



GRIDCON[®] TRANSFORMER – THE VOLTAGE REGULATED DISTRIBUTION TRANSFORMER.

POWER DISTRIBUTION . SMART GRID LÖSUNGEN

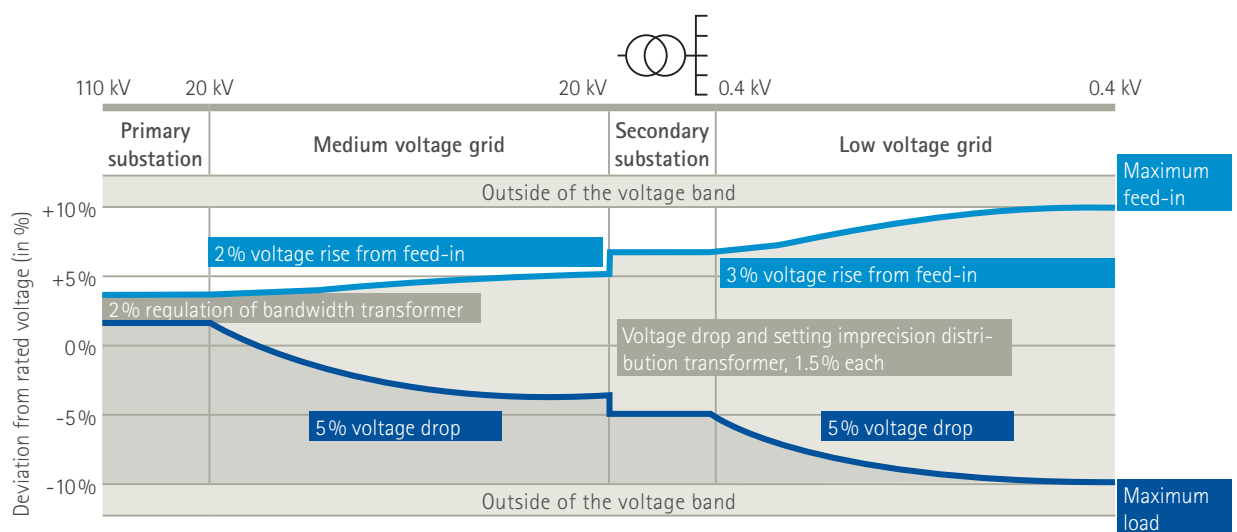


INTEGRATING RENEWABLE ENERGY WITHOUT GRID EXPANSION.



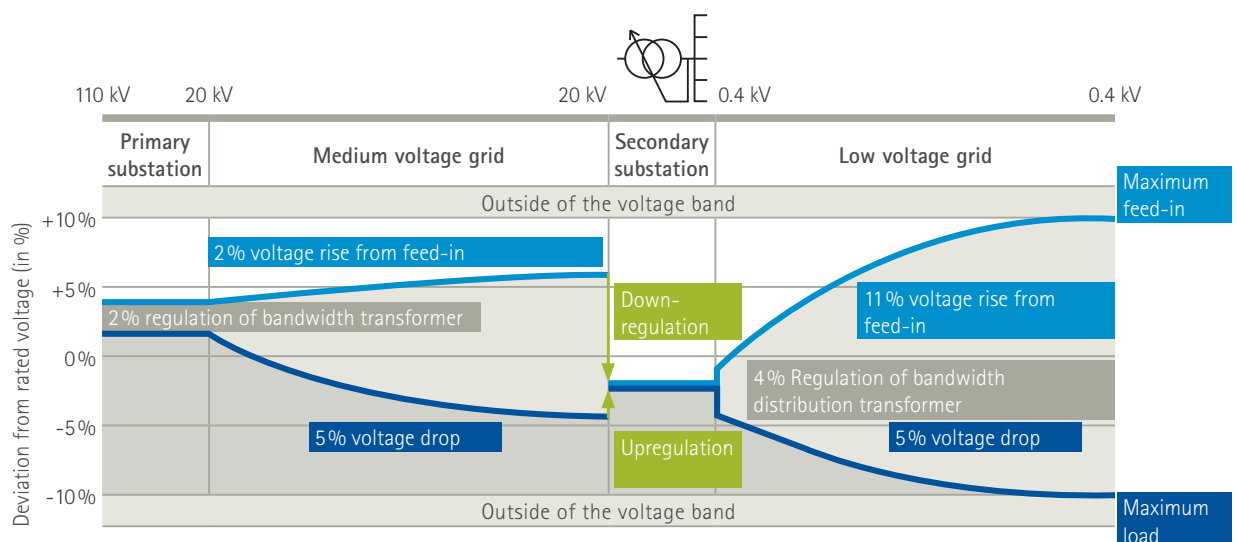
Voltage regulated distribution transformers – the economic alternative to grid expansion.

