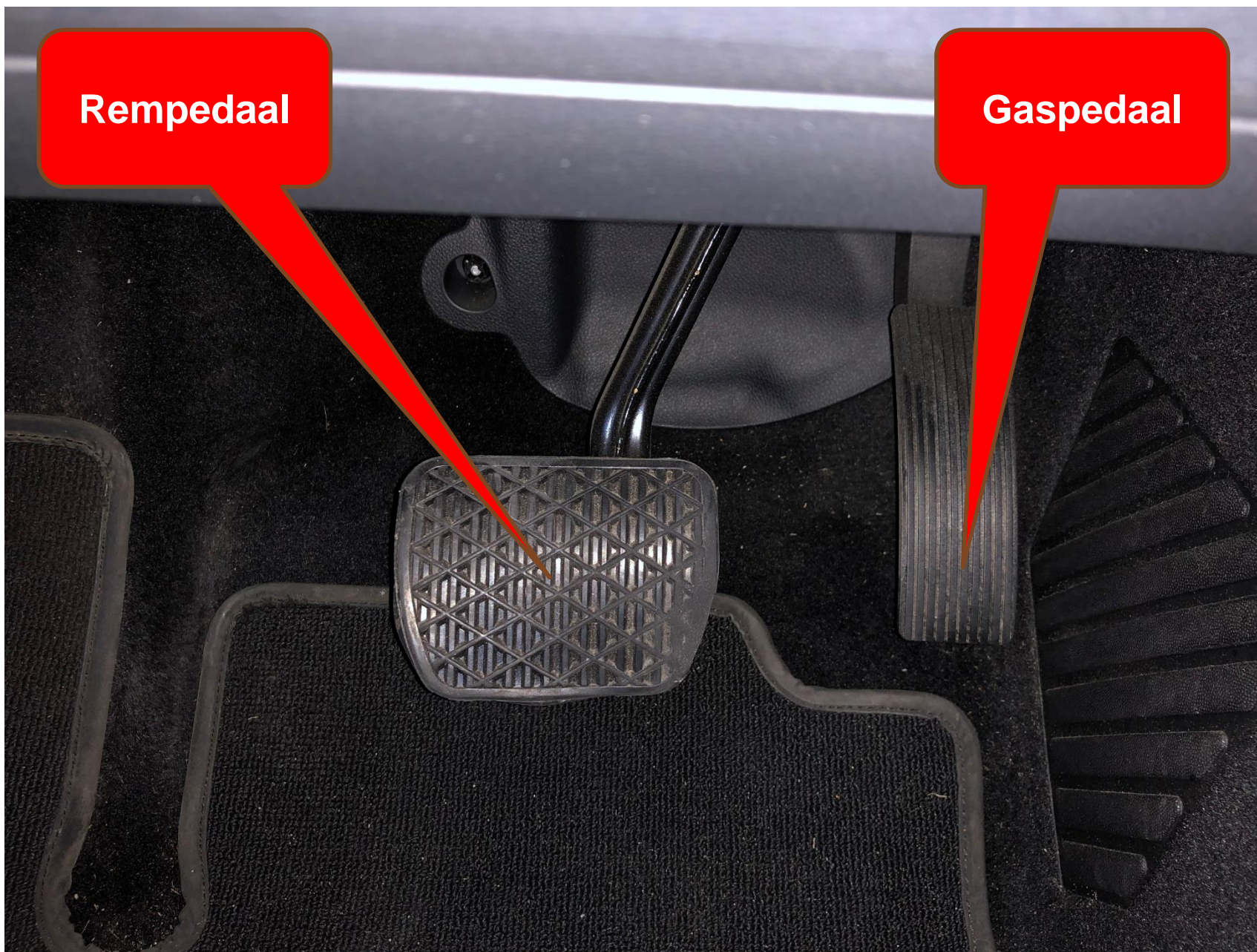


Innovatie en samenwerking in de industrie voor minder CO₂-uitstoot en meer efficiency

