Nemak Schaffhausen AG

Portfolio of Testing Capabilities

Version: 2026

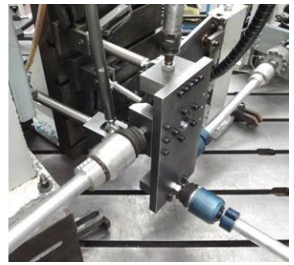
Nemak
Innovative Lightweighting

Schaffhausen Lab Testing Overview

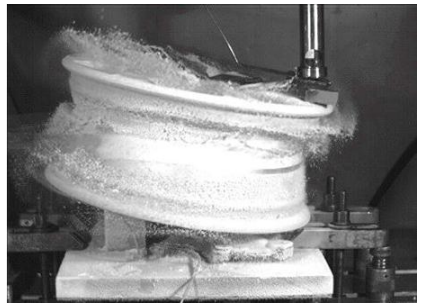
- Certified & accredited testing lab (ISO 9001 / 17025)
- TISAX level 3 certification
- Testing equipment for samples, components & assemblies:
  - Static test (up to 600 kN) & mechanical material characterization
  - Multi-channel cyclic bench test (1-4 channels, up to 320 kN)
  - Impact test (up to 2700 J)
  - Boundary parts (adverse tolerance) testing & requalification of parts from new mould patterns & HPDC dies
- Analytics:
  - Salt spray corrosion test (-40…+70°C, Cap.: 2x1.5x0.7 m³)
  - Fully-equipped metallography & microscopy
  - Scanning Electron Microscopy (SEM, EDX)
  - Chemical analysis
  - Dilatometry

accredited tests applied for accreditation





4-channel wheel carrier



Impact test



Fatigue curves



Pendulum impact test



3D-scanner



Bending/shear test
Tensile test



Corrosion test

Material Properties – Mechanical Characterization

- Standard tests e.g. for generating data sheets a/o for material specification conformity checks:
  - Hardness Brinell / Vickers / Rockwell
  - Low-load Vickers hardness (e.g. for microstructure homogenity)
  - Pendulum Impact testing 25/75/300 Joule (-50…+100 °C)
  - Tensile test D5-10mm (RT…950 °C)
  - Bending test
  - Shear test (e.g. for welded samples)
  - Creep-testing (up to 950 °C)
  - Fatigue curves: HCF tests, push & pull / torque





