



ELECTRICAL TEST SOLUTIONS

Continuously variable control of
voltage, current and power

บริษัท ออเรนจ์ กรีน จำกัด
โทร. 084 0179093



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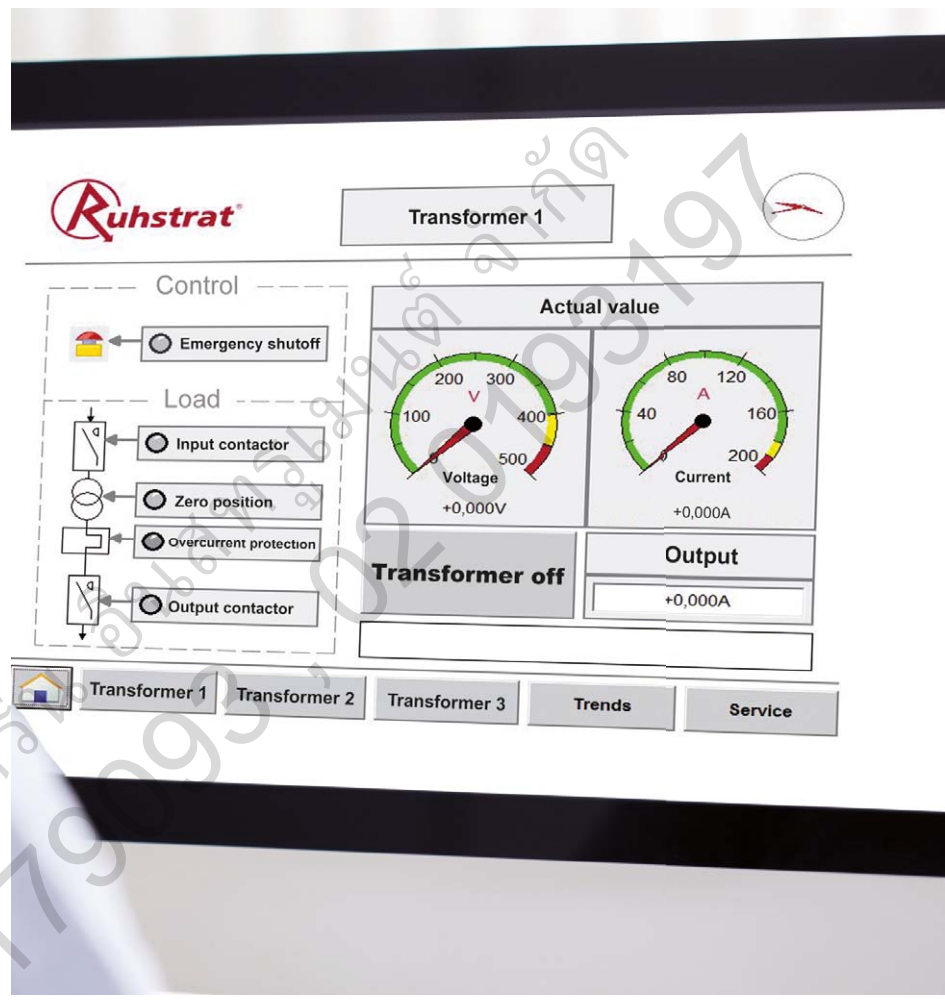
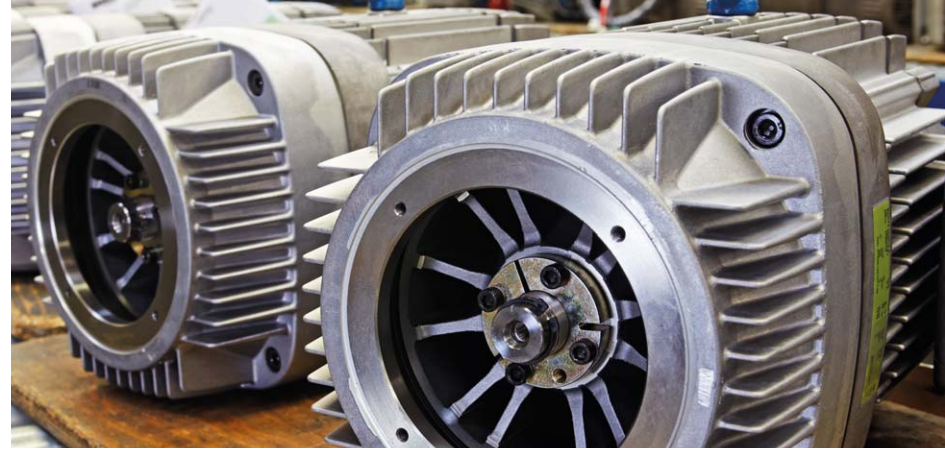
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As an internationally established brand in the area of test engineering systems we bear a special responsibility. Our customers expect optimal results and therefore high-quality products. We confirm the confidence they place in us on a daily basis. For you, we always have the overall picture in mind and offer you the best possible solution.

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Ruhstrat develops customised and highly efficient test systems. Our products incorporate the experience of numerous projects implemented worldwide in diverse industries and enterprises. The customers are from the fields of drive technology, e-mobility, renewable energies, test facilities, cable testing and thermal testing of switchgear.



INTRODUCTION

ELECTRICAL TEST SOLUTIONS

Testing of electric and electronic components, both in industrial enterprises and at schools and universities, is an important aspect of development work as well as quality assurance. An extensive inspection of products is necessary in order to ensure compliance with standards and regulations, and also to guarantee the safety of the products.

Ruhstrat has specialised in this market for many decades and today is a leading-edge provider in the sector for test engineering systems. Ruhstrat offers a comprehensive line of transformer-type and resistor-controlled test engineering systems, as variable transformers for current and voltage supplies and as ohmic, inductive or capacitive test resistors for load tests.

