unusual or difficult-to-handle material.

Where will I locate the sampler?

The sampler's intended location will affect your selection process. You can locate the unit on a vertical or sloped gravity discharge chute, a straight-sided or sloped hopper, vertical or horizontal pneumatic conveying lines, screw, belt, or drag conveyors, and most kinds of process equipment. Space restrictions at your desired sampling location will be a major factor in your sampler choice. A tube sampler is typically mounted at a 45-degree angle off your equipment, while a tube-and-auger sampler can be mounted horizontally. Therefore, if both samplers will work for your application and space is at a premium, you'll probably want to go with the tube-and-auger sampler.

Space restrictions at your desired sampling location will be a major factor in your sampler choice.

The pelican diverter takes much more space. Because its housing needs to be big enough to contain the pelican diverter on each side of the equipment component it's attached to, it's going to be at least twice as wide as the component. This type of sampler also requires quite a bit of flange to flange space vertically. If you require a cross-cut sample and you don't have that much space, you may be able to modify your equipment. If not, you'll probably have to go with the next best choice: a tube or tube-and-auger sampler that works in a strip sampling mode.

Choosing a specific model

A range of samplers from various manufacturers is available in all of the basic sampling modes and operating types described here, in varying configurations. Once you know what mode and type you need, your manufacturer's representative can help you select a specific model. If you plan to talk to more than one representative, be sure to give each the same information about your application and practical requirements. That way, you'll be able to logically compare their recommendations.

In addition to your sampling purpose, your material's physical properties, and your sampler's intended location, which have already been discussed, these factors will help determine which model best suits your application:

- Available utilities for powering the sampler.
- Equipment the sampler will be interfaced with.
- The sampler's control method.

Even though you may have already decided which sampling mode and operating type you need, providing these details to the representative will help him or her make a sound recommendation.

Available utilities for powering the sampler. Verify your plant's electrical supply and voltage. Although most rep-

resentatives can adapt the sampler to whatever electrical supply you have, many samplers are designed to work with a standard 110-volt power supply. If your electrical system is different, explain this so your representative can recommend a model — or modify a standard model — to meet your needs.

Some samplers are pneumatically activated and require a compressed-air supply. If your company doesn't have an air supply of 60 psi or greater, you'll need to eliminate some sampler models from consideration.

Let your representative know if your sampler and its controls must be explosion-proof. This can substantially raise the sampler's cost — although it doesn't need to. To be rated explosion-proof, the sampler's controls must be protected by an often-costly special enclosure. However, your representative may be able to put the controls in a safe area some distance from the sampler itself, thereby keeping costs down.

Equipment the sampler will be interfaced with. Most samplers will interface well with many kinds of equipment, but certain equipment may limit you to specific sampler models. Sample volume and frequency are key factors. For example, if the sampler will be interfaced with a moisture or particle analyzer, you may want a continuous sampling stream. In this case a tube-and-auger sampler with a special variable-speed auger can continuously dribble sample into the analyzer.

The sampler's control method. Options include automatic electrical control, PLC, and control and permissive from the interfaced equipment. (*Control and permissive* means that instead of using an independent controller for the sampler, you might choose to use a controller already set up for the equipment the sampler will interface with; you can also choose to have this controller "give permission" to initiate sampling at the appropriate point in the process.) The type of controller you choose will dictate to what extent your unit can be automated and interfaced to other equipment.

Other specifications. Provide the following information to your representative in addition to that described above:

- Whether the equipment on which the sampler will be mounted moves the material by gravity, such as a discharge chute, or by pressure or vacuum, such as a pneumatic conveyor. (Some sampler models of each type will only work on gravity-based equipment.)
- Design factors of the equipment the sampler will be mounted on (for example, vertical or angular chute; vertical or horizontal pneumatic conveying line; straight-sided or sloped hopper; screw, drag, or belt conveyor).
- For certain equipment, the equipment diameter and height at which the sampler will be mounted.
- Inside and outside diameter of the piping or the steel gauge of the chute, hopper, or other equipment wall.
- Construction material of the piping, chute, hopper, or other equipment the sample will connect with.

It's important that you consider all of the information in this article before selecting your automatic sampler. With accurate information, your sampler representative can recommend and, if necessary, customize the proper sampler for your application. **PBE**

Richard Bassett *was formerly the industrial sales manager for Gustafson Samplers, which has since been acquired by Sentry Equipment Corp, Oconomowoc, Wisconsin; 262-567-7256, fax 262-567-4523 (sales@sentry-equip.com).*