General Process Considerations

DATA SHEET HELP:

The purpose of the Data Sheet is to communicate all of the information and specifications an Application Engineer requires to understand your mixing needs. He will use the information you provide to make a recommendation for an agitator that will most economically satisfy your process requirements.

We do understand that many of our customers and potential customers do not purchase mixers on a routine basis. The Data Sheet asks many questions, and it isn't always clear what the best answer may be for a particular application. The following should help you out. You don't have to read everything. Go directly to the relevant section where you need specific help.

CONTACT INFORMATION:

The contact area requests information needed to return a recommendation to you. You can use whatever "Reference" number or name you like to make sure the paperwork stays organized and we communicate efficiently.

VESSEL DATA:

The vessel data area asks you to describe the vessel you intend to use. Our Application Engineers can recommend a vessel configuration if you like. In this case, skip the vessel section and specify the volume of materials you wish to mix (on the third page of the Data Sheet). You may also want to fill in any headroom requirements and/or space restrictions (on the lower right of the vessel data area; see also below for more help on this topic).

GUARANTEE
ProQuip, Inc. accepts full responsibility for furnishing suitable equipment which shall be fit for the purpose which it is required, and for its successful operation under the conditions for which it was specified

ProQuip, Inc.
Designers and Manufacturers of Agitation Equipment
850 East Highland Road
Macedonia, Ohio 44056-2190 USA
330-468-1850 • (fax) 330-467-3724
www.proquipinc.com
sales@proquipinc.com

If you do have a vessel in mind, then include a tank drawing with your inquiry (best). If a drawing is not available, fill in the vessel data as follows:
Tank Type:

The Data Sheet provides for a cylindrical or a rectangular tank (which includes square vessels). If you tank is not one of these configurations, you should provide a sketch of what you have in mind.

A cylindrical tank can be either vertical like a drum standing up, or horizontal like a drum lying on its side. If it is horizontal, the schematic sketch might be confusing to use, especially in regard to the proposed mixer mounting. Please provide a sketch of what you have in mind.

Top Head:

An open tank means that there is no lid or cover on top. It is open all around the top of the sidewall of the vessel.

A flat head means that there is a flat cover closing off the top of the tank. The mixer will have to access the vessel through a hole or nozzle in this cover.

ASME Flanged and Dished (ASME F&D) and Standard Flanged and Dished (Std. F&D) heads are available from most vessel manufacturers. Many are welded to the tank wall and do not actually have a flange, but they both have standard sizes and dimensions. (But see below under “Straight Side”).

Cone tops are relatively common. Some are “truncated.” That is the cone does not come to all the way a point at the top, but rather has a flat section that cuts off the cone. You need to note this on Page 4 of the Data Sheet.

There are a number of other standard heads available; for example, elliptical or hemispherical heads. There are also many non-standard configurations. If this is the case, mark other, and provide a sketch on Page 4 of the Data Sheet.

Bottom head:

You have almost the same menu for bottom head as for top head above. Note that a Sloped bottom means a flat bottom that slopes to one side of the vessel (usually to allow a large vessel to fully drain). If your vessel has a bottom slope enter the value of the slope in either, a) total drop across the vessel in inches (mm metric), b) degrees slope, or c) inches per foot (m/m metric). Make it clear which of the three methods above you are using.

Tank is New or Existing:

Checking a new tank indicates that the detailed design of the tank is still open to change with very little trouble. Typically the vessel has not yet been released for construction. An existing tank is either completed or well under construction. If an existing tank is going to be used for a new application (other than what it was originally designed for), it may have to be modified in detail. Check either yes or no to let us know if modification is allowed.

Steady Bearing Allowed:

See our Catalogue entry for Steady Bearings to better understand what is meant. Note that the use of a steady bearing often substantially reduces the cost of an agitator. However, a steady bearing will require service (vessel entry) over a range of about every 6 months to every 2 years depending on the application.

Manway Size:

Almost all vessels with top heads have a manway to access the vessel for inspection, cleaning and service. When the agitator is assembled into the vessel, the intank parts have to fit through this manway. If they don't you won't be able to put your equipment together on schedule. You should specify the size as accurately as possible. Note that many manway assembles are sized nominally. That is, the actual clearance may be somewhat less than the nominal size. Ask your vessel supplier for actual values. For rectangular manways enter data as x inches by y inches.