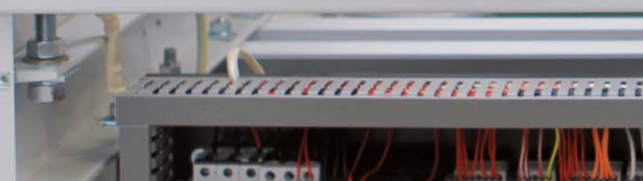
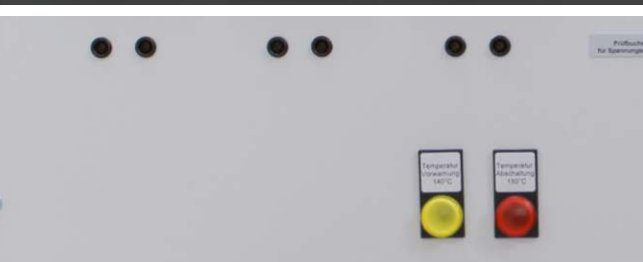
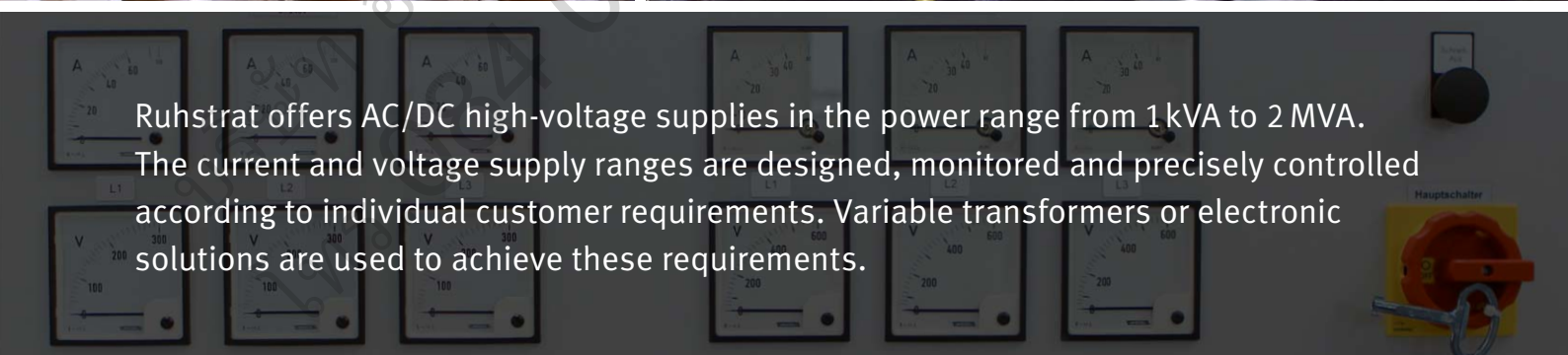
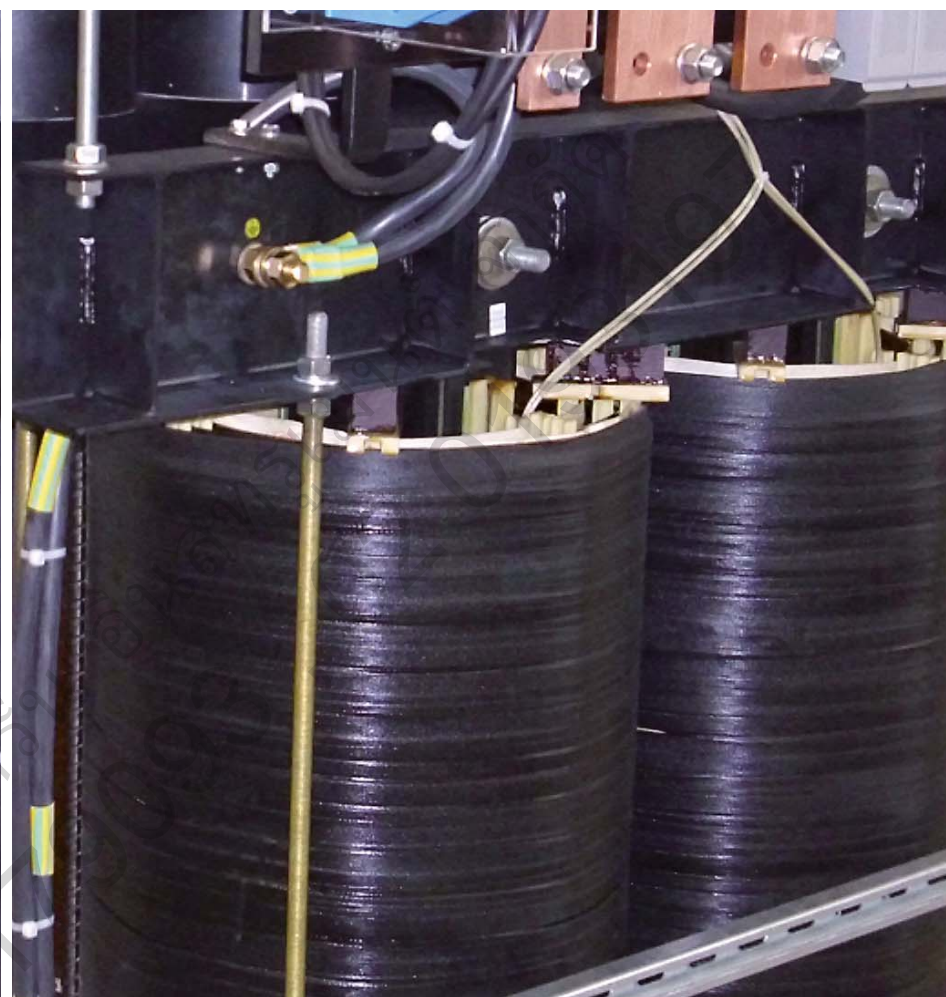
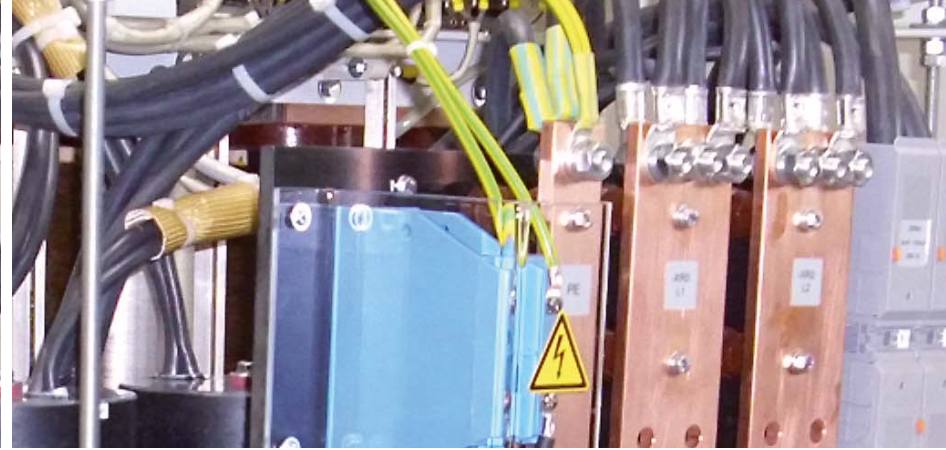
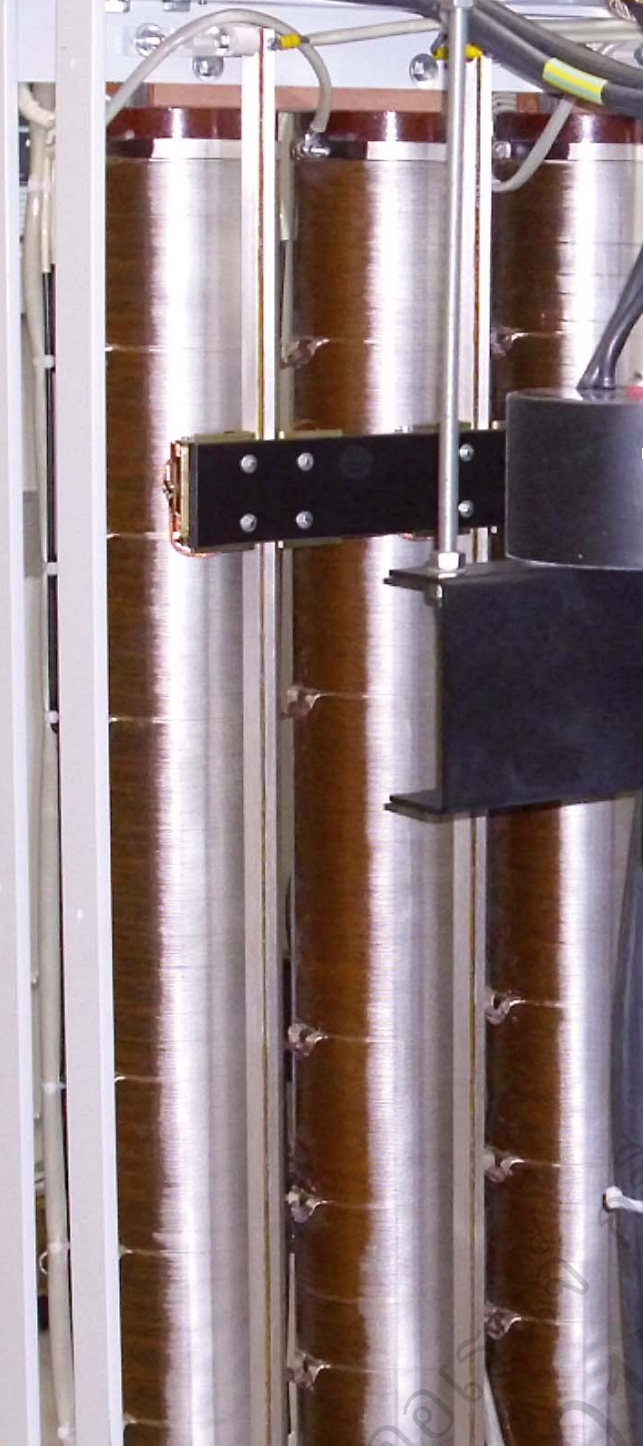
All systems can be equipped with an electronic controller, including a control panel and visualisation. The power spectrum includes devices up to 2 MVA or 5 MW.

»» Facts

- ▶ AC/DC voltage supplies up to 36,000 V
- ▶ AC/DC high-current supplies up to 30,000 A
- ▶ Variable transformers up to 2,000 kVA
- ▶ Inductive loads up to 3,000 A
- ▶ Resistive loads up to 5,000 kW
- ▶ RLC loads up to 1,000 kW or 1,000 kVAR
- ▶ Variable resistors up to 1,000 kW

»» Applications

- ▶ Drive technology, e.g. for no-load measurement of three-phase motors according to IEC 60034-2
- ▶ Cable industry, e.g. for endurance tests of high-voltage cables according to IEC 60840
- ▶ Renewable energies, e.g. for testing inverters (island test) according to DIN EN 62116
- ▶ Switchgear, e.g. for temperature rise test according to IEC 61439-1/-2 and IEC 62271-202
- ▶ Testing of triggering characteristics in circuit breakers, fuses, etc.



AC/DC HIGH-VOLTAGE SUPPLIES

ELECTRICAL TEST SOLUTIONS

AC/DC high-voltage supplies are used to test products of several thousand volts. Applications include testing of motors, pumps, frequency converters, etc. under nominal voltage or at a defined overvoltage in an endurance test.

The sine wave of the test voltage is essential for the reproducibility of your measurements. Transformer-type AC voltage supplies, with amplitude adjustment to the voltage setting, offer the advantage of a constant clean sinus wave from the input all the way to the test item.

The measurements are therefore reproducible and no EMC problems will arise. (Exception: the test item has a negative effect on the supply).

»» Facts

- ▶ Single-phase or three-phase voltage supplies
- ▶ Voltages up to 30,000 Volts AC
- ▶ Voltages up to 6,000 Volts DC
- ▶ Voltage supplies with a variable transformer
- ▶ Electronic voltage supply with a thyristor controller
- ▶ Options: Ethernet, bus system or PLC with visualisation
- ▶ Options: Can be operated via buttons or touch panel on the unit, remote control or PC

