

The influence of high strength electric actuators on the turbocharger

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Afstudeerbegeleider bedrijf: Gijs Honig

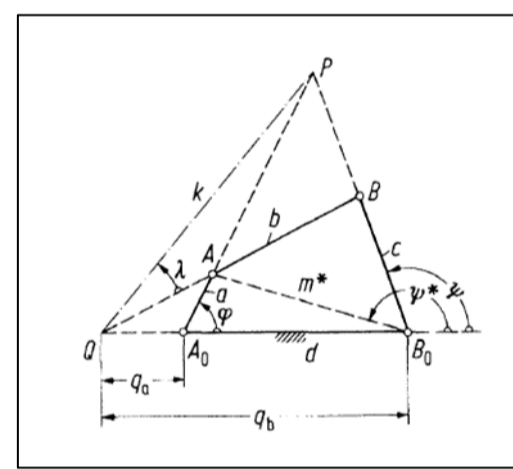
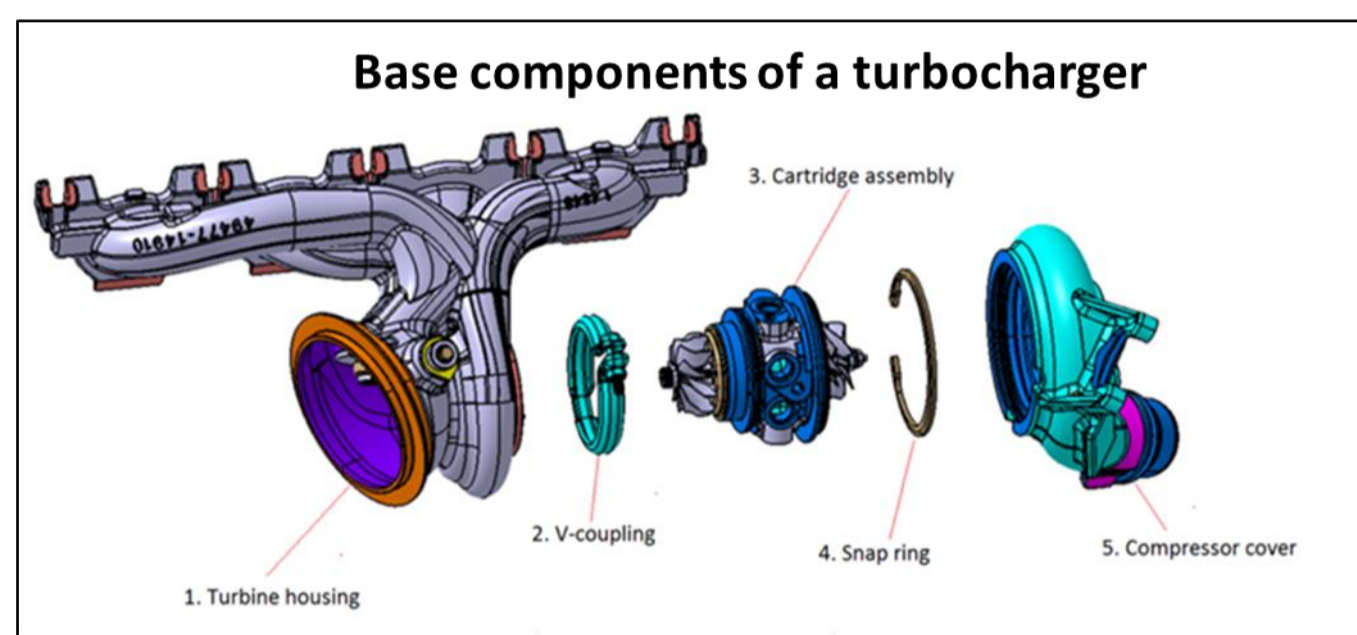
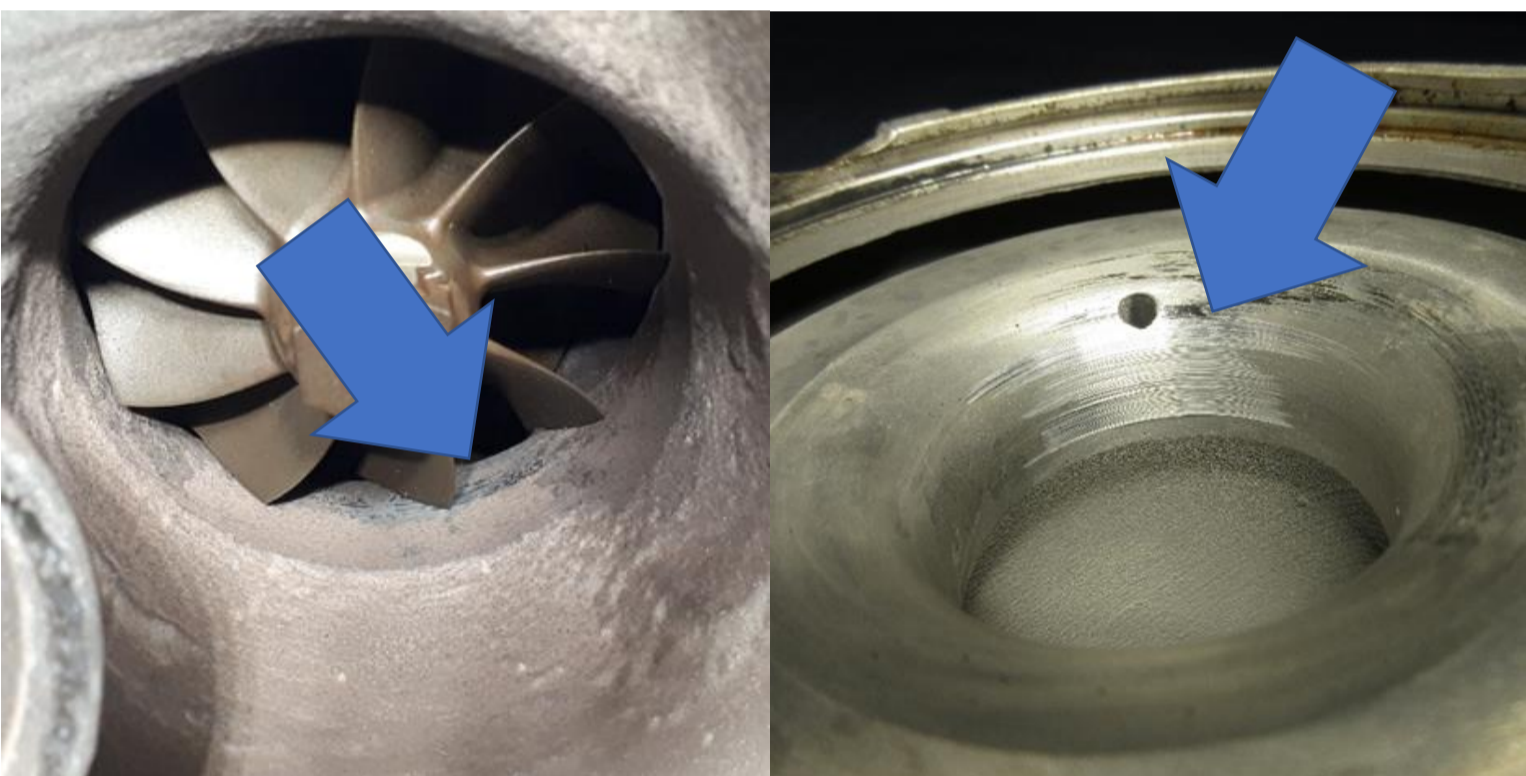
Afstudeerbegeleider opleiding: Salvatore Castelli