Network operators face a difficult dilemma: they need to ensure a stable supply voltage in the low voltage grid and at the same time integrate an increasing amount of renewable energy. Within the voltage band of ± 10 percent of the rated voltage according to DIN EN 50160, a maximum voltage rise of 3 percent is available to renewable energies in the low voltage grid. The rest is reserved for the medium voltage grid, voltage drops, and setting imprecisions. Rapidly growing feed-in volumes are increasing the risk of the voltage band being violated. Network operators are being forced into expensive expansion work even though the capacities of their operating equipment is far from exhausted.



Utilizing grid capacities with voltage regulated distribution transformers.

A voltage regulated distribution transformer gets to the heart of the problem – maintaining the voltage band – by dynamically adapting the voltage. It decouples the voltages of low voltage and medium voltage grid. This results in an 11 percent rather than a 3 percent voltage rise being available in the low voltage grid for feed-in from renewable energies. This usually eliminates the need for expensive grid expansion, and in the few situations where this is not the case, the network operators still gain time. Moreover, with voltage regulated distribution transformers, network operators realize a higher utilization of their operating equipment and therefore use it more efficiently.



GRIDCON® TRANSFORMER – THE VOLTAGE REGULATED DISTRIBUTION TRANSFORMER.

Voltage regulated distribution transformers keep the voltage in the distribution grid stable by compensating for the voltage rise from distributed generation. Likewise they balance the voltage drop caused by additional loads, such as electric cars or heat pumps. Additional cables don't have to be laid, and there is no need for more secondary substations. Since the start of 2011, our field trials have been demonstrating how voltage regulated distribution transformers help to avoid grid expansion.

GRIDCON® Transformer provides the entire functionality required for autonomous voltage regulation in distribution networks:

- The transformation function transforms upper voltage into lower voltage
- The on-load switching function allows the ratio between the upper and lower voltage in the transformer to be dynamically adjusted under load
- The drive function guarantees reliable switching
- The regulator function – including sensors – measures the voltage and derives the switching operations required

Drive function

- Stepping motor
- Runs for less than 1 second per tap-change operation

Transformation function

- Oil transformer
- 250 to 800 kVA
- 24 kV voltage class
- 3 phases
- No change in width and depth compared to a non-regulated transformer
- Maintenance-free over whole life-time (up to 700,000 tap changes)
- Maximum of 9 operating positions, alternatively 5 or 7
- Freely configurable on-load regulating range, e.g. $\pm 4 \times 2.5$ percent (maximum 600 V step voltage)