»» Applications

- ▶ Testing of frequency converters and motors according to IEC 60034





LB RUN System Login

15.07.2011 14:40:00

Prozessvisualisierung Einphasen-Transformator

Einspeisung

Leistungsschalter

Hauptschütz

Thyristorsteller

Stelltrafo Stufe 1

Stelltrafo Stufe 2

Hochstromerregereinheit

Steuern

Leistungsschalter geschlossen

Hauptschütz

Thyristorsteller

Endschalter oben
Endschalter unten

Endschalter oben
Bereich oben
Mittelstellung
Bereich unten
Endschalter unten

Parameter

Takte

Einschaltzeit s

Ausschaltzeit s

Sollwert A

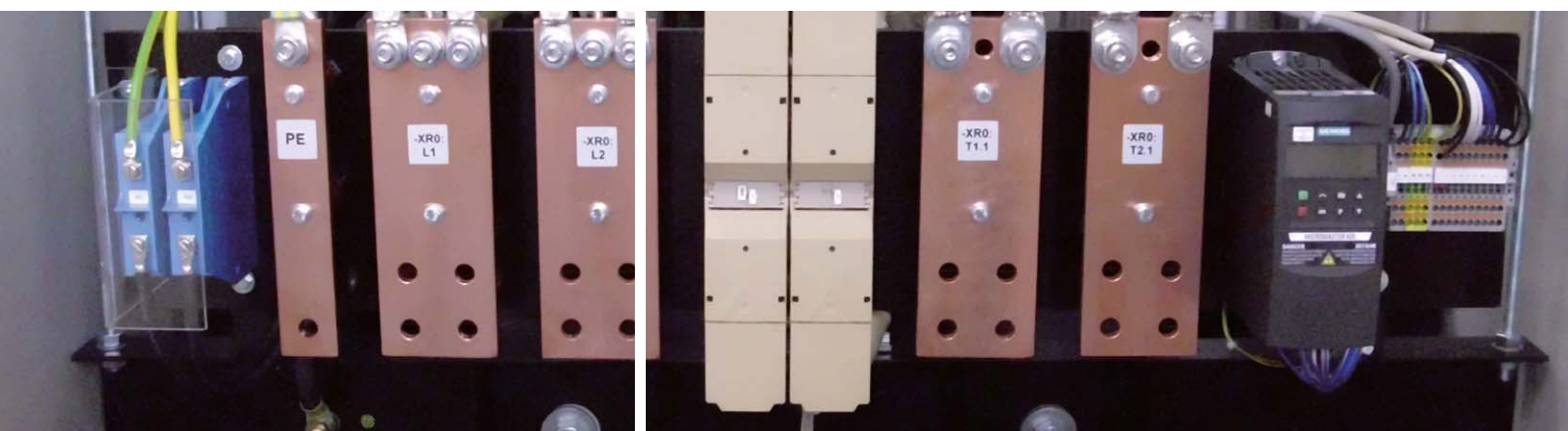
Status

Istwert A

Aggregat ausgeregelt

Regelung mit Zyklus

AC high-current supplies are used for testing of thermal load capacities of low-voltage switchgear or transformer stations (EN62271-202 (VDE0671-202)). The current and voltage supply ranges are designed, monitored and precisely controlled according to individual customer requirements.



AC/DC HIGH-CURRENT SUPPLIES

ELECTRICAL TEST SOLUTIONS

AC high-current supplies are used to test products of several thousand amperes. Applications include warming and testing of switchgear, busbars, fuses, etc. under nominal load or at a defined overload in an endurance test.

Depending on the desired regulating accuracy, high-current supplies consist of a coarse stage and a fine stage in order to increase the resolution for the current regulation. The coarse stage is roughly adjusted to the desired current. The fine stage performs the fine adjustment (automatic stabilisation of the output current).

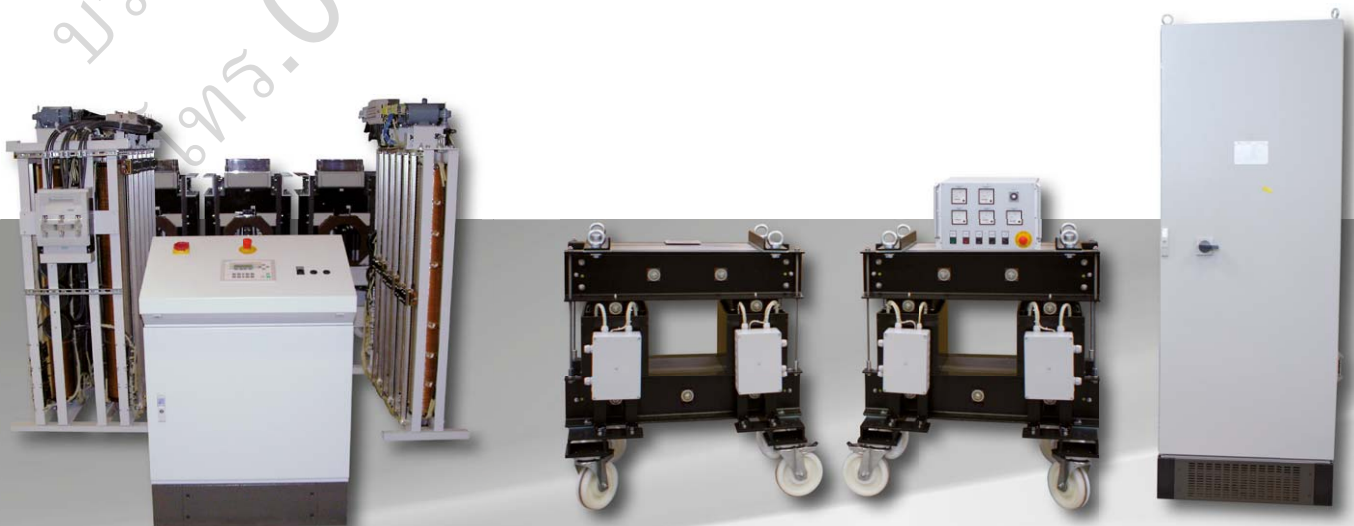
The sine wave of the test voltage is essential for the reproducibility of your measurements. Transformer-type AC high-current supplies, with amplitude adjustment to the voltage setting, offer the advantage of a constant clean sinus wave from the input all the way to the test item. The measurements are therefore reproducible and no EMC problems will arise. (Exception: the test item has a negative effect on the supply).

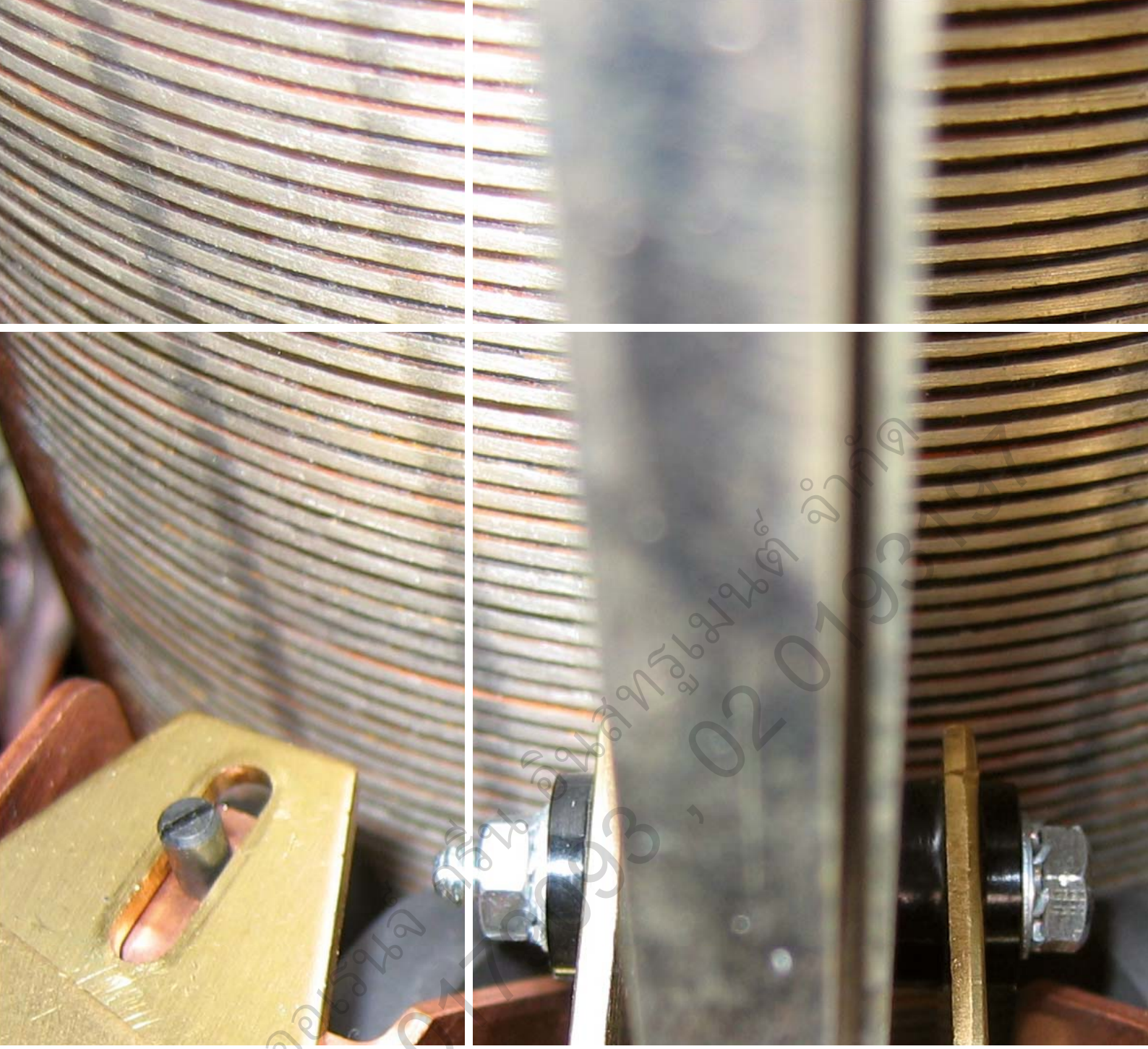
»» Facts

- ▶ Single-phase or three-phase high-current supply
- ▶ Nominal currents up to 30,000 Amperes AC
- ▶ Nominal currents up to 22,000 Amperes DC
- ▶ Separate modular design of control, adjusting and high-current unit
- ▶ High-current unit with degree of protection up to IP54, protection class 2, installation in immediate vicinity of consumer is possible – this minimises cable and busbar distances, therefore reducing voltage drops and busbar losses

»» Applications

- ▶ Thermal testing of cables, contacts, busbars, low-voltage distribution boards and switchgear
- ▶ Testing of triggering characteristics of fuses, circuit breakers, etc.





For the diverse requirements of test facilities, the glass industry, electroplating systems or regulation of industrial furnaces – Ruhstrat develops and manufactures specific variable transformers for continuously variable adjustment of voltages up to 30,000 volts and currents up to 30,000 amperes.



