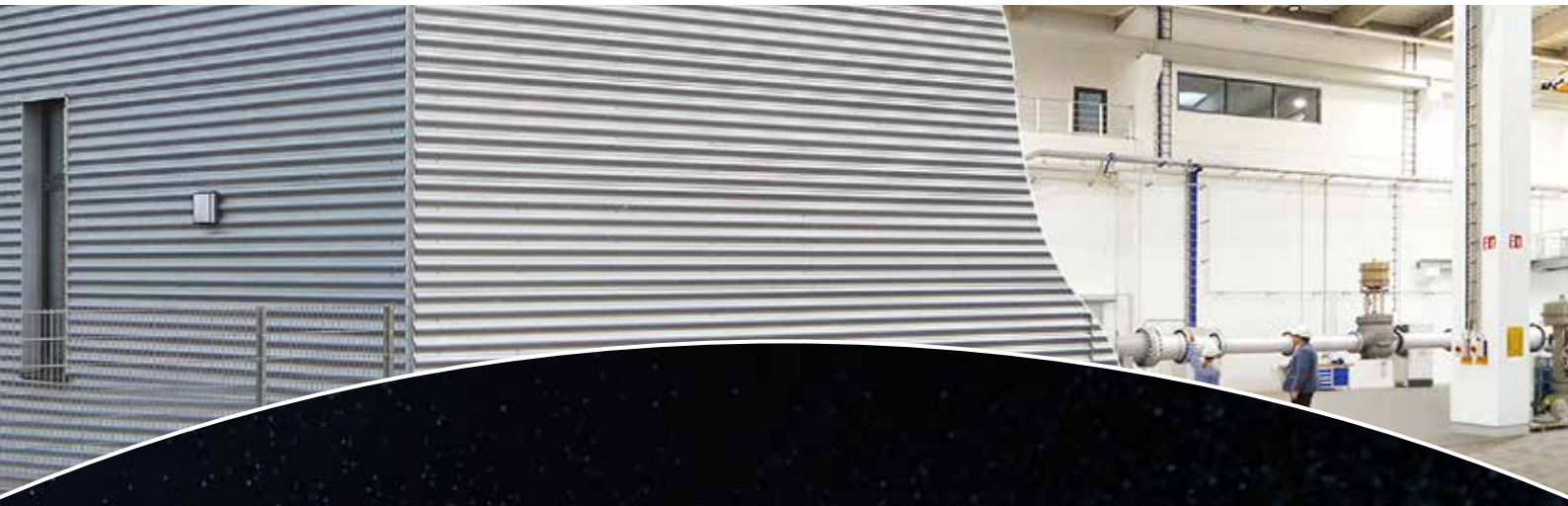
INNOVATIVE CONTROL ENGINEERING

ROLF SANDVOSS INNOVATION CENTER

SERVICES

SMART IN FLOW CONTROL

FLUID MECHANICS



We are SMART IN FLOW CONTROL. We are committed to understanding and controlling the flow of media. Process media in all possible conditions, such as liquids, gases, vapors, multi-phase flows and even liquids containing solid particles, can be simulated on different test benches in the ROLF SANDVOSS INNOVATION CENTER.

In the FLOW LABS, different specimens, such as valves, orifice plates, nozzles and sensors, can be subjected to flow, acoustic and function tests. They can be calibrated and their operation can be simulated under specific plant conditions. In addition to standardized valve tests, including measurements of the valve characteristic according to DIN EN 60534-2-3 and acoustic tests according to DIN EN 60534-8-1 or DIN EN 60534-8-2, specific test scenarios can be agreed. High-precision sensors are available to measure the different process and task-specific variables, for example for acoustic testing.

The flow test benches offer the flexibility to test devices in their different versions. Framework conditions specific to certain test standards are specified in the following descriptions.

WATER

FLOW LAB
Medium: water at 6 bar

The following test conditions are possible on this flow test bench:

- Medium: water
- Max. pressure: 6 bar
- Max. flow rate: 5,500 m³/h
- Process temperature: 15 to 30 °C

The maximum valve size for individual specimens is DN 500. Fluid systems can also be tested on request.

