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## Top Ten Ways to Specify and Buy Reliable Centrifugal Pumps

By Vern Maddox

The following summarizes the top ten ways to specify and buy reliable centrifugal pumps.

1. Prepare specifications and data sheets that are realistic and do it at the earliest possible stage of engineering. Once a pump is proposed and ordered, it is too late in most cases to make beneficial changes.
2. Be sure that everyone involved (process design, systems engineering, plant operators) has realistic targets for "normal" and "rated" operating conditions. The "rated" point is what the pump manufacturer guarantees and is frequently selected as near as possible to the best efficiency point. However, consideration must be given to where the pump will actually operate most of its life. The "normal" and "rated" points should be selected such that the pump will be able to operate in a stable flow range regardless of where the pump is operated.
3. Pay attention to every detail of the pump system. Pump NPSH<sub>r</sub> must be realistic and must be of a sufficient value that the pump never experiences cavitation, regardless of the operating point.
4. Pumps operating in parallel require very careful attention to the system resistance curve so that the required flow is obtained. Pump flows in parallel operation are not simply the sum of the two individual pump flows. The hydraulic system must be studied and piping symmetry, especially on the pump inlet side, is important. Pump vendors should be given the system resistance curve prior to proposing parallel pumps.
5. Pumps can be successfully operated in parallel under practically any conditions as long as each individual pump has a dedicated, flow controlled bypass set to satisfy realistic pump minimum stable flow. This minimum flow should be based on the pump being able to operate continuously through the minimum flow bypass system with no flow instabilities or overheating of the fluid. Thermal minimum flow, as often seen on a pump curve, is not an adequate minimum flow on most pumps and should not be used to size a minimum continuous flow bypass system.

### Upcoming Training Courses

- **Course 607**  
*Design and Maintenance of Aboveground Atmospheric Storage Tanks*  
December 16-18, 2014 in NJ  
January 20-22, 2015 in TX
- **Course 1600**  
*Achieving World Class Maintenance Performance*  
February 10-12, 2015 in TX  
March 17-19, 2015 in NJ  
For more information, see our website at [www.carmagen.com](http://www.carmagen.com).

### Work Highlights

#### Process, Operations & Safety

- *Conducted a fluid coker reactor turnaround discovery and consulted on planned modifications. Provided miscellaneous process consulting, risk based work selection (RBWS), and turnaround planning support.*
- *Provided analytical support on crude characterization and potential for pretreatment to reduce equipment fouling.*

#### Project Management

- *Contracts consulting support was provided for a large LNG project being done in the Far East. Serious difficulties and disagreements developed between the contractor and owner company during the initial stages of the project. After multiple meetings and negotiations among all parties, these were eventually resolved to everyone's satisfaction.*

6. Minimum flow is best determined by considering the pump required net positive suction head (NPSH<sub>r</sub>). Remember that the required NPSH is defined at 3% head loss; so, a pump is actually cavitating slightly at the NPSH<sub>r</sub> given by the pump vendor. Thus, the need to have a safe margin between available and required NPSH. As a very general rule of thumb, a margin of five feet available NPSH over required NPSH is a good starting place. However, this is not a hard and fast rule as some applications may require a larger margin.
7. Reliable pumps must be installed correctly. Buying the right pump correctly is only the first step to long term reliability. The baseplate must be designed for proper grouting and mounting of the pump, driver, and auxiliary systems. The use of a quality epoxy grout will expedite installation and provide for long term stability.
8. Proper alignment of the pump suction and discharge piping must be addressed at the beginning of a project. This is often left to chance during construction but must be addressed early on in a project as it is another very important detail in long term reliability. Pipe flange to pump alignment tolerances must be tighter than at other flange pairs in order to minimize the likelihood of pump reliability issues during operation. API-RP-686 is an excellent guideline for all aspects of pump installation. WRC Bulletin 449 provides guidelines for the design and installation of pump piping systems.
9. When pumps are purchased as part of a project, be sure that the engineering and procurement contractor machinery engineering team understands and implements your requirements. Changes are difficult to make after initial inquiry stages.
10. If you don't have the expertise in-house, get a highly qualified machinery engineer to represent your pump procurement efforts in the engineering contractor's office. To be really effective, this must be done at the very beginning stages of a project. Of all these ten items, this one is the most important, as a qualified machinery engineer will take care of all of the above items and will do them at the right phase of the project.

#### ***About the Author***

*Vern Maddox is a mechanical engineer with over 40 years experience in rotating machinery selection, installation, startup, maintenance, problem solving and vibration analysis of pumps, compressors, steam turbines and a variety of special equipment and components. He was responsible for the machinery engineering, commissioning, startup and operation of a world-class ethylene plant and many smaller facilities. Vern established and supervised engineering groups at two plant sites involved in machinery reliability and condition monitoring/vibration analysis. He also participated in numerous capital projects as a full-time project team member.*

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