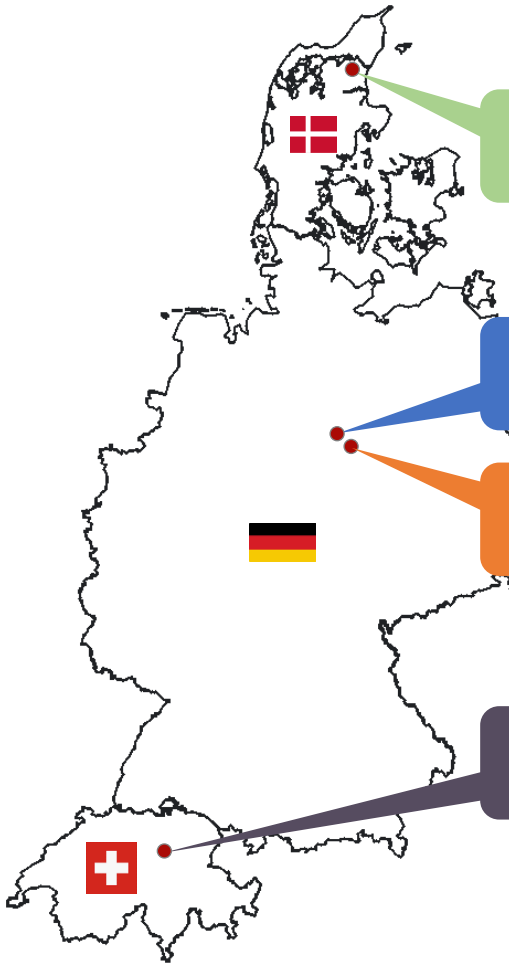
ift whitecell engineering

Clausthal-Zellerfeld

Whitecell Group



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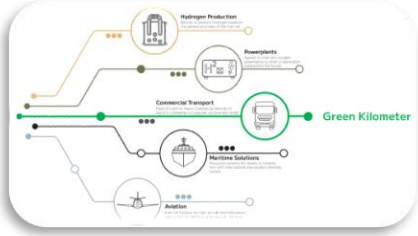
Whitecell Power AG
Verenastrasse 4b, 8832 Wollerau, Switzerland
Kontakt - Innovation Drives Sustainability



Whitecell Group
A total of 140 employees, revenue approx. EUR 22 million (2023)

- **Whitecell Power AG: Parent company.**
  - **Whitecell Systems:**
    Development and production of systems for the green methanol and hydrogen economy, and supplier of high-quality fuel cell and electrolyzer components.
  - **IFT Whitecell Engineering:**
    Engineering and testing services for research and industry, offering development and testing expertise.
  - **Whitecell Eisenhuth:**
    Production of components and stacks for fuel cells and electrolyzers, injection molding tools, small-series plastic, silicone & rubber parts, and 3D printing.Winner of multiple innovation awards in the fields of hydrogen and fuel cells.

Profile

Engineering:

- 49 Employees
- Total area: 13.079 m²
- 800 m² Test field with >45 Test cabins
- Engineering
- Functions test
- Endurance test
- Environmental tests
- Fatigue Strength tests
- Tribology
- Analysis
- Test Rig Construction

Certified:

- DIN EN ISO 9001:2015
- Information security TISAX® Level AL3

Milestones

- **1990** – Foundation of IFT (Ingenieurgesellschaft für Triebwerkstechnik mbH)
- **2001** – IFT, Schaeffler AG 49% Co-shareholder
- **2013** – IFT 100% Subsidiary of Schaeffler AG
- **2015** – Schaeffler Engineering 100% Subsidiary of Schaeffler AG, from IFT and AFT
- **2021** – ift whitecell engineering Subsidiary of whitecell power AG
- **2024** – New sister companies: Whitecell Eisenhuth Whitecell Systems

Range of Services

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Techniques \ Services	Functional Test	Endurance Tests	Environment Tests	Tribology / Analysis	Engineering
Component Test Field					
High Dynamic Drives					
Radionuclide Technology					
Engine Test Field					
Powertrain Test Field					
Environment Test Field					
Wear & Friction Test Rigs					
Material & Measuring Laboratory					
Fatigue Strength Test Field					

Range of Services Testing & Engineering

Component Test Field

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Techniques / Services	Functional Test	Endurance Tests	Environment Tests	Tribology / Analysis	Engineering

- Component Test Field
- High Dynamic Drives
- Radionuclide Technology
- Engine Test Field
- Powertrain Test Field
- Environment Test Field
- Wear & Friction Test Rigs
- Material & Measuring Laboratory
- Fatigue Strength Test Field

TECHNIQUE

Equipment

- 45 test cells
- 85 component test rigs
- Powered up to 100kW
- Speed up to 19.000 rpm
- Modular test rig concept
- 24/7 operation
- High dynamic rigs

Infrastructure

- Cooling circuit -44°C
- Energy recovery
- Battery simulation 800V / 600A / 160kW
- Own test bench construction for special applications

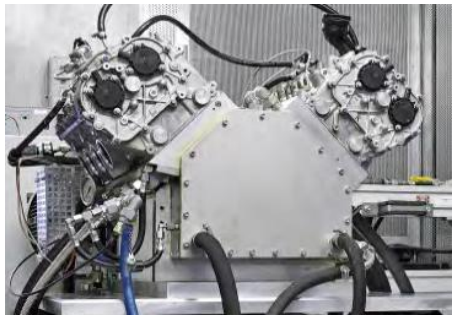
SPECIAL FEATURES

Load

- Medium contamination: dirt, soot, foaming, fuel, acid
- Thermal load: -40°C up to 160°C
- Mechatronic load: high-speed, speed gradient > 10.000rpm/s
- Test environment like mechanical, electrical and hydraulic operation parameters (Virtual ICE)

Measuring

- Mechanical, thermodynamic, hydraulic, acoustic, optical and electrical measurement
- Delta analyzer
- 10x ROTEC Measurements Systems for torsional vibrations, temperature, acceleration, velocity and sound
- Pre- and post-analysis
- Wear measurement via RNT
- Micro movement via laser, encoder, RNT



High Dynamic Drives

ift whitecell engineering

Techniques / Services	Functional Test	Endurance Tests	Environment Tests	Tribology / Analysis	Engineering

- Component Test Field
- **High Dynamic Drives**
- Radionuclide Technology
- Engine Test Field
- Powertrain Test Field
- Environment Test Field
- Wear & Friction Test Rigs
- Material & Measuring Laboratory
- Fatigue Strength Test Field

TECHNIQUE

Equipment

- ETAS Inca
- DiagRA
- Vispiron Rotec
- In-house developed programmable logic controller
- MATLAB®

Infrastructure

- 3 High Dynamic Drives up to 600 kW
- +/- 1.200 Nm alternating torque
- Vibration velocity: 1,8 mm/s
- Very low rotor moment of inertia: 0.116 kgm²
- Gradient up to 60.000 1/min/s
- Rotational speed up to 10.000 1/min
- Battery simulation 800 V / 600 A / 160 kW

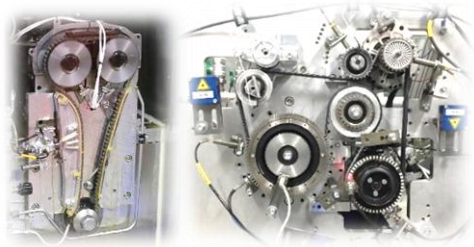
SPECIAL FEATURES

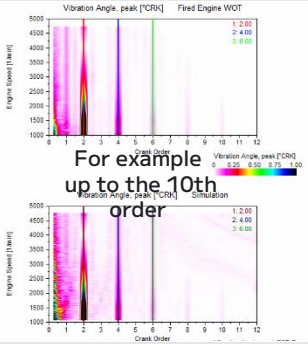
Operations

- Angle-synchronous signal reproduction
- Full frequency spectrum < 500 Hz
- Adjustable Amplitudes (orders/frequencies)
- Combined operation with fired engine
- Reproduction of road surfaces/tyre types
- Functional & endurance tests
- Full path open ECU

