Ross MACKAY Associates Ltd.

SOME DANGERS OF BATCH PROCESSES

by **Ross Mackay**

"At the end of every batch, my pump wants to go home!

These were the words said to me in halting English by a maintenance manager of a major brewery in Manilla during one of my trips to the beautiful Philippines. Although I was accompanied by a translator, the manager insisted on trying out his limited English (which, by the way, was infinitely better than my nonexistent knowledge of Tagalog). As we were obviously having some kind of communication breakdown, I asked the translator to verify the comment. Sure enough, back it came, accompanied by a big grin and lots of head nodding. "At the end of every batch, my pump wants to go home."

Obviously, this was a pump I just had to see!

The pump in question was used to empty the raw wort (essentially unprocessed beer) from a large tank. The line to the pump suction came from a bottom connection in the tank, through a 90 degree elbow and a short section of line to the suction flange of the pump. (Fig. 1)

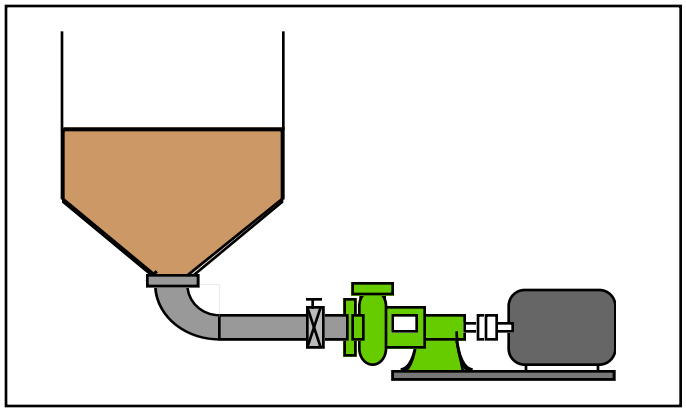

Figure 1

The pump itself was an old fashioned horizontal, end suction pump design where the support mounting was under the bearing housing, with the pump casing in an overhung position. (Fig.2)

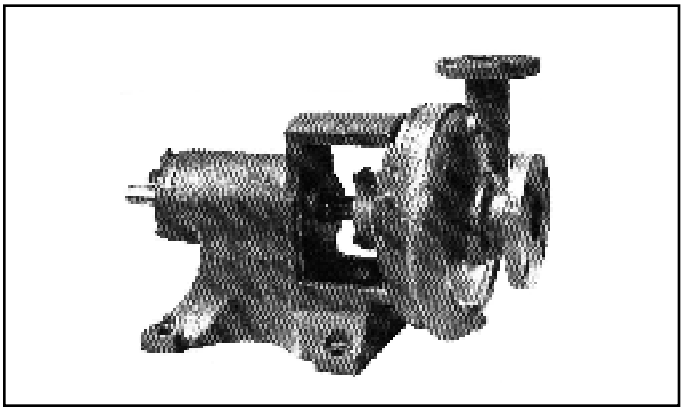

Figure 2

In this case however, the pump casing was also wrapped with brass strapping that was in turn bolted to the floor, effectively securing the casing almost independently of the pump hold-down bolts. When I inquired about the strapping I was advised that it "helped to stop the pump from going home".

After much discussion and assistance from the translator, we finally established that the problem was, at the end of every batch, the pump was vibrating so badly, it would shear the hold-down bolts and move off the base plate. The direction it moved was towards the back door of the brewery which, coincidentally, was only 10 feet from the pump..... "it was trying to go home!".

The strapping around the casing was just an extra effort to keep the pump in place. This is a very typical attempt to cure the symptom instead of addressing the problem and, in most cases it is not a good idea. However this is one of the few applications where addressing at least a part of the problem won't help us very much.

In this instance, all indications were that the problem was from two sources; the process of emptying of the tank and the badly eroded baseplate and foundation.

Like many batch systems in different industries, the tank was designed with the lower part in a conical shape where the tank diameter tapers down to the bottom outlet. This ensures that the tank will indeed empty, but it also frequently results in a vortexing when the level in the tank drops. This causes an unstable swirling action in the pipeline entering the eye of the impeller.

In addition, the swirling problem was compounded by the wort fermenting and the vapor bubbles being entrained in the flow. As mentioned in a earlier column, this will cause the same symptoms as cavitation when the bubbles are imploded when pressurized at the eye of the impeller.

The obvious correction to this common problem is not to completely empty the tank. We can leave sufficient liquid in the tank to maintain a minimum level that will not create a vortex. However, that's not going to happen, because we would then lose that amount of valuable product and there is no longer an empty tank to accommodate the next batch.

In addition, most breweries use a CIP cleaning process that sanitizes the entire system by flushing it through with an aggressive cleaning solution. This too requires to be completely flushed from the system before the next batch of product is processed.

In other words, the method of operating the pump and system is severely detrimental to the pump. We hear a lot on that topic. Almost everyone is looking for the solution to a problem that is caused by "Operations" closing a valve that shouldn't be closed, or starting a second pump that isn't needed. It's under these conditions that heated (and often very emotional) arguments develop about who's doing what to whom. "Operations" argue that "Maintenance" isn't doing their job right and/or it must have been the wrong pump in the first place, so why doesn't "Somebody" replace it with the right one?

It is only with an open discussion of the problem with all departments involved that such a situation can be resolved. Frequently, when the perpetrators of inappropriate actions are made aware of the financial ramifications of these actions, they will stop..... or at least diminish dramatically.

In other cases, such as this particular one, there is no choice, the pump must empty the tank to accommodate the next batch and/or the automatic cleaning (CIP) process.

So, what do we do?

With our particular situation in the Philippines we had to completely replace the pump, baseplate and pedestal. The pump was in need of a major overhaul and, in view of it's age and manufacturing origins, the cost of spare parts would be well beyond the value of a new pump (if indeed they were even available). In addition, the pump design incorporated an excessively long overhang of a very small shaft which was almost guaranteed to vibrate under the given operating conditions, resulting in premature seal and bearing failure. In addition, the baseplate and foundation had eroded almost completely away in some sections leaving minimal support.

In considering a new pump for this type of installation, we must first recognize that we are dealing with stressful operating conditions. There is no point in buying a new pump for this type of application without taking into account the type of problems that the new pump must face, or even reviewing them with your suppliers. In some cases, a "standard" pump may do the job, but in other cases, an upgraded design may be required.

It may helpful to note that an API pump is built to meet more exacting operating requirements than an ANSI pump, and is therefore capable of withstanding considerably more physical and hydraulic stresses than a ANSI pump. Consequently, the API pump could be considered as an option simply to withstand the physical stresses of a particular installation.

Within the last 10 - 15 years, upgraded designs have become available in the ANSI range of pumps. These styles include such additions as solid shafts (as opposed to sleeved shafts), abbreviated overhang lengths, larger seal chambers and bearing isolators. All of these help in improving the ability to withstand operating stresses.

Once again, don't tell me you can't spend the extra money involved for these heavier duty pump options. Depending on the industry, downtime can cost a production line tens of thousands of dollars per hour in downtime costs. Consequently, the few thousand dollars involved for a stronger pump will quickly fade into insignificance. And it won't want to go home after every batch!