VARIABLE TRANSFORMERS

ELECTRICAL TEST SOLUTIONS

Variable transformers are used to regulate alternating voltages or currents under load between zero and the nominal value. They are suitable for the power supply to resistive, inductive or capacitive equipment.

Ruhstrat variable transformers are developed, manufactured and tested in accordance with relevant EC directives, European standards and VDE regulations, in particular DIN EN 61558-2-14 and VDE 0552.

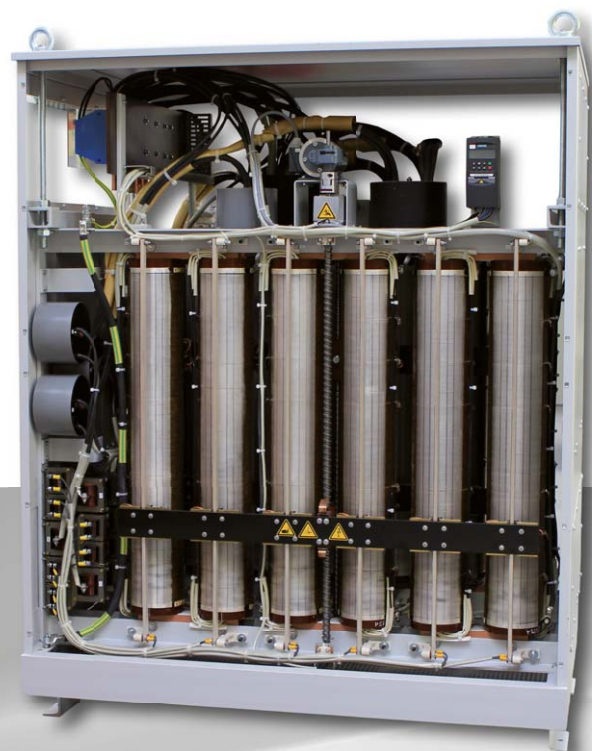
In a column-type regulating transformer the voltage adjustment is achieved through amplitude adjustment. Column-type regulating transformers do not change the curve forms between the input and output voltage and no harmonics or surges are generated.

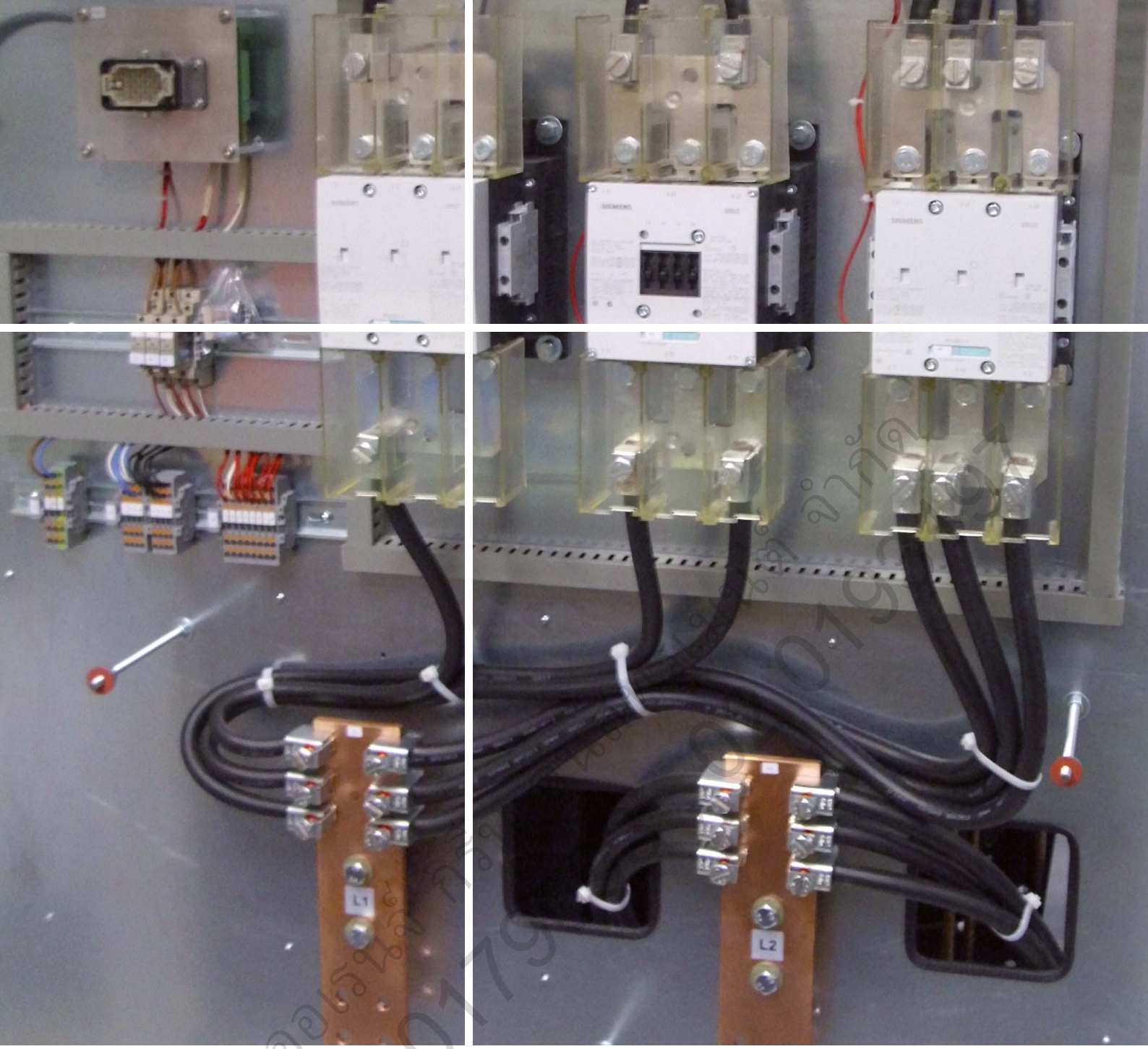
»» Facts

- ▶ Voltage up to 1,000 V
- ▶ Frequency range 800 Hz
- ▶ Degree of protection up to IP 54
- ▶ Variable toroidal and column-type regulating transformers
- ▶ Single-phase or three-phase variable transformers
- ▶ Version as an autotransformer or with a galvanically separated winding
- ▶ According to IEC EN 61558-2-14 and VDE 0552
- ▶ Designed for heavy-duty operation
- ▶ Less voltage drop due to compensating windings
- ▶ Hard silver-plating of the most important contact points – for constantly low transition resistance

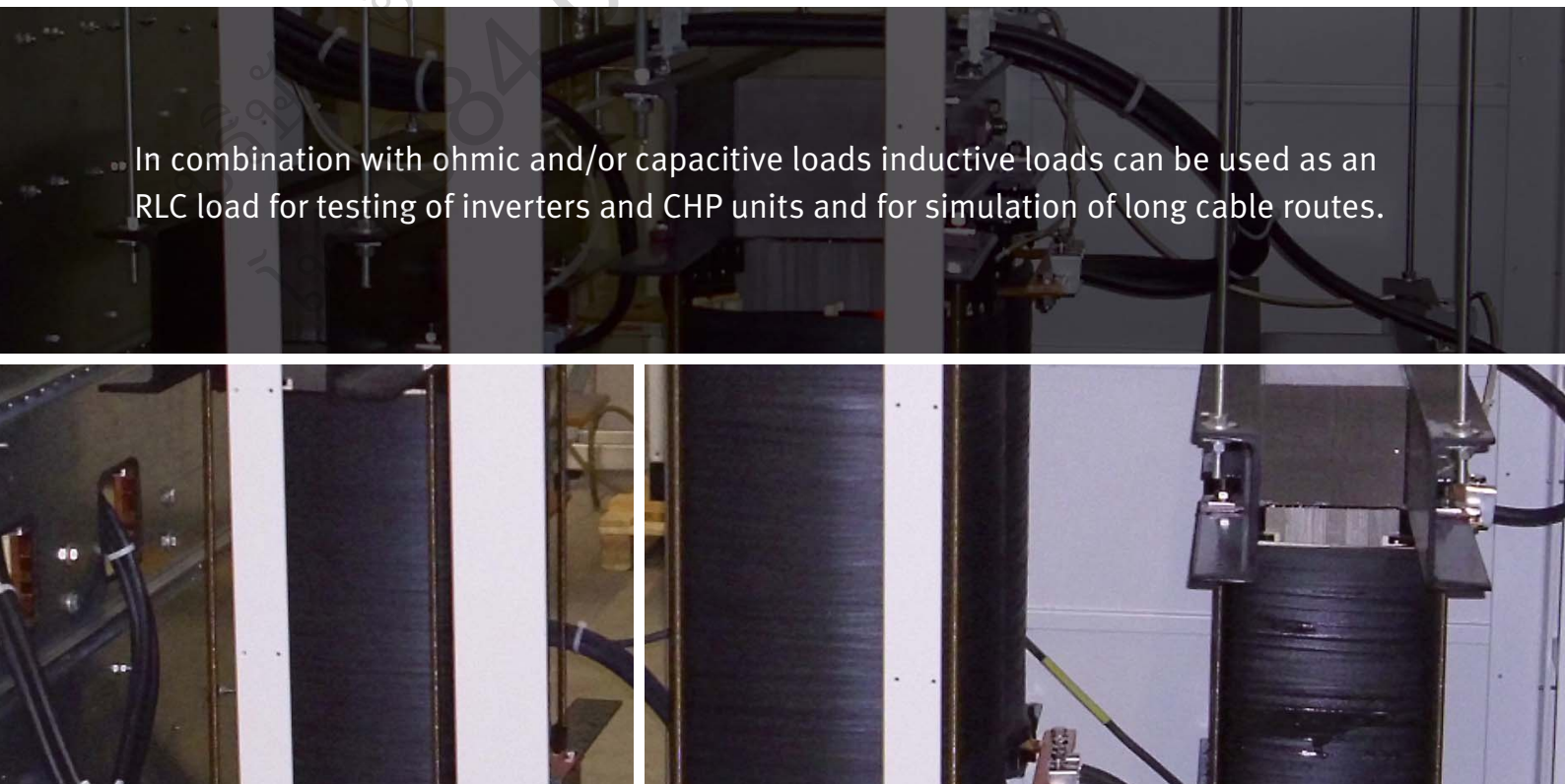
»» Applications

- ▶ High-voltage test facilities
- ▶ Industry (electroplating, glass, etc.)
- ▶ Control of industrial furnaces





In combination with ohmic and/or capacitive loads inductive loads can be used as an RLC load for testing of inverters and CHP units and for simulation of long cable routes.