FLOW LAB
Medium: water at 25 bar

The following test conditions are possible on this flow test bench:

- Medium: water
- Max. pressure: 25 bar
- Max. flow rate: 2,200 m³/h
- Process temperature: 15 to 30 °C

The maximum valve size for individual specimens is DN 300. Fluid systems can also be tested on request.

WATER

FLOW LAB
Medium: water at 120 bar

The following test conditions are possible on this high-pressure flow test bench:

- Medium: water
- Max. pressure: 120 bar
- Max. flow rate: 150 m³/h
- Process temperature: 15 to 30 °C

The max. valve size for individual specimens is DN 150. Fluid systems can also be tested on request.

FLOW LAB
Medium: water (two-phase flows)

This test bench is suitable for simulations of two-phase flows. In addition, specimens can be inspected acting as nodes in district heating or cooling networks depending on the application. This test bench can be used for the following test conditions:

- Medium: water
- Max. pressure: 11 bar
- Max. flow rate: 200 m³/h
- Process temperature: 15 to 120 °C

The max. valve size for individual specimens is DN 150. Fluid systems can also be tested on request.

AIR AND STEAM

FLOW LAB
Medium: air

The following test conditions are possible on this flow test bench:

- Medium: air
- Max. pressure: 11 bar
- Max. mass flow: 70,000 kg/h
- Process temperature: 15 to 30 °C

The max. valve size for individual specimens is DN 500. Fluid systems can also be tested on request.

FLOW LAB
Medium: steam

The following test conditions are possible on this flow test bench:

- Medium: steam
- Max. pressure: 13 bar
- Max. mass flow: 5,000 kg/h
- Process temperature: 150 to 230 °C

The max. valve size for individual specimens is DN 300. Fluid systems can also be tested on request.

NITROGEN

FLOW LAB with nitrogen as the test medium

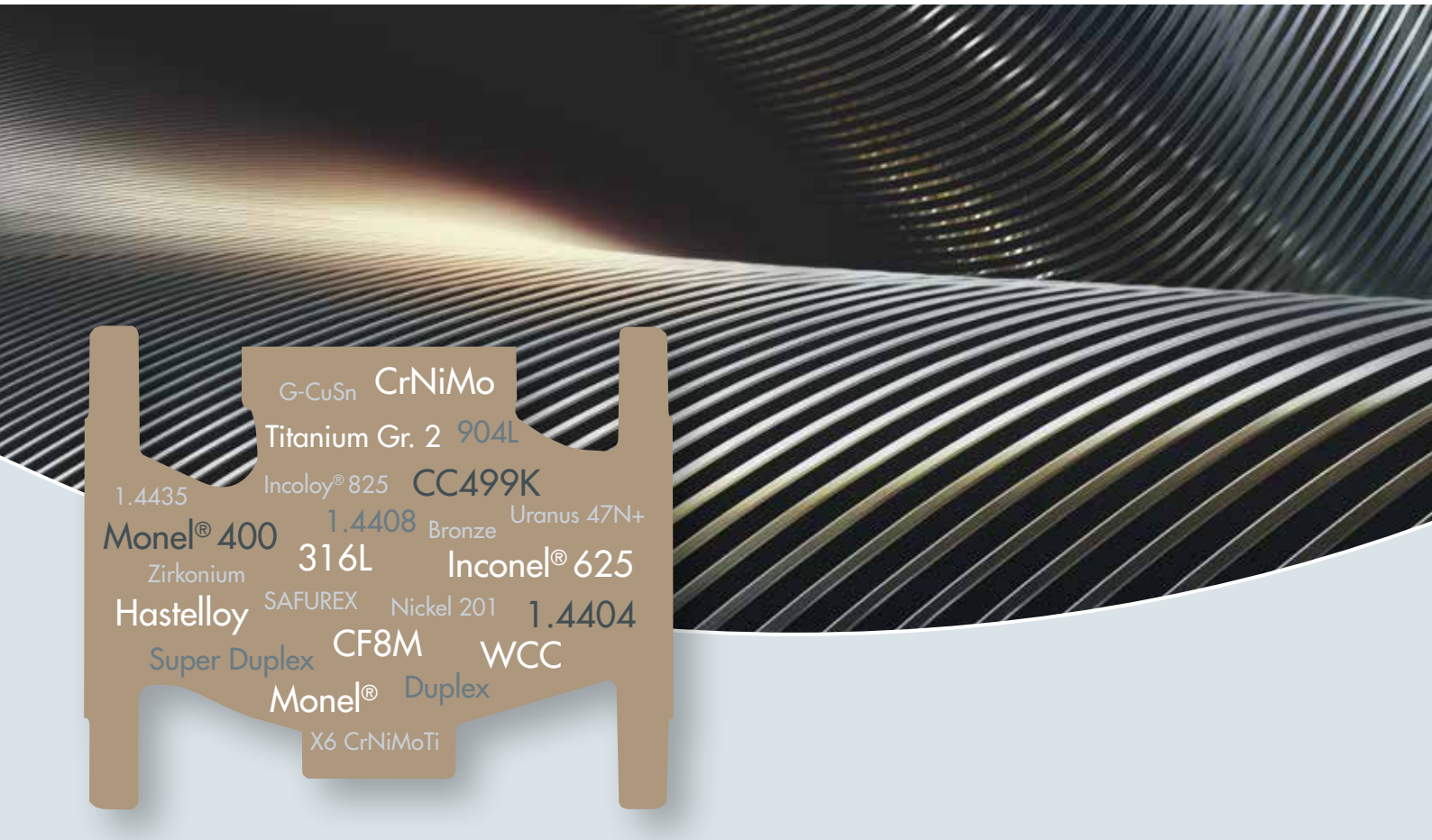
On the cryogenic test bench, we can perform cryogenic tests using both stationary and flowing media.