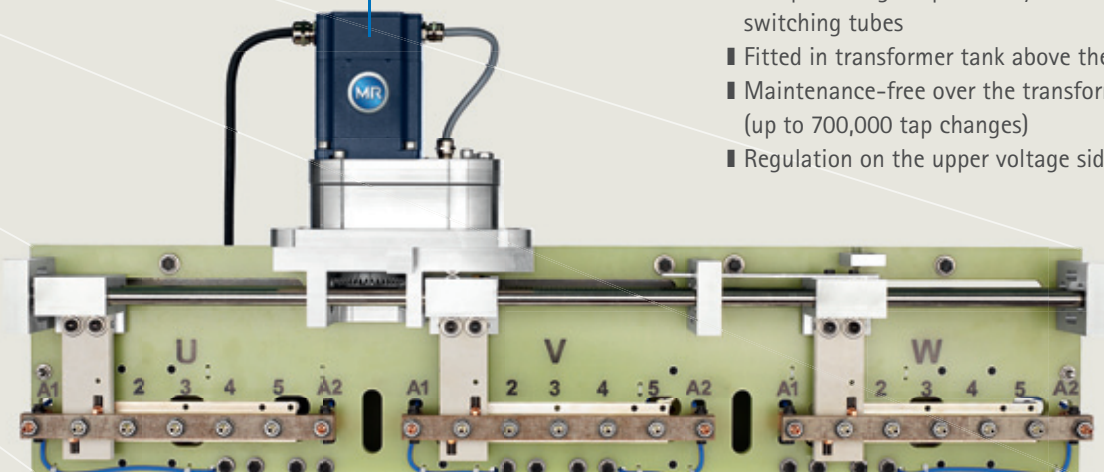
Regulator function

- Voltage regulation on the low voltage busbar
- Three-phase voltage measurement
- Automatic, remote, and manual modes
- Raise / lower operations
- Ethernet and RS232 interfaces
- Control system protocols IEC 60870-5-101, IEC 60870-5-104, IEC 61850
- Sheet steel housing, powder-coated
- Level of protection: IP54



On-load switching function

- On-load tap-changer following the reactor principle
- Arc quenching in specifically developed vacuum switching tubes
- Fitted in transformer tank above the active part
- Maintenance-free over the transformer's life (up to 700,000 tap changes)
- Regulation on the upper voltage side

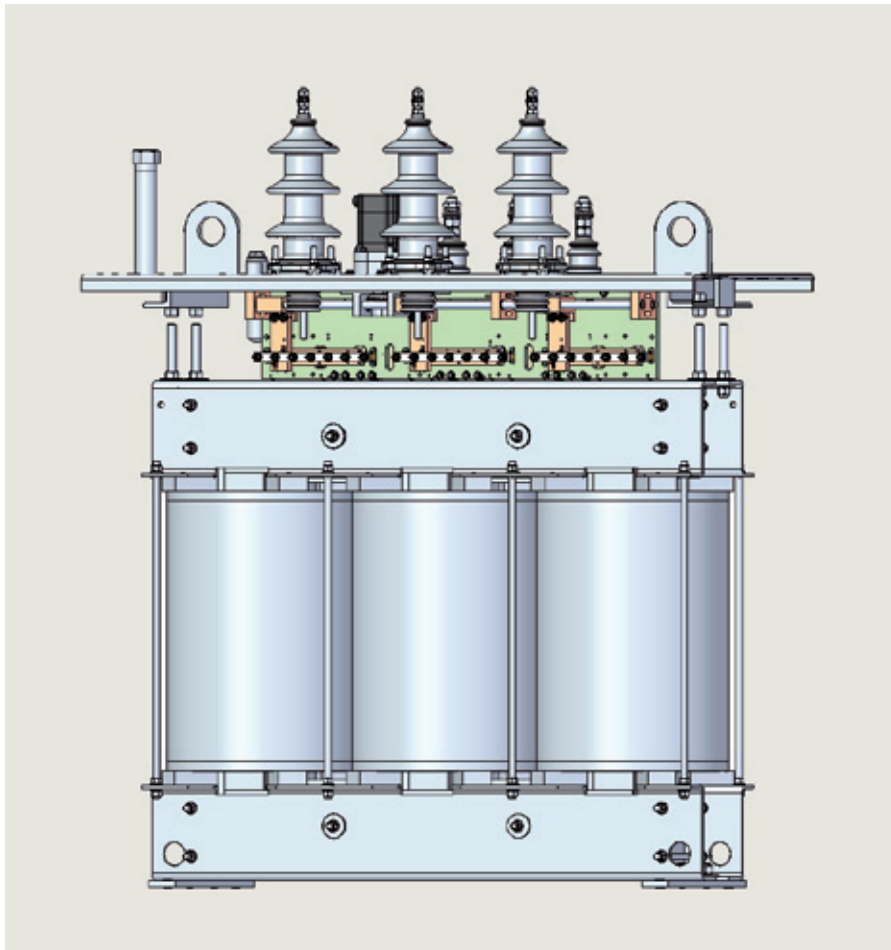


SUITABLE FOR ANY SECONDARY SUBSTATION – ALSO WITH ON-LOAD TAP-CHANGER.