Measuring

- All physical measuring values
- Dynamics (angle-/time-based)
- NVH (acoustics & vibration)
- Torsional Vibration
- Wear measurement via surface scan
- Wear measurement via RNT
- Delta Analyzer





Radionuclide Technology (RNT)

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Techniques / Services	Functional Test	Endurance Tests	Environment Tests	Tribology / Analysis	Engineering

- Component Test Field
- High Dynamic Drives
- **Radionuclide Technology**
- Engine Test Field
- Powertrain Test Field
- Environment Test Field
- Wear & Friction Test Rigs
- Material & Measuring Laboratory
- Fatigue Strength Test Field

TECHNIQUE

Equipment

- RNT handling permit for test field and measuring room
- Manufacturer: Zyklotron AG Karlsruhe (ZAG)
- Model: RTM 2000
- 3 x scintillation vendors 3 “x 3“ NaJ (Tl)
- 2 x measuring windows (Co-57 and Co-56, or comparable gamma energies)

Infrastructure

- Concentration measuring system (KMA), for measuring the wear particles in the oil flow
- Filter measuring system (FMA), for measuring the particles separated in the oil filter
- Reference measuring system (RMA), for referencing a known sample with short half-lives

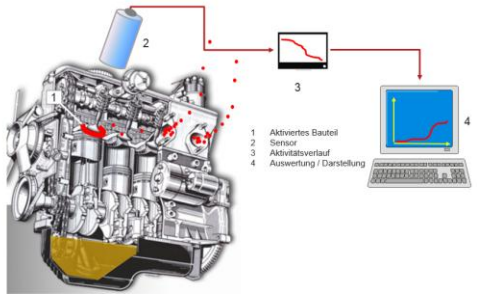
SPECIAL FEATURES

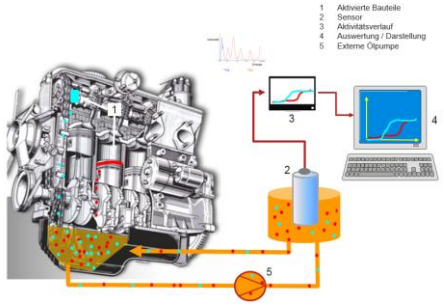
Operations

- Ferrous materials
- Alloy metals, like Molybdenum, Tungsten, Vanadium, Non-Ferrous metals, e.g. Copper
- Bearing metals, e.g. Lead, tin, zinc
- Aluminium, if at least 5% copper is contained (activation takes place via the copper)
- Titanium
- Sintered metals, hard metals

Measuring

- Ceramic materials (Al_2O_3, SiC, Si_3N_4, ZrO_2)
- Plastics and lubricating varnishes, DLC coatings via storage of Be-7
- Thin film differential measurement method (DMV)
- Concentration measurement method (KMV)
- Wear measurements in the Nm/h range
- Motion measurements at optically inaccessible locations (piston ring rotation, floating bush rotation)





Engine Test Field

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Techniques \ Services	Functional Test	Endurance Tests	Environment Tests	Tribology / Analysis	Engineering

- Component Test Field
- High Dynamic Drives
- Radionuclide Technology
- **Engine Test Field**
- Powertrain Test Field
- Environment Test Field
- Wear & Friction Test Rigs
- Material & Measuring Laboratory
- Fatigue Strength Test Field

TECHNIQUE

Equipment

- 5 fired engine test rigs
- 450kW / 1.000Nm / 10.000rpm
- Battery simulation 800V / 600A / 160kW
- WD passenger car chassis dyno 300 kW
- Motorcycle chassis dyno 200 kW
- automation: SARA & own system

Infrastructure

- Cooling chamber
- Common/special fuel infrastructure
- Battery simulation 800V / 600A / 160kW

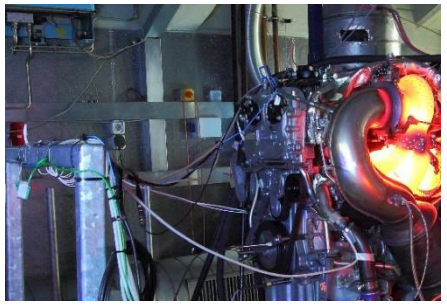
SPECIAL FEATURES

Operations

- Functional & endurance tests
- Thermodynamic test rigs
- High dynamic Rigs
- Full engine / motored engine (parts)

Measuring

- All physical measuring values
- All dedicated process values (online/offline)
- Dynamics (angle-/time-based)
- NVH (acoustics & vibration)
- All relevant emissions
- Delta analyzer
- Torsional vibrations
- Indicated pressure & knock detection
- Wear measurement via surface scan
- Wear measurement via RNT



Powertrain Test Field

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Techniques \ Services	Functional Test	Endurance Tests	Environment Tests	Tribology / Analysis	Engineering

- Component Test Field
- High Dynamic Drives
- Radionuclide Technology
- Engine Test Field
- **Powertrain Test Field**
- Environment Test Field
- Wear & Friction Test Rigs
- Material & Measuring Laboratory
- Fatigue Strength Test Field

TECHNIQUE

Equipment

- 2 powertrain test rigs (2/3 EM)
- Power-range up to 2.250Nm / wheel
- Rig automation: SARA & own system

Infrastructure

- Cooling chamber
- Battery simulation 800V / 600A / 160kW

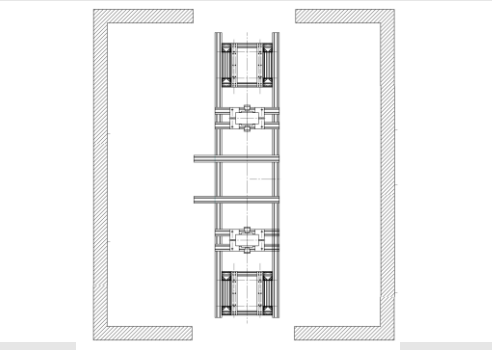
SPECIAL FEATURES

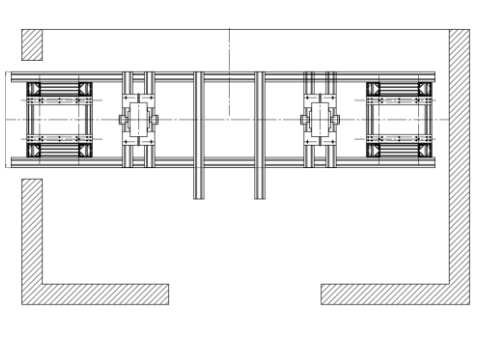
Operations

- Functional & endurance tests
- High dynamic rigs for engine simulation
- Driving Strategy
- Transmission calibration
- Powertrain validation
- Vehicle testing

Measuring

- All physical measuring values
- All dedicated process values (online/offline)
- Dynamics (angle-/time-based)
- NVH (Acoustics & Vibration)
- All relevant emissions
- Indicated pressure & knock detection
- Wear measurement via surface scan
- Wear measurement via RNT
- Delta analyzer





Environmental Test Field

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Techniques / Services	Functional Test	Endurance Tests	Environment Tests	Tribology / Analysis	Engineering