*KIC-MPi
Middelburg
4 Oktober 2019*

Danny van Nielen

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REMMEN

GELIJKTIJDIG



VOL GAS

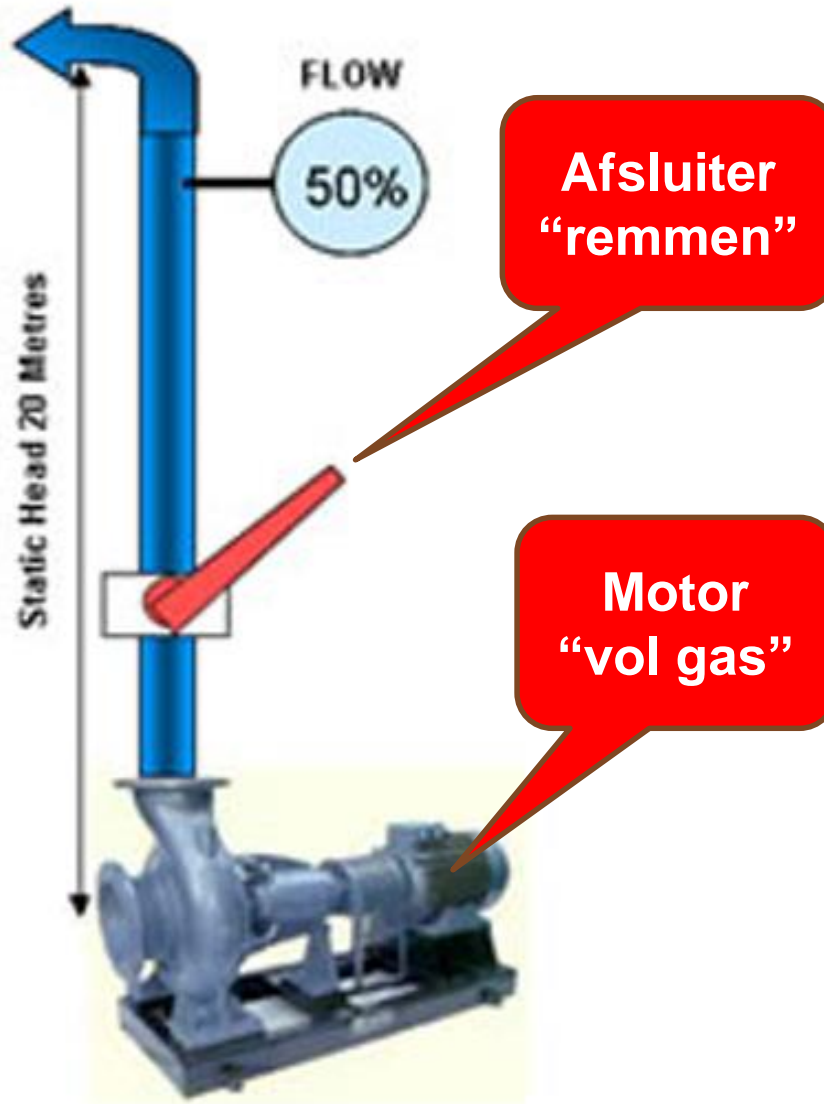


VOL GAS & GELIJKTIJDIG REMMEN

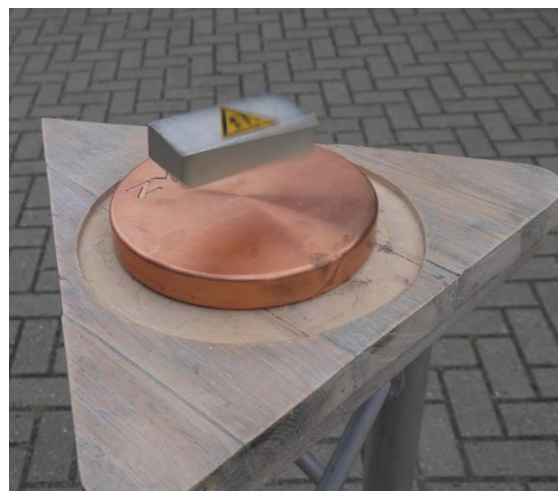
- Remblokken
- Remschijven
- Banden
- Trillingen
- Onderhoud
- Reparatie
- Brandstof



Processen Industrie Wereldwijd



- 75% van pompen in de industrie wereldwijd is 20% te groot. (Fraunhofer Institute 2005)
- 85% van die pompen staan "gesmoord".
- 30 - 70% energieverspilling