INDUCTIVE LOADS

ELECTRICAL TEST SOLUTIONS

Inductive loads are used if the products tested have to be subjected to active and reactive power.

Ruhstrat test reactors are developed and optimised for your specific application and conditions. They operate reliably and safely around the world under widely differing test conditions.

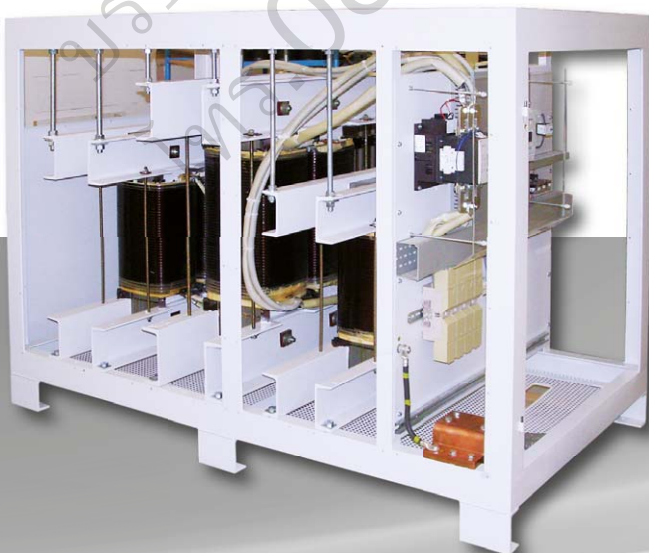
The use of high-quality materials and flawless craftsmanship assure trouble-free operation in development labs as well as test facilities/institutes, schools and universities.

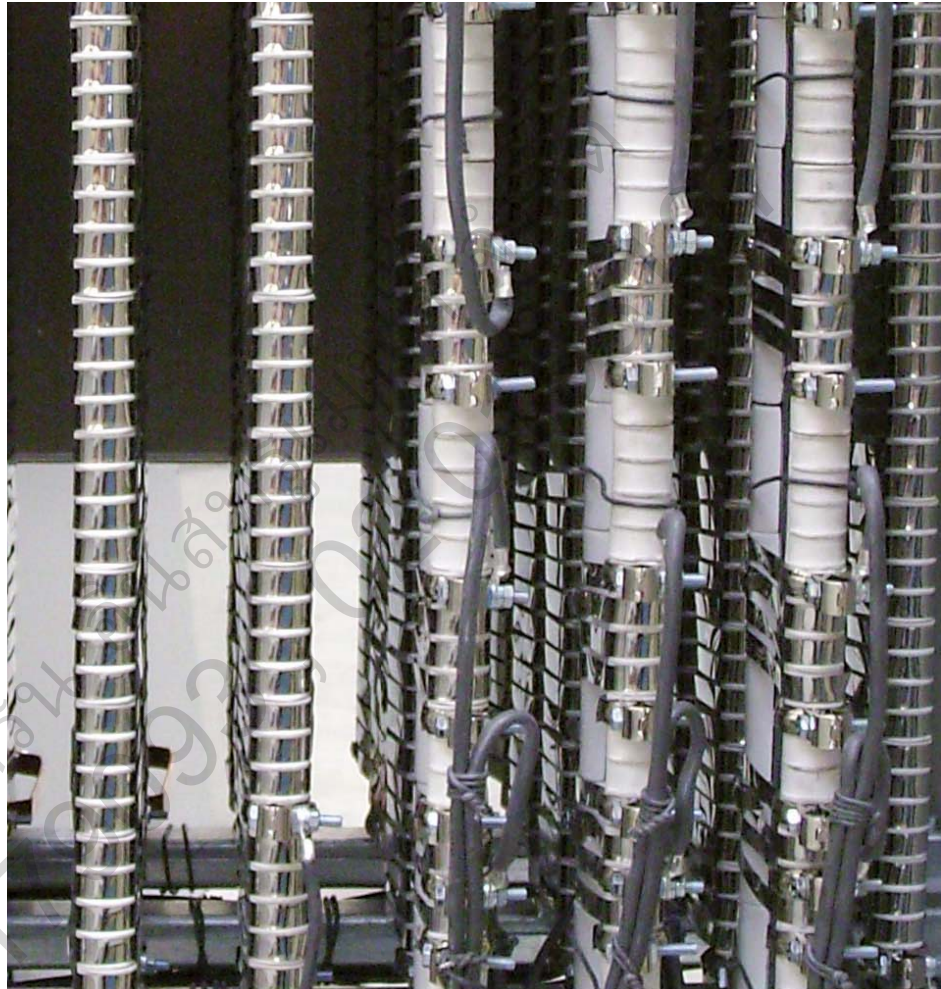
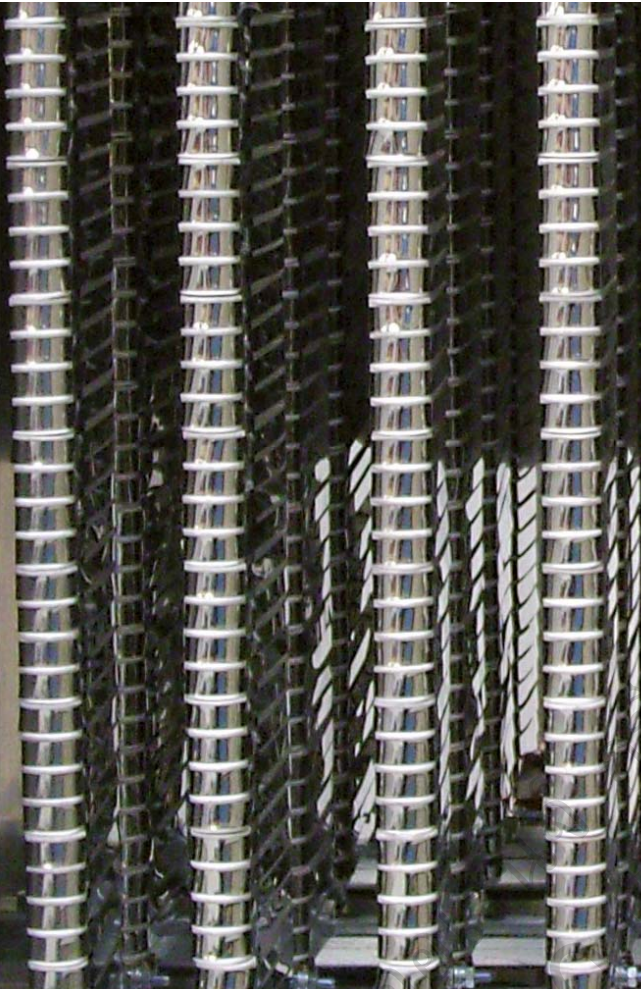
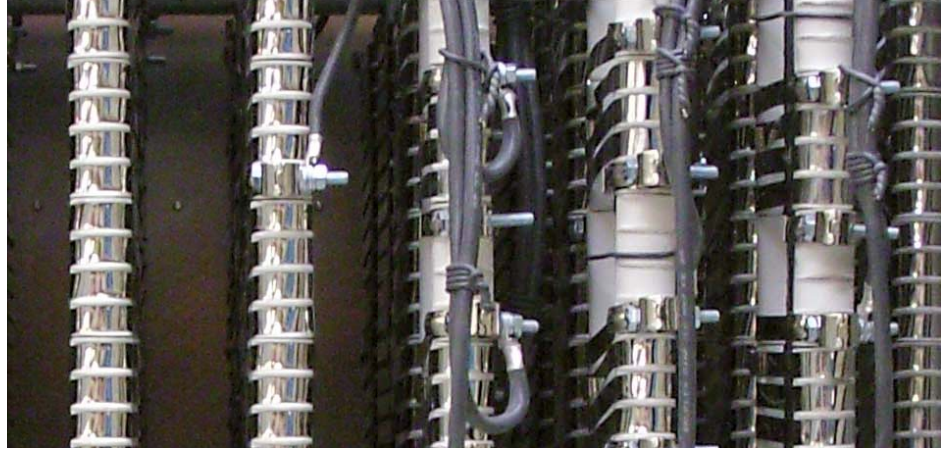
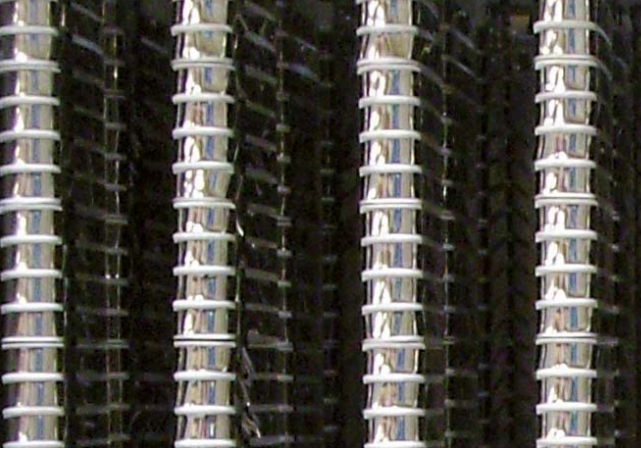
>> Facts

