KelairPumps

Pump*Action*

ISSUE 44 SEPTEMBER 07

Welcome to the 44th edition of Pump Action

In this edition we look at an application for a Sandpiper Air Operated Diaphragm Pump on an aggressive chemical. We also have a feature on pumping diesel fuel and the various issues that need to be taken into account when selecting pumps to operate in this service.

The Pump Clinic article is titled 'Affinity Laws' and gives a brief outline of this quite detailed subject. It discusses how the change in speed of a centrifugal pump affects all areas of its performance and shows how to calculate these factors.

KelairPumps

· PUMPS · BUILDING & FIRE · STEAM TURBINES · WASTEWATER · SERVICE

PumpAction........ ISSUE 44 SEPTEMBER 07

FEATURE

Positive displacement pumps on diesel duty

Sales Engineer Alex Calodoukas (NSW)

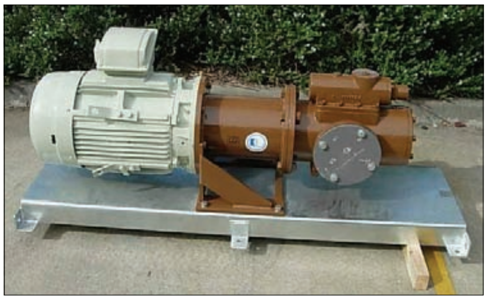
In pumping diesel fuel, we need to take into consideration that it is a thin fluid with low lubricity. Now water is also a thin fluid with low lubricity. And if diesel, transfer and feed duties were similar to water duties, we could use centrifugal pumps as we do for water. Diesel fluid would pump just as well as water using a centrifugal. Diesel duties however, have criteria that set them apart from typical water duties.

Let's look at generator duties to feed a day tank at a particular flow rate. The flow rate required may be quite low (20 l/min to 50 l/min) with a high head that would vary from case to case. A constant flow rate may also be required. For a centrifugal pump, to get the flow rate spot on, you would need to re-design your piping for each system so that the static head and system resistance will give you the specific flow that you need. That means every system needs to be engineered individually. Why do that, when you could use a positive displacement (PD) pump? Run the PD pump at selected rpm and you will have the perfect flow rate for every system, whatever the system pressure. The Viking pump pictured is ideal for that type of duty.

Let's have a look at another typical duty for diesel fuel which is burner feed. When feeding the burners that fire a steam boiler, high flows may be required. Not only that, high pressures may also be required (could be 20 Bar to 40 Bar). But that pressure won't stay constant. As burners come off line, and then go back on line, with the system still running, control valves have to regulate the flow, and pressure spikes occur. In some cases centrifugal pumps can be used, but it's a lot easier to run a PD pump because they are purpose-built for this type of duty.

Pictured are KRAL 'triple screw' pumps. They are being used successfully on diesel fuels, at the pressures mentioned. They are pictured in the horizontal flanged configuration for a stand-alone pump. They are also pictured in the vertical flanged configuration, for skid mounting. This vertical configuration is excellent for space-saving that lends itself well for skid design.

Above KRAL vertical. Below KRAL horizontal



Viking pump

If you have an industrial feed or transfer duty for pumping diesel fuel, contact Kelair Pumps, as we have a range of industrial pumps well suited to this application.

KelairPumps

· PUMPS · BUILDING & FIRE · STEAM TURBINES · WASTEWATER · SERVICE

PumpAction........ ISSUE 44 SEPTEMBER 07

CASE STUDY

Sandpiper and solid solutions keep aiding Accensi

Sales Engineer Hem Prakash (QLD)

Accensi Pty Ltd is a leading national independent contract chemical manufacturing company producing a wide range of formulation types for industry. Typical products include timber preservatives, fungicides, herbicides, insecticides, general agricultural adjuvants and industrial chemicals.

The maintenance manager of Accensi, Dave Stritch (pictured) has nearly 100 pumps on site to supervise maintenance and repair. They include centrifugal, air-operated diaphragm, multistage, submersible, mag-drive and helical rotor.

Accensi had a recent application involving loading and unloading of KOH solution. KOH is potassium hydroxide sometimes called caustic potash. Depending on concentration and temperature, KOH can be highly corrosive.

Dave had preliminary discussions with Hem Prakash from Kelair's Brisbane office on various pumping criteria and apart from compatible material for KOH pumping, the following was established for this application:

- Time available for loading and unloading KOH.
- Ease of operation.
- Ability to run dry when the operator is distracted or unaware that the loading and unloading process is complete so the pump might run dry.
- Less maintenance required e.g. changing seals, bearings, o'rings etc.
- Simple set up without complicated seal flushing arrangement or complicated electrics start/stop and dry run protection.