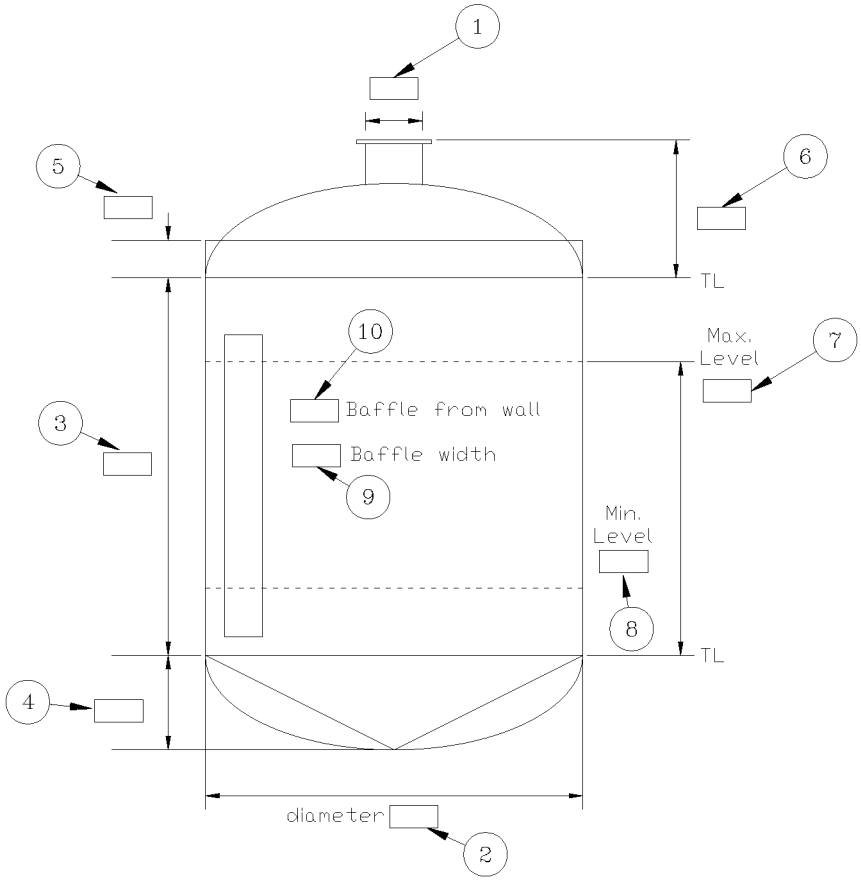
Space and Headroom Restrictions:

This can be an especially important issue for indoor top-entry units. If you have restricted space between the top of the vessel and the roof of the building let us know here. If there are going to be obstructions on the top of the vessel (typically piping), let us know here.

VESSEL SKETCH:

(see sketches)

The sketch is to help specify relatively simple, common vessel configurations. If it does not appear to fit very well with the vessel configuration you have in mind, please provide a drawing or a sketch with your inquiry.



Choose inches or millimeters.

If you are using an ASME flange to mount the mixer, enter the size and rating in the boxes.

1) Enter the nozzle size (if a nozzle is used).
2) Enter the diameter of the vessel. For square vessels, enter the side length. For rectangular vessels, enter the sides as x by y.
3) Enter the length of the straight side of the vessel. Note that this may not be the same as the weld-to-weld distance. Many heads are manufactured with a short length of straight section beyond the dish to facilitate welding to the straight side. Note that for sloped vessels the straight side length is the shortest one.
4) Enter the bottom depth if applicable.
5) If the unit will be beam mounted, enter the beam height here. If you don't know and want us to choose, leave blank and make a note on Page 4 of the Data Sheet. If you choose a beam height that our Applications Engineer feels is too low, he will contact you before proceeding with his recommendation.
6) If the unit will be flange mounted enter the height from the top tangent line to the face of the flange here.
7) Enter the maximum working level here. If you don't know the height we will be able to get it from the maximum volume you will enter of Page 3 of the Data Sheet. If you are planning to fill the vessel above the top tangent line, or fill it completely (no head space), make a note of this on Page 4 of the Data Sheet.
8) Enter the minimum working level here. If you don't know the height we will be able to get it from the minimum volume you will enter of Page 3 of the Data Sheet.
9) Enter the baffle width here. If you don't know and want us to choose, leave blank and make a note on Page 4 of the Data Sheet. Note the number of baffles on the sketch if appropriate.
10) Enter the baffle offset from the wall here. If you don't know and want us to choose, leave blank and make a note on Page 4 of the Data Sheet.

