75 MW Turbine-Generator Journal-Thrust Bearing Upgrade

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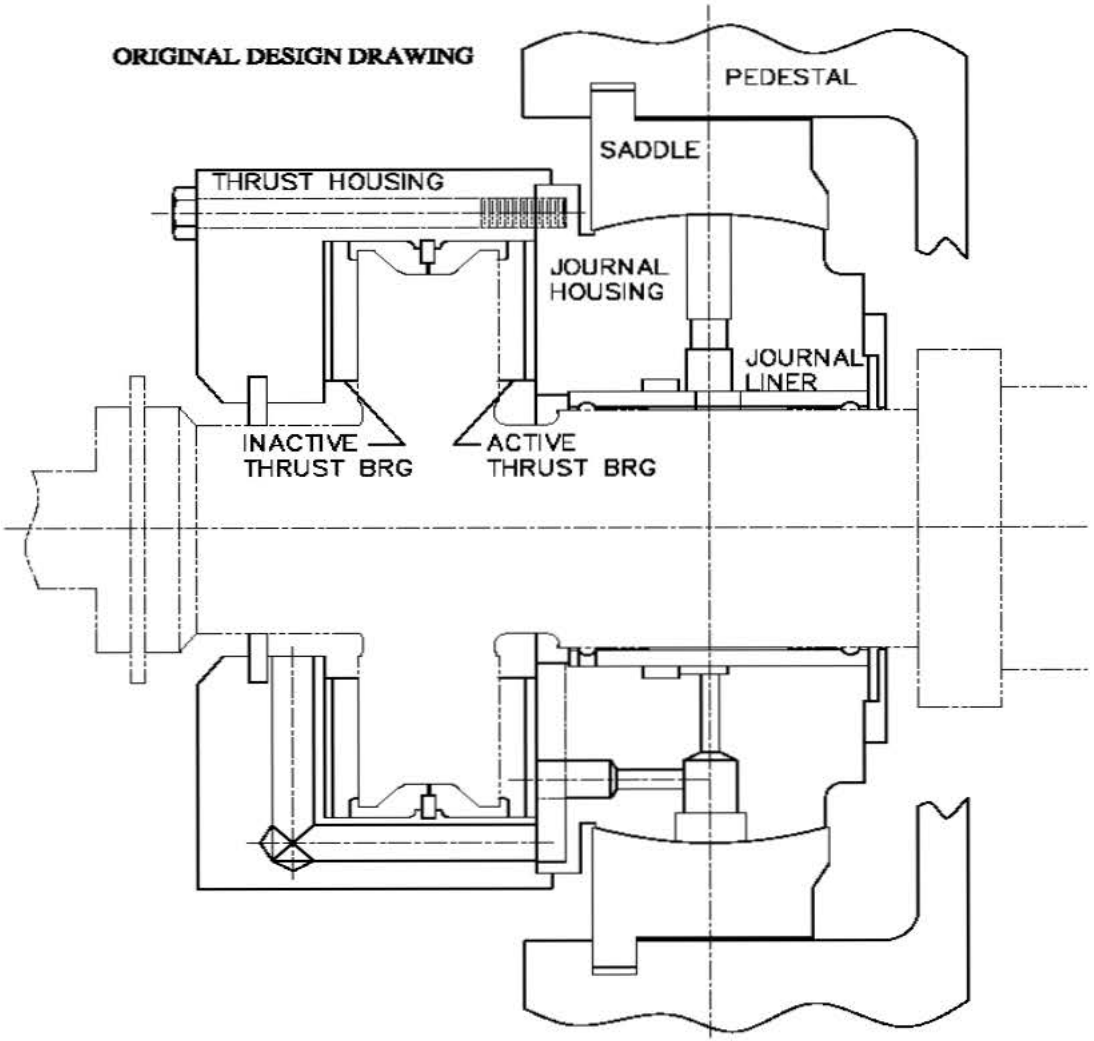
ABSTRACT

This case history discusses the upgrade of the #1 combination journal-thrust bearing assembly in the front standard of a 75 MW turbine/generator set. The existing taper land thrust plates experienced frequent failures and the sleeve journal bearing was wearing prematurely.