Demo set
Copper Magnet principle



Demo set fan skid

More info at www.zytec.eu

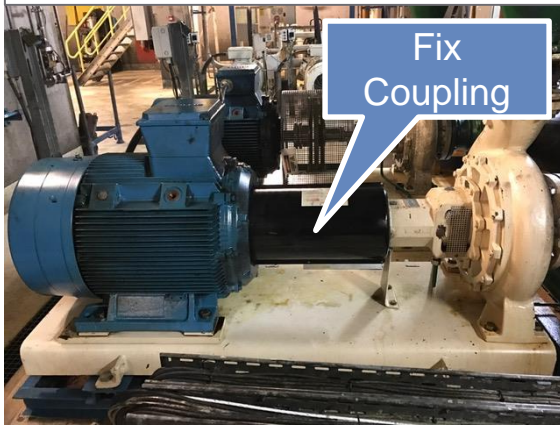
Demonstration



Business Case 4 pumps – 75kW - Cold Rolling Line – Steel Factory

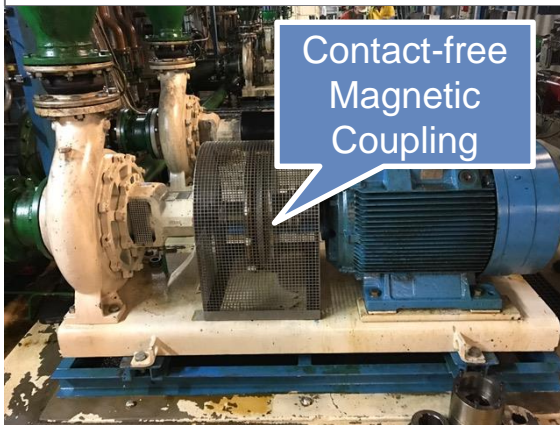
Situation old:

Fixed coupling with choke valve control



Situation new:

Contact-free magnetic coupling with choke valve control



Action:

- Installation 4 magnetic couplings ZYTEC A-TORQ
- 2 days work.

Result:

Sustainability:

- Energy savings 1,1 Mio kWh/annum.
- 600 tonne CO2 reduction.
- 340 households.

Reliability, Maintenance, HSE:

- Less maintenance/ less leakage/ improved safety level.
- Improved overall reliability and extended life span total installation.

Financial:

- | | |
|-------------------------|----------|
| • Payback Period (PBP): | 1,1 year |
| • Company value (NPV): | +€ 883k |
| • Return (IRR): | +89% |



Energy consumption and saving potential

Goal industry: 20 Mtonne CO₂ reduction in 2030
2 Mtonne (additional) + 4 Mtonne (current policy)

Politics/newspaper:
14,3 Mtonne CO₂ reduction in 2030

Maatregel/Technologie	vermeden CO ₂ in 2030 (inschatting)	Gemiddelde kosten Euro/ton CO ₂ bovenop ETS	Kosten 2030 M euro/jaar	Scope 2 en 3
Proces-efficiency ⁸	2 Mton	10 – 70	80	Ca 3 Mton restwarmte, onbekend hoeveel dit aan scope 2 emissiereductie bijdraagt
Elektrificatie en waterstof	4 Mton	70 – 150	440	
Recycling, CCU en biobased chemie	1 Mton	10 – 150	30	ca 1,5 tot 2 Mton bijdrage aan buitenlandse emissiereductie (CCU en recycling)
Lachgas reductie (N ₂ O)	1 Mton	20 – 30	30	
CCS	7 Mton	50 – 70	420	0,5 Mton CCU glastuinbouw
Lopend beleid ⁹ (F-gassen en proces-efficiency)	5 Mton	Rendabel		
Totaal	20 Mton		1000	
Innovatie pilots en demo's			300	

- 65% of all electric consumption in the industry comes from electrical rotating equipment (Fraunhofer Institute).
- 20% of the worldwide demand for electric energy comes from pump systems.
- 75% of the pumps in the industry is at least 20% to large (Fraunhofer Institute 2005).
- Pump capacity usually reduced with choke valve.
- Potential energy savings Dutch industry

4-6 Mtonnes CO₂



**Business Case
Radial Fan
160 kW**



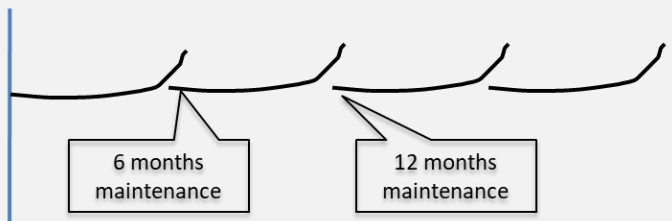
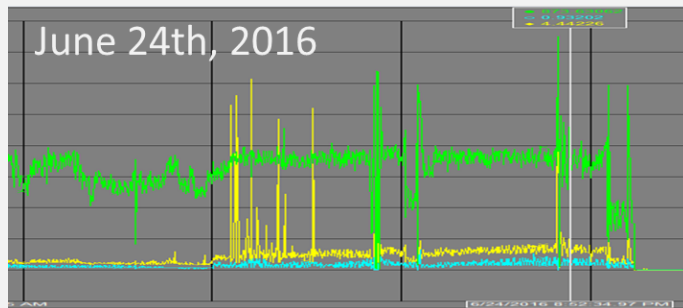
Kees Jan Grin

Situation:

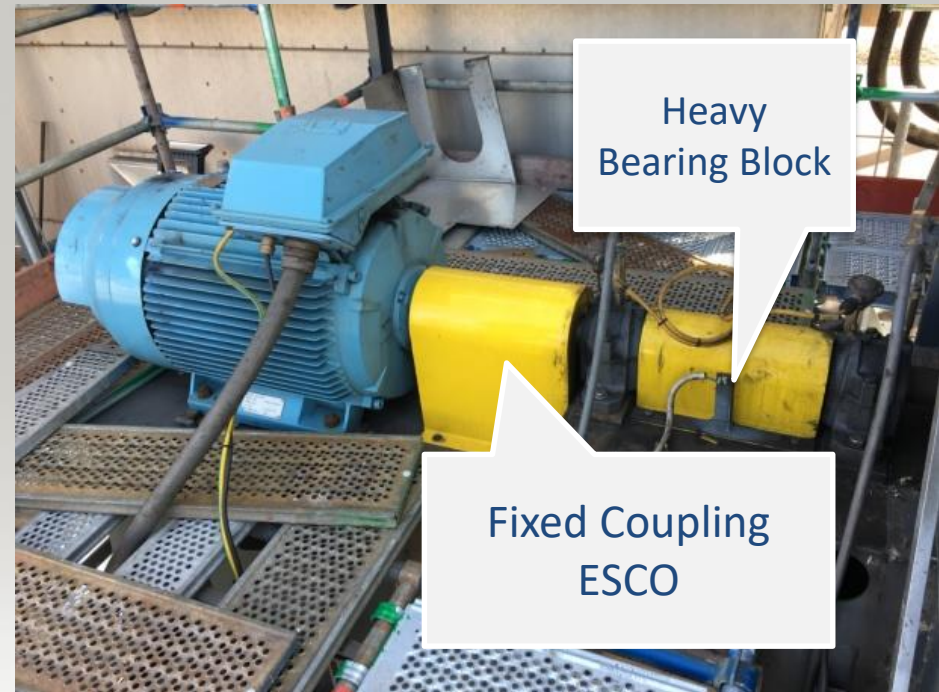
- Critical Fan.
- VFD speed control.
- Requirement to operate within 24 hours after failure.
- Required fan speed 900-1100 rpm.
- Critical fan speed 950 rpm.
- Operating speed 875 rpm.
- Fatigue damage on one side due to low bearing load.
- Increasingly level of vibration driving end and non driving end.
- High risk of bearing failure.
- Bearings replaced every 6 months.
- External cost EUR 25,000. - / replacement.

Vibration monitoring:

- Rpm: 873 min^{-1}
- Driving End (DE): 0,93 mm/s
- Non Driving End (NDE): 4,44 mm/s



Situation old:



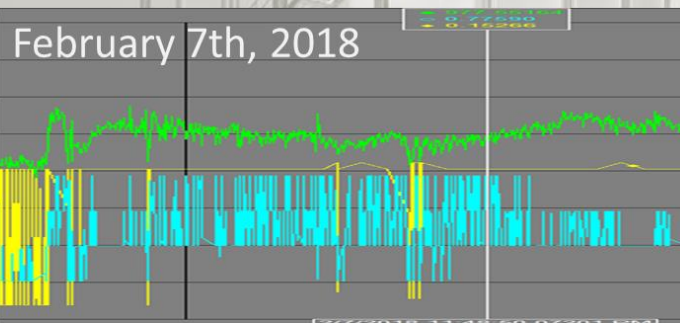
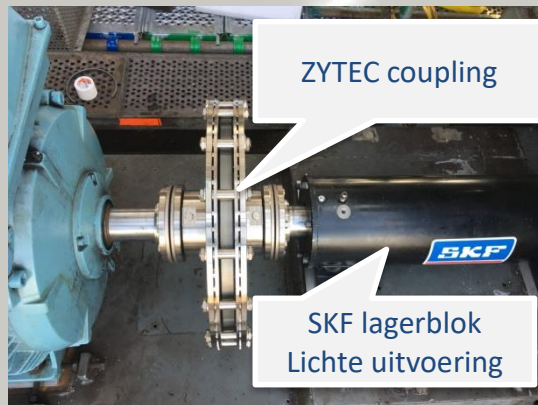
Target:

- Increase reliability of critical fan.
- Reduce maintenance costs and risk of assembly errors.

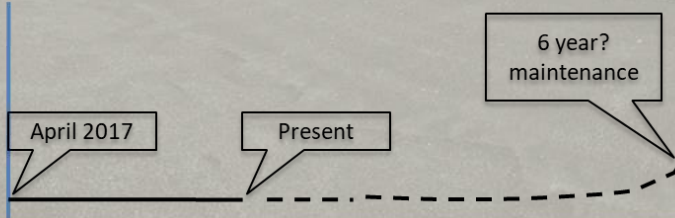
Action:

- Apply SKF alignment sensitive bearing block.
- Install Zytex F-TORQ contact-free magnetic coupling that makes these alignment errors irrelevant.