CONSTRUCTION MATERIALS:

ProQuip does not specify or recommend materials of construction. This is up to the end-user.

Tank:

We need to know vessel material in order to work out practical recommendations for mounting and baffles.

Mixer:

This refers to the material used for intank components of the mixer. If you have special restrictions on drive components, for example “no exposed aluminum,” make a note of this on Page 4 of the Data Sheet.

Steady Bearing Bushing Material:

Glass filled Teflon is most commonly used, but we can work with a wide variety of other materials.

Design Pressure:

Required when any sort of seal is requested. It should exceed the safety system limiting pressure so that the mixer seal can be expected to hold until the safety system relieves. If you intend to pressure test the vessel with the mixer installed (not recommended), make a note of this on Page 4 of the Data Sheet and specify the test pressure.

Design Temperature:

We need this value to calculate the strength of the intank components as well as the sealing system (if used).

Type of Shaft Seal:

If you wish to choose a particular seal manufacturer, enter the name here. You make mark required or preferred. If you mark preferred, our Applications Engineers may offer an alternate recommendation (in addition to the one you prefer). “ProQuip to recommend” should be self-explanatory.

You may choose among common seal designs. See the appropriate pages in our Catalogue describing vapor seals, stuffing boxes, and mechanical seals.

Seal Lubricant:

Double mechanical seals and six-ring (high pressure) stuffing boxes require lubrication. If you have a requirement for a particular lubricant, note it here.

MOTOR CHARACTERISTICS

ProQuip does not specify or recommend motor classifications. This is up to the end user.

Volts, phase, and hertz should be self explanatory.

Note that a specification for 460 volts may be met with a dual voltage motor 230/460, unless you specify otherwise with a note on Page 4 of the Data Sheet.

Enclosure:

Use NEMA, IEC, or otherwise recognized national standard. Do not attempt to mix standards together. You will probably specify a motor that doesn't exist and the no manufacturer is willing to make.

Special Insulation or Requirements:

Unless there is one simple special feature, enter "see note x on Page 4," and enter the details there.

Other:

Unless there is one simple special feature, enter "see note x on Page 4," and enter the details there.

PROCESS DETAILS:

Describe what the mixer should do and how the results are measured:

In other words, why do you need to install a mixer in this vessel? Starting with these materials (specify), I want to achieve these conditions in their mixture (specify). If you have trouble with this, it may help to fill out the sections on Process Considerations and Final Mixture below on Page 3 of the Data Sheet first.

Operation is Batch or Continuous:

A batch operation means that materials are added to the vessel, generally in sequence, and stirred together until a final product is obtained. The vessel is then emptied and the process is usually repeated, producing another batch of the same product. Often you will want to specify a batch time (minutes mixing time). In the typical case this is time between the addition of the last ingredient to the mixture and the time you wish to be able to empty the tank of finished product.

A continuous operation means that materials are fed into the tank at a generally constant flow rate, and finished product is drawn off at roughly the same rate. A simple example is a continuous pH adjustment tank, where wastewater flows though the tank, the pH is monitored and acid or base is metered in to maintain a constant pH at the outflow of the vessel. In this case we need to know the gpmflow rate. This is taken as the outflow of the vessel. If the vessel is also used as a surge tank, where the inflow and outflow are not always equal, let us know in a note on Page 4 of the Data Sheet.

Normal Operating Volume:

How much material is mixed in the vessel? This value should include all the ingredients. If materials are added stepwise, and each needs to be mixed before adding the next ingredient, make a note of this and list the order of addition on Page 4 of the Data Sheet.

Minimum (Operating Volume):

What is the smallest volume of materials that will be in vessel when mixing is required? Be careful in designing your vessel for a process that requires starting with a small volume of initial additives. One choice you might consider is a cone bottom, which would make mixing at the start more effective.

Maximum (Operating Volume):

Will there be exceptional cases or upset conditions when the level will be higher than normal? How far might this go? Note that raising the liquid level into a dished head or completely filling the vapor space at the top of the vessel requires special mixer design considerations. If this is expected make a note of it on Page 4 of the Data Sheet.

Mixer should be selected for:
Normal volume or Maximum volume:

If the maximum volume condition is rare and would be corrected when found, you would generally choose Normal volume. If the vessel is, for example, going to be used for toll mixing, and you expect to mix bigger than normal volumes of a specific product on occasion, you might choose Maximum volume. There is generally very little consequence in choosing one over the other, but there are some applications that require a large vapor space in the vessel. If you are uncertain how to answer this question, talk to one our Applications Engineers about you specific concerns.

