

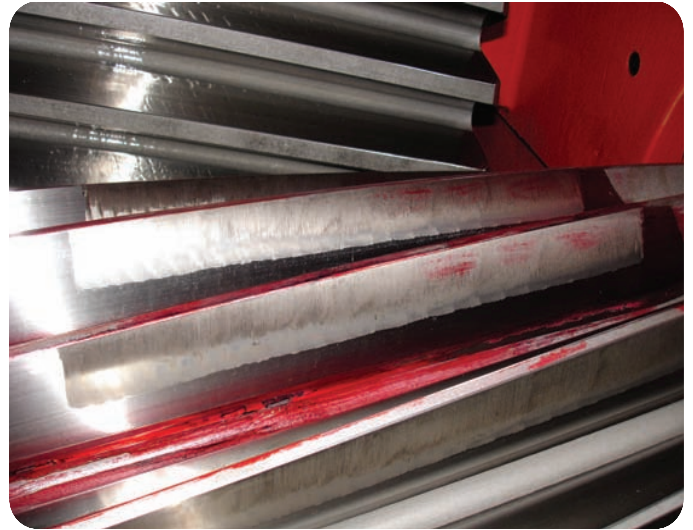
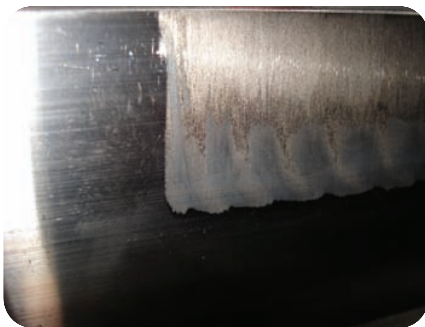
Gear scuffing

**SUBJECT VESSEL
TYPE**
LNG Carrier

ISSUE
Scuffing of the main
reduction gearing

Severe scuffing damage occurred on the teeth of the two input pinions and main wheel of the main propulsion gearing during trials of a newly built diesel electric LNG carrier. The propulsion system consists of twin electric motors driving a single output main propulsion shaft and fixed pitch propeller through single reduction, single-helix gears. Lloyd's Register Technical Investigations (TI) was asked to attend onboard at the newbuilding yard to inspect the tooth flank damage and assist with the failure investigation.

Failure of the gears was traced from trial records to occurring during a rapid acceleration test. In this test, the propulsion plant was accelerated from stationary to full away in a little over eleven minutes.



The scuffing damage was due to a breakdown of the elasto-hydrodynamic oil film which should normally be present between mating gear teeth. The breakdown resulted from a combination of the selection of the pinion gear tooth-end design and the rapid rate of torque input to the pinion gears from the electric propulsion motors. It was considered likely that the damage was initiated at the starboard mesh and then transferred to the port mesh in way of the main wheel.

The damaged pinion gears were returned to the gearing manufacturer for remedial

machining including design modifications to the gear tooth flank. The main wheel tooth flanks were polished in-situ.

Following repair, the reduction gearing successfully completed sea trials. This was achieved by modifying the pinions helix correction and end relief. The propulsion electric motor speed-torque characteristics had also been modified to reduce the initial rate of torque delivery to the pinion gears.

LESSON

Gear meshing design can be complex. Precision must be employed when cutting gear teeth and aligning the gear wheels to ensure good contact between the mesh. Correct lubrication is also essential in preventing premature gear failure.