A combination journal-thrust assembly was designed and installed in the front standard of the turbine. This assembly incorporated fully equalized ball & socket tilting pad thrust bearings with directed lubrication and a ball & socket tilting pad journal bearing. The spherical support fit was replaced by a cylindrical support fit. The ring saddle supporting the journal housing was redesigned to be bolted to the thrust housing.

The Turbine-Generator Train

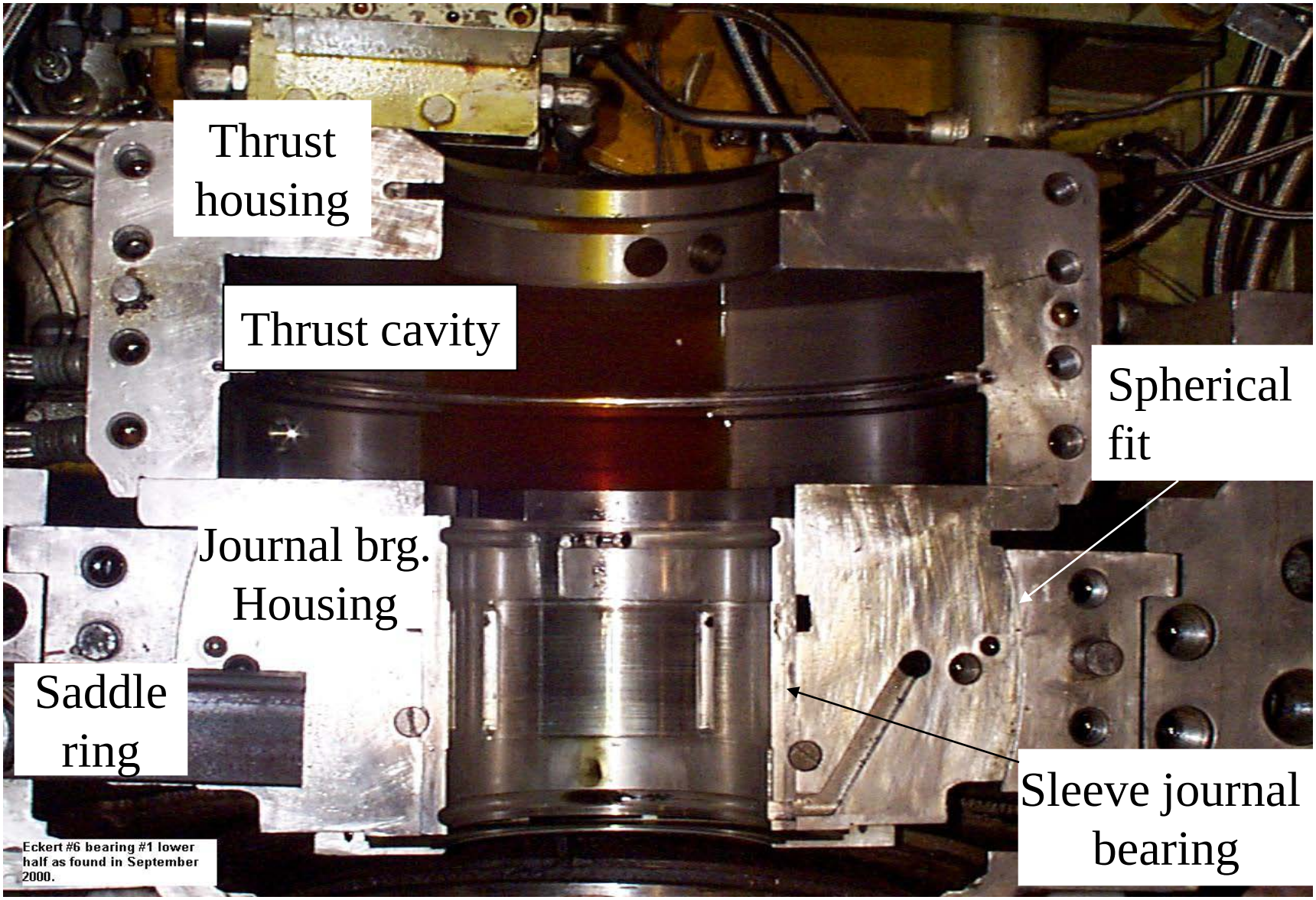