The following test conditions are possible in the stationary state:
- **Medium:** nitrogen to cool down specimens from the outside and helium to pressurize specimens from the inside
- **Temperature:** –196 °C up to room temperature (adjustable in bath of nitrogen liquid or gas)
- **Max. pressure:** 570 bar
- **Typical tests:** leak tests (seat leakage and fugitive emissions)

In addition, equipment can be tested at cryogenic temperatures and under real-life flow conditions. Depending on the desired process temperature, liquid nitrogen or nitrogen gas flows through the specimens in such tests. Optionally, the specimen can be fully insulated (for example in air separation plants) and positioned at a defined angle to verify the course of the temperature curve at critical parts.

The following test conditions are possible in the flowing state:
- **Medium:** nitrogen flowing through the specimens
- **Process temperature:** –196 °C up to room temperature
- **Max. pressure:** 7 bar

MATERIALS SCIENCES



Materials engineering

Using suitable materials is key to designing durable, reliable products. As a result, one of the main tasks of materials science and engineering is to assess materials and parts to determine their maximum permissible conditions of use.

Material-specific analyses and life cycle inspections support us in our R&D activities and in determining the application-specific materials and part geometries.

ENVIRONMENTAL SIMULATIONS

As products are not always installed in moderate environments, ROLF SANDVOSS INNOVATION CENTER provides facilities to simulate the different atmospheric conditions that exist across the world. Accelerated simulations help determine the resistance of metal and non-metal parts, semi-finished products, raw materials, surface coats and entire devices to these conditions. The processes involve exposing the specimens to several artificial atmospheres, including seawater and industrial atmospheres, humid environments and different weather conditions.

