

A Whitepaper by Michael Pearce

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Chemists have come up with a new formula, samples have been sent out and the sales force has come back with rave reviews and orders. A review of your manufacturing facility reveals that the new product cannot be manufactured on your existing equipment. What are you going to do? You need to specify and purchase a new piece of equipment. Here are some steps to take that will help you decide what piece of equipment you should buy.

Batch Size

Deciding batch size is necessary in order to determine if you can fulfill the requirements of your customers. In order to do this, you need to research your yearly requirements. Once you have the yearly requirements, you will be able to figure out monthly, daily, and hourly requirements. See the steps below for instructions on how to calculate these values. Running multiple mixers or the same mixer on more than one shift may be required.

- In order to get your monthly requirement, divide the yearly requirement by 12.
- In order to get your daily requirement, divide the monthly requirement by the number of working days in a month.
- In order to get your hourly requirement, divide your daily requirement by the number of working hours in a day.

Type of Mixer

Now that you know batch size, you need to determine what type of mixer to use. Do you need a high-speed disperser, a low-speed agitator, or a twin-shaft configuration? If you are unsure, contact your mixer manufacturer.

After you know the type of mixer, decide how the mixer will be mounted. Typically, anything under 500 gallons is pedestal mounted and anything over 500 gallons is bridge or flange mounted. The need of vacuum and/or pressure will dictate some design parameters related to mounting. If you need vacuum and/or pressure there will be a dished head in the design—unless the vessel is very small. If you do not, the lid will be flat.

Speed Control

The next decision to make after you know the type of mixer and how it will be mounted is how to control the shaft speed. Options include using single-speed, two-speed, or variable speed. Single-speed uses only one speed, and two-speed has the ability to switch between two speeds.

There are several different variable speed options to take into consideration. The first is a variable sheave pulley, which is a manual system. With variable sheave pulleys, the operator cranks a handle that mechanically changes the pitch in the driver pulley to speed up or slow down the speed of the mixer shaft. The second option is a variable frequency inverter. This is by far the most popular type of speed control. There are many manufacturers and a wide variety of options available for variable frequency inverters. Inverters offer several different torque ranges and torque speed ranges. The third option is the hydraulic drive, the most versatile and powerful type of drive available. Most people assume that hydraulic drives are too noisy. With the new pumps and motors available today, this is simply not true. Another common misconception is that hydraulic drives leak. With the proper installation and normal routine maintenance, hydraulic systems should not leak.

Material Handling

After you have determined mixing speed, you will need to establish what method to use in order to get your raw materials into the mixer. If bulk liquids are stored in bulk storage tanks, the easiest way to load them is to pump them into the mixer. Look at the distance from the bulk storage tank to the mixer, decide how fast you want to pump the liquids, and choose a pump. While you are doing this you will need to decide the pipe size, which will dictate the inlet nozzle size. If your bulk liquids are held in totes or drums, they can still be pumped into the mixer through the same procedure. Depending on volume, minor liquid additions can be handled by hand pouring them through a hinged opening. Larger volumes of minor liquids may have to be pumped into a mixer similarly to how you pump bulk liquids.

If powders are received and stored in bulk storage, they will have to be delivered to the mixer by a conveying system. Super sacks can be handled either by conveying equipment specifically designed to handle super sacks or by hoisting them over the mixer and opening the outlet. Fifty-pound bags are typically cut and dumped directly into the mixer via a hinged opening in the lid of the mixer. Another method of handling 50-pound bags is a floor mounted bag opening station with a conveyor. If you have both super sacks and 50-pound bags and opt for a conveying system, there is equipment available that has a bag dump station mounted to the super sack delivery system. Dust collection should be considered depending on what powder handling system you decide to use.

Mixer Location

Explosion Proof

As you are specifying your equipment, you should know whether or not the area where the mixer will be located is classified as explosion proof. If it is explosion proof, you need to know the area's classification. If you are unsure of the area's classification, contact your local fire marshal. The most common explosion proof area classification is Class 1, Division 1, Group D. Class 1 locations are areas where flammable gases may be present in sufficient quantities to produce explosive or flammable mixtures. Division 1

designates an environment where flammable gases, vapors, liquids, combustible dusts or ignitable fibers, and flyings are likely to exist under normal operating conditions. These groups further define hazardous atmospheres:

Group A - Atmospheres containing acetylene.

Group B - Atmospheres containing hydrogen or gases and vapors of equivalent hazard such as manufactured gas.

Group C - Atmospheres containing ethyl-ether vapors, ethylene, or cyclo-propane.

