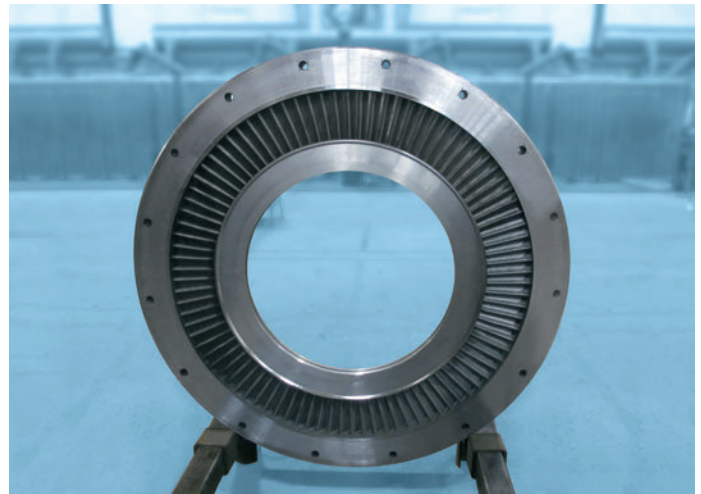


# DISHED DIAPHRAGM REPAIR OPTIONS

## MD&A Turbine-Generator Repair Facility

Depending on the severity of Dishing (Deflection) of a Diaphragm, there are a number of repair options that can be considered that vary in cost and cycle. The following outlines the causes of diaphragm dishing and the various repair alternatives that can be considered based on the Deflection found.



### Causes of Diaphragm Dishing / Deflection

- Inadequate base material and/or weld filler material creep strengths.
- Inadequate original geometric design stiffness and/or structure.
- Inadequate size and/or placement of the main structural welds.
- Poor quality and/or lack of fusion of the main structural welds.
- Over temperature operation.

### Minimal Dishing / Deflection Options

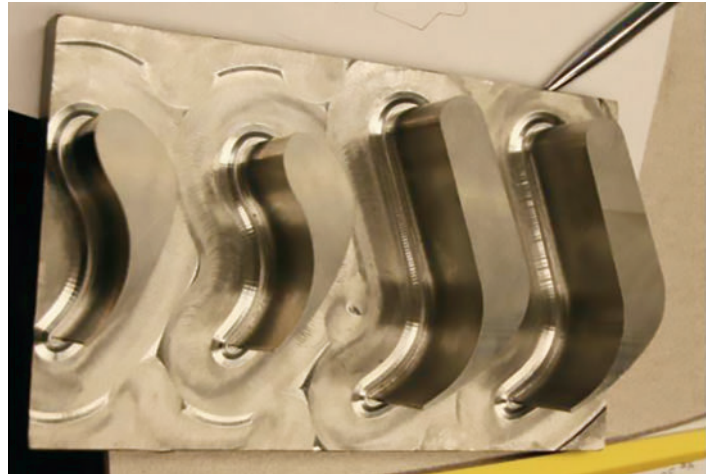
- **Steam Seal Face Insert** – Reposition the diaphragm up-stream to the correct axial position by installing an insert in the steam seal face.
- **Offset Packing / Spill Strips** – Supply new “offset geometry” packing segments and tip spill strips to re-establish the correct axial clearances between the rotating and stationary components.

- **Skim Cut Machining** – Machine the discharge side of the diaphragm inner web to increase tight axial clearances to the rotating wheel.
- It should be noted that minimal dishing repair options do not address the fundamental root cause of the dishing, and over time, experience indicates that the dishing will continue.



### Severe Dishing / Deflection Options

- **Dishing Weld Repair** – A diaphragm dishing weld repair involves the removal of the admission and/or discharge side structural welds, re-positioning the diaphragm inner web ring back into the correct axial position, re-welding the structural welds using a proven weld process to ensure good weld fusion and penetration, stress relief, and final machine. If applicable, improved size and/or placement of the main structural welds and improved weld filler material creep strengths can be applied.
- **Manufacture New Replacements** – Supply of replacement diaphragms involves the reverse engineer of the diaphragm(s), procurement of the materials, and producing the replacement diaphragm(s) off critical path, allowing manufacture of new diaphragms prior to the next outage. Again, if applicable, improved size and/or placement of the main structural welds and improved base material / weld filler material creep strengths can be applied.
- **Incorporate Improved Stiffness Features** –Improved stiffness features can be incorporated into either the repaired and/or new replacement diaphragms, depending on the original geometry. Improved stiffness can either include longer “high” partitions or the addition of bridges to increase stiffness and structure of the diaphragm.



### Solving Your Problem

In the event diaphragm dishing appears to be present, MD&A will work collectively with each customer to help determine the most appropriate repairs based on each customer's unique circumstances. MD&A's turbine-generator experts will evaluate the data with you, determine the degree of dishing on each diaphragm, and propose cost effective repair options that fulfill short term and long term reliability.

#### MD&A TURBINE-GENERATOR REPAIR FACILITY

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