

# COUPLING RECERTIFICATION INCREASES PLANT RELIABILITY

## COUPLING FUNDAMENTALS

Regularly scheduled inspections, preventative maintenance and condition monitoring can assist in the early identification of potential problems, preventing damage to the coupling and connected equipment. There are a number of maintenance strategies that can be used to identify and prevent coupling failures and each methodology comes with pros and cons. The best strategy for an auxiliary pump will differ significantly from that of a 50,000 HP steam turbine compressor train.

A coupling will achieve its maximum service life when operated within its designed alignment and torque ratings. It is impossible to determine the precise loading of a coupling, since the combination of stresses due to torque and misalignment cannot be accurately quantified. Detrimental operating conditions as a result of inaccurate thermal growth offsets, shifting equipment foundations or high torsional oscillations, will shorten a coupling's effective service life if the load case exceeds the as-designed values.

### Key Points

- Visual coupling inspections should be performed during scheduled turnarounds.
- Kop-Flex® recertification is the best policy to achieve maximum uptime for critical equipment.
- Recertifications can be performed during a plant turnaround, resulting in a "like new" coupling for 50-60% the cost.

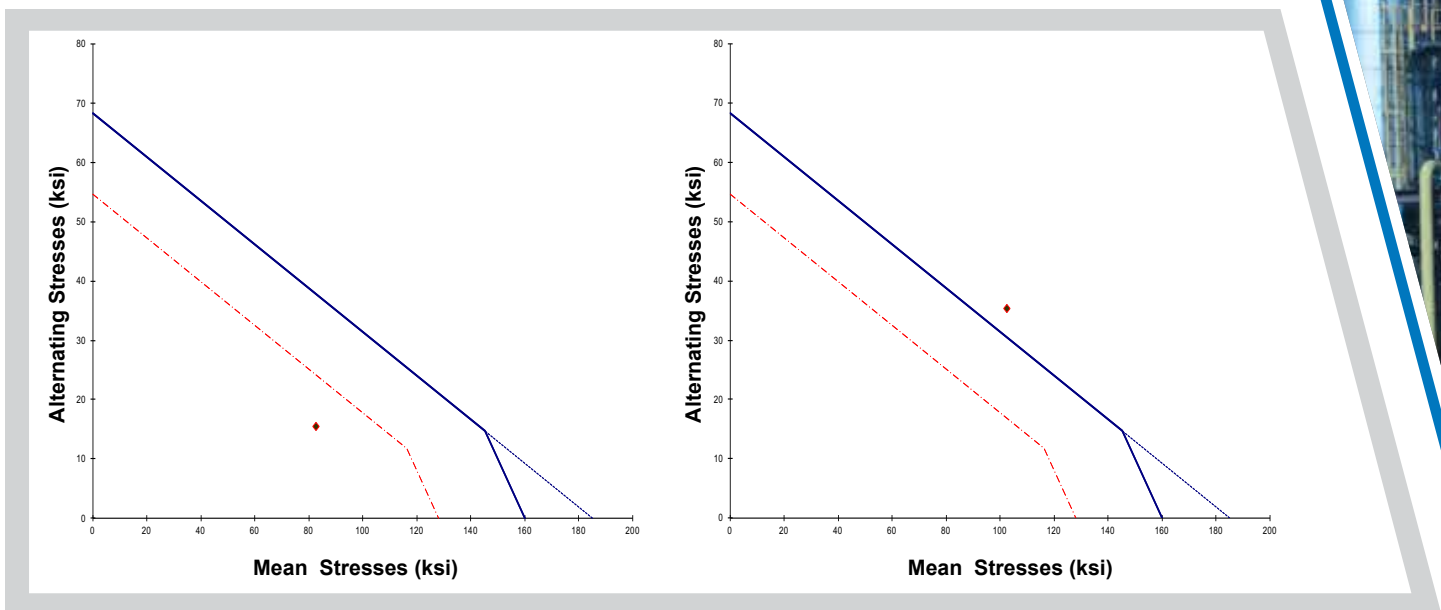


Image 1 – Comparison between Goodman Diagrams of “as designed” and possible real world load case (indicated by the red dot) where infinite life is no longer achievable.

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The coupling Safety Factor is applied to address uncertainties during the coupling design process. Industry trends have resulted in an increased interval between plant turnarounds and more operating hours on equipment between service. The following circumstances may contribute to an accelerated reduction of the coupling safety factor during extended operating periods.

- Corrosion
- Contamination
- Operating in high temperatures
- Damage from coupling handling
- Fretting between disc packs



Corrosion



Contamination



Fretting



Damage from handling

### INSPECTION CRITERIA

For critical equipment, scheduled turnarounds provide the best opportunity to perform a visual inspection of a coupling in service. These inspections are inherently invasive and cracks in the disc pack may not be visible without the removal and disassembly of the coupling. Condition monitoring is therefore the most widely used strategy for critical equipment.