Group D - Atmospheres containing gasoline, hexane, naphtha, benzene, butane, propane, alcohol, acetone, benzol, lacquer solvent vapors, or natural gas.

Group E - Atmospheres containing metal dust including aluminum, magnesium, and their commercial alloys, and other metals of similarly hazardous characteristics.

Group F - Atmospheres containing carbon black, coal, or coke dust.

Group G - Atmospheres containing flour, starch, or grain dusts.

Once you know the area classification, pass this information along in your specifications. Do not leave it up to the mixer sales representative to guess.

Ceiling Height and Door Dimensions

The next critical piece of information you need to provide to the mixer manufacturer is the ceiling height of the area intended for the mixer. A good mixer manufacturer will immediately look at the design and be able to decipher whether ceiling height poses a problem. Something else to consider is your dock door dimensions and the logistics of moving the mixer and vessel from the delivery truck to its final location. This detail is frequently overlooked, which causes problems when installing mixers. Observe the path from the truck to the mixer location. Are there any sharp corners or low overhead obstructions that the riggers will have to navigate? The better you understand any obstacles that may arise, the easier installation will be.

Utility Requirements

Utility requirements are also very important to consider before installing a mixer. Most manufacturing plants in the United States have 460 volt, 3 phase, 60-hertz electrical power. The manufacturer needs to know the electrical requirements of your facility. Available water and air should also be taken into account. If your product needs to be heated or cooled, inform the manufacturer of how you intend to handle this issue and include pressure requirements, flow rates, and temperatures.

Options

Much like buying a car, there are many options that can be offered by mixer manufacturers. For example, typical options offered for a 500-gallon dual shaft mixer used for manufacturing an adhesive product are: a dedicated vacuum system mounted right on the mixer, simple controls or a semi-automation or full automation

package, material handling options, a working platform, and even installation. Decide what you want the mixer manufacturer to provide and what you intend to provide yourself.

Another option you need to bear in mind is how to control your mixer. A local control panel with speed controls and local readouts for amp draw, product temperature, and shaft speed is the most common and least expensive option. Another option for controls is a semi-automation package or a fully automated process. If you are going to operate a mixer from an existing control system, be sure to give as many details about the existing system to the manufacturer as possible.

Specifications

Once you have established the type, size, and location of your new mixer you should communicate this information to your mixer manufacturer. Describe the product(s) you intend to mix in as much detail as possible including maximum viscosity and specific gravity (these dictate horsepower). Most mixer manufacturers have standard geometries for most batch sizes. Unless you have a specific place you are trying to put the vessel such as an existing hole in a mezzanine, it is usually best to stick with the standards.

Mixer Specifications

There are two basic scenarios for deciding specifications. The first is expansion of an existing product line. If you are currently manufacturing the product and are happy with batch times and product quality, you will need to provide information about the current mixing process to your manufacturer. Look at the horsepower, blade types, and shaft speeds. Also, take the time to check the amperage draw of the motors. It is not uncommon to find that the motors provided are much too large for the application. Having some extra horsepower is good for mixer flexibility, but too much is a waste. When you provide all of this information, expect to get some questions back from the manufacturer. A skilled manufacturer will always have questions about your current process.

The second scenario for deciding specifications is mixing a totally new product. With a new product it is important to run trials of the mixers suggested by manufacturers. This will allow you to test out certain mixers and pick the one you like the most. Once these trials are successfully completed, you can begin the process of writing specifications.

Vessel Specifications

Once the mixer is specified it is time to specify the vessel. Unless you have specific space limitations, use the manufacturer's standard vessel geometry. Review your piping requirements so you know what size and how many nozzles you will need in the lid, and remember to provide vacuum and pressure requirements. If you have heating or cooling requirements, consider the jacket. There are three basic jacket designs: the common jacket, the dimple jacket, and the half-pipe coil jacket. If your pressure requirements are below 15 psi, use a common jacket. Higher pressures require dimple jackets or half-pipe jackets.



HOW TO SPECIFY MIXING EQUIPMENT

There is more to specifying a mixer than meets the eye. When deciding what mixer you want to use and specifying all of the details, be sure to do your homework, be decisive, and communicate with your manufacturer. Research is another vital key in making the right decision. Once you and your manufacturer make a decision, it is important to be consistent. Changing your machinery frequently can hurt production by confusing your employees. Communication is everything. If you forget one detail about location, pressure, and so on, you could end up purchasing a mixer that you are unable to use.

We hope this advice will help you feel more comfortable with the responsibility of choosing mixing equipment.