AEGIS Case Study

Project title	Structural Finite Element Analysis: Rotor Modification Assessment Traction Motor
Date	June 2020

SCOPE/OBJECTIVE

Due to frequent in-service failures of the rotor bars on Passenger Train traction motors especially at the rotor bar connection to the endplates which had often resulted in breaking a number of lugs away from the rotor core, a design modification was implemented to resolve this issue, however, failures have continued to occur.

Our client developed an alternative solution using a modified rotor endplate to better support the rotor bars. The modification consists of the addition of protrusions on the outer edge of the two endplates of the rotor; these protrude between the rotor bars giving additional support to them between the end rings.

AEGIS were asked to perform a structural analysis using Finite Element Analysis, for both the existing and proposed rotor designs, whilst considering the following load cases to ensure that the proposed modification resolves the problem:

1. Thermal-induced load (200°C)
2. Centrifugal force (4210 rpm)
3. Inertial load (±10g)
4. Eccentric load
   i. Ring eccentricity (174 µm)
   ii. Face eccentricity (330 µm)
5. Other load factors
   iii. Thermal residual stresses (450-250°C)
   iv. Rotor acceleration/deceleration load (26 rad/s2)
6. Torque load (15.6 & 11kNm)

TECHNOLOGY USED (IF APPLICABLE)

ANSYS Mechanical
SpaceClaim
SOLIDWORKS 3D CAD

HOW WE HELPED

AEGIS engineers worked closely with its client to ensure that the service provided is second to none. Although the project scope involved analysing the designs against a set load cases to demonstrate improvement or otherwise, AEGIS were eager to go the extra mile and investigate the root of the problem and provide significant value-adding assessment.

DMKT 52/24 Traction Motor Rotor with Failed Rotor Bars.

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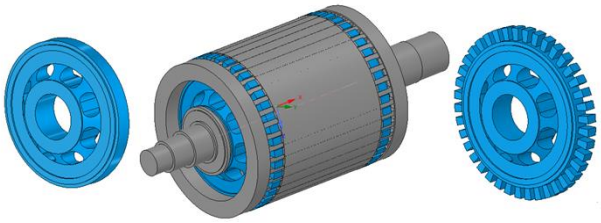
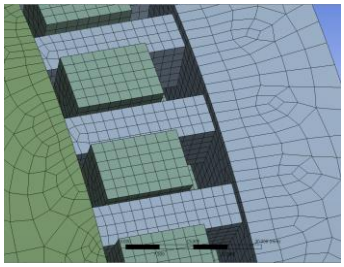
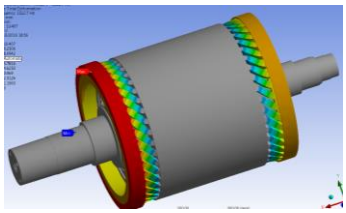
View of Rotor Bars #15 to #18 after penetrant inspection. The inspected rotor showed that 10 out of the 18 bars were completely cracked some which had deeply penetrated.



A Rotor CAD Model with original (left) and modified (right) endplates where protrusions are introduced to the assembly.



A close view of the FE model where fine and structured meshing attributes were assigned to the areas of interest: rotor bars, endplate protrusions and endring.



Tortional modal frequency with visual deformation results of the rotor assembly using Finite Element Analysis

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