Secondary substations are designed for minimum space requirements. Only if voltage regulated distribution transformers fit in these stations are they an economic solution. The challenge is to design a voltage regulated distribution transformer with the same dimensions as a non-regulated one.

Makes full use of the available space – our innovative way of installing the on-load tap-changer in the transformer.

- The on-load tap-changer fits perfectly in the space available above the active part of the transformer
- Because of the vacuum technology, the on-load tap-changer doesn't need its own oil compartment
- Since the tap change takes place in special vacuum tubes, there is no possibility of oil contamination





	Transformer 630 kVA with GRIDCON® iTAP®	Typical specification transformer 630 kVA
Width	1,288 mm	1,500 mm
Height	1,730 mm	1,750 mm
Depth	826 mm	850 mm

HIGHER PERFORMANCE, HIGHER VALUE.

The perfect solution for distribution network operators.



Maintenance-free and long-lasting

- Life-time identical to non-regulated distribution transformer
- The on-load tap-changer doesn't use any electronics which restrict its service life
- Maintenance-free due to vacuum technology



Maximum operational reliability

- No critical operating statuses thanks to the reactor switching principle
- A communication interface permits interaction with the control system if required
- GRIDCON® Transformer is the product of all our experience. We have been developing on-load tap-changers since 1929. More than 35,000 vacuum technology based and over 10,000 reactor type on-load tap-changers from Maschinenfabrik Reinhausen are in use around the world



Low life cycle costs

- 700,000 reliable tap changes make maintenance superfluous
- The on-load tap-changer works reliably over the entire transformer life
- If necessary, motor and voltage regulator can be replaced with ease



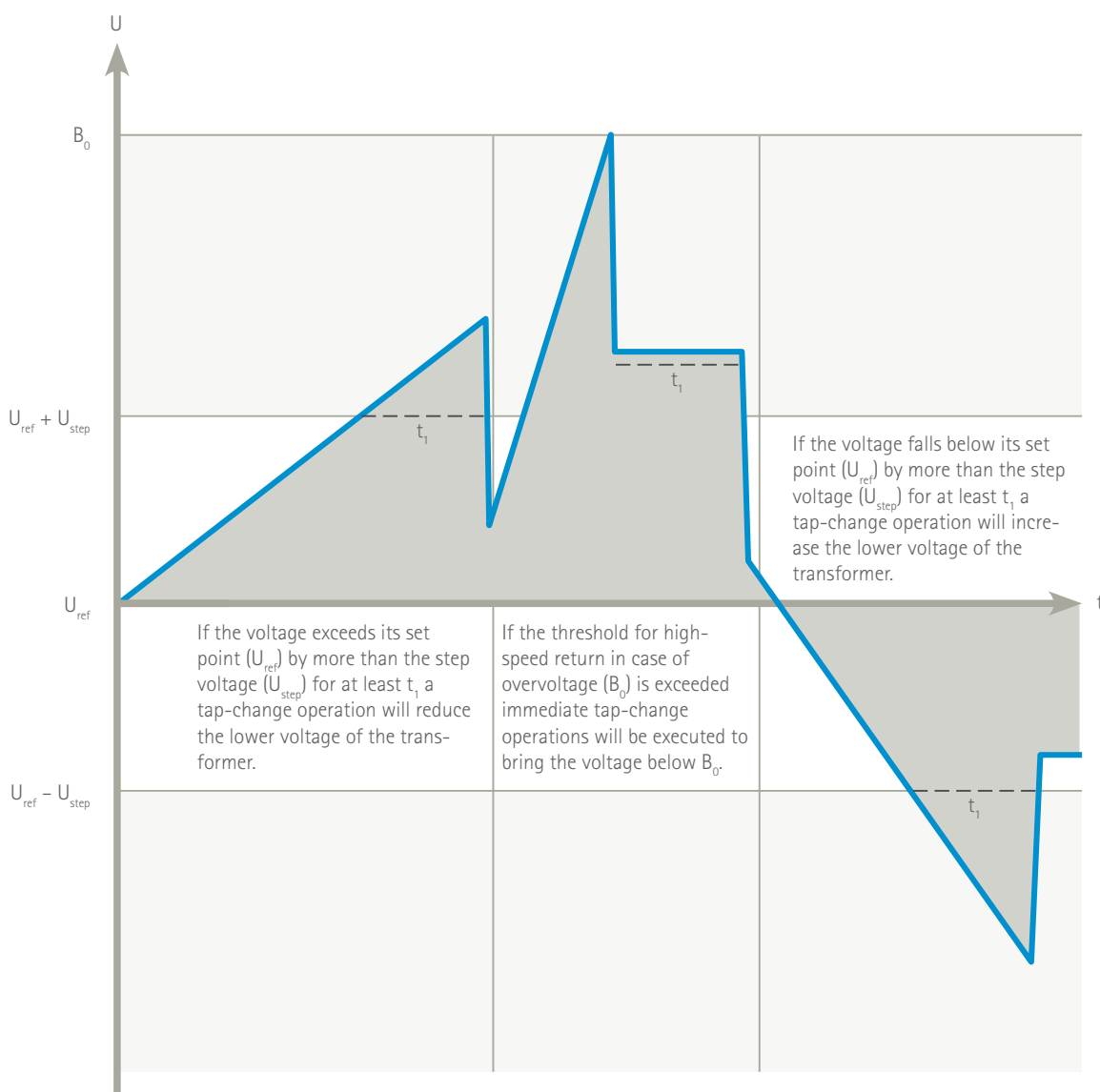
Designed with future requirements in mind