Turbine – Front Standard



Bearing description:

The original bearing is a combination journal-thrust, with compound taper plate thrust bearings, and a sleeve liner for the journal bearing. The thrust bearing assembly is overhung. The thrust housing is bolted to the journal bearing housing which is spherically fitted inside a saddle ring, supported by four OD pads with adjustment shims underneath.

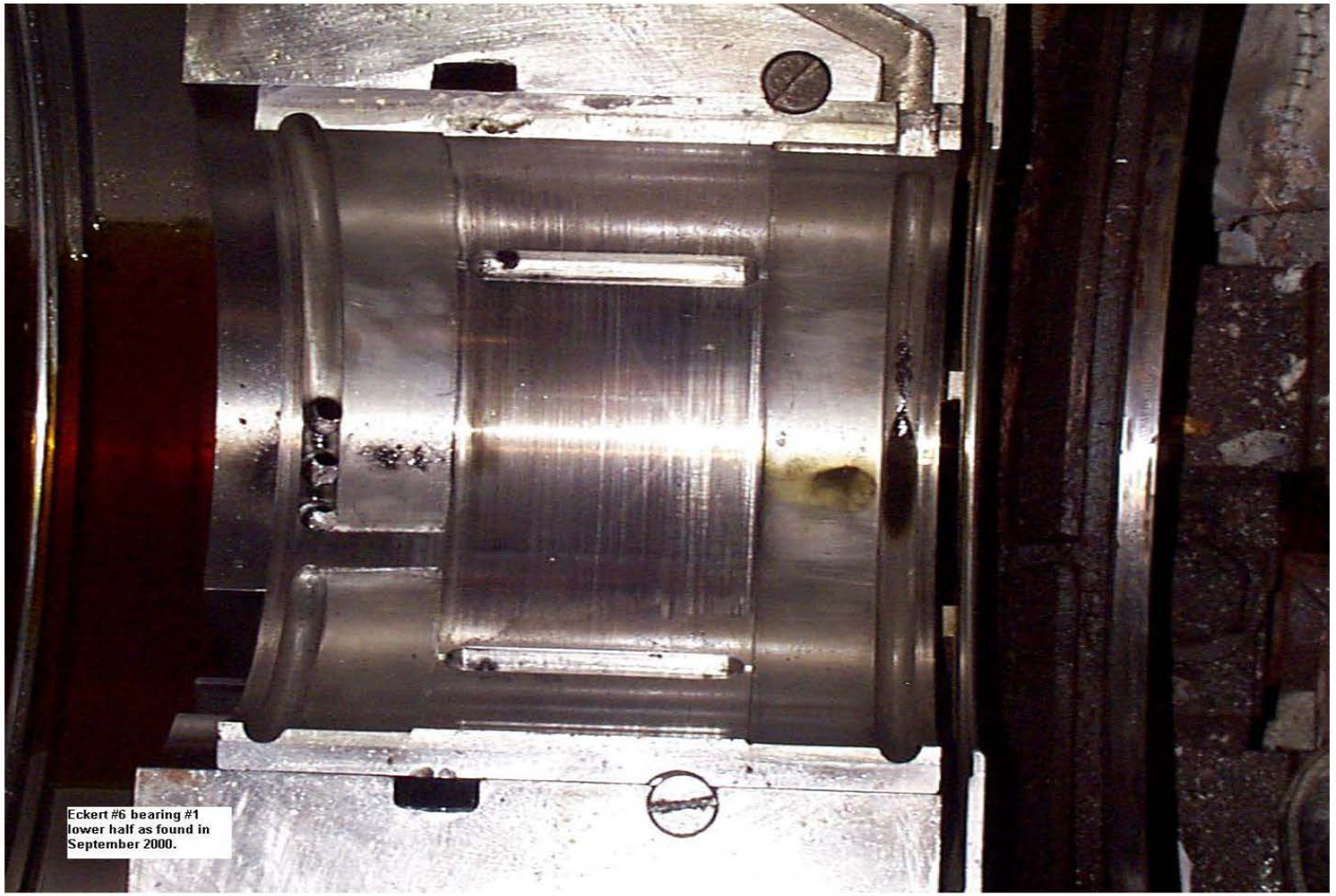
OEM bearing assembly without the thrust bearings



