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Stainless Pumps...

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resistance normally provided by the alloy, the enhanced passive film is somewhat thicker and more tenacious than that formed naturally.

To prevent staining of stainless steel and restore the corrosion resistance, finished parts are often given a passivation treatment, which consists of immersing in a solution of nitric acid. For removal of soluble salts, corrosion products, free iron and other metallic contamination resulting from handling or atmospheric contamination, an aqueous solution containing 20 to 50 vol% nitric acid is recommended for CF8M castings. *(See ASTM A 380 Table A2.1 Part II and Part III).*

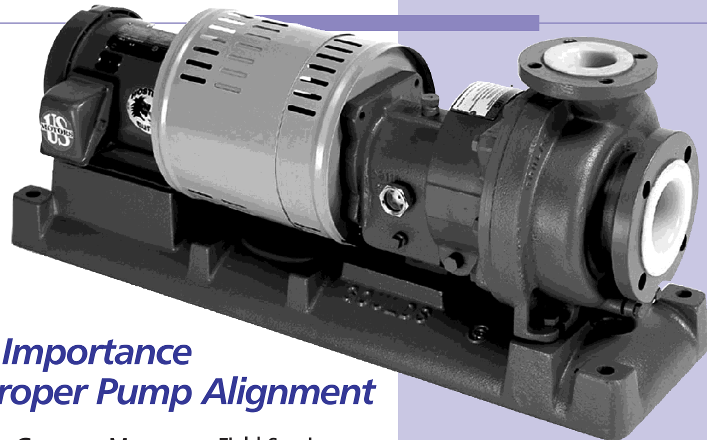
Final Comments

Regardless of treatments used, whether acid pickling, or mechanical cleaning, castings can eventually show signs of rusting if stored outside, due to the settling of ferrous particles or other wind blown contaminants in the environment. For this reason it is important to provide protection and store stainless steel equipment in a dry, iron free environment. An understanding of service conditions and surface cleaning requirements is essential to provide corrosion resistant "stainless" castings.

While it may appear confusing to determine which treatments ought to be specified for specific applications, the ASTM A380 document provides an excellent reference which should be reviewed thoroughly by those specifying, as well as those supplying stainless steel equipment.

Selected References:

1. Standard Practice ASTM A380-96, *"Cleaning and Descaling Stainless Steel Parts, Equipment and Systems;"* Annual Book of ASTM Standards, Vol. 01.03, p 145-156
2. *"Update on Cleaning Stainless Steels"* Staff Report, Metal Progress, June 1973, p 38-60
3. Robert R. Gaugh, *"Descaling and Cleaning of Stainless Steel and Heat Resisting Alloys,"* ASM Metals Handbook Desk Edition, 1985, American Society For Metals, p 29.42
4. C.P.Dillon, *"Cleaning, Pickling, and Passivation of Stainless Steels,"* Materials Performance, May 1994, NACE International, p 62-64
5. Arthur H. Tuthill, and Richard E. Avery, *"Specifying Stainless Steel Surface Treatment,"* NiDi Technical Series No. 10 068, Nickel Development Institute, (Reprint from: Advanced Materials & Processes, December 1992)



The Importance of Proper Pump Alignment

Nicolas Ganzon, Manager – Field Services, PRO Services - Goulds Pumps, ITT Industries

Why Align?

Why should a company embark upon a campaign of quality alignment? One word: Money. In the best case scenario, poor alignment will slowly and continuously suck money from your bottom line. In a worst case scenario, a catastrophic failure will cut your operations day short and cost more in repair and lost production.

Reliable Operation

The most common manifestations of poor equipment alignment are increased vibrations, reduced equipment reliability, or outright failure. Any of these reasons are good enough to justify proper alignment since, what is the use of having equipment if it is broken? If these reasons were not enough, the following list should help:

- Increased vibrations
- Shaft failure
- Bearing failures
- Mechanical seal leaks
- Noise

Poor alignment can seek its revenge anytime, and usually when the most inopportune time.

Operating Cost

The reasons for alignment are most often centered on equipment reliability, and for good reason. Poor reliability is closely associated with equipment downtime; the bain of a process industry. But while equipment reliability is the poster child for proper alignment, there is still a darker side: power consumption. Depending upon the severity of misalignment, increases in power costs between 2% and 9% may be seen. In some cases, it has been reported the power consumption may increase as much as 17% .

The math is simple…A 2% impact on power consumption on a 20 horsepower pump translates into $154 per year in operating costs. A 9% impact is worth $692 per year. These costs affect the bottom line and can be quite significant in a typical process plant with hundreds, if not thousands, of pumps.

