In the oil and gas industry, replacement in kind often appears to be a time and cost-saving measure. Yet, every application has unique requirements. Purchase the best equipment for each situation using careful analysis of the demands that will be put upon it.
INTRODUCTION
When a piece of equipment at a storage terminal or pump station stops working, it’s common to want to replace it with the same type of equipment. Likewise, if you’re planning a terminal or pipeline expansion, you may be inclined to purchase additional pieces of the equipment already in use at that site.

In theory, using the same equipment throughout your facility saves time and money. In practice, this isn’t always the case. You may not be able to get identical equipment, so the spare parts you have on hand may not be useful. Even when exactly the same equipment is available, it may not be the best solution for the new application.

To determine which equipment will be most cost-effective for a specific situation, it’s essential to start by evaluating the demands that will be put on that equipment. This may seem like an unnecessary delay when you want to get to market as fast as possible, but it will reduce downtime and save money in the long run. Moreover, a company experienced in engineer-procure-construct (EPC) services can streamline the process, allowing you to purchase the best equipment for your needs and still keep your facility running on schedule.

PROS AND CONS OF REPLACEMENT IN KIND
In the event of a pipeline shutdown, time is money. When you need new equipment, using the same type currently in place may seem like it will save both.

You probably have a warehouse of replacement parts and necessary tools. So, you won’t have to waste time ordering additional parts when something breaks or can invest in a second set of spare parts to keep on hand. Plus, your staff already has the knowledge and experience to handle any necessary repairs, meaning the new equipment can be fixed quickly and easily if it breaks.

Both of these factors have the potential to minimize downtime and save money. However, such cost savings only materialize if the new equipment is appropriate for the new application. If the new equipment causes cavitation or does not provide adequate discharge pressure or flow, it is likely to cost more in the long run due to unforeseen repairs.

HYDRAULICS VARY BY SITE
Though you may have multiple pumps of “Type X” working efficiently at a specific facility, when you build an expansion at a new elevation or with different delivery requirements you’ll need to analyze the hydraulics at that site to be sure the existing pump type can handle the process.

Installing the same equipment without analyzing the hydraulics can create a number of problems. The suction head might be too low, which would cause the pump to cavitate. Cavitation could, in turn, damage the pump impeller, a breakdown caused by a huge investment you’d just put in place. Over time, excessive vibration might damage the pump seal, potentially setting off pump alarms and causing the pump to leak. In extreme cases, the adjacent piping and equipment also might be damaged.

LOCATION IMPACTS DISCHARGE PRESSURE
Analyzing the hydraulics on the discharge side of the equipment is equally important. If discharge losses are higher in the new application than at the original site, the new destination will see lower pressures than the original. Once again, this creates problems downstream.

For example, when a compressor doesn’t provide adequate pressure to homes, some appliances will not operate properly. Consumers won’t be happy to discover their gas-powered furnaces, water heaters and ranges aren’t working as promised.

In any of these scenarios, you will likely need to shut down equipment at least briefly for repairs. To avoid this loss of productivity, it is essential to fully analyze the demands that will be put on terminal and pipeline equipment before purchasing a replacement.

DATA COLLECTION AND ANALYSIS
The more detailed information you have available, the more effective the equipment selection process can be. But collecting the necessary data can be challenging.

A team from a company that can deliver EPC services can simplify this process by gathering accurate and comprehensive data on your existing systems.
You can expect your team to start with a conservative model and refine it as more information becomes available. For instance, the need for a robust pump would decrease with the elimination of every bend in a pipeline.

This approach results in a design that goes easy on the system to allow for worst-case scenarios, but is flexible enough to be modified once it is certain they don’t exist.

CASE STUDY: PROCUREMENT OF TWO NEW VERTICAL CAN PUMPS

A pipeline company required two new vertical can pumps to accommodate new tankage and flow paths. The client needed the new gasoline tanks to have the same hydraulic performance as the existing tankage. Specifically, it needed to provide equivalent maximum flow rates — 6,000 barrels per hour (bph) — for both the new and existing pumps.

The client believed that purchasing pumps identical to its existing pumps would be most cost-effective, since spare parts would be readily available on-site.

ANALYSIS

Before the company purchased identical pumps, we conducted a detailed hydraulic study to determine if they would be the best equipment for the application. Evaluating the new pumps relative to the existing pumps required three different scenarios.

In the first, naphtha was pumped through a meter skid and injected into a tank via an eductor system. The second scenario evaluated gasoline recirculation through the existing pump and through the new pump. The third scenario also evaluated gasoline movements, but it focused on tank-to-tank transfers instead of recirculation.

In both the naphtha injection and tank transfer scenarios, the tank liquid level was adjusted for the suction and discharge side of the pump to create three subcases regarding operation: best, worst and average. The new pumps and the existing pumps were both modeled with the existing pump curves.

RESULTS

We evaluated hydraulic performance at 100 percent pump speed. In all scenarios, both pumps experienced similar operating conditions.

Minor variations in average flow rate and net positive suction head (NPSHa) were detected in the new pump. Also, its flow rate fell short of 6,000 bph while at 100 percent pump speed in the naphtha injection scenario. However, if the hydraulic model were to be field verified, the results would more accurately represent current operating conditions.

In all other cases, the new system met or exceeded the key objective flow rate of the existing system, or 6,000 bph.

RECOMMENDATIONS

Due to the similar operating conditions and performance of the new pumps in this hydraulic analysis, we recommended that the new pumps be installed as clones of the existing pumps.
VENDOR-AGNOSTIC PRODUCT SELECTION
It is not uncommon for oil and gas companies to become dependent on a single vendor. When this happens, your equipment options are reduced and it may be difficult to get competitive bids from that vendor.

By contrast, a qualified EPC team will take a vendor-agnostic approach to product selection. Your team will help you identify the best solution regardless of vendor or brand, often at a lower price. Because EPC companies maintain strong working relationships with multiple equipment vendors, your team will be able to get quotes from several brands, which generally results in a better deal for you.

If the equipment you’re currently using truly is the best product for the job, but it is no longer available, your EPC team can work with the vendor to procure a “clone” that uses similar parts and replicates performance.

EPC companies also can help manage a range of other issues with the vendor, including advising on your procurement strategy and filling any gaps in your procurement capabilities. This might include document submittals and as much, or as little, coordination as the procurement office wants.

CONCLUSION
Whether you’re installing a new pump, compressor or other piece of custom-built equipment, assuming the same equipment you used previously will be appropriate for the current application could be a costly choice. It’s essential to do your due diligence before purchasing equipment, each and every time.

Working with an experienced EPC team simplifies all aspects of this process, including data collection and analysis, equipment selection and procurement. If you oversee a number of projects or sites, your EPC team can help you establish a repeatable due diligence procedure. By outsourcing the most technical and time-consuming tasks, you can purchase the most appropriate equipment for your application in a timely and efficient manner.

BIOGRAPHY
COLIN MANDRICK, PE, is a senior mechanical engineer for the Terminals and Pipelines Group in Burns & McDonnell. He has design and construction experience for both public and private sector clients and specializes in booster station design, refined products, hydraulic modeling, loading and offloading of transport vessels, crude oils, pipeline connections and facility upgrades.