Problem:

The original bearings had unsatisfactory resistance to the loads, the misalignment, and the lack of effective axial movement of the front standard. Due to erosion of the sliding supports, the supports could not slide and the front standard would not properly align with the shaft. This resulted in numerous failures of the thrust and journal bearings and forced outages.
The spherical fit of the bearing housing assembly did not help with the alignment.
Due to alignment concerns, the journal bearing was set low, so the bearing was lightly loaded which resulted in oil whirl and oil whip, damaging the journal bearing and the shaft.

Damaged journal bearing



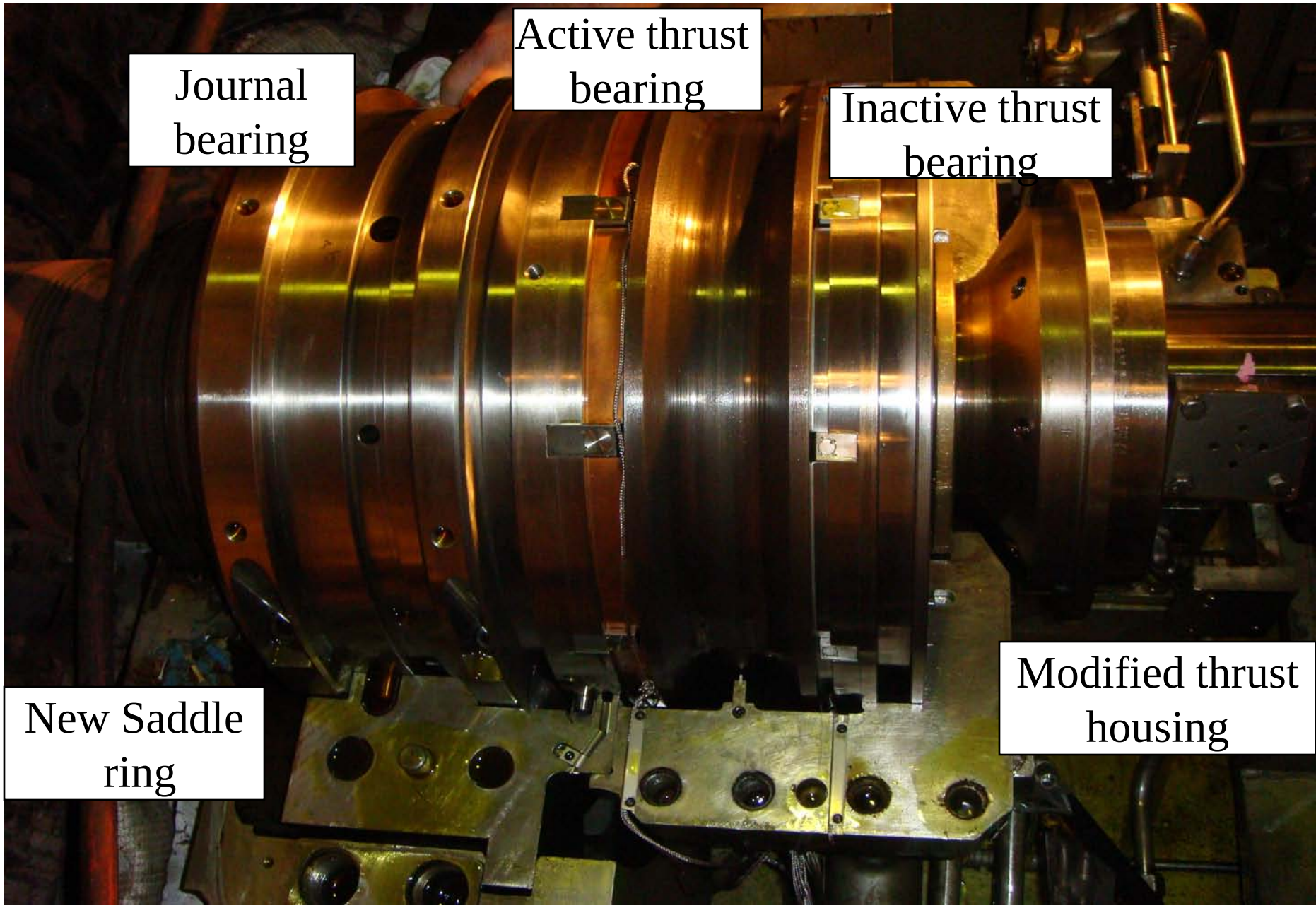
Active Thrust Plate with light wear and major failure.