Situation new:



Vibrations
-80%



Result:

Reliability:

- MTBF 6 mnths → 6 years (est. by SKF).
- Reliability from 89% → 95%.
- Operating fan speed @ 975 rpm within requirements.

Maintenance:

- Vibrations reduced by > 80%
- Less maintenance, savings EUR 50,000 / annum.
- Less scaffolding, savings EUR 1,500 per year.
- Less chance of human assembly errors
- Less chance or error positioning labyrinth.

HSE:

- Less logistic movements / activities due to less maintenance, which means less chance of safety incidents.

Sustainability:

- Long life is from 6 months to 6 years is first step in circular economy

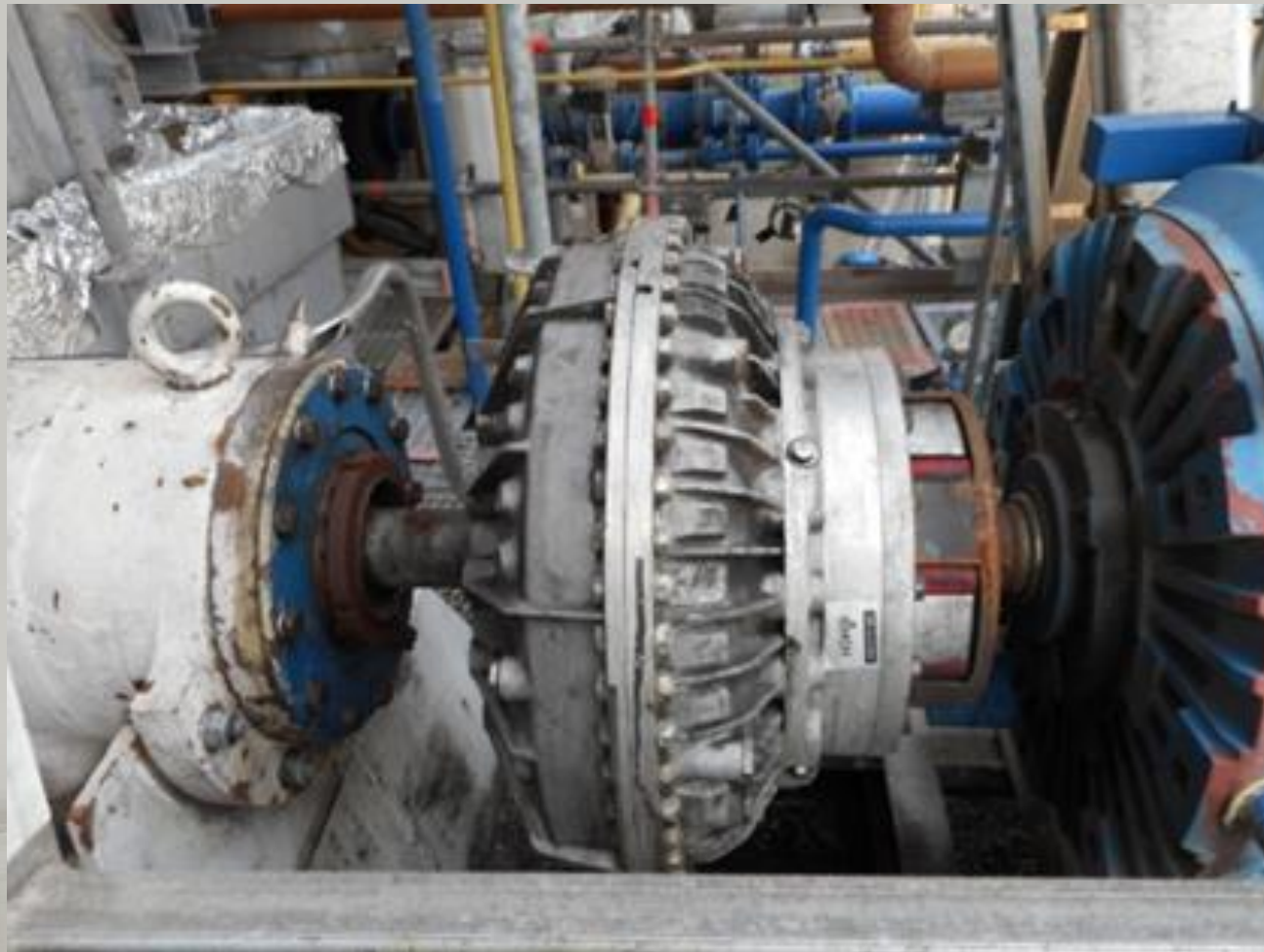
Financial:

- NPV (value increase Indorama) = EUR 440,000.-.
- IRR (financial return) = 140%.
- Payback time = 0.8 years.
- Average savings = EUR 51,500.-/year.

