Bachelor's Thesis Engineering Technology 2018-2019

COATING THICKNESS MEASUREMENT FOR ATLAS COPCO COMPRESSOR ROTORS

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Specialization Preparation programme for Master of Electromechanical Engineering Technology

CONTEXT

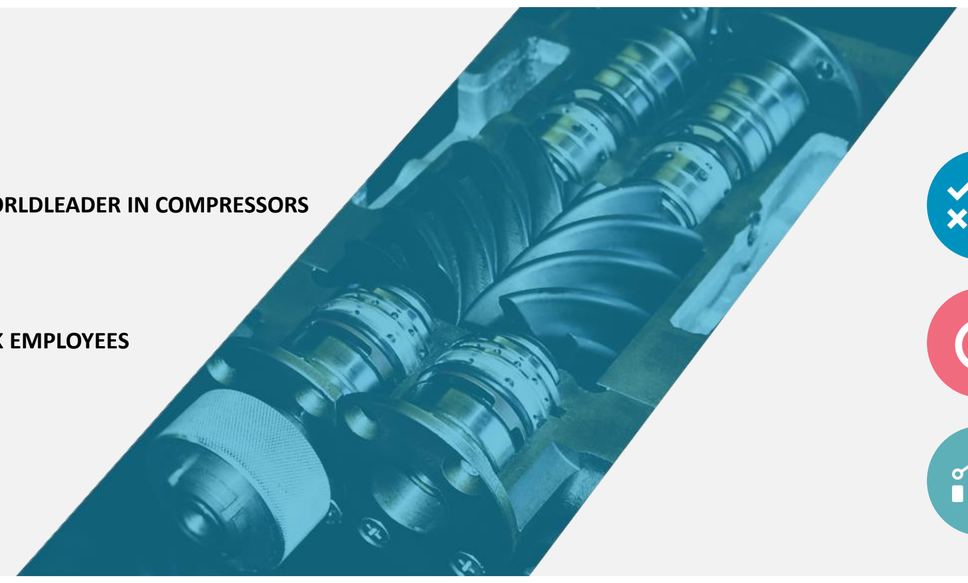
OILFREE AIRCOMPRESSORS GET A THIN COATING OF 90 & 130 µm.

ON EACH INDIVIDUAL ROTOR THE COATING THICKNESS MUST BE MEASURED PRECISELY.

THESE NON-DESTRUCTIVE TESTS FORM A CRITICAL STEP IN THE PRODUCTION PROCESS.

WORLDLEADER IN COMPRESSORS

34K EMPLOYEES



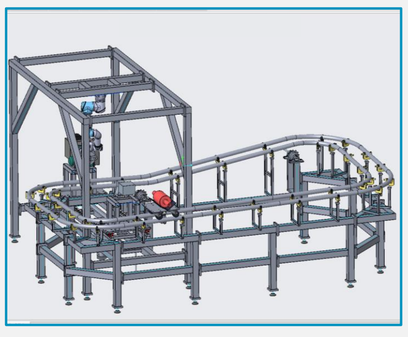
ASSIGNMENT

AT THE MOMENT THESE ARE MEASURED BY HAND. THE THICKNESS IS ONLY INDICATED AS APPROVED OR DENIED WITHOUT SAVING ANY DATA.

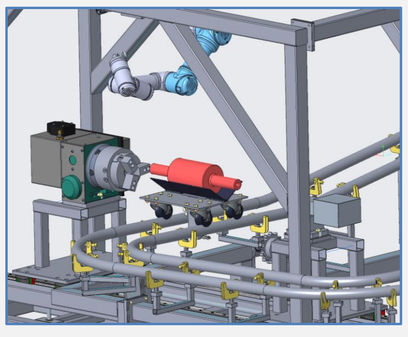
HOWEVER, THE SMALL SCALE OF THE MEASUREMENT IN COMBINATION WITH THE SENSITIVE PROBE CAUSE LARGE MEASUREMENT ERRORS.

IN ADDITION, THE MEASUREMENTS ARE NOT REPEATABLE, HARD TO COMPARE TO EACH OTHER AND DON'T ALLOW FOR DATA STORAGE.

