



## Equipment: Pump Reliability

By Terry Harris

Can my centrifugal pumps last forever?

The answer to this question is yes! Now the word forever needs to be defined for this article. Forever in this article is defined as the work life of an employee who installs the pump properly. This can be 30-40 years. This is where the “reliability” world of maintenance comes into the play. And it’s the big picture world of equipment and maintenance reliability. It’s not just one or two things that we do that make the difference; it’s a combination of all the factors. Miss one of the factors, and the years of service go down.

### What are all these factors?

The main failure component in a centrifugal pump would be the bearing if you asked a maintenance person. The bearings in a Durco 3 x 2 -10 pump running 1800 RPM have a B10 life of 30 years. Most bearings will last 5 times more in over half the cases with good practices. The only items that affect this life are the following:

- The load on the bearing
- The number of rotations
- The lubrication of the bearing
- The precision installation and repair

We can control each of these four factors, but this is another large article.

### Review

Let’s review the factors to get our pumps to last forever.

### Factor #1: Precision Equipment Ordering Techniques

All pumps must be ordered from the manufacturer with reliability specifications set. The pump should have balance specifications

established when making the order. In the mid 80’s, a major drug manufacturer ordered many pumps for a major expansion. When the pumps arrived they did not meet the balance standards set for them. The pumps were returned, and new balanced pumps were shipped to them. Other items in ordering may be shaft straightness specifications, bearing bore alignment specs, bearing bore tightness, and shaft bearing tolerance. All these standards need verification paperwork to prove these standards. In some critical applications at one grain processing plant, the new shaft material is checked with a predictive technology called “Pulse Echo Wave” that detects defects in new shaft materials that do not show up in standard testing.

### Factor #2 Precision Installation Techniques

Installing pumps using precision techniques add years of service to the components in the motor and pump. It allows you to do precision alignment that cannot be achieved by just bolting the frame to the floor or depending on the factory-shipped base. First the motor/pump assembly must be installed on a machined surface that is very substantial in design. Reliable base thickness for motors is metal that is as thick as the motor foot. This can be compensated by good foundations and grouting the entire base surface to develop a solid base structure. Some highly reliable companies pour footers and pump bases for each pump. These bases are then leveled and grouted under the entire surface and then anchored firmly. This creates a motor/pump base with no movement.

### Factor #3 Precision Alignment Techniques

Precision alignment techniques are a main key to the forever life cycle. It cannot be accomplished without doing some good practice in Factor #2. What is good alignment? Good alignment is not getting it within the 0.003 inch specifications that show up in the coupling



# CROWN SOLUTIONS CUSTOMER NEWSLETTER

information you receive from the vendor. Precision alignment is getting within 0.001 inch in all three planes, horizontal, vertical, and angular. There are 4 methods used in alignment: straight edge, single dial indicator, reverse dial indicator, and laser.

Using a straight edge will get you at best 0.003 inch but only in horizontal and vertical and no better than 0.006 inch angular. Single dial indicators can get you in the 0.003 inch range but it takes many hours to get there. Reverse dial can get you to 0.001 inch in all planes in efficient time with training and experience. Laser can get you to within 0.0001 inch with less training than any other. The advantage of laser systems is that you can easily calculate in thermal growth as you align the components.

There are the bad alignment practices that will mess up any alignment project. Not addressing soft-foot, using old shims, dirty or rusty bases, bent washers, and not using a torque wrench.

#### **Factor #4 Precision Piping Techniques**

Poor piping practices will reduce even the best efforts in alignment. Piping practices where pipes are not properly supported and are causing stresses to be placed on the pump will add stresses to the pump components. Inlet piping should be supported so as to have no weight bearing on the pump. The outlet pipe also needs supported to reduce these stresses. The inlet piping should have no obstructions for 10 pipe diameters in front of the suction of the pump, but this practice is very impractical in the real world and seldom practiced. There should be at least 3 pipe diameters in front of every application and use the next bigger size pipe than the inlet flange.

The key is to keep the inlet flooded with no turbulence. This reduces cavitations and impeller shaft stresses that shorten seal and bearing life.

A fact that I have witnessed with a laser alignment tool is having a pump motor set aligned perfectly and loosening the inlet flange bolts and watching the alignment change by 0.003 inch due to pipe stress.

#### **Factor #5 Precision lubrication standards**

Lubrication is the key to long pump life. The lubrication film between the loaded bearing rollers and races is 5 microns or less. The lubricants we buy from the vendor have 15 micron and larger particles in the new oil. The oil our maintenance people handle probably has 40 micron particles. Our bearings become the devices to grind these particles to below 5 microns. All of our oil should be filtered to 5 microns absolute before installing it in the pump. We should check it regularly and keep it clean by changing or filtering. The vent port should have a desiccant filter to keep moisture out. Clean moisture free oil extends equipment life by 3-5 times.

Oil has a life of 30 years at 70° F. For every 20° F rise in temperature, the life is cut in half. I'm not saying we need to cool all oil reservoirs, but we need to understand that the oil will need to be replaced more often in hot operating conditions. For an application running at 140° F, the oil needs changed every 1.5 years just based on temperature.

So with this information in mind, we can safely say that equipment properly installed can last a life time. *CROWN* keeps these factors in mind as we help our customers to improve reliability in their process areas. ❖



**Crown Solutions Co., LLC**

945 South Brown School Road  
Vandalia, OH 45377

(937) 890-4075

[www.crownsolutions.com](http://www.crownsolutions.com)



Solutions & Technologies