Operating Temperature and Pressure:

These values should reflect the normal mixing environment, not the design limits for the vessel.

PROCESS CONSIDERATIONS:

LIQUIDS ONLY:

Blend miscible liquids:

The process consists of adding liquid ingredients to the vessel and stirring them together to produce the final product. Our Applications Engineer will design a mixer that will stir the entire contents of the vessel, leaving no "dead" zones. He will also calculate and report a "blend time" to you. The blend time is the time it will take for the contents of the vessel to reach a state of better than 95% uniformity after the addition of the last ingredient. Simply put, 95% uniformity means that any sample taken from anywhere in the vessel will have ratios of components within 5% of the ratios of components actually added to the vessel. If you want a higher degree of uniformity, you should indicate this in the Section Above: "Describe what the mixer should …" A higher degree of uniformity will require a larger mixer, a longer blend time, or some combination of both.

Hold or prevent stratification of existing mixture.

The process requires maintaining uniform properties of the contents of the vessel. Temperature uniformity may also be included here. Typically we are referring to storage and equalization applications where batches of the same material are periodically added, and batches periodically drawn off. Note that if small amounts of additives (like inhibitors, antifoam, preservatives, etc.) are occasionally added to contents, it is important to point this out.

Contact immiscible liquids:

The process requires dispersing a liquid into droplets suspended into a continuous phase of a second immiscible liquid. Commonly used in mass transfer processes. The droplets should be small to facilitate mass transfer, but not so small as to homogenize or emulsify the phases, so that separation is difficult or impossible.

Emulsification:

The process requires dispersing a liquid into droplets suspended into a continuous phase of a second immiscible liquid. The droplets should be small enough to remain dispersed. The product should not separate into two distinct phases upon standing. Emulsifying agents are commonly used to facilitate and stabilize the emulsion. These applications usually require a description of existing equipment known to work or pilot tests.

Heat Transfer:

The contents of the vessel are to be heated or cooled. The mixer should be designed to aid in transferring heat from coils, plates, a jacket, etc. to the contents of the vessel. Our Applications Engineer will provide you with a calculated inside heat transfer coefficient. You need to provide the heat capacity of the liquid in the vessel as well as the heat transfer coefficient. We can often estimate these, but prefer to use the same values you used in sizing the vessel and heat transfer system.

Chemical reaction:

At least two of the ingredients are expected to react with each other. Unless the reaction is well known (like pH control, for example), we will need to have values for the physical properties of the ingredients and the reaction products. See immediately below to enter material properties.

LIQUIDS and SOLIDS:

Suspend solids adequately to prevent buildup:

The vessel will contain a small amount of solids that have to be continuously flushed through or emptied out along with the contents.

Suspend solids entirely off bottom:

This describes the conditions required for most solids suspension applications. The bottom will remain relatively clean at all times. Particles may accumulate in small dunes for very short periods, but these will be unstable and continuously swept up into the liquid as fast as they from.
The particle concentration will be almost uniform up to a level of about 85% of the vessel diameter. Higher levels are possible, see below.

Suspend solids uniformly:

The same conditions as above, but the concentration of solids will uniform throughout the batch height.

Note that achieving uniformity to a height up to 1.2 times the vessel diameter requires an increasingly larger mixer. It is possible to suspend uniformly up to 2 times the vessel diameter, but the mixer required will be very large. It is not possible to suspend anything but very slow settling solids to heights greater than 2 times the diameter of the vessel without using a draft tube or other special design.

Note that the top 2 to 5 percent of the liquid (at the surface) will never achieve true uniformity with the bulk of the slurry in the vessel. Simple overflow discharge seldom works for these applications. If you need advice, make a note on Page 4 of the Data Sheet.

Dissolving:

Normally requires “Suspend solids entirely off bottom” conditions. However, some dissolving applications result in large changes in viscosity over the course of dissolution. Others, like rubber dissolving, result in large changes in the particle properties in the course of dissolution. When this is an issue, make a note of it on Page 4 of the Data Sheet.

Washing and leaching:

As per Dissolving.

LIQUIDS and GAS:

Gas dispersion:

A gas is sparged into a liquid and dispersed by the mixer into small bubbles. Usually this is done to transfer oxygen into the liquid from air. For example, an aerobic fermenter.