- Component Test Field
- High Dynamic Drives
- Radionuclide Technology
- Engine Test Field
- Powertrain Test Field
- **Environment Test Field**
- Wear & Friction Test Rigs
- Material & Measuring Laboratory
- Fatigue Strength Test Field

TECHNIQUE

Equipment

- Climatic chambers -40° to 200°C
- Coolant or oil temperature -40° to 135 °C
- Independent control of ambient and medium
- Humidity control 0...100%
- Shaker up to 40 kN

Infrastructure

- Cooling circuit -44°C
- Energy recovery
- Battery simulation 800V / 600A / 160kW
- Hydraulic power rail
- Own test bench construction for special applications

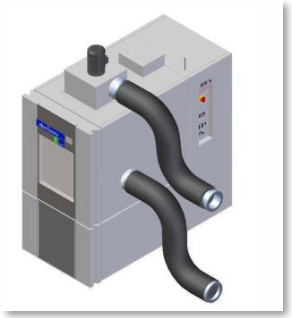
SPECIAL FEATURES

Operations

- Control of various actuators (LIN,CAN,SENT...)
- Functional & endurance tests
- LV124/VW80000
- Vibration
- Mechanical shock
- Mechanical, electrical & hydraulic misuse

Measuring

- All physical values
- All simulated values
- Simulation ↔ Rig
- All dedicated process values (online/offline)
- Dynamics (angle-/time-based)
- NVH (acoustics & vibration)
- Wear measurement via surface scan
- Wear measurement via RNT



Wear & Friction Test Rigs

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Techniques \ Services	Functional Test	Endurance Tests	Environment Tests	Tribology / Analysis	Engineering

- Component Test Field
- High Dynamic Drives
- Radionuclide Technology
- Engine Test Field
- Powertrain Test Field
- Environment Test Field
- **Wear & Friction Test Rigs**
- Material & Measuring Laboratory
- Fatigue Strength Test Field

TECHNIQUE

Equipment

- 15 wear test rigs (rotational, translational)
- 1 tribometer MTM
- Online wear: RNT (Radio Nuclide Technology)
- High dynamic rotational friction rig
- Micro friction & sealing rig

Infrastructure

- < 350 m² testing area for wear test & friction
- High-resolution measuring technology & data evaluation
- Own test bench construction for special applications
- Own photo labs, measuring rooms, materials laboratory...

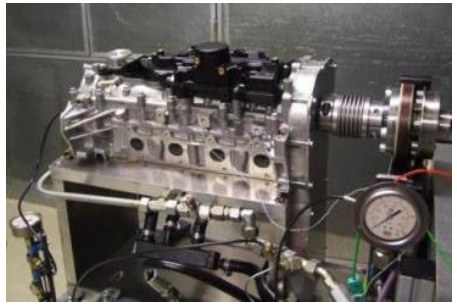
SPECIAL FEATURES

Load

- Medium contamination: dirt, soot, foaming, fuel, acid
- Thermal load: -40°C up to 160°C
- Mechatronical load: High-speed, speed gradient > 10.000rpm/s
- Test environment similar to mechanical, electrical and hydraulic operation parameters (Virtual ICE)

Measuring

- All physical measuring values
- All simulated values
- Simulation ↔ Rig
- All dedicated process values (online/offline)
- Dynamics (angle-/time-based)
- NVH (acoustics & vibration)
- Wear measurement via surface scan
- Wear measurement via RNT



Material and Surface Laboratory

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Techniques \ Services	Functional Test	Endurance Tests	Environment Tests	Tribology / Analysis	Engineering

- Component Test Field
- High Dynamic Drives
- Radionuclide Technology
- Engine Test Field
- Powertrain Test Field
- Environment Test Field
- Wear & Friction Test Rigs
- **Material & Measuring Laboratory**
- Fatigue Strength Test Field

TECHNIQUE

Equipment

- 3D measuring machine, Roundness, Straightness, Roughness measurement
- Transmitted light measurement
- Photo microscopes
- Hardness measurement
- Material-laboratory-Microscope
- REM use on request

Infrastructure

- Materials laboratory with chemistry suction cupboard
- Material Cutting Device
- Embed and Grind Device
- Photo laboratory

SPECIAL FEATURES

Operations

- Return Part Analysis on individual components (timing chain, valve train, transmission ...) with system view and system understanding
- Approval for measurement on RNT parts available

Measuring

- All physical measurements tactile and optical
- Material examination and assessment

Fatigue Strength Test Field

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Techniques / Services	Functional Test	Endurance Tests	Environment Tests	Tribology / Analysis	Engineering

- Component Test Field
- High Dynamic Drives
- Radionuclide Technology
- Engine Test Field
- Powertrain Test Field
- Environment Test Field
- Wear & Friction Test Rigs
- Material & Measuring Laboratory
- **Fatigue Strength Test Field**

TECHNIQUE

Equipment

- Resonance pulsators up to 20 kN
- Resonance pulsators up to 100 kN
- Resonance magnetic test system up to 20 kN
- Hydraulic system up to 7 kN and 500 Hz
- Hydraulic system up to 20 kN and 150 Hz

Infrastructure

- Own photo labs, measuring rooms, materials laboratory...

SPECIAL FEATURES

Services for Automotive Customers

- Dynamic strength tests
- Service strength tests
- Crack detection and damage analysis
- Lifetime valuation
- Environmental simulation (-40 up to 160°C)

Measuring

- All physical measurements tactile and optical
- Material examination and assessment

Functional Test / Example

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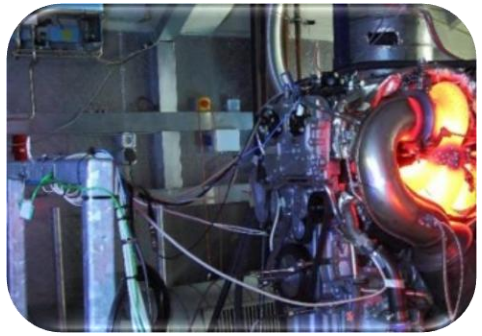
Techniques \ Services	Functional Test	Endurance Tests	Environment Tests	Tribology / Analysis	Engineering
Component Test Field					
High Dynamic Drives					
Radionuclide Technology					
Engine Test Field					
Powertrain Test Field					
Environment Test Field					
Wear & Friction Test Rigs					
Material & Measuring Laboratory					
Fatigue Strength Test Field					

Bearings

Exhaust gas turbocharger wastegate

Valve train



Roller bearing e-machine

Chain drive

...

