Class 60 Traction Motor - PE Endbell
Sept 2011 – Aug 2012

Introduction:

Based on inherent defects found on their Class 60 traction motors during routine overhauls, our customer DB Schenker Limited, first asked us to research the causes of these defects and on examining our findings, re-design a new PE Endbell support for the armature windings.

Defects in the traction motor:

During the disassembly of the traction motors at routine overhauls several of the armatures were found to have severe damage to the PE Endbell. The cast aluminium PE Endbells that support the armature windings were found to have structural cracks between the support boss and spider arms as indicated in the photos 1 and 2 below.

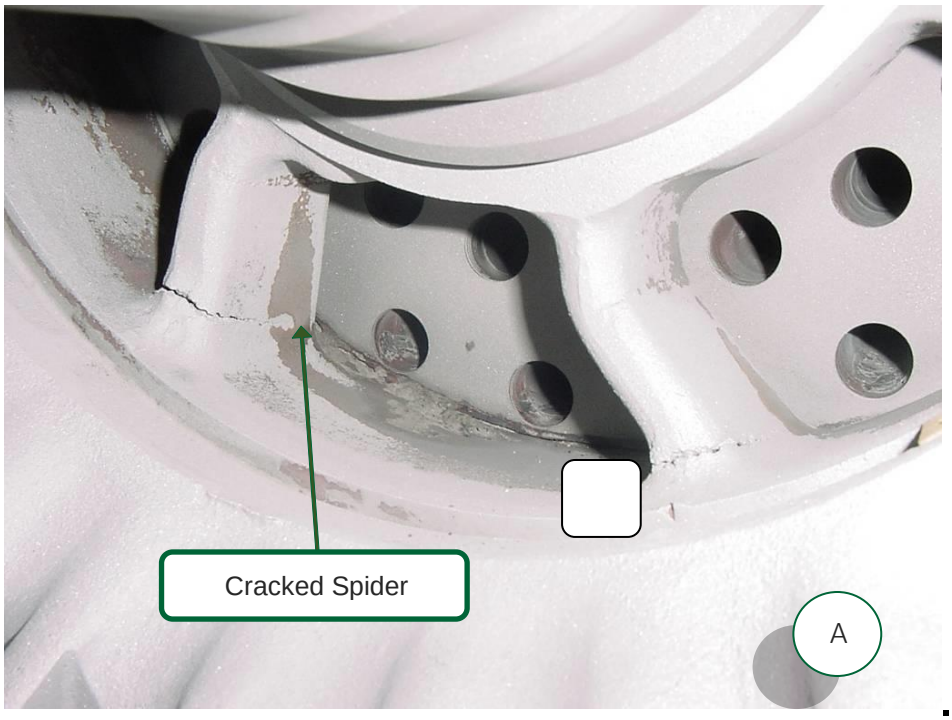
The cause of the failures is most likely speed or inertia related fatigue. Failure to address the damage to the PE Endbell would most likely lead to catastrophic armature failure.

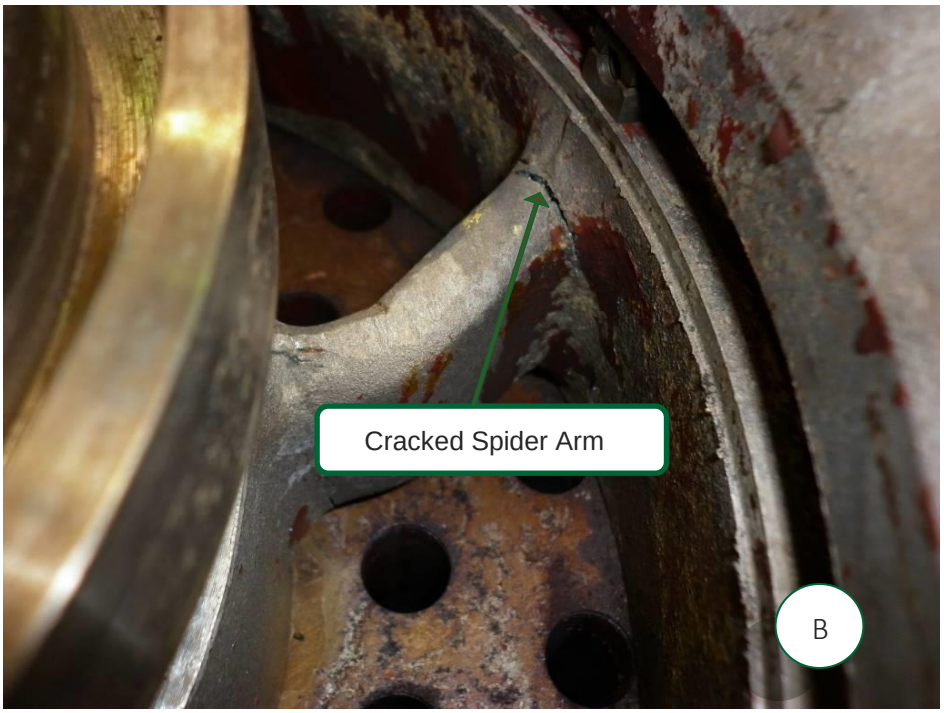
Solution:

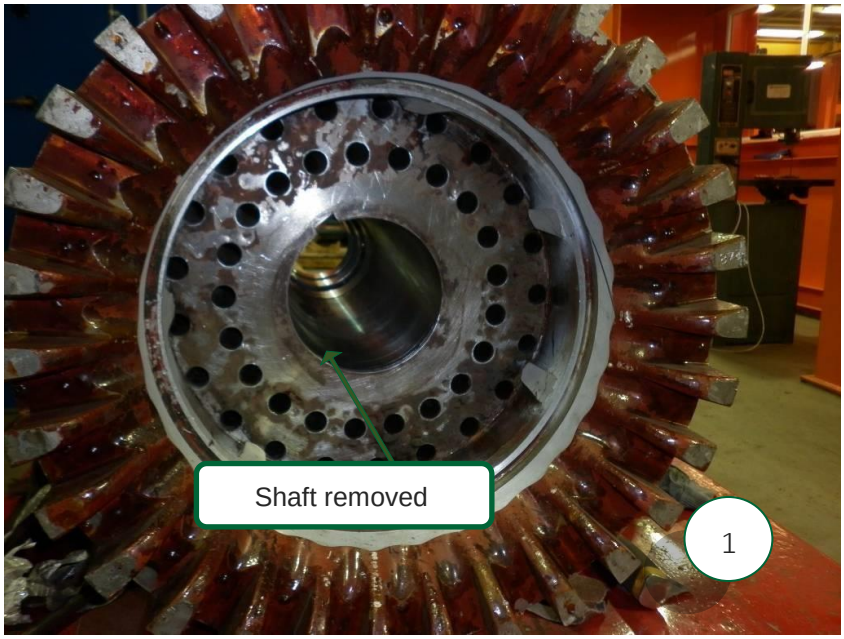
The implementation of the solution and process (page 3) recommended by the project design and development team. Prototype components are to be manufactured in-house and assembled into a sample armature. The completed armature to be assembled into a traction motor and rigorously tested.

The new design solution including structural information, mechanical drawings, completed armature assembly, and test results were inspected by DB Schenker engineers.

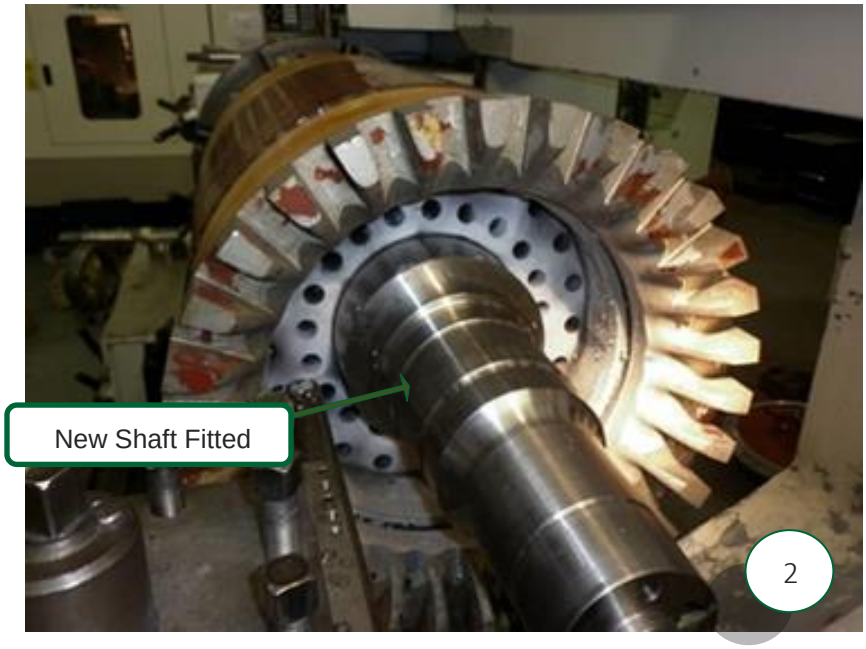
The project was granted approval and pending a successful trial Associated Rewinds were requested to apply the new design armature PE Endbell assembly to all their damaged Class 60 armatures.