Fatigue curves



Pendulum impact test



Tensile test



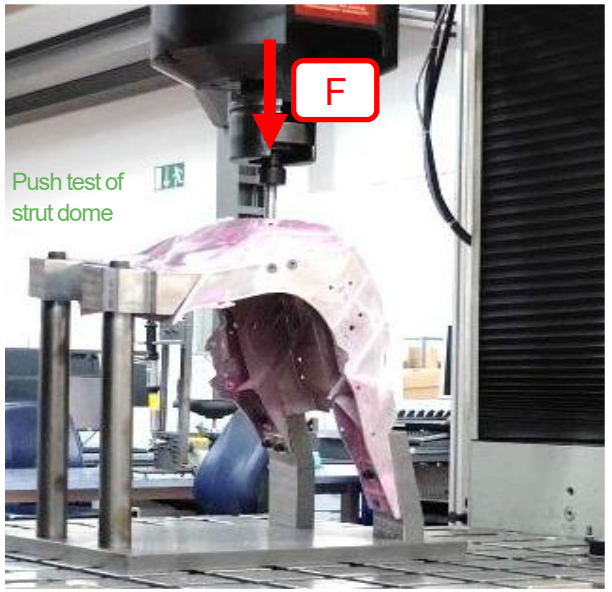
Bending/shear test

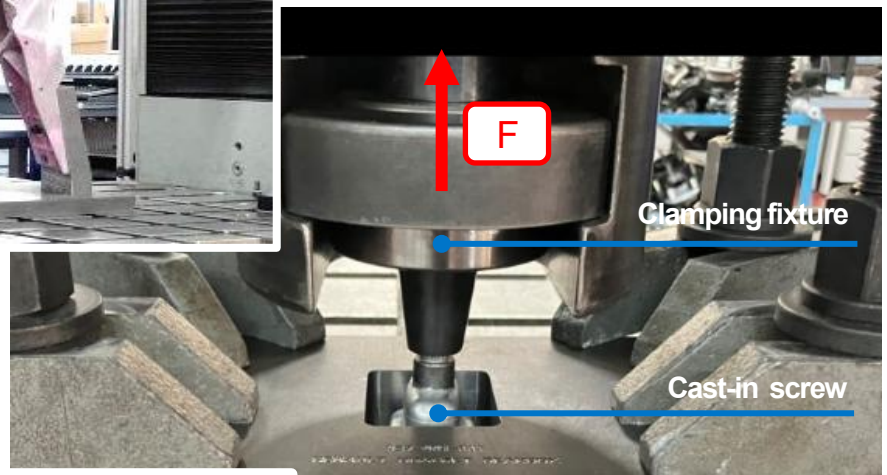


Hardness testing machine

Static Load Bench Test

- Features of available assets:
  - Force max. 600 kN, displacement max. 1000 mm
  - Realization of bending, shear, push or pull tests
  - Documentation of deformation till fracture
  - Possibility of test recording by high-speed camera
  - Applicable e.g. for quasi-static crash tests on complex parts such as shock towers, battery frames, subframes, A-pillars, support brackets, longitudinal members, pull-out tests on screws (right foto), …







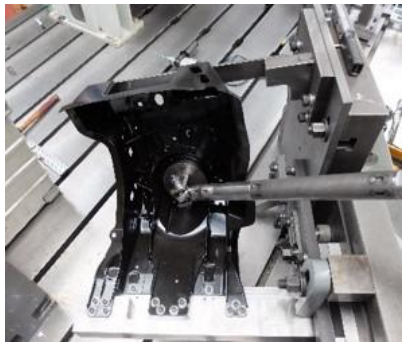




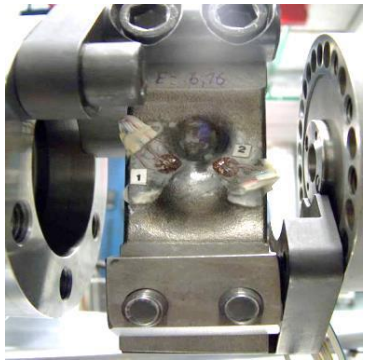


Cyclic Load Bench Test

- Service load collectives including:
  - Force max. 320 kN
  - Torque max. 500 Nm
  - Displacement max. 250 mm
  - Frequency max. 60 Hz
  - 1-channel endurance bench test
  - Fluid pressure test max. 10 bar
  - Possibility of recording temperature rise during testing (thermal imaging camera)
  - → Verifaction of numerical simulation and validation (depicted below)