Solution:

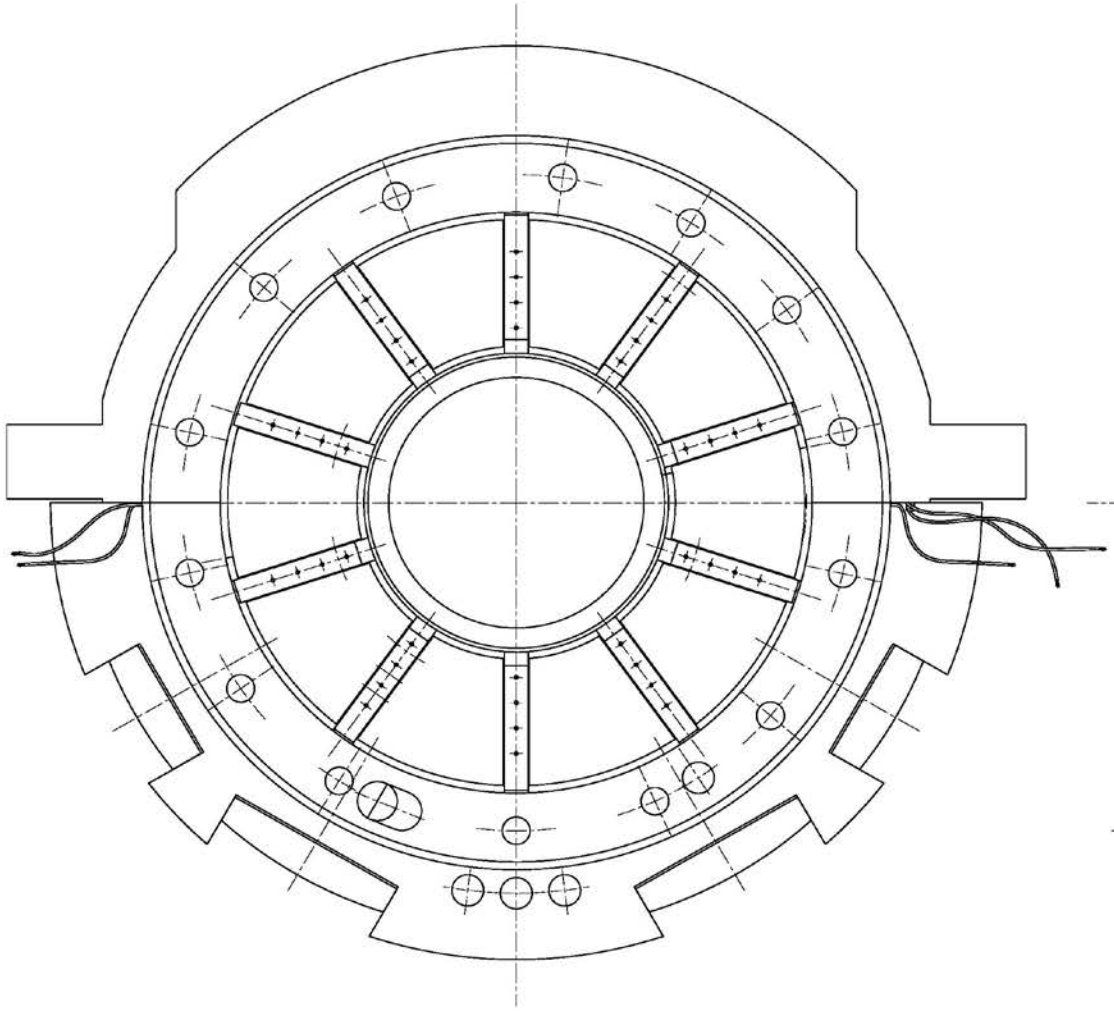
A combination journal-thrust assembly was designed and installed in the front standard of the turbine. This assembly incorporated fully equalized ball & socket 56% offset pivot tilting pad thrust bearings with directed lubrication, a ball & socket tilting pad journal bearing, and a new saddle ring.

