1. They are not installed properly

Improper installation with precision face not against the adjacent component

There are a number of potential issues that arise during installation. First, the screw may not be properly seated. Under torquing will cause reduced holding power and risk backing out under vibration or shock loads. Over torquing may lead to permanent deformation and stress cracks of the collar causing uneven surface contact and reduced holding power or complete failure. Second, they are not installed with the precision face seated against the bearing face. As far as we know, we are the only manufacturer that takes the extra care to precision face your shaft collar. Ruland indicates the precision face with a groove that should always be installed against the mated component.

2. Wide shaft tolerance

Shaft collars are designed to fit nominal shafting. Ruland’s recommended shaft tolerance is +.000” (-0.050mm) / -0.015” (0.05mm), however, collars are often used on worn, old, or remachined shafts or tubing which have less strict tolerances. This creates a situation where the shaft collar may feel over- or under-sized when installing depending on where the shaft is within the tolerance range negatively impacting holding power and component alignment. An oversize may require you to use a screw driver to pry open the collar and slide it on the shaft causing permanent damage to the collar. An undersized shaft may cause you to try and tighten the screw as much as possible to get it to fit leading to over torque and failure.

3. Set screw material is softer than shaft material

Set screw shaft collar holding power is derived from the screw biting into the shaft. To do this the screw material must be harder than the shaft material. If your shaft is hardened (typically Rockwell C 48-55) a set screw shaft collar can not be used. If your shaft is unhardened it must have a rating less than Rockwell C 40 for proper use with steel screws or Rockwell B 80 for stainless steel screws. Ruland alloy steel set screws have a rating of Rockwell C 50 and stainless screws have a rating of Rockwell B 96. The shaft material being harder than screw material is most evident in applications where the shaft collar is being used as an axial stop or vibration is present. It will cause the screws to back out and the shaft collar will fail.

4. Poor hardware

Hardware is the most important part of the shaft collar. It is where they derive all of their holding power. The primary considerations of hardware are tensile strength of the material, lubrication, thread quality, and tightly held geometry and size tolerances. If any of these are compromised it will negatively impact performance. For example, lubrication can be altered by adding thread locking compounds, high pressure lubricants, moly grease or special plating. Any of these can lead to set screw, deformation of the screw thread thereby breaking installation, breaking off of the screw or screw backing out during installation, and screws backing out during operation. Another hardware consideration is the use of forged or brazed sockets. Screws with brazed sockets are often used with set screw shaft collars as a cost reduction measure. They are less consistent and more susceptible to reaming out.

5. Poor design

Shaft collars are viewed as simple components, but there is a lot of design work that goes into properly manufacturing them. Sizing of the bore, width, outer diameter, and screw are critical to proper function. If any of these are over- or undersized in relation to each other it will lead to reduced holding power and the collar may not function correctly. An example is the intent to increase holding power by designing an oversized outer diameter. Increasing the outer diameter without comparable changes to width and screw size will force the screw to use more of its torque to bend the excess material around the shaft. This leaves less torque available for clamping forces relative to overall holding power. Another example is using set screws in clamp type shaft collars. There are standard product lines available on the market that use a one- or two-piece clamp type collar with a set screw in the OD for increased holding power. The addition of a set screw actually works against the clamping forces present in clamp shaft collars reducing holding power. For every action, there is an equal and opposite reaction also known as Newton’s Third Law.

6. They are misapplied

This is the most common reason shaft collars fail. Since they are viewed as simple components enough time is paid to proper selection. The designer must consider how the shaft collar is going to be used – guide, spacer, axial stop, component alignment, etc. — and what the application requirements are — temperature, holding power, shaft type, ambient environment, etc. —. An example of this is using a set screw shaft collar in an application that requires frequent repositioning. Set screw collars will mar the shaft if properly used and are almost impossible to adjust in small increments. Most likely the shaft will have to be replaced after a few adjustments resulting in down time and higher long term system maintenance costs.

7. Shaft collar is not precision faced.

Shaft which has been manufactured using a two-piece collar. This may not always be a viable alternative, but will give you more control of the tolerance and works well when the collar is in a fixed position. Before making any design alterations to your shaft be sure it will not impact performance of the shaft. Should you plan to reposition the shaft collar on a regular basis a special design may need to be considered.

THE FIX

Consult your manufacturer for the proper screw seating torque and use a torque wrench for installation. Ruland publishes all installation instructions here on your product page. Additional installation information and other useful tips can be found in our inside story.

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Always test your design and consult with a reputable manufacturer if you are making any changes to hardware or dimensions.

Consulting a shaft collar article that highlights all of the design considerations to make when choosing a shaft collar.

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