

## **Special Application Conditions** - Vertical shafts (continued)

It is necessary to use an appropriate threadlocker on **ALL** setscrews because the continuous expansion and contraction of metals, however slight, cause threaded products to vibrate loose.

For reversing vertical applications, a polymer thrust washer and split locking collar will be require below one bearing assembly (see Fig 21-2, page U-21).

### **Vibration & Impact**

Vibration and impact cause problems in multiple ways. These problems manifest themselves differently under varying conditions, so they are addressed here separately.

How **vibration** affects any bearing will depend on the frequency and amplitude (strength) of the motion. A plane bearing operates with *freeplay* in the bearing so it can rotate or slide. This *freeplay* allows the shaft to shuttle back and forth in the bearing which can cause damage to the bearing and possibly to the machine. *Freeplay* can be a major source of heat in a bearing that can lead to early failure.

Rolling element bearings encounter this same *freeplay* action, although to a much lesser degree. The condition of the bearing races quickly become a serious issue when the shaft is loaded and then unloaded in the bearing; in some cases, this will cause the races to crack and fail.

Clearly, it is best to try to identify the source of the vibration and control it at the source as much as is possible. If that cannot be done, then high frequency vibration is most effectively handled by utilizing a preloaded rolling element bearing.

**Impact** load is different from higher frequency vibration and is generally better handled with plane bearings than ball bearings. There are a lot of issues to be considered here such as the choice of material that is necessary to perform in other parameters of the application. As a rule of thumb, higher performing materials are harder and more brittle while lower performing materials generally are softer and much more impact resistant. Fortunately, high impact situations usually do not require use of higher performing materials.

Rolling element bearings have hardened races in order to support the movement within ball bearings – the end result of hardening is more brittleness. Impact applications are normally solved with plane bearings than with rolling element bearings. As with all other harsh applications, vibration and impact will loosen setscrews, so an appropriate threadlocker is required.

### **Drive Design**

Some drive designs are easier on bearings than others. Many systems are designed with a cantilevered drive but this type of design loads the bearing unevenly. Whenever possible, drives should be placed BETWEEN a pair of bearings. If a cantilevered design is required, the pair of bearings supporting that drive shaft should be separated as far apart as practical.

Whenever possible, shaft mounted gear reducers should have some support that relieves the cantilevered shaft as the sole support.