Equipment Alignment

Steps

1. **Installation quality** – Good alignment is predicated upon a quality installation. This means proper foundations, base-plate installations and piping. Before mounting alignment equipment, check for the following:

   - **Foundation soundness** – Overall condition of the foundation should be monitored and considered as equipment is aligned. Foundations can change over time, and this can affect the equipment alignment. Compare the quality of the foundation to the alignment records to determine if any problems correlate.
   - **Baseplate installation** – There are a couple of checks that should be performed that may directly impact the alignment: Baseplate-foundation separation, corrosion on the mounting pads, and broken welds or cracked castings.
   - **Pipe Strain** - The ideal condition should be where the piping can be maneuvered into place by hand and axial separation is no more than the gasket thickness ± 1/32". Additionally, the piping should be inspected for proper support during operation.

2. **Soft Foot checks** - Soft-foot is a condition where the pump or motor feet do not contact the baseplate properly. To check for

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soft-foot place a dial indicator on the contact foot of the equipment, and tighten the hold-down bolts. The indicator reading should not change more than .002". Repeat the process for all the other feet.

3. **Alignment** - There are several methods for aligning equipment: dial indicator [rim-and-face], reverse dial indicator, and laser. The Pros/Cons of each method are outlined later. For general process equipment, alignment is attained when the alignment criteria of Table 1 are achieved. As with every rule, there are exceptions:

   - For electric motors, the motor shaft initial (cold) parallel vertical alignment setting should be 0.05-0.10 mm (0.002-0.004 in.) lower than the pump shaft.

   - For other drivers (e.g. steam turbines, engines, etc…) follow the driver manufacturers' recommendation.

Table 1
Maximum Allowable Misalignment

Parallel	Angular
0.05 mm (.002 in.)	0.03 degrees [0.125 mm/cm (0.0005in./in.) of coupling face diameter]

4. **Documentation** - Thorough documentation of the installation checks, final alignment values, and special findings should be made after each alignment. Equipment will move after initial alignment and operation. This information will help trend the movements to help identify any unusual occurrence and its cause.

Methods

While the scope of this article does not allow for the detailed description of each alignment method, there are benefits and limitations to each.

Elements of an Alignment Program

Skills

The ability to properly align equipment is a skill that must be continually practiced. Suffice it to say, purchasing the dial indicators or laser alignment equipment does not make one capable of aligning equipment.

Methods	Pro's	Con's
Dial Indicator [Rim-and-face]	• Relatively simple with good accuracy, especially on short spans • Can be used on equipment whose shafts cannot turn	• Outer diameter of coupling flange [rim] must be smooth and concentric to shaft centerline. • Face of coupling must be smooth and square to shaft. • Accuracy affected by axial movement of shafts
Reverse dial indicator	• Good accuracy with larger spans [e.g. coupling spacers]. • Not affected by coupling concentricity and face perpendicularity. • May be performed without removing couplings	• More complicated than dial indicator or laser. • Shafts must be able to turn
Laser	• Good accuracy • Not affected by coupling concentricity and face perpendicularity • Simple to use	• High initial costs

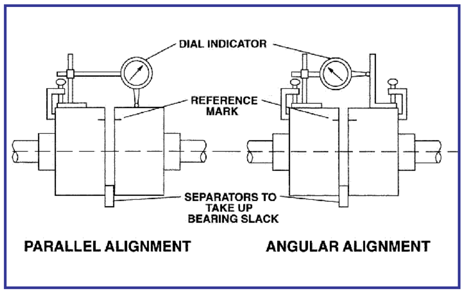
When to align

In general, equipment alignment should be checked after the pump is installed or any changes have been made to the pump, motor, or coupling. This would include repairing the pump, re-tightening loose hold-down bolts, or reconnecting piping to the pump. There are some additional periods in which to perform an alignment check:

- **Before grouting baseplate** - Occasionally a new pump and driver cannot be aligned. Motor feet may become "bolt-bound" when there is not enough clearance between the hold down bolt and the foot-hole to allow movement for alignment. Equipment should be aligned after positioning on the foundation, but before grouting to ensure that they can be aligned properly.

- **After connecting piping and grouting baseplate** - Excessive flange loads can distort the pump and/or pumps pedestal and alter the equipment alignment.

- **Hot Alignment** - After the pump and the piping system have reached their normal operating conditions, alignment should be checked to ensure that thermal expansion has not altered the alignment. Equipment should be aligned to hot conditions.



- **Periodically** - As mentioned earlier, even though equipment may be rigidly tied down, movement over time does occur and this will alter the alignment.

- **Before removing pump from system** - If a troublesome pump needs to be removed for repair, checking the ending alignment will assist in identifying the cause of the problem. If equipment is continually found to be out during these checks, it could mean improper tie-down of the pump/motor, or excessive flange loads.

Conclusion

While it may be a tedious task, proper equipment alignment benefits the reliability and cost effectiveness of a pump installation. Repair costs are reduced as less stress is placed on the equipment, and overall efficiency is improved, as less energy is lost.

Align early and align often for maximum benefits.

Send your comments or suggestions to:
John Beca - ITT Industrial Pump Group, 240 Fall Street, Seneca Falls, NY 13148 or email: jbeca@fluids.ittind.com
View the latest in pumping technology at: www.gouldspumps.com