The following equipment is used for this purpose:

Artificial weathering

- Simulations to investigate exposure to increased solar radiation and rainfall
- Typical tests according to DIN EN ISO 4892-2
- Typical specimens: plastic and elastomer parts, complete valve accessories, (paint) coatings applied to test plates and parts
- Max. test volume: 21,000 cm^3

ENVIRONMENTAL SIMULATIONS

Artificial industrial environment

- Simulation at 100 % humidity (optionally using SO_2)
- Typical tests according to DIN EN ISO 6270-2, DIN 50018 or DIN EN ISO 6988
- Typical specimens: complete valve accessories, (paint) coatings applied to test plates and parts, electronic components, adhesive joints
- Max. test volume: 60,000 cm^3

Salt spray testing

- Simulation of seawater environments
- Typical tests according to DIN EN ISO 9227
- Typical specimens: test plates and parts made of metal, (paint) coatings applied to test plates and parts made of metal
- Max. test volume: 0.43 m^3

MATERIAL-SPECIFIC ANALYSES

Various coefficients are required to assess the materials. This is why our ROLF SANDVOSS INNOVATION CENTER is equipped to determine different mechanical coefficients by testing special specimens and parts made of metal, plastic and elastomers. In addition, chemical analyses can be performed on metal parts made of iron-, aluminum- or nickel-based alloys. Thermal analyses of organic materials (plastics, elastomers, lubricants, adhesives and (paint) coatings) are possible as well. Further test procedures include identifying substances that impair paint adhesion, determining the compression set for elastomers and reviewing the resistance to certain media. Quality assessments are put together for lubricants, elastomers, plastics and adhesives under a variety of mechanical, thermal and chemical loads.

The following equipment is used for this purpose:

MATERIAL-SPECIFIC ANALYSES

Pendulum impact tester

- Notched bar impact test of metals
- Typical tests according to DIN EN ISO 148 (Charpy, 300 J)
- Test temperature: –196 °C up to room temperature

DSC and TG analyses

- Thermal analysis of organic materials
- Typical specimens: plastics, elastomers, adhesives, lubricants, paint coatings

MATERIAL-SPECIFIC ANALYSES

Static material tester

- Determining mechanical material coefficients
- Typical tests according to DIN EN ISO 6892, DIN 53504, DIN ISO 34-1, DIN EN ISO 178, ISO 4587
- Max. test force: 50 kN
- Test temperature: –80 to 250 °C

Optical emission spectrometers

- Determining the chemical composition of iron-, aluminum-, copper- or nickel-based alloys

LIFE CYCLE TESTS

Good products are characterized by their long service life, even if they are operated in the most adverse process and ambient conditions. To achieve this durability, individual parts as well as complete control valves can be subjected to life cycle tests at ROLF SANDVOSS INNOVATION CENTER.

The tests cover the specimens' chemical, thermal and mechanical resistance as well as their flow characteristics and suitability for specific climate conditions. The available test facilities include various simulation and climatic cabinets, ovens and flow test benches.

LIFE CYCLE TESTS

Temperature and climate

Various heating chambers, climatic cabinets and a climatic room are available to perform life cycle tests to assess the thermal and climatic resistance. Testing covers temperature- and climate-dependent analyses of individual parts (such as diaphragms, seals, packings, lubricants or plastic parts) as well as function tests for entire devices over a specific life cycle.

Heating chambers
Test temperature: up to 230 °C
Max. test volume: 0.38 m³

Climatic cabinets
Test temperature: –70 to 180 °C
Adjustable humidity: 10 to 98 %
Max. test volume: 0.39 m³

Climatic chamber
Test temperature: –70 to 130 °C
Adjustable humidity: 10 to 98 %
Max. test volume: 38 m³

LIFE CYCLE TESTS

Fugitive emissions

At ROLF SANDVOSS INNOVATION CENTER, one of the default leakage tests we perform relating to the service life of our valves is a fugitive emissions test according to ISO 15848-1. Compliance is attested by issuing the associated certificates. The following additional testing standards are applied as well:

- ISO 15848-2
- API 622
- API 624
- FCI 70-2

Tests can be performed under the following framework conditions:
Medium temperature: –196 to 550 °C
Medium pressure: up to 570 °C

Fluid dynamics

Life cycle function tests for individual parts and entire devices can be performed on our flow test benches under real-life flow conditions using the following test media:

Air
Max. pressure: 10 bar
Process temperature: 15 to 30 °C

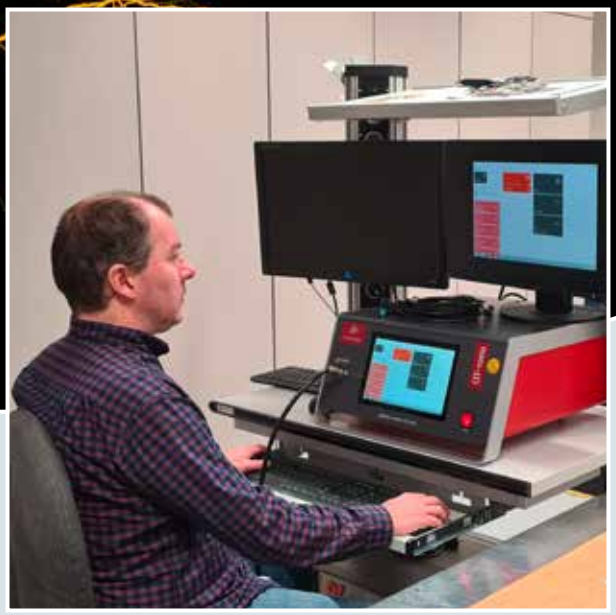
Water
Max. pressure: 10 bar
Process temperature: 15 to 30 °C

Steam
Max. pressure: 13 bar
Process temperature: 150 to 230 °C

CE CONFORMITY FOR ELECTRIC PRODUCTS

Product safety and CE conformity are the basic requirements every product has to fulfil. At ROLF SANDVOSS INNOVATION CENTER, different test areas are available to inspect electrical products, for example to verify their electromagnetic compatibility, explosion protection and electrical safety.

CE CONFORMITY FOR ELECTRIC PRODUCTS



EMC

Electromagnetic compatibility (EMC) is the ability of electrical and electronic devices, plants and systems to operate in their electromagnetic environment without creating inadmissible adverse effects. For electronics, EMC is an essential quality feature since inadvertent influences on the functioning of other electronic devices can have unforeseeable consequences.

All electronic devices by SAMSON undergo EMC testing.
EMC tests for radiated interferences and emission measurements at frequencies up to 18 GHz can be performed in an anechoic chamber.

Further stations have been set up to test electrostatic energy and conducted interferences, like they occur when the voltage drops or lightning strikes.
The following additional testing standards and recommendations are applied as well:

- EN 61000-6-1
- EN 61000-6-2
- EN 61000-6-3
- EN 61000-6-4
- EN 61000-6-7
- EN 61326-1
- EN 55014
- NAMUR Recommendation NE 21

CE CONFORMITY FOR ELECTRIC PRODUCTS

Explosion protection

For explosion-protected, intrinsically safe equipment, product safety is based on proof of protection against thermal ignition. At ROLF SANDVOSS INNOVATION CENTER, the required tests can be conducted at the OD024 Lab, which is accredited by PTB and TÜV Rheinland®.

Vibration tests

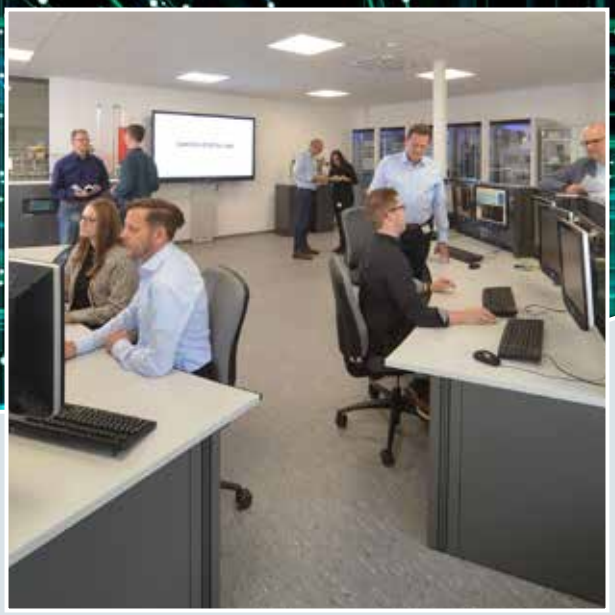
Equipment may be exposed to vibration during storage, when being transported to its place of installation or while in operation. Such critical conditions can be simulated on a vibration test bench to perform standardized analyses at the product development stage.