- A maximum of 9 operating positions and step voltages of up to 3 percent allow a regulating range of up to 24 percent. The on-load tap-changer can also be configured asymmetrically for situations with mainly loads or mainly feed-in supplies
- Full use can be made of the voltage band of ± 10 percent according to DIN EN 50160

REGULATION ALGORITHM.

The integrated voltage regulator facilitates an autarkic mode in which the GRIDCON® Transformer adjusts the voltage autonomously based on the state of the grid. To do so, the voltages of all 3 phases are measured on the low voltage bus bar and switching operations are derived in accordance with the parameters of the algorithm. A hunting threshold ensures that phase asymmetries do not lead to oscillating tap-change operations.

The following parameters of the regulation algorithm can be configured individually: Voltage set point (U_{ref}), step voltage (U_{step}), dead time (t_1) and threshold for high-speed return in case of over-voltage (B_0).



In addition to the configurable standard regulation algorithm, alternative individual algorithms can be implemented on request. Moreover, the integration of the transformer into larger regulation schemes is possible via communications means based on standard protocols.

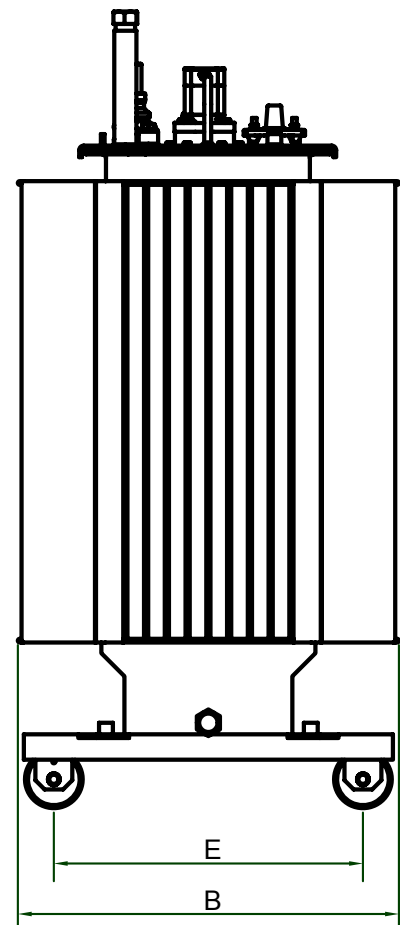
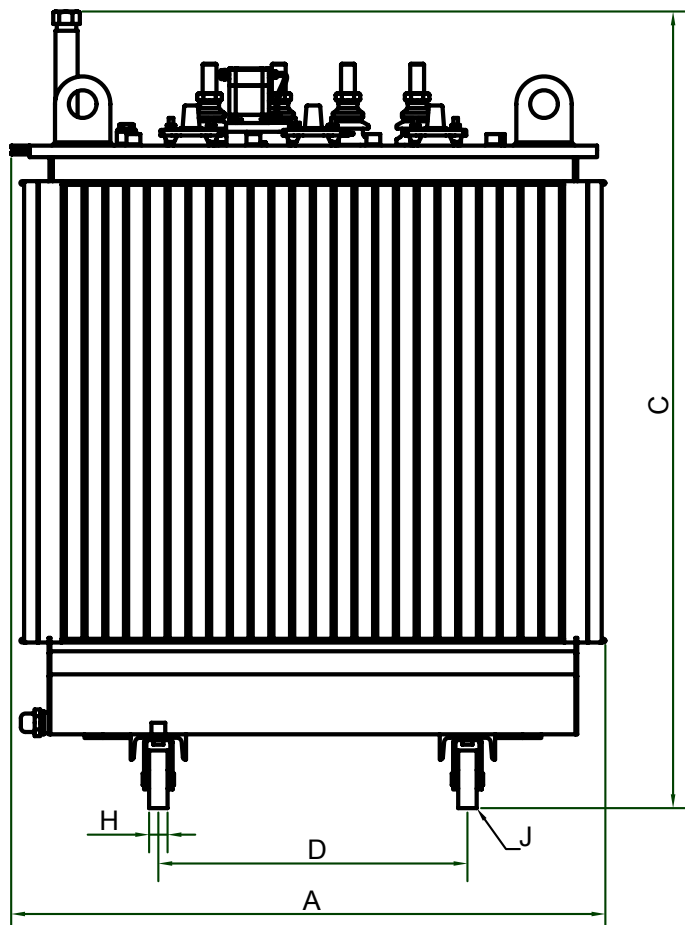
TECHNICAL DATA – TRANSFORMER.

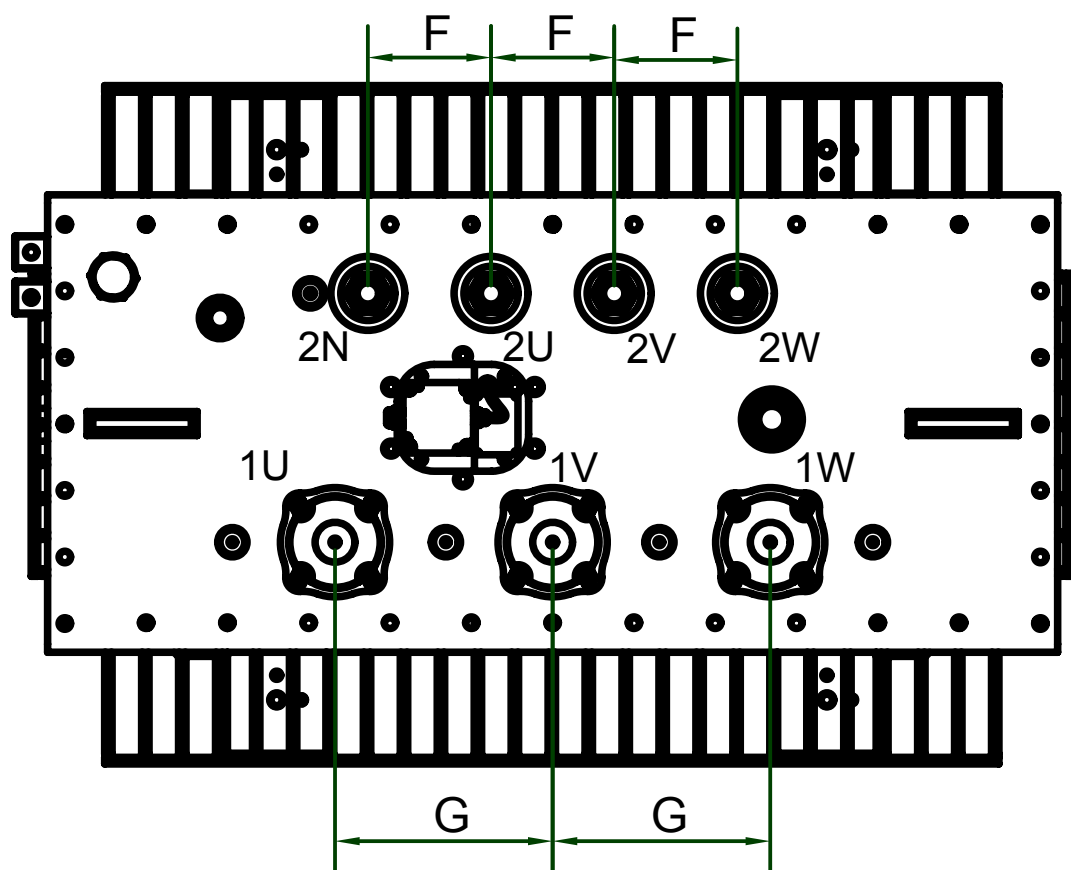
Examples – others on request.