Cracked Spider
A


Cracked Spider Arm
B

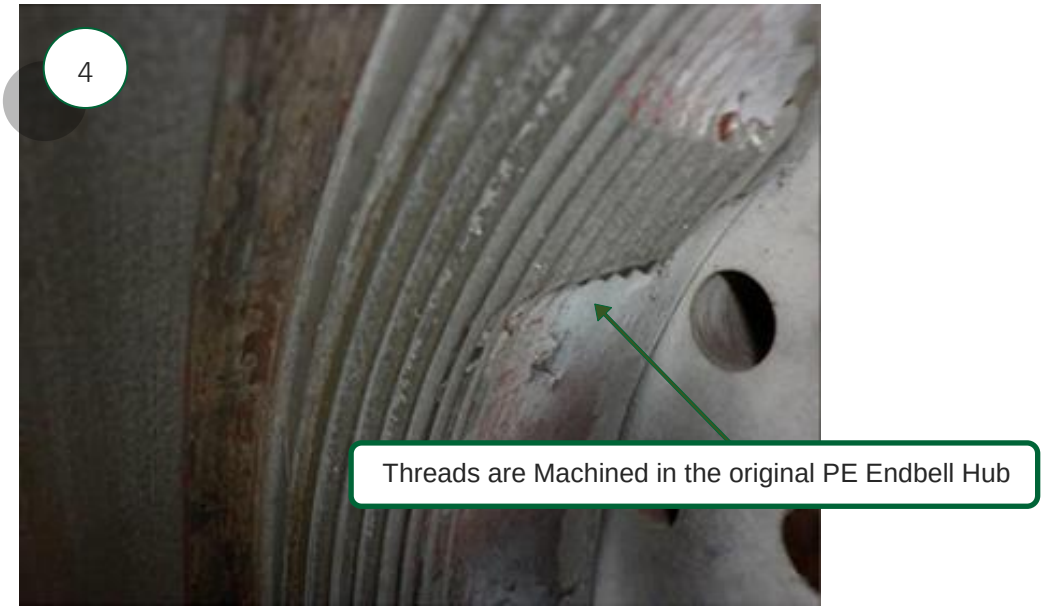


1. The Internal Boss and Spiders of the original PE Endbell are machined out and the shaft is pressed out of the armature using a hydraulic press.

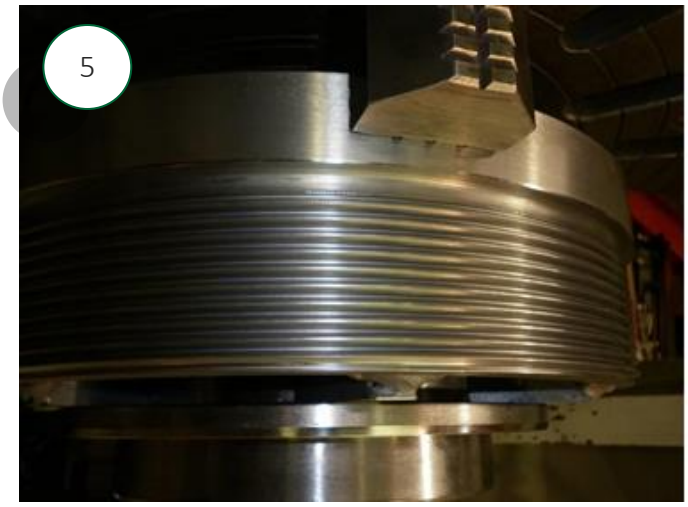


2. A new shaft is fitted with the armature centered in the lathe.

3. The Shrink Fit Collar is mounted on the new shaft.



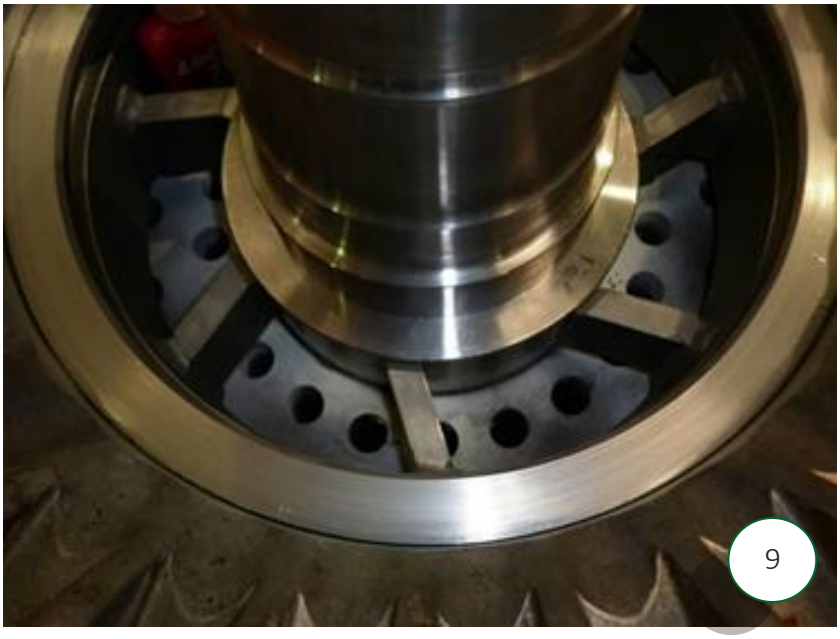
4. Machined threads are cut in the outer spider area of the original PE Endbell (Hub) in preparation for fitment of a new external PE Endbell support.