Functional Test / Example

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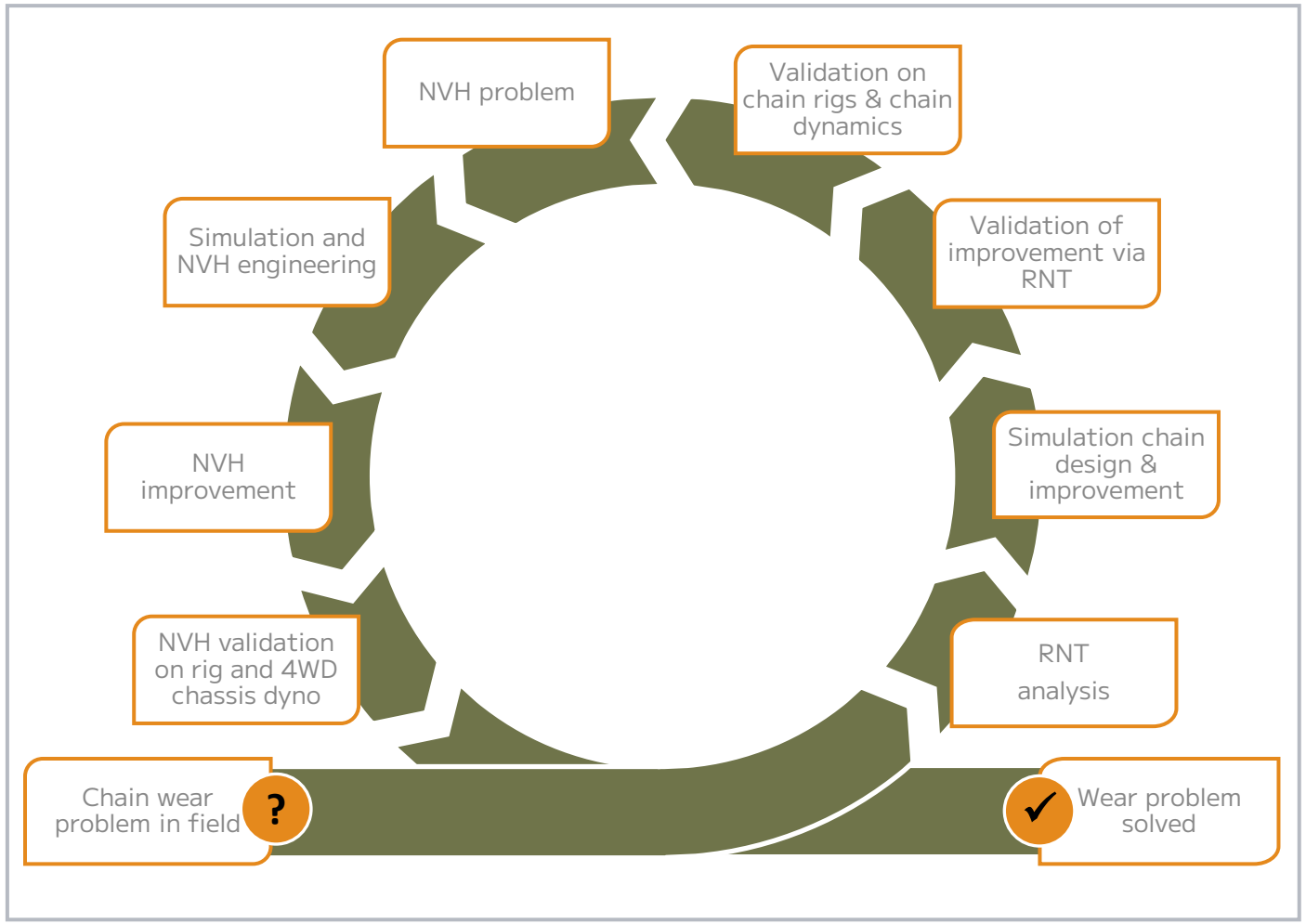
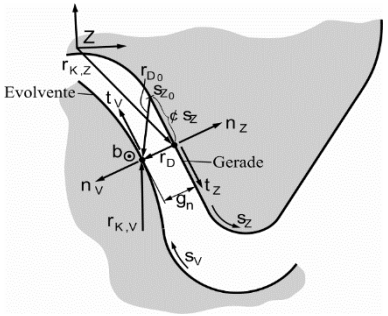
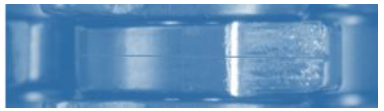
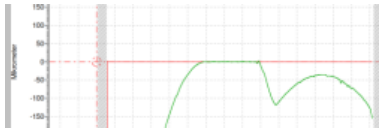
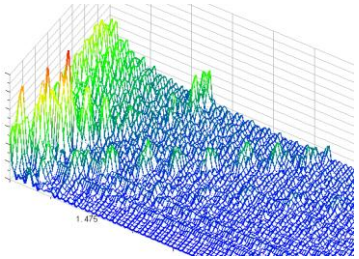
Techniques \ Services	Functional Test	Endurance Tests	Environment Tests	Tribology / Analysis	Engineering
Component Test Field					
High Dynamic Drives					
Radionuclide Technology					
Engine Test Field					
Powertrain Test Field					
Environment Test Field					
Wear & Friction Test Rigs					
Material & Measuring Laboratory					
Fatigue Strength Test Field					











Endurance Tests / Example

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Techniques \ Services	Functional Test	**Endurance Tests**	Environment Tests	Tribology / Analysis	Engineering
Component Test Field					
High Dynamic Drives					
Radionuclide Technology					
Engine Test Field					
Powertrain Test Field					
Environment Test Field					
Wear & Friction Test Rigs					
Material & Measuring Laboratory					
Fatigue Strength Test Field					

Up to 450 kW
Up to 3.000 Nm

Coolant-/oil- conditioning

High dynamic drive / Virtual ICE

Early detection of damage

Own automation platform SARA with interfaces to common tools (i.e., MATLAB®)

Failure analysis

Rig engineering & construction

Failure diagnosis

Documentation

24/7 operation

Environment Test / Example: Oxygen Supply for Hydrogen Fuel Cell

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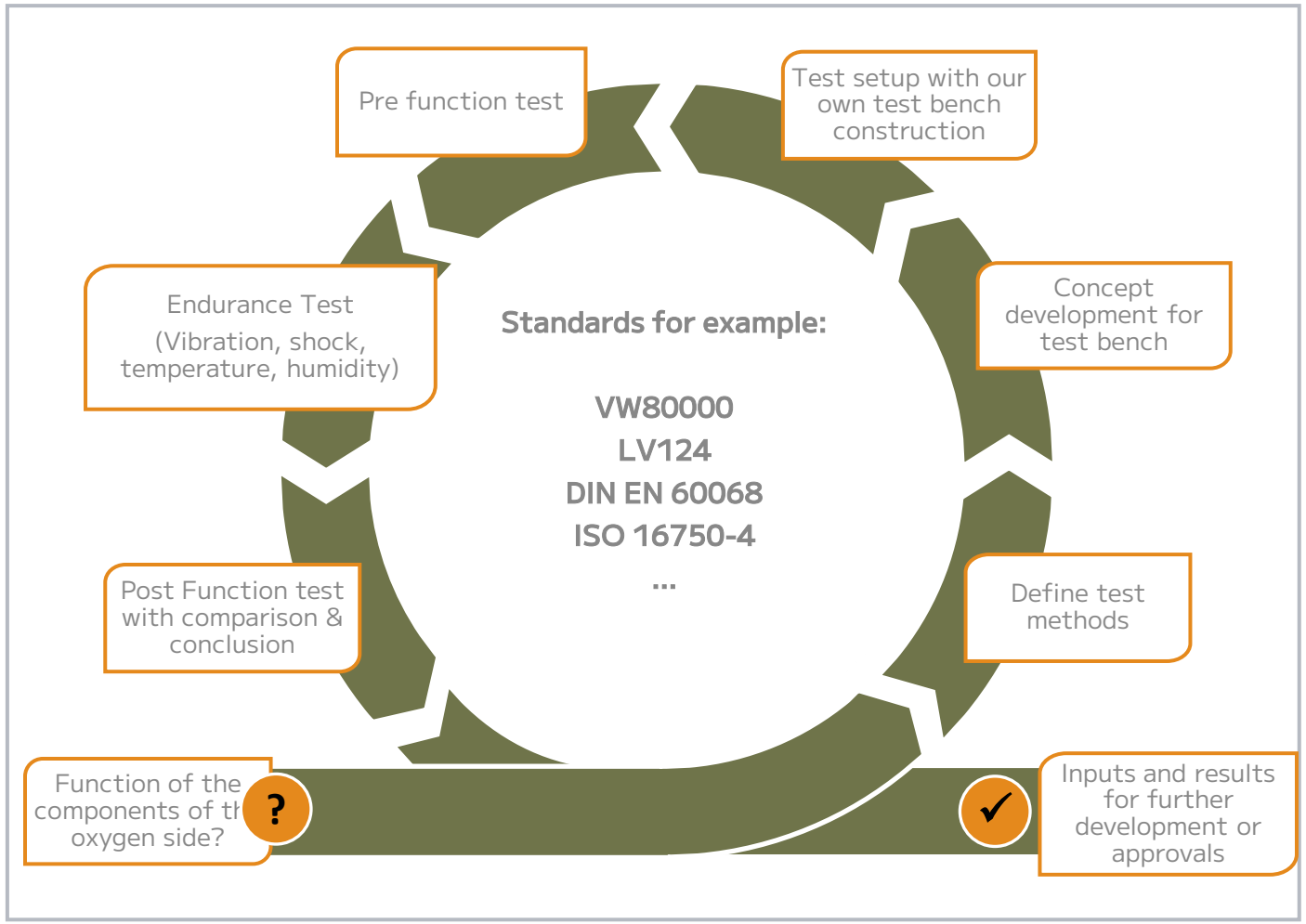
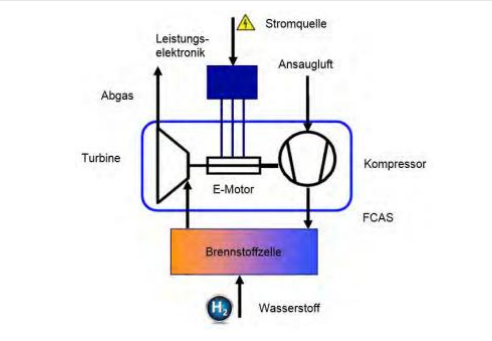
Techniques \ Services	Functional Test	Endurance Tests	**Environment Tests**	Tribology / Analysis	Engineering