Business Case

Radial Fan

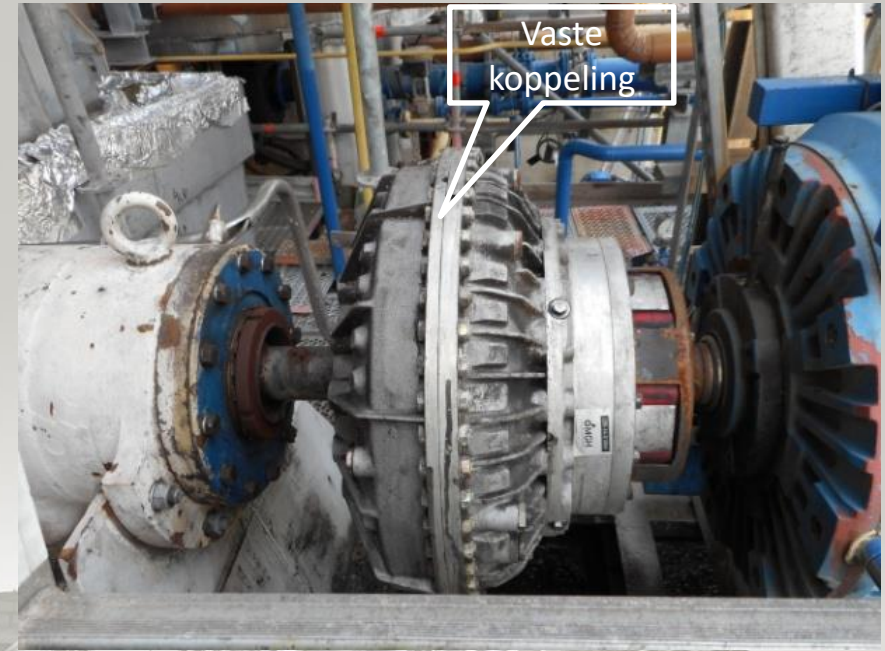
200 kW



Situation:

- Factory (about 1980) for production of cyclohexane.
- 4 pcs. radial fans of which:
 - 3 pcs. with motor power 200 kW, mass inertia 170 kgm².
 - 1 pcs. motor power 200 kW mass inertia 260 kgm²
- Liquid coupling with flexible coupling.
- Bearing block fan in oil bath.
- ATEX environment T3.
- HSE risk current fluid coupling.
Coupling can fail with slight oil loss and serious harmful effects. Oil can enter the process and can ignite.
- Every 2 years maintenance of the fluid coupling, external costs Eur 25,000

Situation old:



Target:

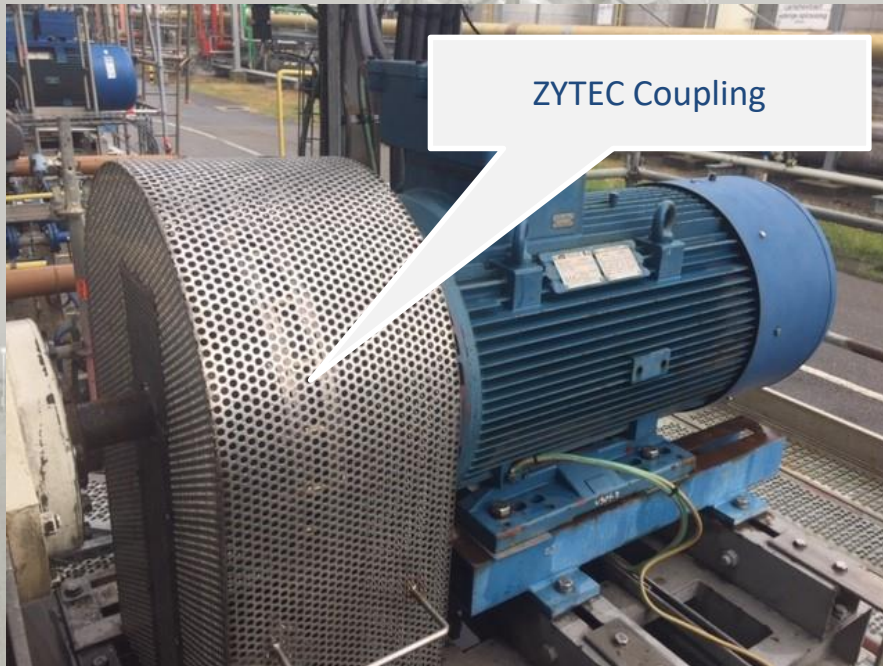
- Reduce HSE risk due to oil leakage and fire.
- Increase reliability and availability of the total installation.
- Reduction of maintenance costs and downtime losses.