5. The new design external PE Endbell support is manufactured with a thread size that corresponding to the outer hub as per photo 4.

6. The new design external PE Endbell support is threaded and locked into the original outer hub.

7. New Machined Spider Arms are equally spaced and TIG welded to both the New Inner Collar and the New Design External PE Endbell support.



8. The rebuilt armature is Washed, Stoved and Fully Tested.

9. The armature is Vacuum Pressure Impregnated, Stove Dried and Re-tested. The completed armature is Dynamically Balanced to Specification.

The Project

The management of Associated Rewinds set up a team of personnel to research the defects found on the traction motor including any relevant information available from the train operator, bogie over-hauler and depot maintenance department.

It was decided the team would also develop, design, and manufacture a prototype for trial purposes, and pending approval from DB Schenker engineers, the new design PE Endbell would be fitted to all damaged traction motor armatures in the fleet.

The Team

P Geoghegan	Research & Development
J Warren	Research & Development
D Mahon	Material research & Purchasing
K Keaveney	Design & Drawing
M Dooley	Design & Prototypes
Associated Rewinds	Manufacturing
John Dunne	Production
Jacek Jonczyk	Fitment and Analysis
Robert Jonczyk	Fitment
Paul Udale	In Service Trials & Examinations

The Process

1. Research and develop a new design PE Endbell
2. Preparation of drawings and specifications for new design
3. Selection of materials
4. Manufacture of tooling / jigs
5. Manufacture of parts, internal and external assemblies
6. Fitment and Qualification of the finished assembly
7. In service trials including monitoring of the traction motor
8. Qualification of the finished assembly

Research and Develop a New Design PE Endbell

The team researched the causes of the failures on the PE Endbell and looked at possible new designs that would support the armature windings and structurally improve the PE Endbell.

The traction motor consists of several assembled parts including a laminated core, a commutator, a shaft, a PE Endbell and a CE Endbell. When these parts are assembled the armature windings are then fitted and secured.

One of our objectives was to design a method that would be fit for purpose without the need for renewal of the armature windings or commutator which would substantially increase the cost to our client.

Preparation of Drawings and Specifications for New Design.

Several variations for a new design PE Endbell and implementation process were discussed. Some of the ideas were transferred to drawings in solid works and prototypes were manufactured.

Selection of Materials for the New Design PE Endbell

Based on the agreed new design the material selected was high grade steel for its structural strength and compatibility with the other components.

Manufacture of Tooling / Jigs.

Associated Rewinds decided to manufacture all the components for the new design PE Endbell in-house. This would include the production setup, the design and manufacture of tooling and jigs and the manufacture of prototype components before commencement of full production.

Manufacture of Parts, Internal and External Assemblies.

Prototypes of the components required for the new design PE Endbell were manufactured. The components were assembled into an armature and checked for conformity to the final design drawings. The armature was dynamically balanced and assembled into a traction motor. The running motor was tested and fully monitored over a four hour period at full speed and all relevant information was recorded.

In Service Trials and Monitoring

The team in conjunction with the customer agreed for a trial fitment of 1 traction motor in Feb 2012. It was also agreed the motor would be initially monitored by one of our UK Service Support Engineers, Paul Udale. The motor would be returned to Associated Rewinds for a full examination after an agreed service period.

Technical Risk

Any changes to traction motors in relation to materials used and design will introduce a degree of risk and may require engineering approval from the customer. However, due to the rigorous in-house testing procedures, we were extremely confident that any risk would be mitigated and that our new design will prolong the life of the traction motor.

Technical approval

Following successful trials DB Schenker granted approval for the fitment of new the new design PE Endbells into their fleet of traction motors.

Outcome

As of September 2018 we continue to work closely with DB Schenker who have not reported any faults with the PE Endbell re-design, and rebuild carried out by our project team.

DB Schenker have expressed to Associated Rewinds their complete satisfaction with the results of the work we have carried out.