- **Component Test Field**
- High Dynamic Drives
- Radionuclide Technology
- Engine Test Field
- Powertrain Test Field
- **Environment Test Field**
- Wear & Friction Test Rigs
- **Material & Measuring Laboratory**
- Fatigue Strength Test Field





Environment Test / Example: Vibration test Dummy Battery

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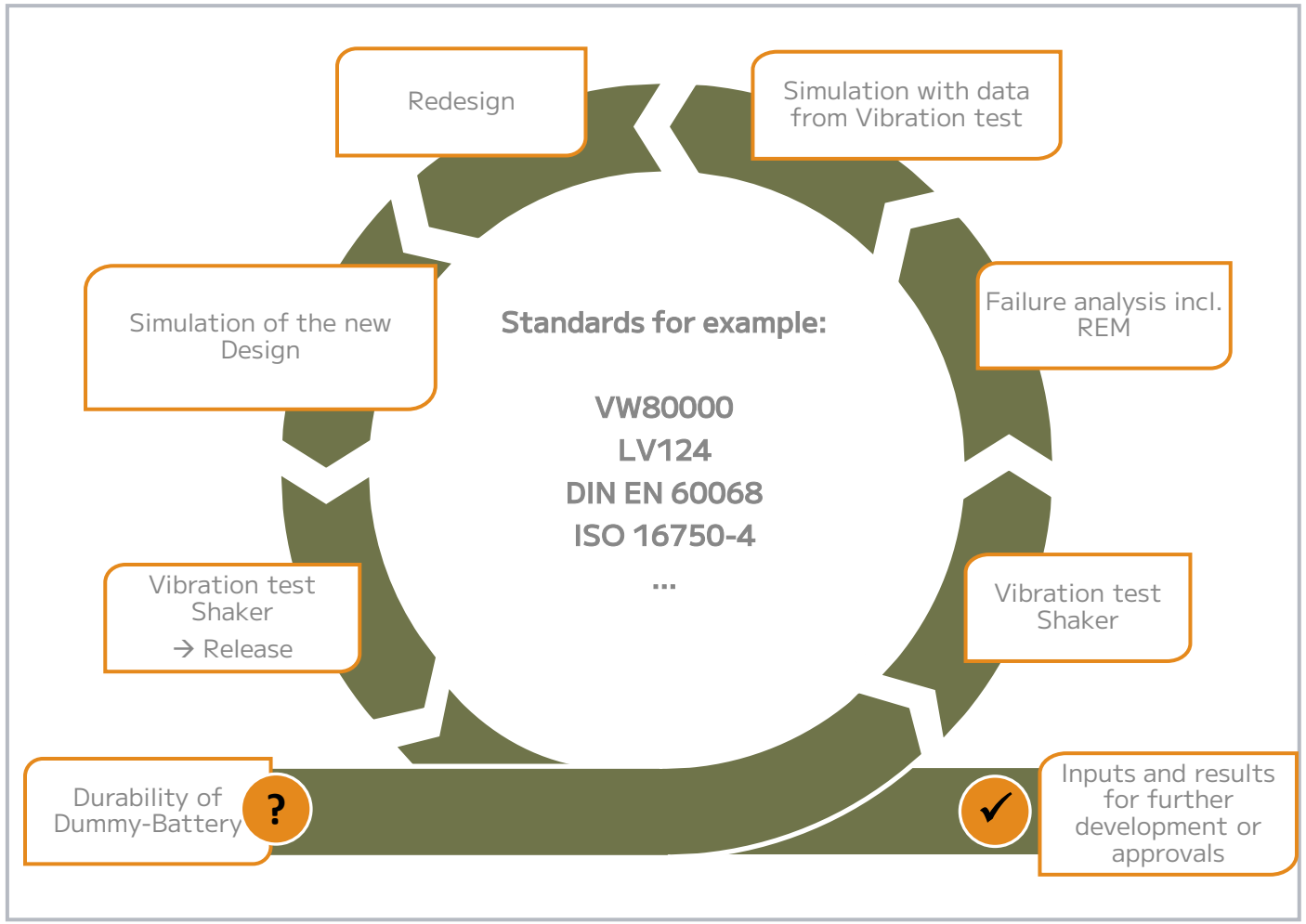
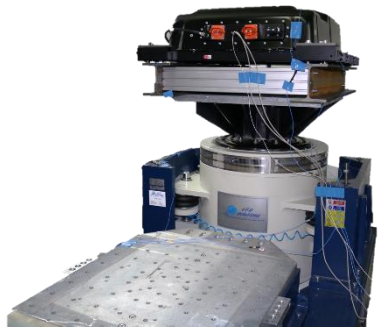
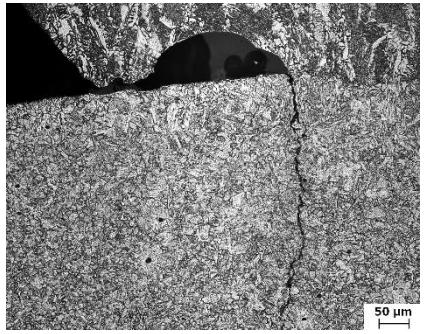
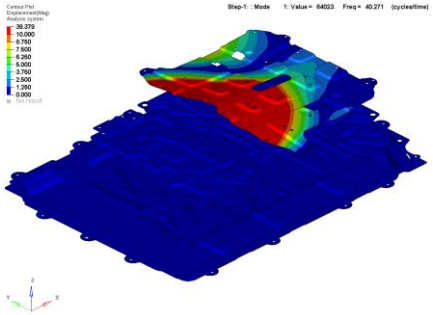
Techniques \ Services	Functional Test	Endurance Tests	**Environment Tests**	Tribology / Analysis	Engineering