For example, the typical failure mode of a disc pack due to excessive misalignment is “unraveling” from the outermost discs (where the stresses are highest), inward. This results in a decreased torque capacity given fewer remaining discs, and also introduces a coupling imbalance which can be identified in the 1X frequency. As vibration trends up over time, the issue can be identified and the equipment shut down safely, typically avoiding catastrophic failure. However, if a transient misalignment or torque is severe enough to cause the discs to fail, it can happen too quickly for the fault to be identified and equipment shut down safely.

For non-critical equipment, periodic visual inspections of the disc packs may be a sufficient strategy to keep your equipment

running. These inspections can be done under a strobe while the equipment is running, but it is strongly recommended that the equipment be stopped and locked out to ensure safety. Kop-Flex should be contacted if any anomalies are found and the following criteria should be considered to determine if the coupling is fit for continued service:

- Spreading at the disc pack bolt or in an individual link
- Spreading in two consecutive disc pack links
- Cracked discs
- Loose disc pack bolts



Image 3 – Unacceptable spreading in disc pack

For a diaphragm flex element, the following inspection criteria should be considered and Kop-Flex contacted in the presence of any anomalies:

- Scratches, gouges or nicks on the diaphragm profiles.
- Presence of rippling effect along the diaphragm profile, indicative of a torque overload (Image 4 below).
- Excessive runout between diaphragm flanges indicating yielding.



Image 4 – Rippling on diaphragm profile due to torque overload.

Field replacement of flex elements or factory recertification are the primary maintenance options available to rotating equipment managers. For lower speed, non-API 671 applications requiring a quick turnaround, field replacement of the disc packs may be ideal. For critical applications, Kop-Flex® recertification resets the damage accumulation the coupling may have endured while operating under severe loading conditions and returns the service factor to the original as designed value. By addressing these issues, greater rotating equipment reliability can be achieved and plant uptime maximized.

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### COUPLING RECERTIFICATION

Kop-Flex has service facilities in the U.S.A. and Europe, which are committed to keeping your equipment running. Each service center has dedicated service operations that offer part cleaning, precision measurements, non-destructive testing and balancing equipment. Since the coupling is subjected to rigorous inspection and testing procedures, we feel as confident in a recertified coupling as a new coupling shipped from our shop. Whether the coupling is in need of design modifications requiring the manufacture of new components, or routine repairs to address hub bore damage and balancing, it will be returned to the customer with the same warranty as a new coupling. Additionally, if an update to the coupling drawing has occurred, new parts can be fabricated and balanced with the coupling assembly as well.

After a visual inspection and confirmation of the returned parts, a mechanical evaluation is performed on all critical dimensions such as the mating male and female pilots. The pilots are designed with a slight interference fit in order to maintain concentricity between parts. Wear on the pilots will increase with each installation, which may lead to balance issues. Additionally, Magnetic Particle Inspection (MPI) is performed on all major components, as seen in Image 4.



Image 4 – Spool piece undergoing MPI

While tapered hub/shaft interface connections typically allow for easy installation and removal of the coupling, installation and removal problems may arise. Light drag marks such as those seen below (Image 5), can be dressed and repaired while maintaining the original tolerances of the part. If the drag marks are too severe to be repaired, a new hub can be machined and balanced with the existing parts later.



Image 5 – Repairable bore damage

If the coupling components are found fit for future use, they are cleaned using glass bead blasting which removes surface rust, eliminates the need for skimming the parts and produces a ~ 45 RMS surface finish (Image 6).



Image 6 – Coupling hub before and after bead blasting

Once the components have been inspected and cleaned, they are reassembled with new disc packs, disc pack hardware, and flange hardware and re-balanced to the original specifications of the coupling (Image 7). The balanced coupling is then treated with a corrosion preventative and packaged in a custom wooden crate for return shipping.



Image 7 – Rebalancing coupling

A coupling recertification can be performed during a plant turnaround, resulting in a “like new” coupling for 50-60% the cost. While numerous maintenance strategies are available, the Kop-Flex® recertification program is the only way to guarantee the replacement coupling is as good or better than the original.



Image 8 – Recertified coupling from old to new





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you could get a like-  
new coupling for less?

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## KOP-FLEX®

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The proper selection and application of power transmission products and components, including the related area of product safety, is the responsibility of the customer. Operating and performance requirements and potential associated issues will vary appreciably depending upon the use and application of such products and components. The scope of the technical and application information included in this publication is necessarily limited. Unusual operating environments and conditions, lubrication requirements, loading supports, and other factors can materially affect the application and operating results of the products and components and the customer should carefully review its requirements. Any technical advice or review furnished by Regal Beloit America, Inc. and its affiliates with respect to the use of products and components is given in good faith and without charge, and Regal assumes no obligation or liability for the advice given, or results obtained, all such advice and review being given and accepted at customer's risk.

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