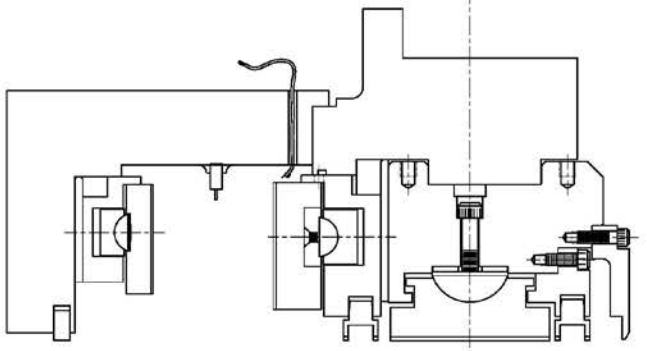
The new saddle ring has a cylindrical fit for the journal bearing assembly, and it is bolted to thrust housing. This allows much simpler settings, installation, and maintenance of the whole assembly.

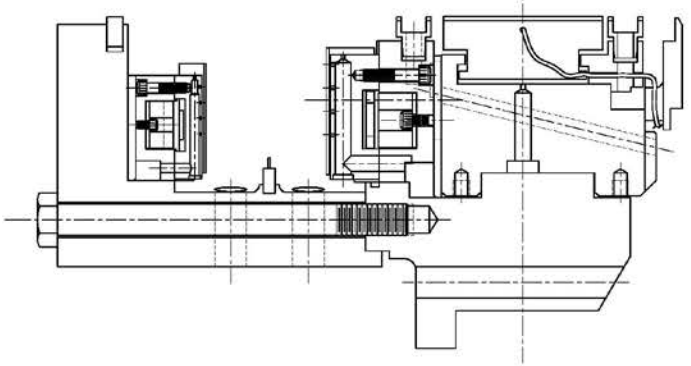