- **Component Test Field**
- High Dynamic Drives
- Radionuclide Technology
- Engine Test Field
- Powertrain Test Field
- **Environment Test Field**
- Wear & Friction Test Rigs
- **Material & Measuring Laboratory**
- Fatigue Strength Test Field









Tribology, Analysis / Example: Benchmark Wastegate Actuator

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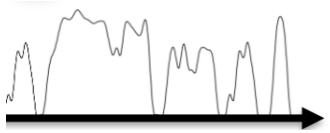
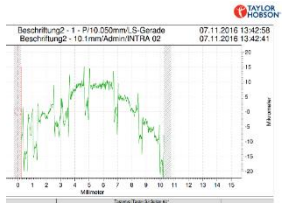
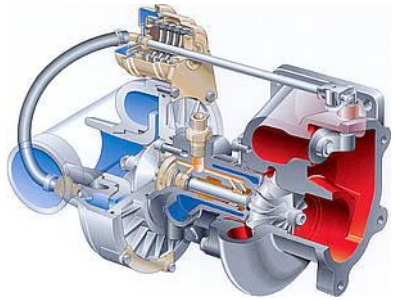
Techniques \ Services	Functional Test	Endurance Tests	Environment Tests	**Tribology / Analysis**	Engineering

- Component Test Field
- High Dynamic Drives
- Radionuclide Technology
- Engine Test Field
- Powertrain Test Field
- Environment Test Field
- Wear & Friction Test Rigs
- Material & Measuring Laboratory
- Fatigue Strength Test Field



Tribometer & RNT → Pre-selection of material pairs → Validation on component rigs → Final selection of material pair → Validation on fired engine rig with RDE profile





Engineering / Example: Seat ring problem

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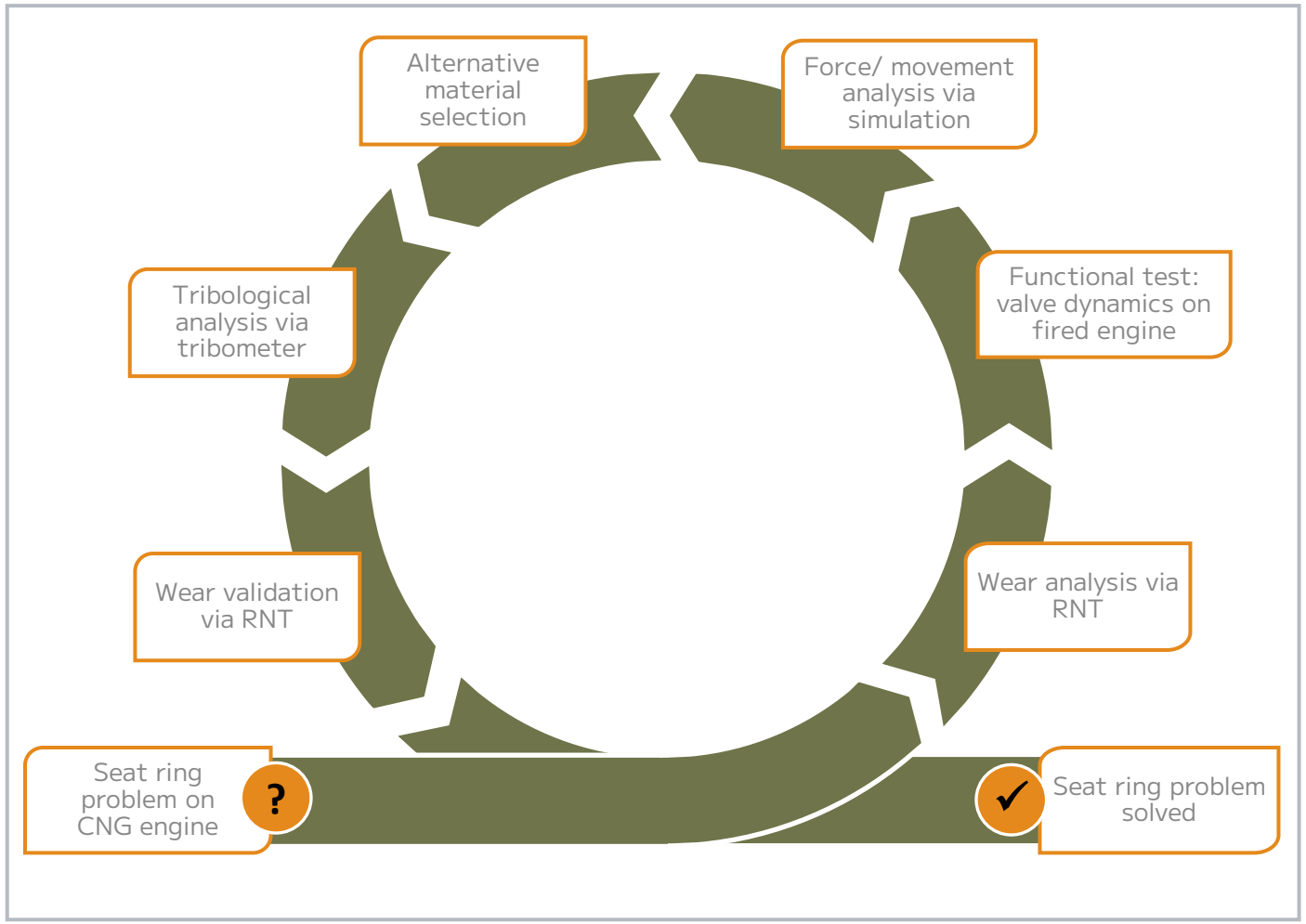
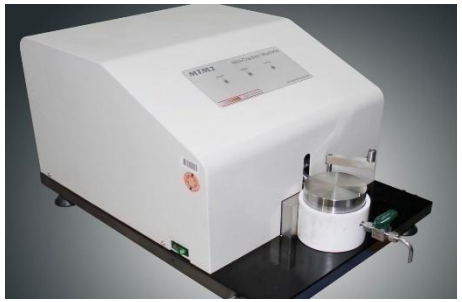
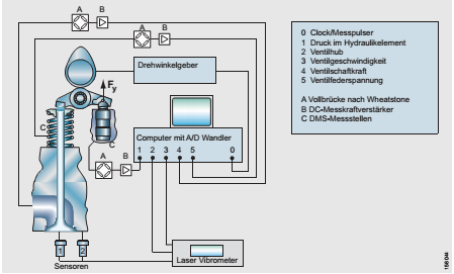
Techniques \ Services	Functional Test	Endurance Tests	Environment Tests	Tribology / Analysis	**Engineering**

- Component Test Field
- High Dynamic Drives
- **Radionuclide Technology**
- **Engine Test Field**
- Powertrain Test Field
- Environment Test Field
- **Wear & Friction Test Rigs**
- **Material & Measuring Laboratory**
- Fatigue Strength Test Field







