

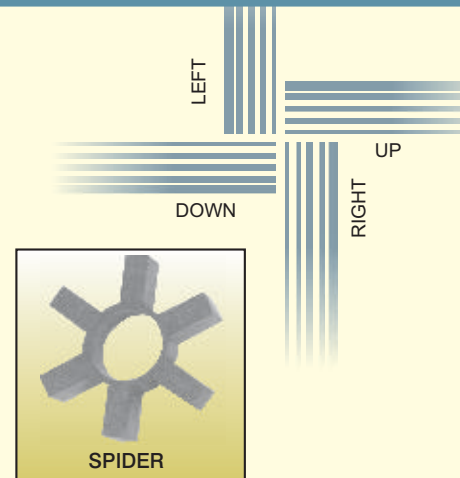
SHAFT ALIGNMENT

It is indeed a tricky and slightly difficult subject, but it has to be done systematically and precisely. The costs involved in improper shaft alignment are too huge for us to be indifferent to its importance.

We briefly describe the consequences of improper Shaft Alignment.

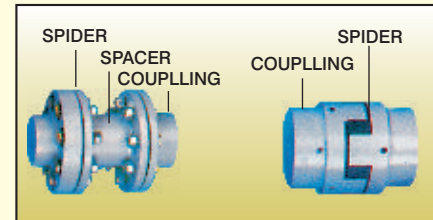
1. FREQUENT REPLACEMENT OF SPIDERS : Couplings can take some misalignment, but spiders tend to fail prematurely. In spacer type couplings it takes 15-20 minutes to replace the spider, in non-spacer couplings it takes a minimum of 02 hours, since the coupling has to be removed from the Shaft, Spider replaced and motor re-aligned.

Cost : a) A few hundred to a few thousand Rupees. (of Spider)
 b) Man power - A few hundred rupees.
 c) Downtime - Production loss, a few lakhs.



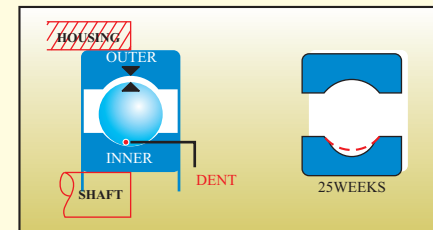
2. REPLACEMENT OF COUPLINGS : Nothing should happen to couplings since they are robust. If we do not replace spiders in time, eventually couplings get damaged.

Cost : a) A few hundred to a few thousand Rupees. (of Coupling)
 b) Man power - A few hundred rupees.
 c) Downtime - Production loss, a few lakhs.



3 FREQUENT FAILURE OF BEARINGS : Misalignment causes hammering within the rolling elements/races. The internal parts of bearings get damaged and slowly but steadily clearance between rolling elements/races increases. This increases the vibration, leading to accelerated wear. In a few months the bearing is gone.

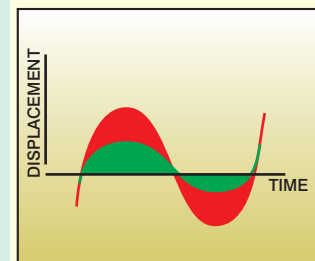
Cost : a) A few hundred to a few thousand Rupees. (of Bearings)
 b) Manpower : A few hundred rupees.
 c) Downtime : Production loss, a few lakhs.



4 VIBRATION : This is a bigger phenomenon, misalignment is one contributing factor.

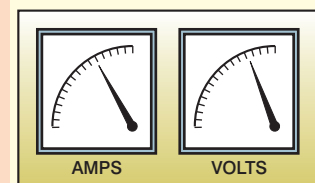
The other factors are :

1. Looseness of bolts/nuts in driver/driven equipment
2. Bent shaft : This is mainly due to improper procedures of dismounting
3. Improper balancing of Rotors, Impellers, Coupling, Gears, Pulleys etc.
4. Hydraulic forces within the pump
5. Continued vibration can cause fatigue failure o shaft. In this case the shaft acts like a spring, subject to cyclical compression & tension which will mean that eventually a part of the shaft will shear from the neck.
6. Vibrations are not easily absorbed by earth & get reflected back to adjacent machines. **THIS MEANS ADJACENT MACHINES WHICH ARE OTHERWISE O.K. WILL ALSO START FAILING PREMATURELY. HENCE VIBRATION IS COMPARED TO CANCER WHICH SPREADS RAPIDLY.** You will now appreciate how important it is to control vibrations, especially in bigger machines (more than 40 HP)



5) POWER CONSUMPTION : There is considerable data based on research internationally on effects of increased power consumption vis a misalignment. A rule of Thumb is Appx. 2 to 2.5% on an average. Power consumption is significant is large machine (40 HP & above). The savings in terms of power consumption alone justifies INVESTMENTS in the required tools & training vis a vis shaft alignment.

$$\text{POWER} = V \times I \times \text{Cos } \phi$$



Alignment of shafts

Misaligned shafts will often cause problems with components in the machinery. **Investigations made in USA have shown that misalignment can be traced as the cause of about 50 % of the breakdown in rotating machinery.**

Organized and implemented alignment of the shafts therefore is a **very profitable form of preventive maintenance.**

Two basic types of misalignment

The basic types of misalignments are parallel (offset) and angular. In practice these always occur in combination. The objective with shaft alignment is to adjust two units of rotating machinery so that the shaft of the units are in a straight line.

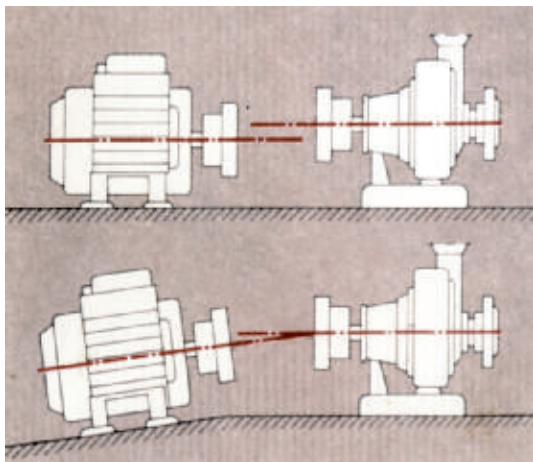
Misalignment and bearing life

The function and reliability of a machine depends to a large degree on how well its shafts are aligned.

Misaligned shafts generate a moment which creates a reaction force in the bearings of the drive and driven units. **A 20% load increase**

from misalignment reduces the calculated bearing life by almost 50%. Another serious effect is the wear on seals which will increase the risk of additional damage to the bearing by intrusion of contamination or leakage of the lubricant.

It is easy to understand that implementation of a well organized alignment program for critical machines will save cost and trouble. The service life of both bearings and seals will improve. Other spin-off effects are less vibration, noise and energy consumption.



Misaligned shafts may cause:

- increased bearing load,
- reduction of bearing life,
- increased wear of seals,
- increased vibrations,
- increased noise, and
- increased energy consumption,
-

which will be avoided by proper shaft alignment.