Gas absorption:

As per gas dispersion, but the gas is intended to substantially react with the liquid or a component in the liquid. Any gas vented to the surface will be recycled. For example, a hydrogenator.

Stripping:

As per gas dispersion, but material is expected to be transferred from the liquid to the gas. For example, a monomer stripper.

LIQUIDS:

List these in order of addition (if appropriate). Also describe mixing procedure in "Describe what the mixer …" above on this page or in a note on Page 4 of the Data Sheet. If you do not know the value of one of the parameters listed, you may be able to send a sample to ProQuip's lab for evaluation. We need 500 ml of liquid, and we require a MSDS sent to us before you ship the sample. We are capable of handling most material hazards for small quantities.

Name:

If the name is proprietary, make up a label or ID so we can communicate clearly.

Weight %

How much is added as a percentage of the total weight of all of the other components.

Sp. Gr.

The specific gravity of the liquid.

Viscosity:

You should enter the viscosity in centipoises. If you use some other measure of viscosity, make a note on Page 4 of the Data Sheet. See below under "Final Mixture" for some cautions about reporting viscosity.

SOLIDS:

If you do not know the value of one of the parameters listed, you may be able to send a sample to ProQuip's lab for evaluation. We need 500 gm of solids, and we require a MSDS sent to us before you ship the sample. We are capable of handling most material hazards for small quantities.

Name:

If the name is proprietary, make up a label or ID so we can communicate clearly.

Weight %

How much is added as a percentage of the total weight of all of the other components.

Sp. Gr.

The specific gravity of the solid itself. Do not report the bulk density as the specific gravity.

Settling Rate:

This is not required unless you do not know the specific gravity or the particle size, but is always helpful if you have it. We expect the value for the largest particles will be provided; or alternatively, a range of settling velocity for mixed sized particles.

Particle size range:

Use mesh or microns for dimensions and indicate which you are using. A sieve analysis is very helpful if you have one.

Solids added:

1) Wet or dry: Dry solids addition is normal. We will assume the solids pour easily unless told otherwise. Wet solids addition means that the solids are added as a slurry concentrate or that they are aggregated together in a paste or cake when introduced into the vessel. If you check wet solids addition, explain details with a note on Page 4 of the Data Sheet.

2) Insoluble or Soluble: insoluble solids do not dissolve in the liquid and are expected to remain as solid particles in the final product. Soluble solids will dissolve in the course of mixing.

3) Fluffy: the solids tend to aggregate together and will likely float on the liquid surface unless the mixer is designed to draw them down.

4) Sticky or gummy: the solids tend to stick together and will likely sink in clumps unless the mixer is designed to suspend them until the aggregates break up.

5) Abrasive: the solid particles are hard and sharp. They are expected to erode moving parts.

4) Sticky or gummy: the solids tend to stick together and will likely sink in clumps unless the mixer is designed to suspend them until the aggregates break up.

5) Abrasive: the solid particles are hard and sharp. They are expected to erode moving parts.

GAS:

Name:

If the name is proprietary, make up a label or ID so we can communicate clearly.

Flow rate:

The gas flow rate in cubic feet per minute (or cubic meters per unit time).

Measured at what pressure, psig, and what temperature (ºF/ºC)

FOAMING TENDENCY:

Describe if a foaming problem is known or suspected. This box is not exclusively for applications where gas is sparged. Use it for systems that are likely to foam from entrainment of surface air.

FINAL MIXTURE:

Sp. Gr.

The specific gravity of the final mixture.

Viscosity:

You should enter the viscosity in centipoises. If you use some other measure of viscosity, make a note on Page 4 of the Data Sheet. WARNING: Many "thick liquids," with a viscosity greater than about 5,000 cps are non-Newtonian. Their apparent viscosity varies with how vigorously they are stirred. One viscosity measurement does not provide enough information about these liquids. If you are not sure, send a 500 ml sample to ProQuip for a viscosity analysis (No charge). Send MSDS to ProQuip before shipping sample.

Other description:

Note any other characteristics of the mixture that might make it special or unusual.

Is the process performed at present?

Are you mixing or have you mixed the final product, yes or no?

Describe the present installation, etc.

Is the performance satisfactory, yes or no?

If not, describe why:

The above information is often very helpful in designing a mixer for your application. In particular the poor performance of an existing process can be used to flag a non-Newtonian fluid or some other characteristic of the materials that was not covered in the information above. Note that even a process that is working well might not be using the optimum mixer configuration. If we find this to be the case, our Applications Engineer will explain it in his recommendation to you.