Engineering / Example: High Dynamic Drives

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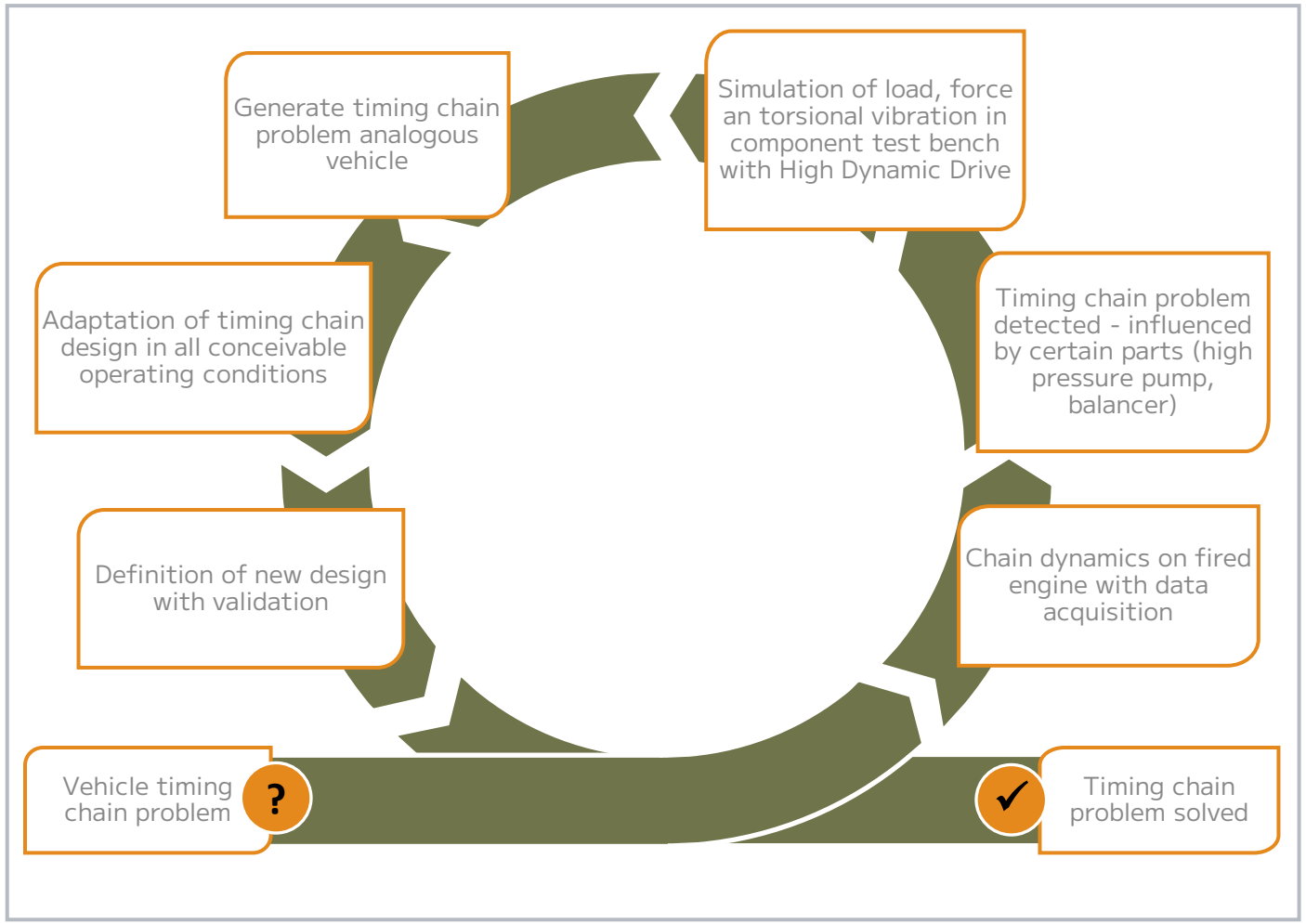
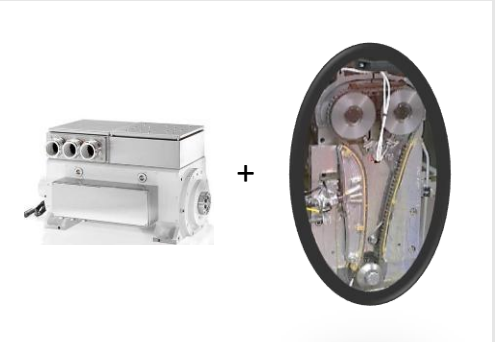
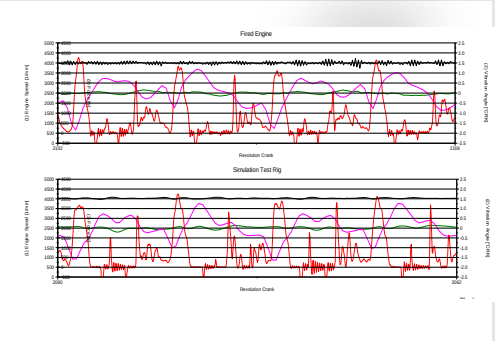
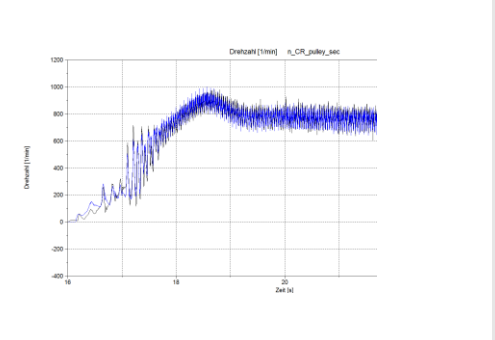
Techniques \ Services	Functional Test	Endurance Tests	Environment Tests	Tribology / Analysis	**Engineering**

- Component Test Field
- **High Dynamic Drives**
- Radionuclide Technology
- **Engine Test Field**
- Powertrain Test Field
- Environment Test Field
- Wear & Friction Test Rigs
- **Material & Measuring Laboratory**
- Fatigue Strength Test Field









Engineering / Example: EV Powertrain

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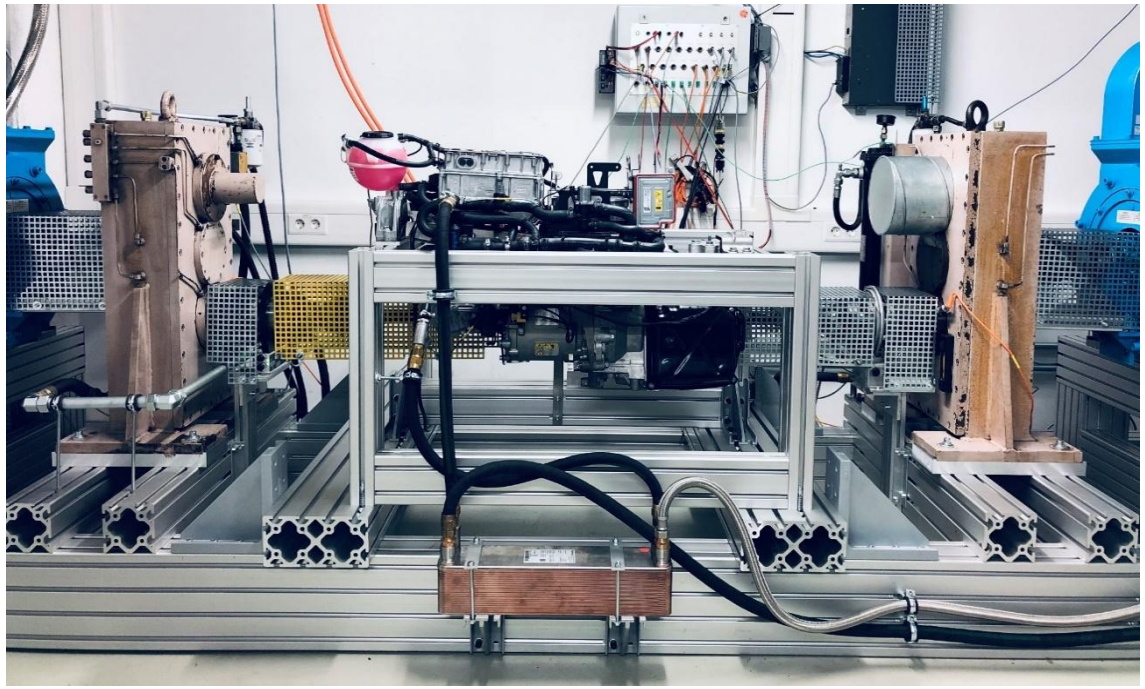
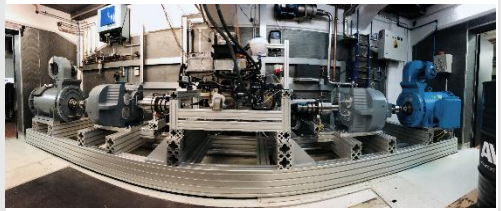
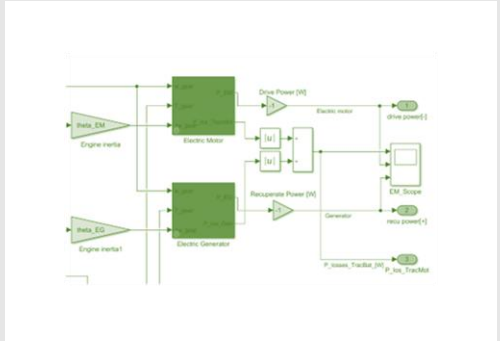
Techniques \ Services	Functional Test	Endurance Tests	Environment Tests	Tribology / Analysis	**Engineering**
Component Test Field					
High Dynamic Drives					
Radionuclide Technology					
Engine Test Field					
Powertrain Test Field					
Environment Test Field					
Wear & Friction Test Rigs					
Material & Measuring Laboratory					
Fatigue Strength Test Field					