- ▶ AC/DC reactors
- ▶ Voltage up to 1,000 V
- ▶ Current up to 3,000 A with selectable inductance
- ▶ Inductances with tapping points
- ▶ Optionally with contactors and coupling relays for switching the inductance values

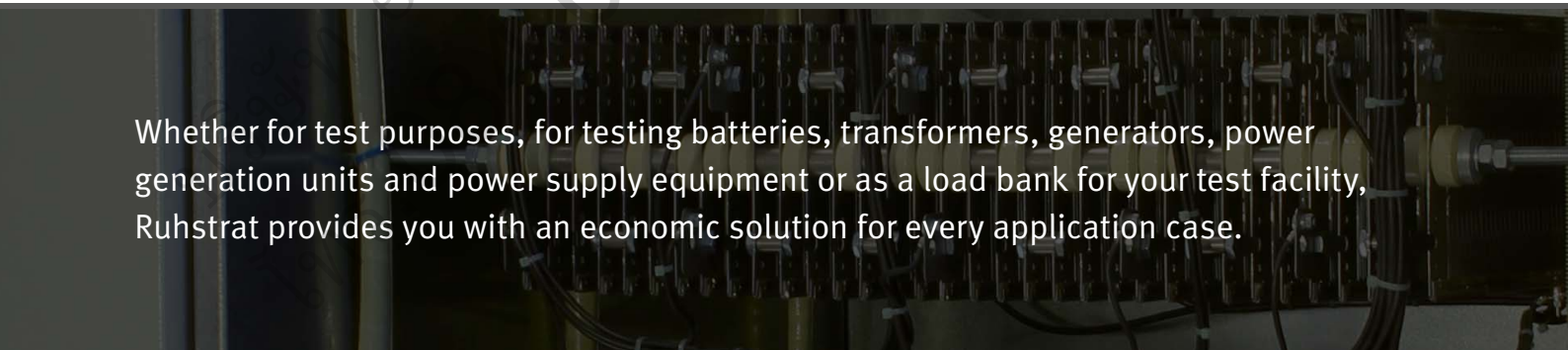
>> Applications

- ▶ Testing of power converters and switched mode power supplies
- ▶ Testing of switches and relays
- ▶ Equivalent networks





Whether for test purposes, for testing batteries, transformers, generators, power generation units and power supply equipment or as a load bank for your test facility, Ruhstrat provides you with an economic solution for every application case.



RESISTIVE LOADS

ELECTRICAL TEST SOLUTIONS

Testing under the use of ohmic loads, both in industrial enterprises and at schools and universities, is an important aspect of development work. For testing of electric and electronic components, Ruhstrat offers a suitable resistor type for a broad range of test facilities.

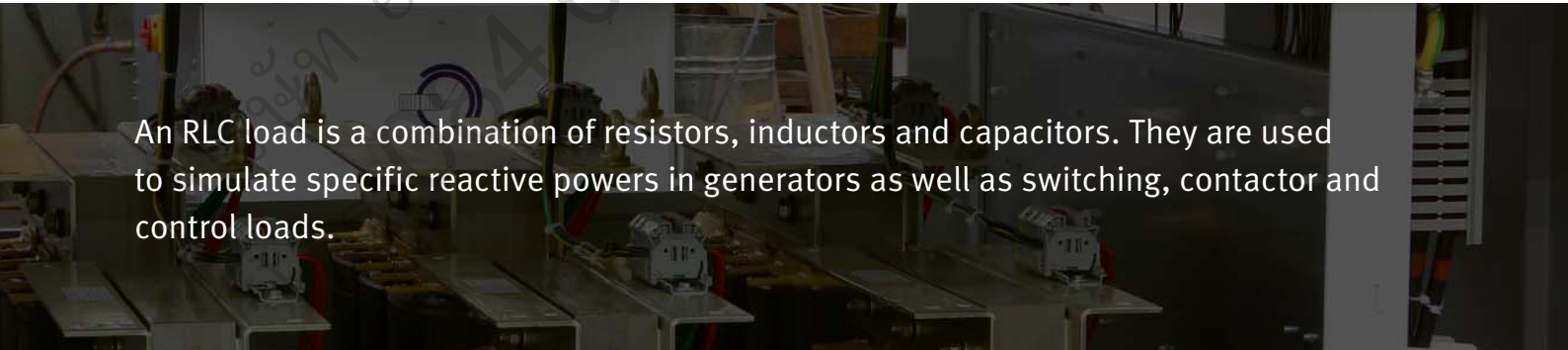
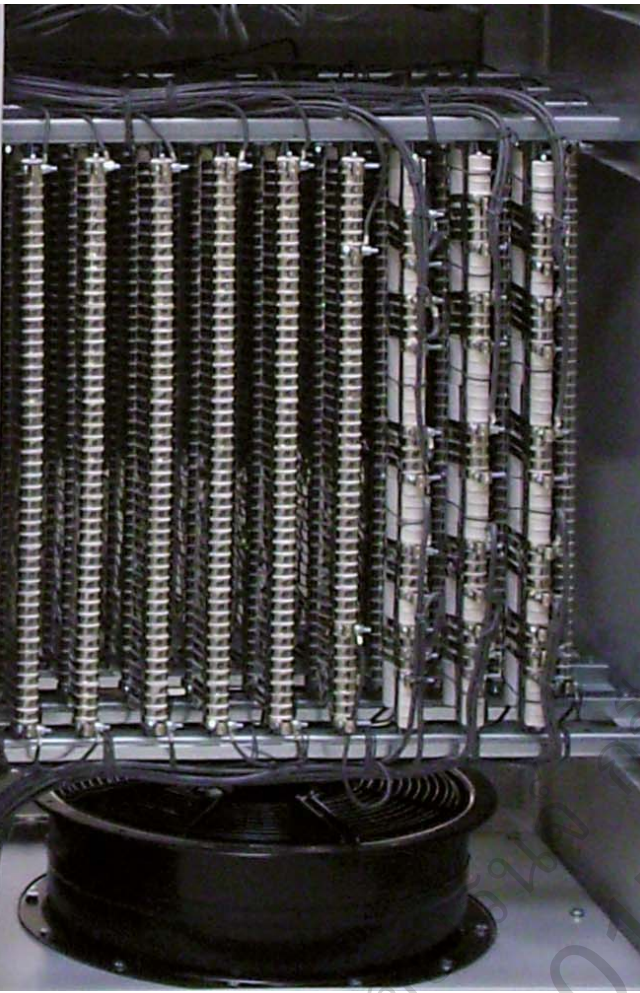
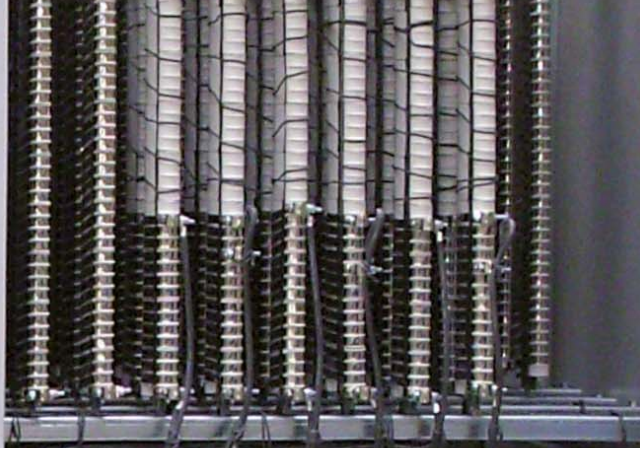
»» Facts

- ▶ Power up to 5,000 kW
- ▶ Single stages can be switched on and off under load
- ▶ Option: Customised solutions with step circuit, regulation, measurement and control
- ▶ Options: Ethernet, bus system or PLC with visualisation
- ▶ Options: Can be operated via buttons or touch panel on the unit, remote control or PC

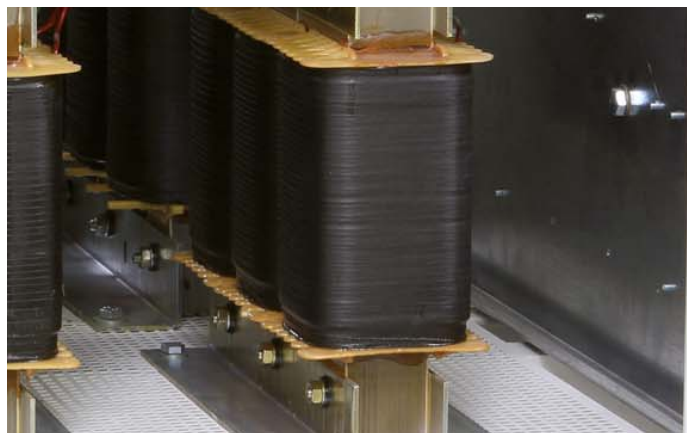
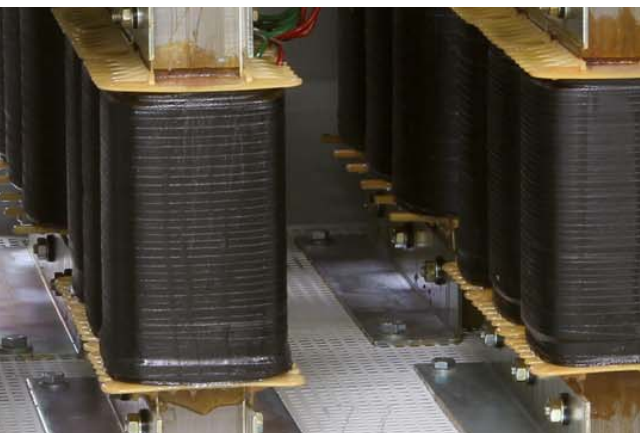
»» Applications

- ▶ Load testing of generators
- ▶ Load testing of switchgear
- ▶ Load testing of power electronics
- ▶ Load testing of transformers





An RLC load is a combination of resistors, inductors and capacitors. They are used to simulate specific reactive powers in generators as well as switching, contactor and control loads.