	250 kVA	400 kVA	630 kVA	800 kVA
Winding material HV/LV	Copper / Copper or Aluminium / Aluminium			
Tank type	Hermetic-corrugated tank			
Cooling type	ONAN			
Max. ambient temperature	40° C			
Max. installation altitude	1,000 m over NN			
Frequency	50 Hz			
Vector group	Dyn5			
Impedance voltage	4 %	4 %	4 % or 6 %	6 %
No load losses P_0 (transformer)	Loss class A_0 , B_0 or C_0			
Short circuit losses P_k (transformer)	Loss class B_k or C_k			
Additional losses potential-equalisation chokes	Dependent on configuration of tap changer between 0% and 5% of total transformer losses			
High voltage	Selectable, max. 24 kV voltage class			
Steps	5, 7 or 9 on-load steps Configuration selectable, e.g. +6/-2, +5/-3, +4/-4			
Step voltage	Selectable, max. 600 V, common 1.5%, 2% or 2.5%			
Insulation level	LI 125 AC 50			
HV-bushing	12 – 24 kV / 250 A plug-bushing DIN 50180 or ceramic-bushing DIN 50386			
Low voltage	Selectable			
Insulation level	LI – AC 3			
LV-bushing	1 kV / 250 – 5000 A DIN EN 50386			
LV-connecting lug	Flange connection DIN 43675 or conductor terminal IEC 61238			
Protection device	Non, optional DGPT2			
Thermometer pocket	Thermometer pocket according to DIN 42554 on LV-side			
Driving rolls	Lengthwise and crosswise DIN EN 50216-4, material: steel			
Coating	RAL 7033, total coating thickness $\geq 140 \mu\text{m}$			
Width x depth x height (in mm)	1,080 x 760 x 1,650	1,260 x 850 x 1,650	1,410 x 850 x 1,750 ($u_k=4\%$) / 1,500 x 870 x 1,750 ($u_k=6\%$)	1,550 x 990 x 1,800
Total weight (in kg)	1,910	2,380	2,950 ($u_k=4\%$) 3,150 ($u_k=6\%$)	3,500

TRANSFORMER – DIMENSION DIAGRAMS.