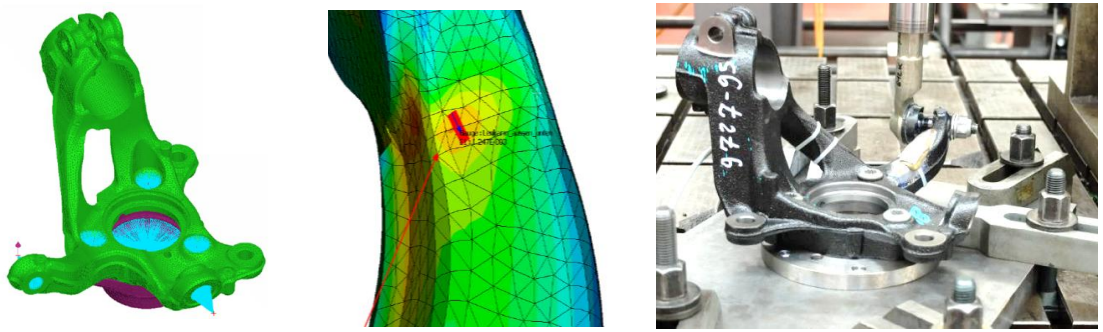
1-channel bench test for chassis parts



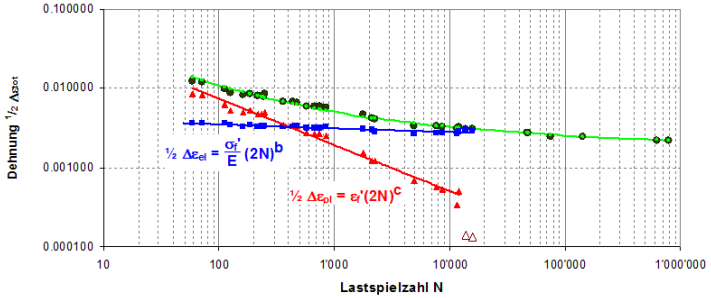
Torque- / spherical test specimen



1-channel bench test passenger car knuckles / wheel carriers



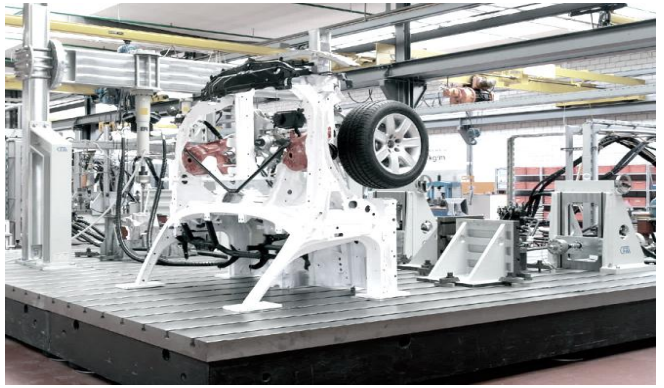
Numerical simulation setup of a passenger car front knuckle



E-N fatigue curves

Multi-Channel Cyclic Load Bench Test

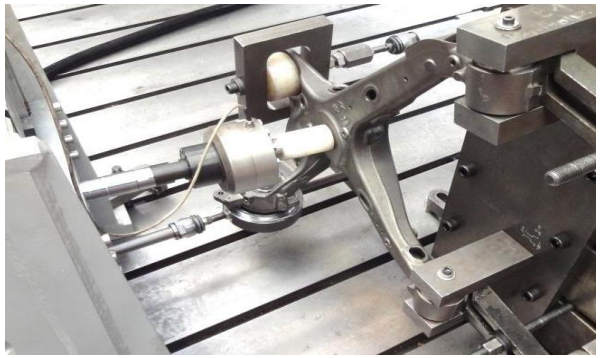
- Service load collectives including:
  - Force max. 400 kN
  - Displacement max. 250 mm
  - Frequency max. 60 Hz
  - System testing
  - Component testing
  - Sub-component testing
  - Environmental test:
    stress corrosion (salt spray)
- Multi-channel tests:
  - up to 4-channels in x/y/z directions
    with varying frequencies