Vibration tests can be performed under the following framework conditions:

– Typical tests according to DIN EN IEC 60721-3-1, DIN EN IEC 60721-3-2, DIN EN IEC 60721-3-3, EN 60068-2-27, EN 60068-2-64

Max. specimen height: 300 mm
Max. specimen weight: 10 kg
Max. rated force: 1 to 2 kN (depending on type of vibration)
Max. acceleration: 40 to 80 g (depending on type of vibration)
Frequency range: 2 to 4 kHz
Typical specimens: valve accessories, individual electronic components, small actuators and very small valves

DIGITAL TECHNOLOGY IN PRACTICE



DIGITAL LAB

Our DIGITAL LAB is the place to verify the interoperability of devices (such as our positioners) with all common control, engineering and asset management systems as well as cloud-computing platforms.

The following in-depth connectivity tests and services to ensure interoperability with all important control systems typically used in process plants can be performed at our DIGITAL LAB:

- Near-real-life and manufacturer-independent lab experiments to optimize device engineering
- Life cycle testing to demonstrate prior use
- Application-specific solutions
- Application-based, hands-on training

Are you interested and looking for further information? Contact us at: Innovationcenter-en@samsongroup.com

SAMSON AT A GLANCE

STAFF

- Worldwide 4,500
- Europe 3,600
- Asia 700
- Americas 200
- Frankfurt am Main, Germany 1,800

INDUSTRIES AND APPLICATIONS

- Chemicals and petrochemicals
- Food and beverages
- Pharmaceuticals and biotechnology
- Oil and gas
- Liquefied Natural Gas (LNG)
- Marine equipment
- Power and energy
- Industrial gases
- Cryogenic applications
- District energy and building automation
- Metallurgy and mining
- Pulp and paper
- Water technology
- Other industries

PRODUCTS

- Valves
- Self-operated regulators
- Actuators
- Positioners and valve accessories
- Signal converters
- Controllers and automation systems
- Sensors and thermostats
- Digital solutions

SALES SITES

- More than 60 subsidiaries in over 40 countries
- More than 200 representatives

PRODUCTION SITES

- SAMSON Germany, Frankfurt, established in 1916
  Total plot and production area: 150,000 m²
- SAMSON France, Lyon, established in 1962
  Total plot and production area: 23,400 m²
- SAMSON Turkey, Istanbul, established in 1984
  Total plot and production area: 11,100 m²
- SAMSON USA, Baytown, TX, established in 1992
  Total plot and production area: 20,000 m²
- SAMSON China, Beijing, established in 1998
  Total plot and production area: 47,000 m²
- SAMSON India, Pune district, established in 1999
  Total plot and production area: 28,000 m²
- SAMSON AIR TORQUE, Bergamo, Italy
  Total plot and production area: 27,000 m²
- SAMSON CERA SYSTEM, Hermsdorf, Germany
  Total plot and production area: 14,700 m²
- SAMSON KT-ELEKTRONIK, Berlin, Germany
  Total plot and production area: 1,100 m²
- SAMSON LEUSCH, Neuss, Germany
  Total plot and production area: 18,400 m²
- SAMSON PFEIFFER, Kempen, Germany
  Total plot and production area: 20,300 m²
- SAMSON RINGO, Zaragoza, Spain
  Total plot and production area: 19,000 m²
- SAMSON SED, Bad Rappenau, Germany
  Total plot and production area: 10,400 m²
- SAMSON STARLINE, Bergamo, Italy
  Total plot and production area: 27,000 m²
- SAMSON VDH PRODUCTS, the Netherlands
  Total plot and production area: 12,000 m²
- SAMSON VETEC, Speyer, Germany
  Total plot and production area: 27,100 m²

SAMSON AKTIENGESELLSCHAFT

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