RLC LOAD

ELECTRICAL TEST SOLUTIONS

RLC loads are used to test the effects of long cable routes in PV systems, voltage peaks of CHP units or island operation of renewable energy systems. Phase shift angles needed for testing can be simulated with the combination of ohmic, inductive and capacitive loads.

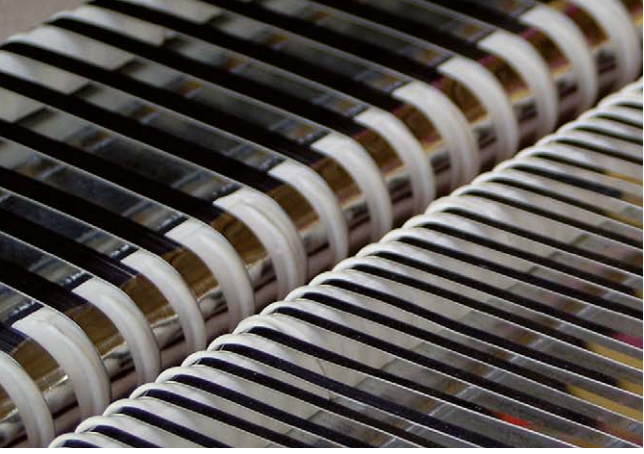
»» Facts

- ▶ Power up to 1,000 kW or 1,000 kVAr
- ▶ Voltage up to 1,000 V
- ▶ Resistance elements, tube resistors or steel grid resistors are suitable for the realisation of the ohmic load resistors
- ▶ We manufacture these inductive components (reactors) with different levels of ohmic resistance
- ▶ Options: Ethernet, bus system or PLC with visualisation
- ▶ Options: Can be operated via buttons or touch panel on the unit, remote control or PC

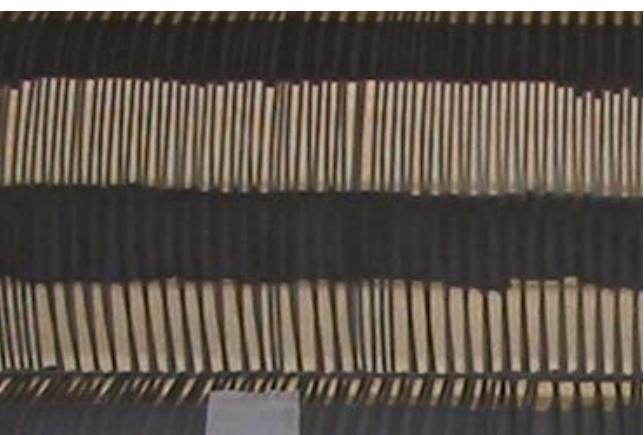
»» Applications

- ▶ Testing according to IEC/EN 62116 and VDE 0126-1-1 for island detection as oscillator circuit and resistance load





Testing under the use of ohmic loads is an important aspect of the development work of many industries, schools, universities and research facilities.



LOAD AND VARIABLE RESISTORS

ELECTRICAL TEST SOLUTIONS



Load and variable resistors are used for continuously variable adjustment of current, ohmic resistance and power.

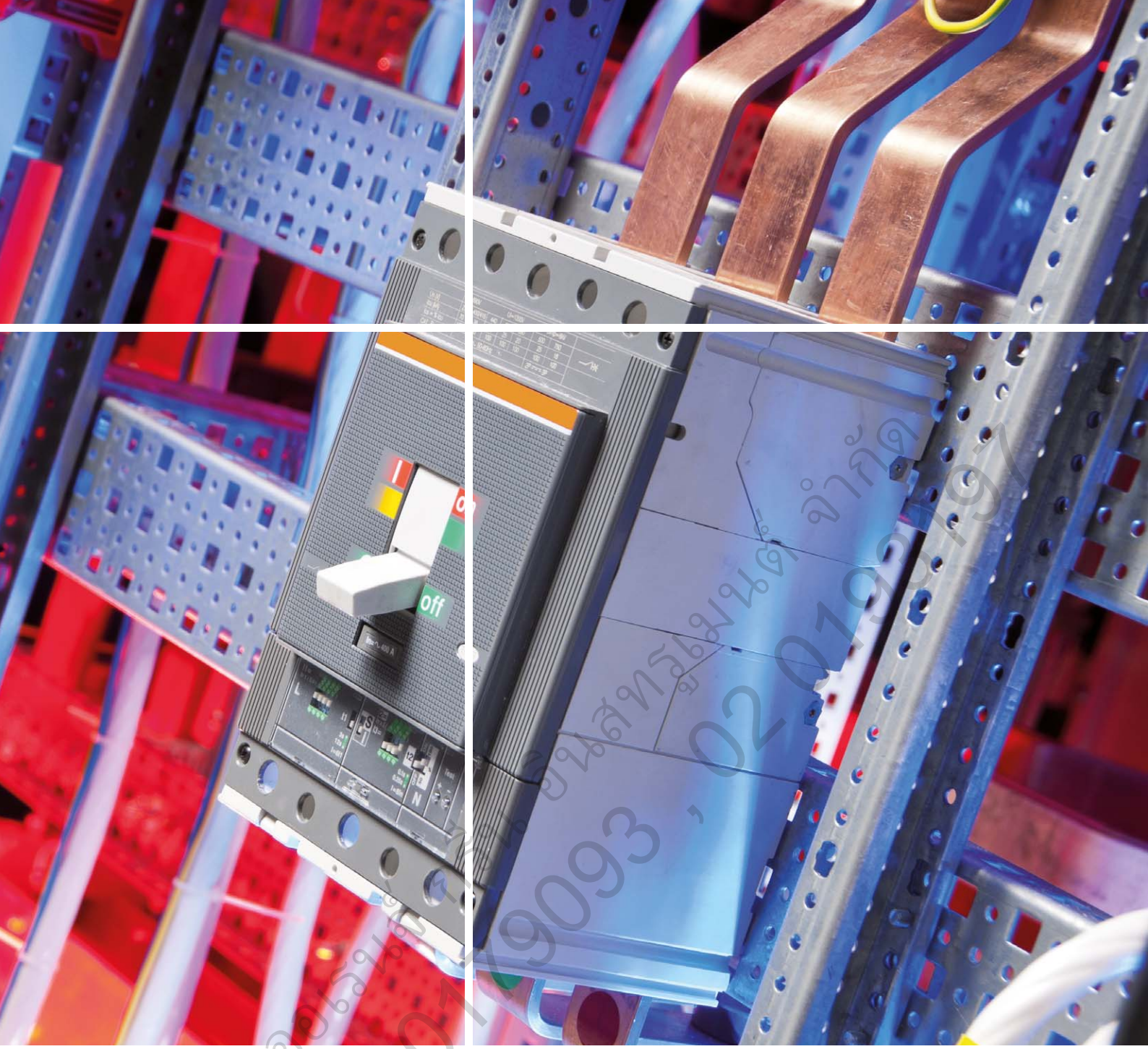
»» Facts

- ▶ Voltage up to 1,000 V
- ▶ Power up to 8 kW
- ▶ Very low temperature coefficient due to the use of resistor material made of CuNi 44
- ▶ Constant ohmic resistance over large temperature ranges
- ▶ Continuously variable adjustment of the resistance, e.g. via a motor drive
- ▶ A stepped winding enables optimal design of the resistor to save space while executing high powers at constant voltage
- ▶ Option: Low-inductance version due to bifilar winding
- ▶ Option: Customised features with step circuit, regulation, measurement and control

»» Applications

- ▶ Schools and universities
- ▶ Drive technology





Supplemented by a high degree of experience in the construction of switchgear Ruhstrat provides solutions far beyond the field of transformers. Potential system solutions are power supply cabinets with power switches and PLC control systems.



SWITCHGEAR PANELS

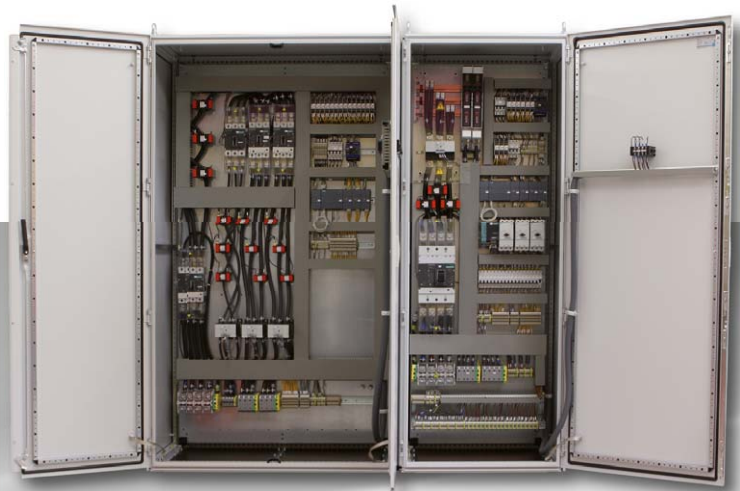
ELECTRICAL TEST SOLUTIONS

For the test engineering systems we provide complete switchgear panels with fuses, contactors, measurement, operation and monitoring elements. If required, high accuracies (up to 0.5% of the final measurement value) and flexible adjustment options can be realised with high quality measuring components.