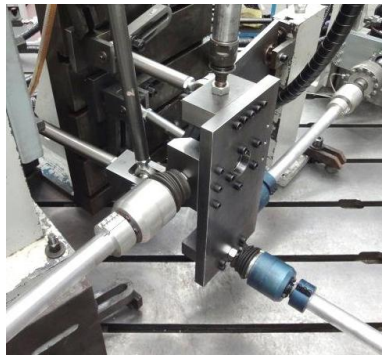
Shock tower system test



4-channel chassis test



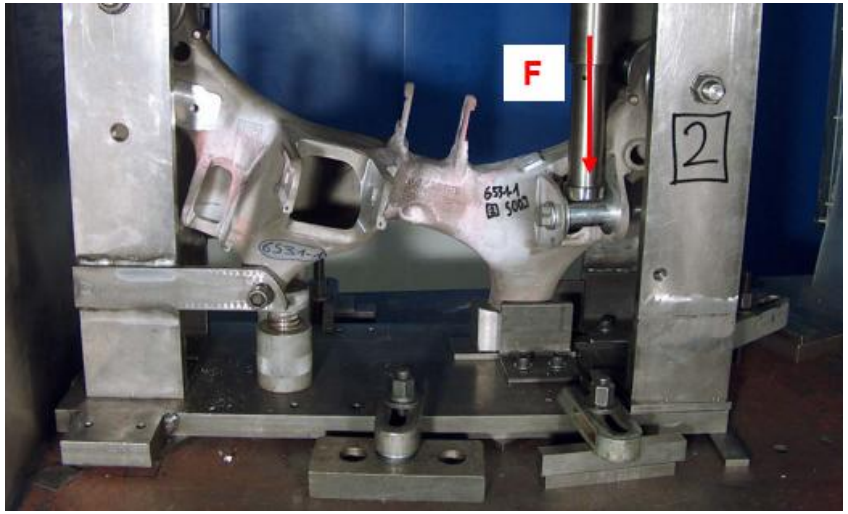
Trailing arm 2-channel component test



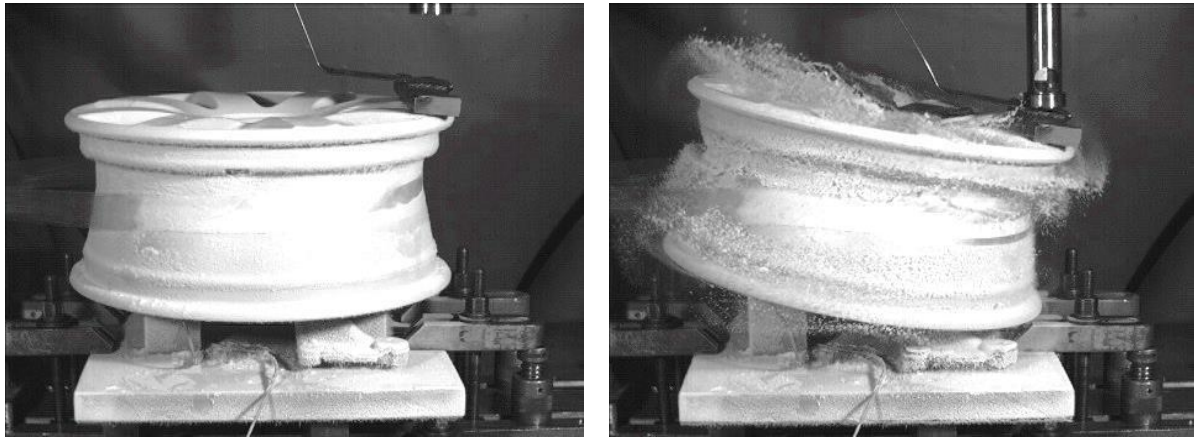
4-channel wheel carrier

Impact Test

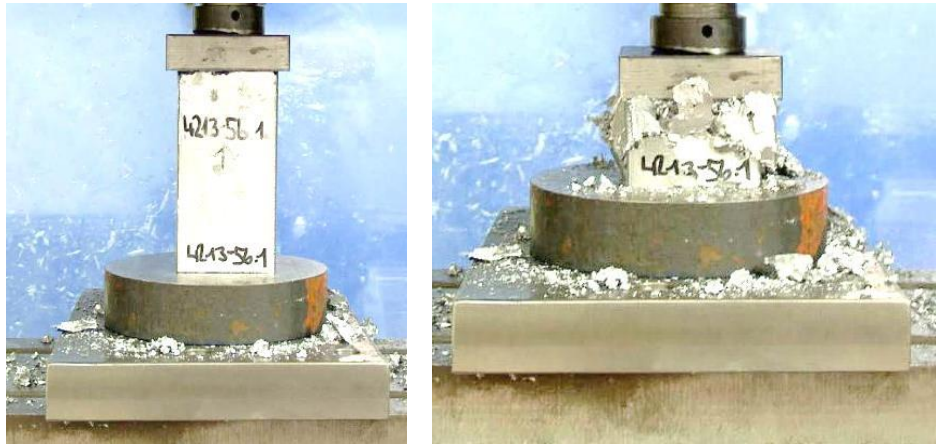
- Test framework fits standard samples, segmented/ complete components a/o subassemblies:
  - simulation of crash load cases → impact energy max. 2700 Joule
  - Load cell 200 kN
  - Max. height 2.69 m
  - Velocity max. 7.2m / sec
  - High speed video recording
  - Data recording 100 kHz
  - Temperature min. -40° C



Impact test setup for subframe kinematic points



Impact test of aluminum rims mounted on cast iron knuckles



Impact test on standard metal samples

Measurement Technology

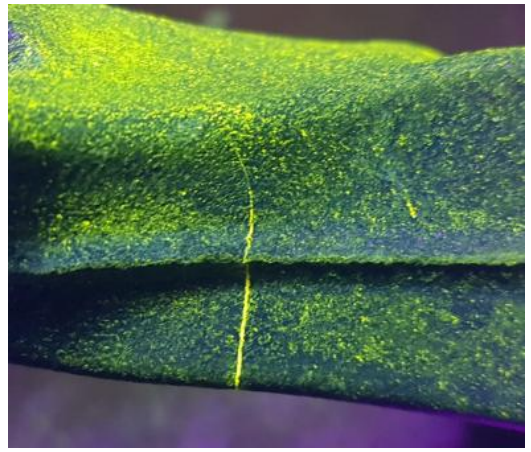
- Further equipment & applications
  - 3D scanner for e.g. check on deformation after test, results usable for reverse engineering
  - eigen frequency analysis
  - Ultrasonic test: Young's Modulus of castings
  - Screwing station: test on screwing force, thread fracture force, comparison of differently coated screws
  - Roughness measurement
  - Light/Scanning Electron Microscope: check for crack-inducing surface/material defects
  - Crack test:
    - dye penetrant test
    - magnet particle test