Upgraded Bearing Assembly



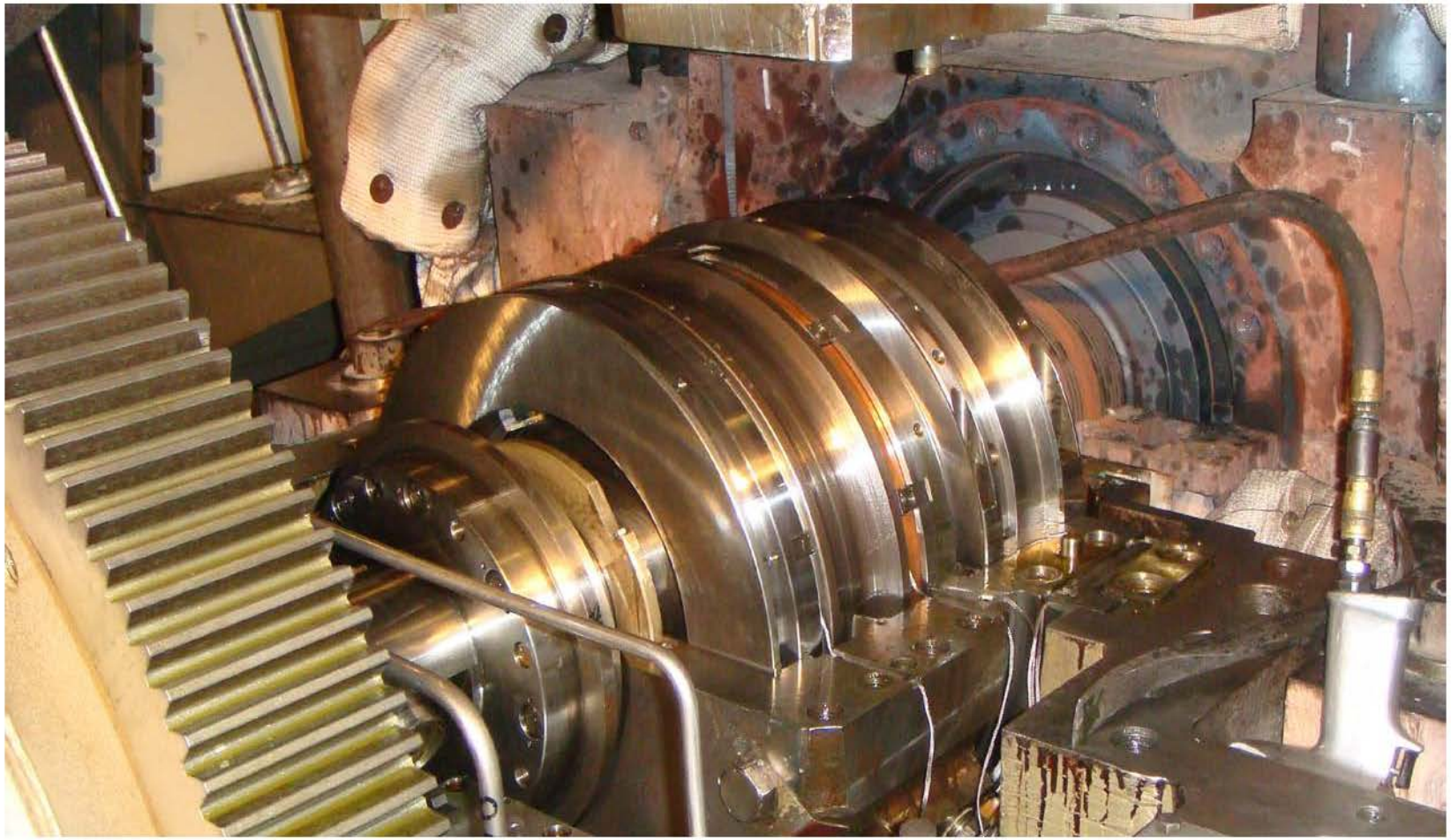
New design assembly drawing



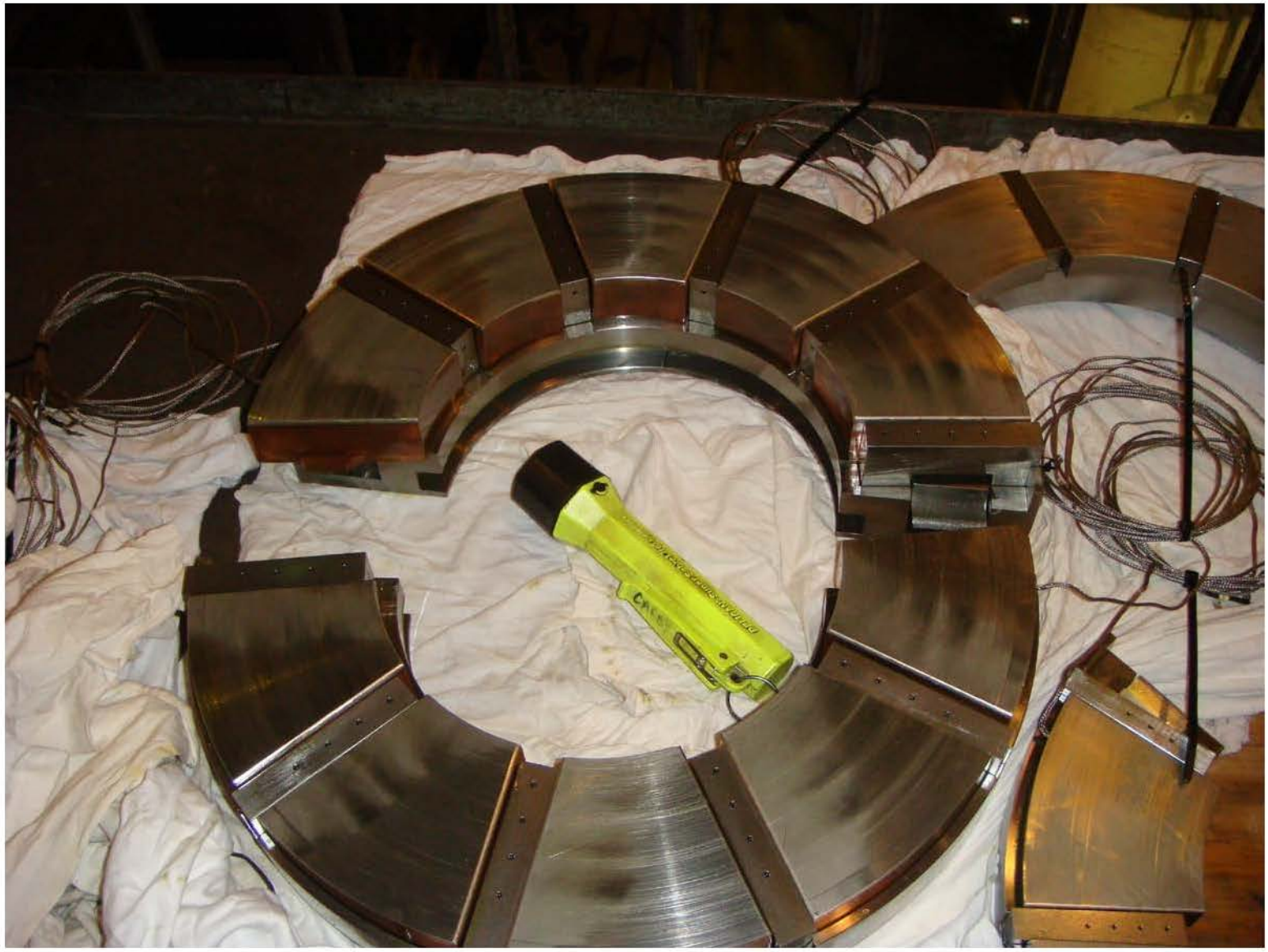




Photograph of upgraded Bearing Assembly



The active thrust bearing after 6 years in service.



The inactive thrust bearing after 6 years in service

The journal bearing loaded pads, after 6 years in service.

Conclusion:

The solution was implemented in one unit in 2000, and has run successfully with only scheduled maintenance.

Same solution was implemented in two more similar units and one 170 MW unit after that.