Action:

- Installation of ZYTEC contact-free magnetic coupling F-TORQ.HI

Situation new:

ZYTEC Coupling



Result:

HSE:

- Oil leakages are excluded and can no longer enter the process or ignite.
- Preventing risks for staff and the environment.
- Less logistical movements / activities due to less maintenance, which means less chance of safety incidents in EX environments.
- No open fire for heating up flexible coupling hubs for installation in EX environment.

Reliability:

- The risk of failure has been reduced and the total installation has become more reliable.
- Less downtime of the installation due to less maintenance of complete installation due to lower wear on motor and fan.
- The peak current load (630%) at the start is shorter (from 3 sec to 1.5 sec) and the starting current load is lower (from 250% to 15 sec to 150% to 25 sec)

Maintenance:

- Completely maintenance-free Contact-free Magnetic Coupling.
- Because the coupling is Contact-free, the vibrations of the installation are not a mechanical load in the coupling. The coupling does not cause a pulsating bearing load in the shaft bearings of the fan and motor. This reduces maintenance / repair of the bearings.

Sustainability:

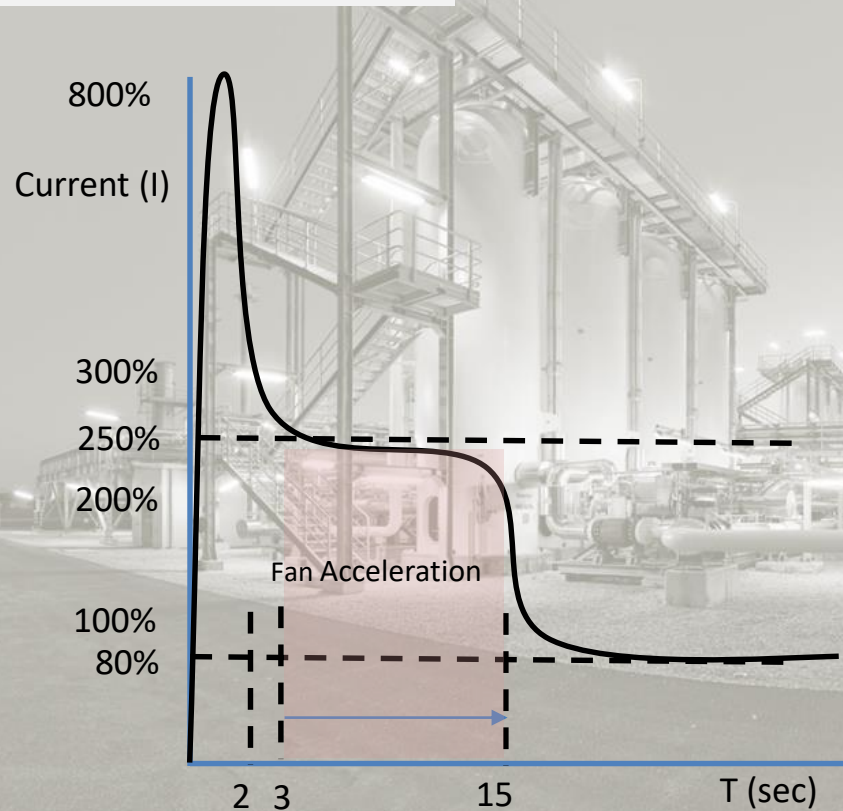
- Long life is from 2 years to 20+ years is first step in circular economy

Financial:

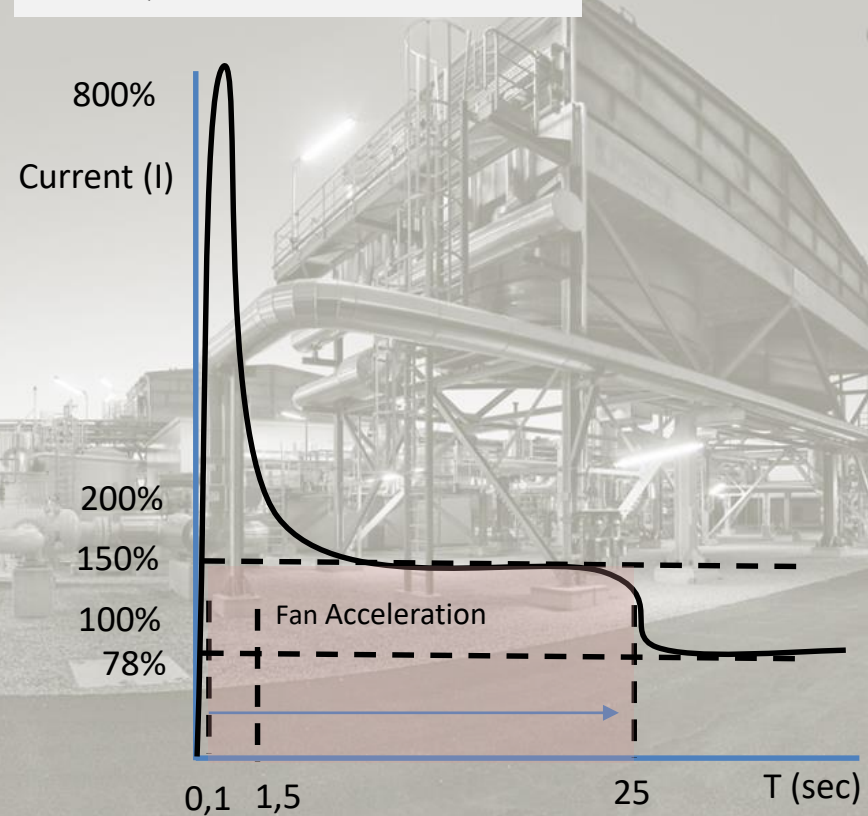
- Eur 12,5k / year savings on maintenance / repair.
- Higher output total factory i.v. shorter / no unscheduled downtime.
- Reduction of costs for safety measures and work permits.

DOL Start Process: F-TORQ.HI versus Fluid Coupling Current –time diagram

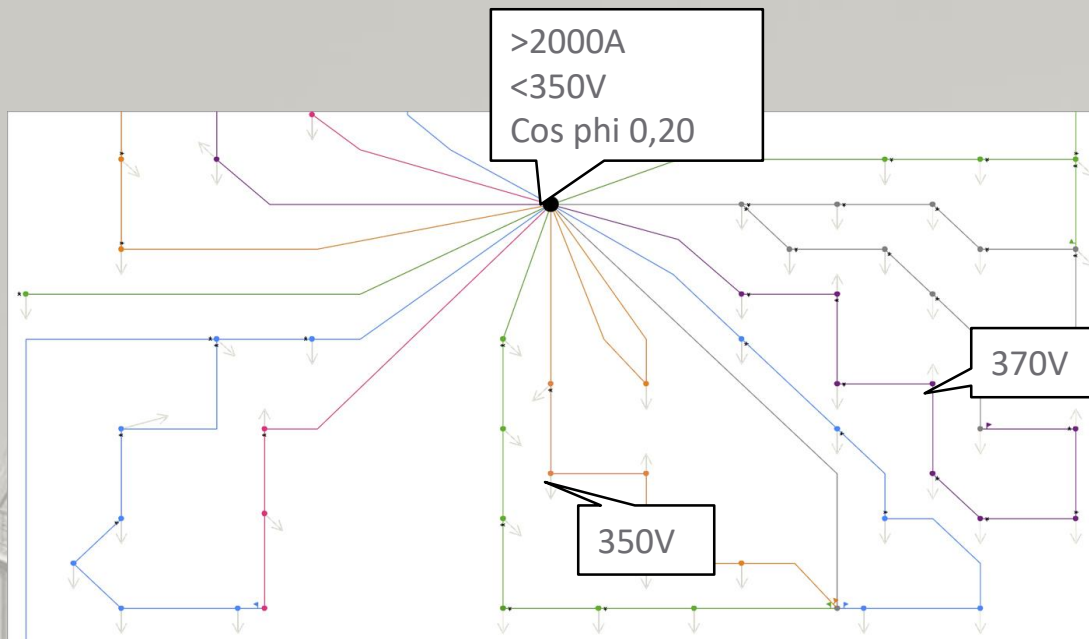
Fluid + Flexible Coupling
Combination



Contact-free Magnetic Coupling
F-TORQ



Power Quality



Situation old:

- During the first moment of the start-up process, the motor draws about 6 seconds 630% (2270A) of the nominal amperage (360A). As a result, a voltage drop is caused in the entire network, possibly leading to the risk of disturbing other machines. The voltage and amperage are then temporarily disturbed.
- During the start-up process, the motor draws 250% amperage (900A) for a period of about 15 seconds.

Situation new:

- During the first moment of the start-up process, the motor draws approximately 630% of the nominal amperage for about 1.5 seconds. 50% shorter than with a fluid coupling, which reduces the risk of disturbance of other machines.
- During the start-up process, the motor draws 150% amperage (540A) for a period of about 25 seconds. This is a lower load for the electricity network.