Periode afstuderen: september 2021 tot januari 2022

Electric Actuators have become standard to control turbochargers. These actuators are very potent and can induce high forces in the turbocharger. After testing a turbocharger under development, failures were observed that could be caused by the actuator. Further defining the problem showed that there was a variance of factors that could lead to the failures. The most relevant factors were taken into account when the final results were calculated. It can be concluded that the actuator does have influence, however it is unlikely to have caused the observed failures. With this knowledge MTEE can investigate future problems more effectively.

Assignment starter:

Failure in the form of contact between the wheels and their housings

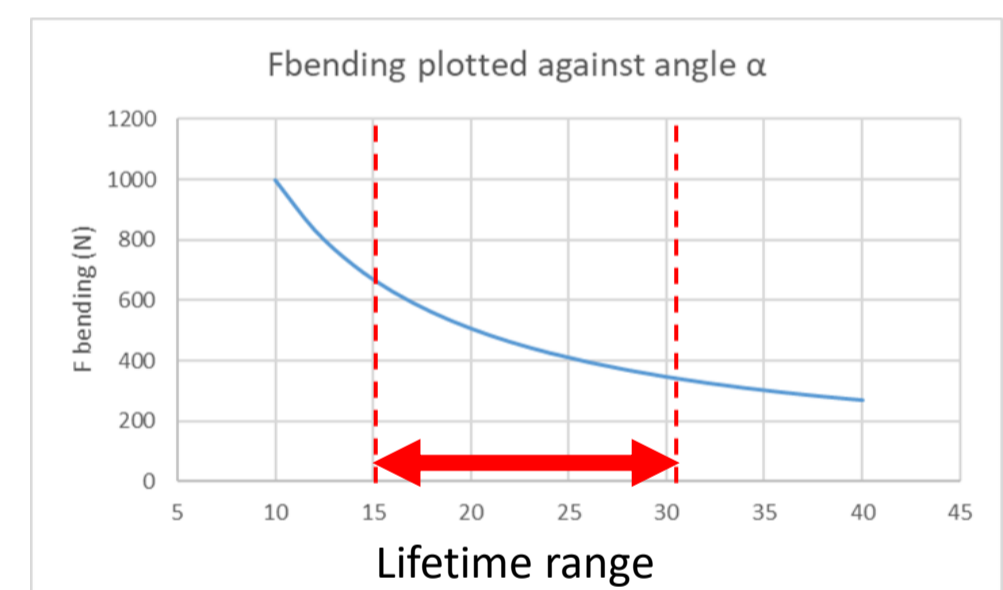
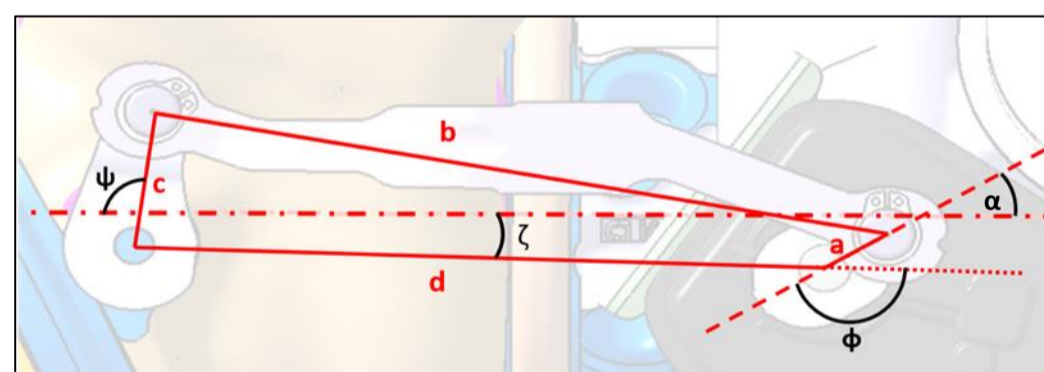
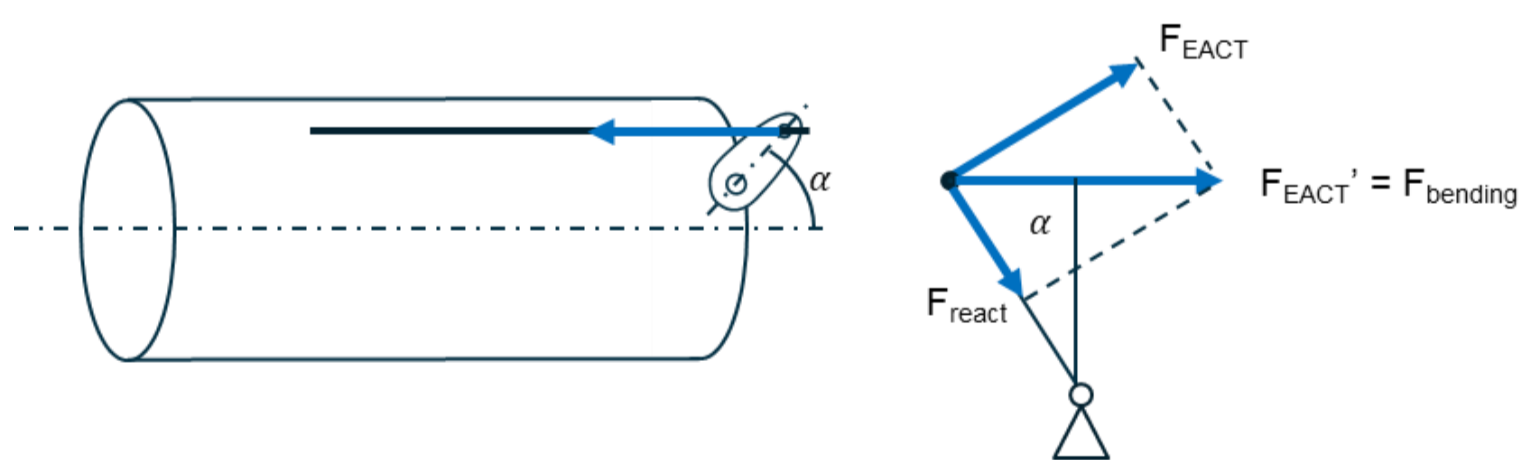
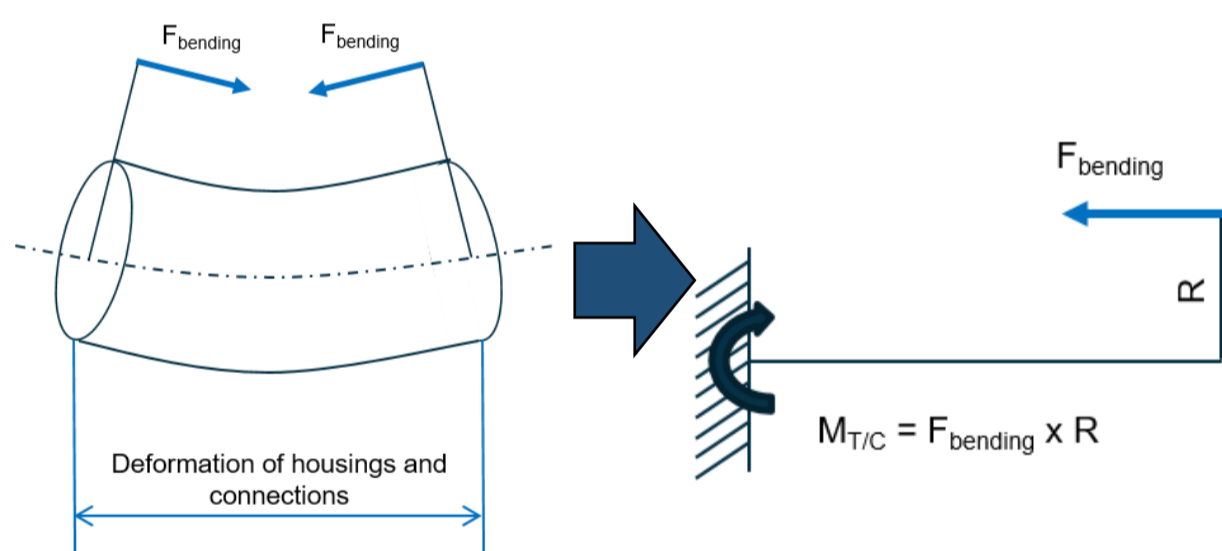


What linkage parameters are most influential?

α is the most influential parameter, force in linkage system may double during turbocharger lifetime (below)
Use four bar linkage model to predict alpha during operation, several parameters change as a result of turbocharger use and lifetime (left)
Calculated $F_{bending}$ was used as input for housing deformation simulation

Build up necessary theoretical knowledge:

Define specific turbocharger knowledge: shaft motion and tip clearance.
What happens to materials properties at elevated temperatures?
How may a rotary actuator try to influence the turbocharger?



Determine whether contact between the wheels and their housings can occur

A summation of all the relevant factors was made:

- Wheel growth as a result of thermal expansion and centrifugal forces
- Radial growth of the wheels as a result of bearing play
- Deformation of the housings as a result of operation and actuator forces
- Tilting of the cartridge in the turbine housing
- Misalignment of the cartridge and the compressor cover

Conclusion

It was determined that hitting was plausible.

However the damage pattern observed at the start of the project does not overlap with the damage pattern that was suggested by the results, the influence of the actuator is dubious

Partnerbedrijven

