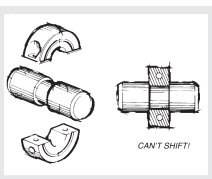
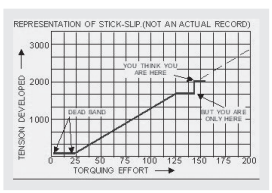
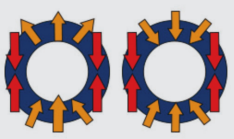
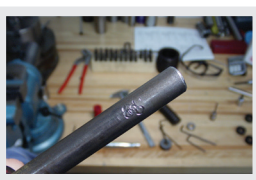
THE 7 REASONS	THE FAILURE	THE FIX
1. They are not installed properly  Improper installation with precision face not against the adjacent component	There are a number of potential issues that arise during installation. First, the screw may not be properly seated. Under torquing will cause reduced holding 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.	Consult your manufacturer for the proper screw seating torque and use a torque wrench for installation. Ruland publishes all installation instructions here or on your part's product page. Additional installation information and other useful tips can be found in our Inside Story.
2. Wide shaft tolerance  Representation of an undercut shaft	Shaft collars are designed to fit nominal shafting. Ruland's recommended shaft tolerance is +.000" (.00mm) / -.002" (.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 undersized when installing depending on where the shaft is within the tolerance range negatively impacting holding power and component alignment. An oversized shaft 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.	Consider using precision shafting. This is the best way to ensure full shaft collar performance. If nominal shafting is not an option and your shaft can not be replaced you can put an undercut in the shaft and use a two-piece shaft 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.
3. Set screw material is softer than shaft material  Left: Deformed set screw after being installed on a hardened shaft. Right: Set screw after being installed on a Rockwell C 40 shaft.	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 86 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.	Install the shaft collar then remove the screw and examine. In the event you can not separate the collar from the shaft a hammer may need to be used. If the rim around the cup point is flattened, you most likely have shaft material that is harder than screw material. Consider using a clamp type shaft collar to avoid this problem.
4. Poor hardware  Representation of stick-slip	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 stick-slip, deformation of the screw threads during installation, breaking off of the screw head during installation, and screws backing out during operation. Another hardware consideration is the use of forged or broached sockets. Screws with broached sockets are often used with set screw shaft collars as a cost reduction measure. They are less consistent and more susceptible to reaming out.	Forged sockets are generally superior to broached and allow for more consistent performance of the shaft collar. Consult with your manufacturer prior to shaft collar selection as this is not always stated in their specifications. At Ruland, we only used forged sockets and call them out here for set screws and here for clamp screws. Our clamp screws (SHCSs) test beyond industry standards allowing for maximum torque capabilities. Full hardware information can also be found on your product's page.
5. Poor design  Left: Representation of two-piece collar with set screw. Right: Representation of standard two-piece collar.	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 reducing 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.	Always test your design and consult with a reputable manufacturer if you are making any changes to hardware or dimensions.
6. They are misapplied  Shaft which has been marred due to repeated installation of a set screw shaft collar.	This is the most common reason shaft collars fail. Since they are viewed as simple, not enough design 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.	Review application parameters carefully before selecting a shaft collar. We wrote the definitive shaft collar article that highlights all of the design considerations to make when choosing a shaft collar.
7. Shaft collar is not precision faced.  Shaft collar used as a mechanical stop on a cylinder.	We talked a little about precision facing above, but it needs additional detail as it is critical to performance. Precision facing ensures the face of the shaft collar is perpendicular to the bore. It is an important factor when selecting a shaft collar for use in a component alignment or axial stop application. Cylinders are a good example of why precision facing is important. The shaft collar is meant to limit the stroke of the cylinder. If the face is imprecise it can lead to uneven contact with the cylinder head causing the collar to "walk" down the shaft and a longer stroke. Over time you will lose positioning in the application which will degrade system performance.	Precision facing is measured by TIR. The closer you are to zero the more precise the face. Ask your manufacturer what their TIR is as most do not publish this information. We do put this number on our site since it is a valuable part of product performance. Ruland TIR on most shaft collars is ≤ .002" (.05mm). We created an in depth video on product performance and runout which can be viewed here. Bearing locknuts have a more precise face due to their use in high precision applications. Heavy duty shaft collars have a wider tolerance.