We use Siemens PLC controllers as standard equipment. We are pleased to observe special requirements of our customers.

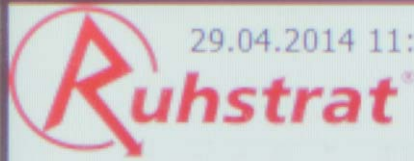
»» Facts

- ▶ PLC controller with Siemens or Allen Bradley
- ▶ Use of high-quality components of well-known manufacturers
- ▶ Design, production, testing and commissioning of the switchgear by Ruhstrat



SIEMENS

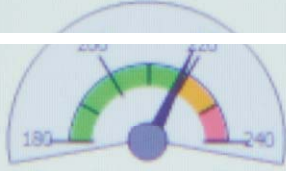
SIMATIC HMI



29.04.2014 11:18:04

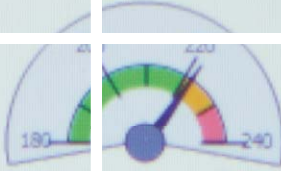
USER:

DELTA VOLT



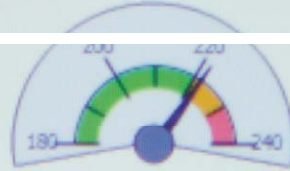
L1 - N

218,6V



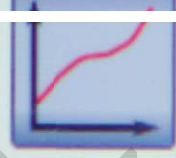
L2 - N

221,9V



L3 - N

221,9V



Regelung

ON

TEST LAUF

ACK

F1

F2

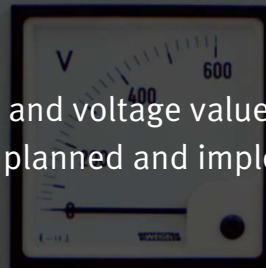
F3

F4

L3



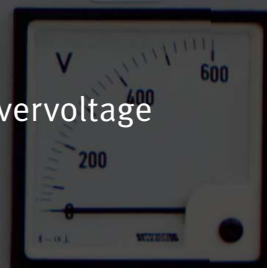
L1



L2



L3



The display of current, resistance and voltage values, power, frequency and overvoltage and undervoltage monitoring are planned and implemented by us.

Prüfbuchsen für Spannungsmessung

Temperatur Vorwarnung 140°C



Temperatur Abschaltung 150°C



Eingangsschutz ein



Eingangsschutz aus



MEHR



WENIGER



Vorwahl 1=240V 2=460V



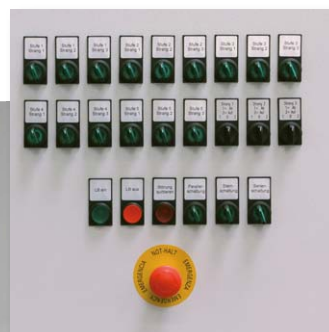
OPERATION / INTERFACES

ELECTRICAL TEST SOLUTIONS

Diverse customer requirements can be realised for switching, regulating and controlling the systems. The operation can be performed at the unit, on an operating panel, with a remote control and / or via the control room.

»» Facts

- ▶ Operation is possible by means of illuminated toggle switches or buttons, a power switch, touch panel or PC keyboard.
- ▶ Analogue or digital measuring instruments, indicator lamps, built-in multimeters, touch panels or a monitor are provided as display elements.
- ▶ Profibus or Ethernet interfaces can additionally be offered as an option for external operation of the systems.



Zertifikat



GL Systems Certification bescheinigt hiermit, dass das Unternehmen

RUHSTRAT GmbH

Leinetal / Auf der Mauer 1, D-37120 Bovenden



für den Geltungsbereich

Entwicklung, Herstellung und Vertrieb von

- Transformatoren, Stelltransformatoren, Drosseln, Spannungskonstanthalter und Widerstände
- elektrisch- und brennstoffbeheizte Industrieöfen

ein Managementsystem eingeführt hat und anwendet.

GL Systems Certification bestätigt, dass das Managementsystem des oben genannten Unternehmens überprüft wurde und sich in Übereinstimmung mit den Forderungen folgender Norm befindet:

ISO 9001:2008

Dieses Zertifikat setzt voraus, dass das Unternehmen sein Managementsystem nach der angegebenen Norm anwendet und aufrechterhält. Dies wird von GL Systems Certification überwacht.

Dieses Zertifikat gilt vom 30.03.2013 bis zum 29.03.2016

GL Systems Certification Hub Germany

J. Kugel
Jasmin Kugel

Zertifikat Nr. QS-329HH



Gemeinsamer Lloyd SE, Competence Centre Systems Certification, Brooktorfka 18, D-20457 Hamburg



CERTIFICATE OF COMPLIANCE

Certificate Number 20130528-E359523
Report Reference E359523-20130528
Issue Date 2013-MAY-28

Issued to: RUHSTRAT GMBH
AUF DER MAUER 1
37120 BOVENDEN GERMANY



This is to certify that representative samples of COMPONENT - SYSTEMS, ELECTRICAL INSULATION Class 155 (F) Electrical insulation system designated R-155-1.

Have been investigated by UL in accordance with the Standard(s) indicated on this Certificate.

Standard(s) for Safety: 1446, Systems of Insulating Materials - General
CSA C22.2 No. 0 Appendix B, General Requirements -
Canadian Electrical Code, Part II

Additional Information: See the UL Online Certifications Directory at
www.ul.com/database for additional information

Only those products bearing the UL Recognized Component Marks for the U.S. and Canada should be considered as being covered by UL's Recognition and Follow-Up Service and meeting the appropriate U.S. and Canadian requirements.

The UL Recognized Component Mark for the U.S. generally consists of the manufacturer's identification and catalog number, model number or other product designation as specified under "Marking" for the particular Recognition as published in the appropriate UL Directory. As a supplementary means of identifying products that have been produced under UL's Component Recognition Program, UL's Recognized Component Mark, , may be used in conjunction with the required Recognized Marks. The Recognized Component Mark is required when specified in the UL Directory preceding the recognitions or under "Markings" for the individual recognitions. The UL Recognized Component Mark for Canada consists of the UL Recognized Mark for Canada, , and the manufacturer's identification and catalog number, model number or other product designation as specified under "Marking" for the particular Recognition as published in the appropriate UL Directory.

Recognized components are incomplete in certain constructional features or restricted in performance capabilities and are intended for use as components of complete equipment submitted for investigation rather than for direct separate installation in the field. The final acceptance of the component is dependent upon its installation and use in complete equipment submitted to UL LLC.

Look for the UL Recognized Component Mark on the product.



William R. Carney
William R. Carney, Director, South American Certification Programs
UL LLC



Any information and documentation involving UL Mark services are provided on behalf of UL LLC (UL) or any authorized licensee of UL. For questions, please contact a local UL Customer Service Representative at global@ul.com

CUSTOMISED PRODUCT SOLUTIONS – MADE IN GERMANY

ELECTRIC TEST SOLUTIONS FROM THE CONCEPTUAL DESIGN THROUGH TO SERVICING

When the brothers Adolf and Ernst Ruhstrat opened their small electrical shop in 1888 in Göttingen, our company's success story was still unwritten.

Today Ruhstrat Power Technology (RPT) designs and produces electrical testing solutions, voltage optimizers and transformers. In the electrical testing field, RPT specializes in testing facilities for temperature rise, motors and pumps as well as testing systems for high voltage cables (heat cycle tests).

In the area of voltage optimization, RPT relies on over 80 years of experience to offer modern equipment to protect against voltage dips and ensure voltage stabilization. RPT's transformer

production for low and middle voltage with control cabinets guarantee a continuous high quality of all electrical elements.

The expert knowledge about the technology of electrical testing solutions, voltage optimizers, transformers and systems with control cabinets, control and PLC, makes us a strong and innovative partner to our customers,

»» Facts

- ▶ More than 125 years of experience
- ▶ Certified according to ISO 9001 since 1993
- ▶ Competent project consultation and implementation for customised solutions – worldwide
- ▶ Everything from a single source
 - Peripheral equipment from in-house development and production
 - In-house research and development and close cooperation with institutes and universities
 - In-house production and high vertical product diversification makes us flexible and dynamic with respect to requests for modifications
 - In-house electrical and mechanical design engineering
 - In-house programming
- ▶ Economical, eco-friendly engineering
- ▶ Energy-efficient and space-saving design
- ▶ Expert implementation and manufacture of all equipment based on international standards
- ▶ Professional installation and commissioning – worldwide
- ▶ Theoretical and practical training of customer personnel
- ▶ Extensive after-sales support – also for third-party products
 - Maintenance and servicing
 - Spare parts
 - System optimisation
 - Repairs
 - Modifications / adaptations
 - Maintenance contracts



REFERENCES

RUHSTRAT TEST SOLUTIONS – IN USE WORLDWIDE

Projects implemented in electrical test engineering

In the company's history of more than 125 years we have implemented thousands of test engineering systems.

The locations include:

Austria, Belgium, Brazil, China, Denmark, Finland, France, Germany, Great Britain, Greece, India, Israel, Italy, Mexico, Poland, Portugal, Russia, Singapore, Sweden, Switzerland, Taiwan, Thailand, Turkey, USA.



REFERENCES

OUR SATISFIED CUSTOMERS

Some of our satisfied customers:





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