Test setup for screwing test



3D-scanner



Crack test

Analytics & Further Laboratory Competencies

- Salt spray corrosion test:
  - Capacity: 2,1 m 1,5 m x 0,76 m / 2000 L / 500 kg
  - -40…+70°C, varying humidity
- Chemical analysis:
  - LECO combustion analysis for sulphur & carbon content
  - OES, X-Ray diffractometry (reactivable)
  - -40…+70°C, varying humidity
- Metallography:
  - Fully equipped sample preparation (cutting, embedding devices, impregnation, etching)
  - Grinding/polishing automat, up to 6 samples at once
  - Zeiss light microscope for microstructural checks
  - Stereomicroscope, Keyence digital microscope for (fracture) surface investigations
  - Zeiss Scanning Electron Microscope with EDX for chemical composition check on microscopic small objects/ defects on surfaces, e.g. for failure analysis of components
- Dilatometry:
  - thermal expansion, material phase transitions (heat treatment verification)





Corrosion test





Metallography & microscopy

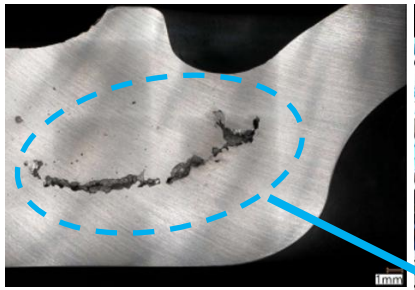
Examples of Frequent Component Tests

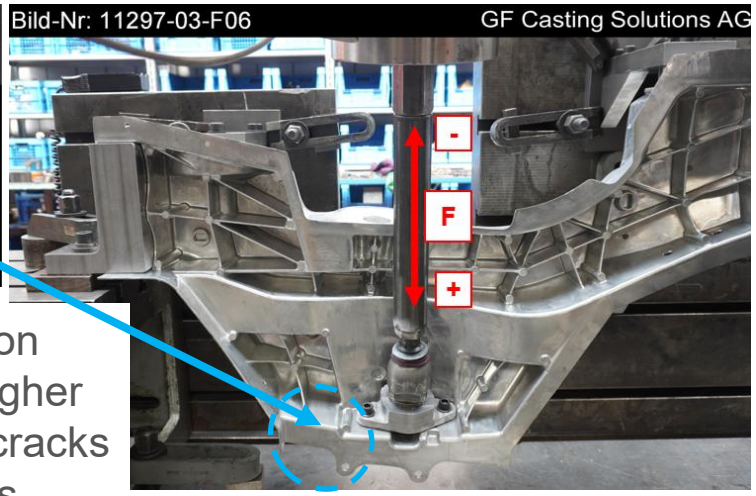
Recurrent tests on prototypes, pre-series and running serial parts

Boundary parts control

Plant asks for check of accordance to OEM spec. after detected peculiarity during production process:

e.g.: X-ray (porosity), dimensional check (bearing tolerances)





Example: cyclic test on parts of batch with higher porosity. Result: No cracks in porous part regions, batch released.

Requalification

Customer mandates re-validation of serial parts from new moulds / tools / HPDC dies according to OEM spec.:

e.g.: in-cast insert tests, material properties, fatigue service tests





Example: max. load screwing tests on inserts

Further Competence Areas

- Machining @ prototyping workshop:
  - Complex geometries, test rig fixtures, material samples
  - CAM milling centers (up to 800 x 500mm, 3-/5-axis available)
  - Turning machine (dmax = 380mm)
  - Grinding machine (working area 420 x 200mm)

- Additional know-how and devices:
  - assembly / joining (e.g. screws, press-in bearings, welding)
  - Heat treatment
  - Welding for test rigs, metallographic welding evaluation



5-axis machining center


Turning machine



Prototype example (e-Housing)


Heat treatment furnace
(available in different sizes)



Nemak
Innovative Lightweighting

Your Contact:

Sebastian Wierschke
Head of Product Validation
Mobile +41 79 536 62 43
sebastian.wierschke@nemak.com

Nemak Schaffhausen AG
Ebnatstr. 91G
8201 Schaffhausen
Switzerland


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