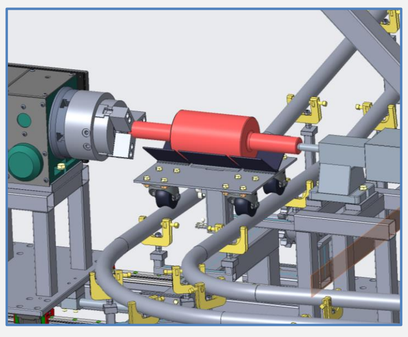
DESIGN



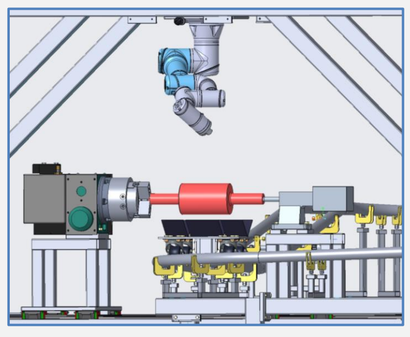
LOADING THE ROTORS



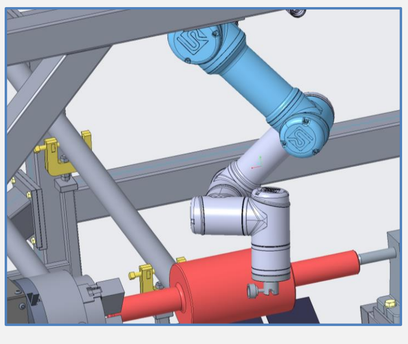
TRANSPORT TO MEASURING STATION



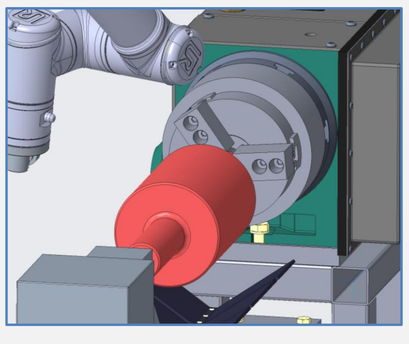
CLAMPING THE ROTOR



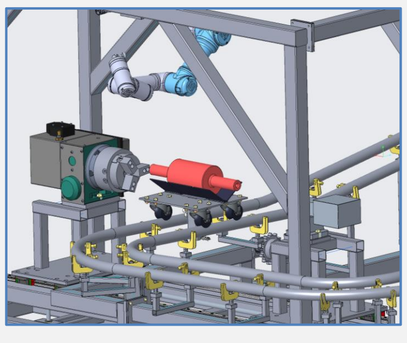
MOVING TO REFERENCE POSITION



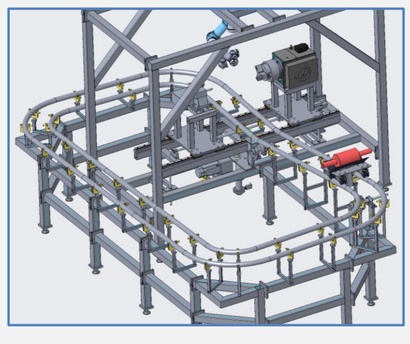
MEASUREMENTS



ROTATING 1/5th FOR NEXT MEASUREMENT



ROTOR BACK ON TRANSPORT SYSTEM



CHAIN LIFT AND GRAVITATIONAL TRANSPORT

MEASUREMENT

1 CHALLENGE 1: CALIBRATION ERRORS

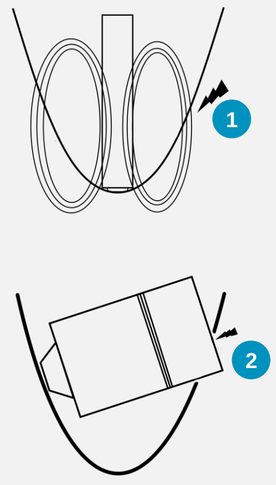
- The biggest error arises from using the inductive measurement on the complex geometry of the rotor.
- The measured value depends on the magnetic energy extracted from the coil. Because of the magnetic characteristics of the material, the measurement will change depending on the curvature of the surface.
- Therefor, a traditional calibration will introduce a lot of errors and a new sort of calibration must be used.
- **SOLUTION:** A preliminary study will empirically determine correction factors, adjusting the calibration depending on the radius of curvature of the rotor at any given point.

2 CHALLENGE 2: ACCESSIBILITY

- The rotors have a complex geometry, with flanks that make it difficult to reach each point.
- **SOLUTION:** This problem is tackled by using a probe with internal sensor. The robot can now be used to reach every point.

3 CHALLENGE 3: ACCURACY

- The probe is highly sensitive. Small deviations in position or angle will lead to large errors in the measurement.
- **SOLUTION:** This is solved by working with an accurate 6-axis robot and inductive sensors.



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