Hem recommended a Sandpiper S20B3P1PPAS000, which is a Polypropylene pump with Santoprene elastomers. This addressed all the criteria established earlier, for the following reasons:

- The S20 has a maximum flow rate of 568 l/min
- Sandpiper's flow and pressure can be regulated simply by inlet air supply thus easy to operate.

- The pump can run dry without damage which is a very useful feature especially when unloading, and when it might be running dry and unknown to the operator.
- Sandpipers require little maintenance since they are seal-less and hence no complicated seal flush arrangement required.
- Sandpipers can be easily set up with no complicated electrics involved.

Finally, no expensive bypass or pressure relief valves are required since discharge pressures equal to, or greater than, air pressure stops the pump without damage.

Dave Stritch says, "Kelair's Hem Prakash has been our preferred pump sales engineer for more than a decade with solutions that normally exceed all our set criteria. And by adopting this recent solution we have reduced our installation costs."

Kelair Pumps Australia Pty Ltd ABN 28 001 308 381 215 Walters Road Arndell Park NSW 2148
Ph: 1300 789 466 Fax: 02 9678 9455 Email: kelair@kelairpumps.com.au www.kelairpumps.com.au
QLD Fax: 07 3808 8758 VIC Fax: 03 9569 7866 TAS Fax: 03 6331 9102 WA Fax: 08 9248 2255

PUMP CLINIC 18

PUMP AFFINITY LAWS

There are occasions when you might want to permanently change the amount of liquid you are pumping, or change the discharge head of a centrifugal pump. There are four ways you could do this:

- Regulate the discharge of the pump by using a valve or orifice.
- Change the speed of the pump by changing the motor or using a variable speed drive
- Change the diameter of the impeller.
- Purchase a new pump

Of the four methods the middle two are generally the most sensible ones. In the following paragraphs we'll learn what happens when we change either the pump speed or impeller diameter, and as you would guess, we will see what other characteristics of the pump are going to change along with these values.

To determine what is going to happen we begin by taking the new speed or impeller diameter and divide it by the old speed or impeller diameter. Since changing either one will have approximately the same affect we will refer to only the speed in this part of the discussion.

As an example:

$\frac{\text{NEW SPEED}}{\text{OLD SPEED}}$ = A VALUE, or $\frac{\text{1500 RPM}}{\text{3000 RPM}}$ = 0.5

The capacity, or amount of fluid you're pumping, varies directly with this number.

- Example: 50 metres³ per hour x 0.5 = 25 Cubic metres per hour

The head varies by the square of the number.

- Example : 20 metre head x 0.25 (0.5^{2}) = 5 metre head

The Power required changes by the cube of the number.

- Example: A 9 kW motor was required to drive the pump at 1500 rpm. How much is required if you go to 3000 rpm?
- We would get: 9 x 8 (2^3) = 72 kW is now required.
- Likewise if a 12 kW motor was required at 3000 rpm and you decreased the speed to 1500 the new kilowatts required would be: 12 x 0.125 (0.5^3) = 1.5 kW required for the lower rpm.

The following relationships are not exact, but they give you an idea of how speed and impeller diameter affects other pump functions.

The net positive suction head required by the pump (NPSHR) varies by the square of the number.

- Example: If the NPSHR at 1450rpm is 3m, what would be the NPSHR for the given pump if its speed was increased to 2900rpm
- A 3 metre NPSHR x 4 (2^2) = 12 metre NPSHR at 2900rpm

The amount of shaft run out (deflection) varies by the square of the number

- As an example you had 0.07 mm run out at 2900 rpm and you slowed that shaft down to 1450 rpm the run out would decrease to 0.07 mm x 0.25 (0.5^2) or 0.018 mm.

The amount of friction loss in the piping varies by approximately 90% of the square of the number. Friction loss through fittings and accessories varies by almost the square of the number.

- As an example: If the system head loss was calculated or measured at 65 metres at 1450 rpm, the loss at 2900 rpm would be: 65 metres x 4 (2^2) = 260 x 0.9 = 234 metres

The wear rate of the components varies by the cube also

- Example: At 1450 rpm the impeller material is wearing at the rate of 0.5 mm per month. At 2900 rpm the rate would increase to: 0.5 x 8 (2^3) or 4.0 mm per month. Likewise a decrease in speed would decrease the wear rate eight times as much.

We started this discussion by stating that a change in impeller speed or a change in impeller diameter has approximately the same effect. This is true only if you decrease the impeller diameter to a maximum of 10% This is true because as you cut down the impeller diameter, the housing is not coming down in size correspondingly so the affinity laws do not remain accurate below this 10% maximum number.

The affinity laws do however remain accurate for speed changes and this is important to remember when we convert from gland packing to a balanced mechanical seal. We sometimes experience an increase in motor speed rather than a drop in amperage during these conversions and the affinity laws will help you to predict the final outcome of the change.