- Driving strategy
- Trans-mission calibration
- Powertrain validation
- Vehicle testing







Engineering / Example: EV Powertrain

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Techniques \ Services	Functional Test	Endurance Tests	Environment Tests	Tribology / Analysis	**Engineering**
Component Test Field					
High Dynamic Drives					
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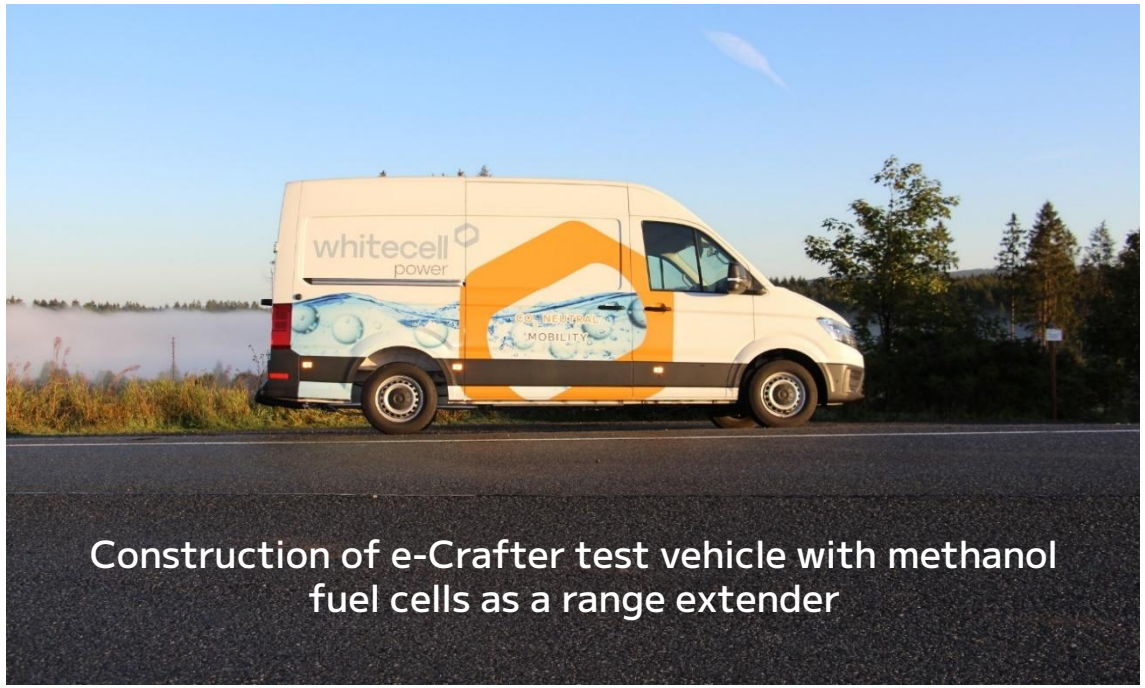
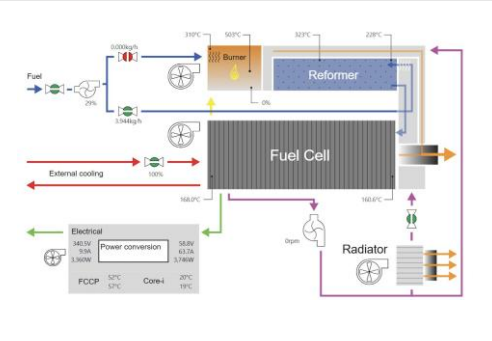
Material & Measuring Laboratory					
Fatigue Strength Test Field					

Conception → Design → Integration → Vehicle testing



Construction of e-Crafter test vehicle with methanol fuel cells as a range extender



Engineering / Example: EV Powertrain

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Techniques \ Services	Functional Test	Endurance Tests	Environment Tests	Tribology / Analysis	**Engineering**
Component Test Field					
High Dynamic Drives					
Radionuclide Technology					
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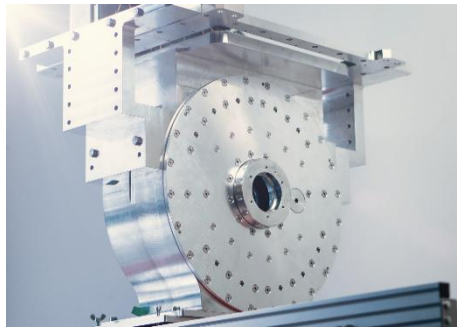
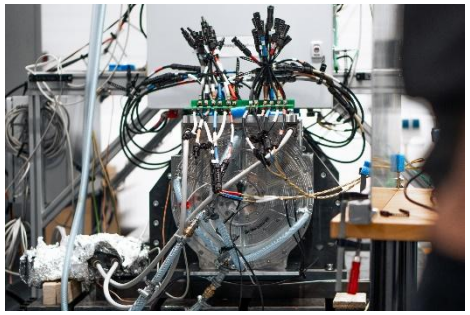
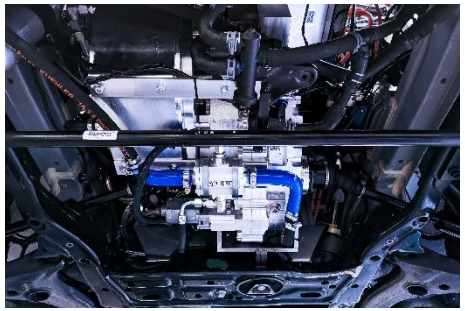
Powertrain Test Field					
Environment Test Field					
Wear & Friction Test Rigs					
Material & Measuring Laboratory					
Fatigue Strength Test Field					

Conception → Design → Integration → Vehicle testing

Construction Demo Car e-Crafter with newly developed Vaionic eDrive system







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Thank you.

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bernd.stange@ift-whitecell.de · www.ift-whitecell.de