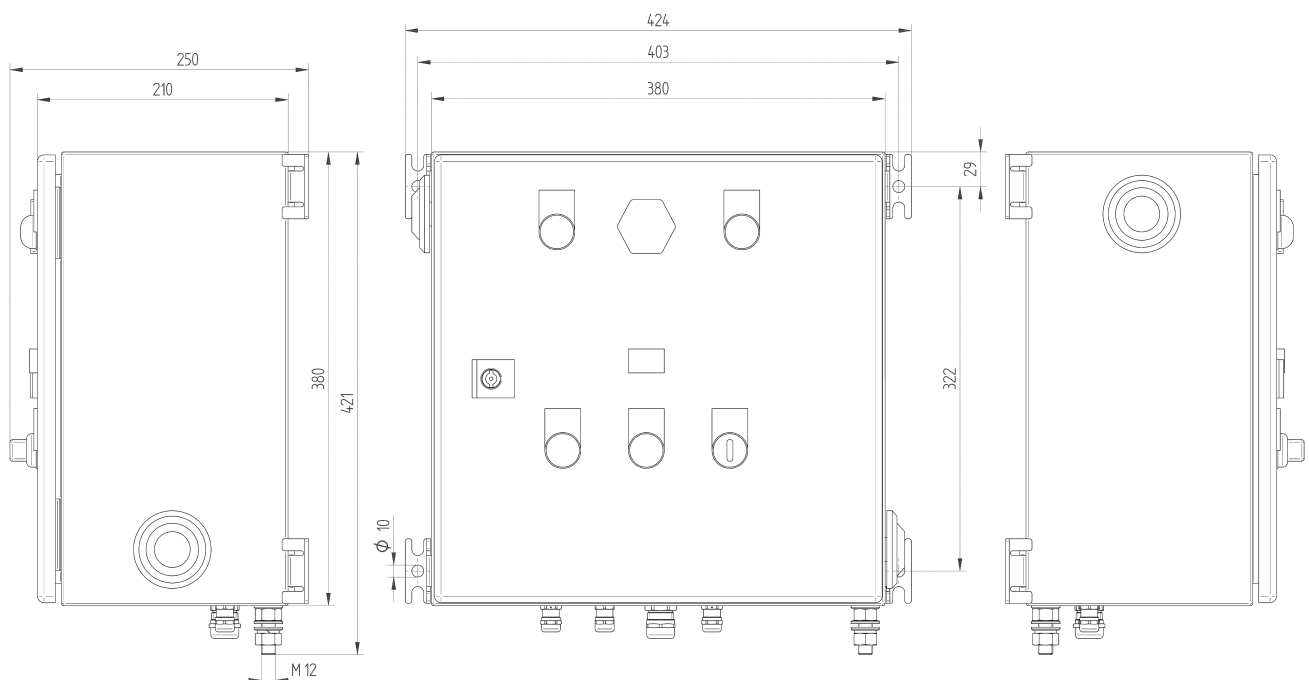
	250 kVA 10/20 kV	400 kVA 10/20 kV	630 kVA 10/20 kV	630 kVA 10/20 kV	800 kVA 10/20 kV
u_k	4%	4%	4%	6%	6%
Pos.	Dimensions (in mm)	Dimensions (in mm)	Dimensions (in mm)	Dimensions (in mm)	Dimensions (in mm)
A	1,080	1,260	1,410	1,500	1,550
B	760	850	850	870	990
C	1,650	1,650	1,750	1,750	1,800
D	520	670	670	670	670
E	520	670	670	670	670
F	150	150	150	150	150
G	265	265	265	265	265
H	40	40	40	40	40
K	Diameter 125	Diameter 125	Diameter 125	Diameter 125	Diameter 125





TECHNICAL DATA – VOLTAGE REGULATOR AND CONTROL CABINET.

Voltage regulator and control cabinet	iTAP® III
Voltage	3 AC 400 V
Current	1 A
Frequency	50 Hz
Test voltage to ground	2 kV/1 min
Operating temperature	-25° C ... +60° C
Duration of the tap-change operation	0.9 s
Shortest gap between tap-change operations	3 s
Interfaces	Ethernet, RS232
Protocols	IEC 60870-5-101, IEC 60870-5-104, IEC 61850
Housing (W x H x D)	380 x 380 x 180 mm
Weight	15 kg



Maschinenfabrik Reinhausen GmbH

Falkensteinstraße 8
93059 Regensburg, Germany

Phone: +49 941 4090 0
Fax: +49 941 4090 7001
E-Mail: powerdistribution@reinhausen.com

www.reinhausen.com

Please note:

The data in our publications may differ from the data of the devices delivered. We reserve the right to make changes without notice.

IN3148382/00 EN – GRIDCON® Transformer –
F0301300 – 09/12 – pu
©Maschinenfabrik Reinhausen GmbH 2012

MR WORLDWIDE

AUSTRALIA

Reinhausen Australia Pty. Ltd.
17/20–22 St Albans Road
Kingsgrove, NSW, 2208
Phone: +61 2 9502 2202
Fax: +61 2 9502 2224
E-Mail: sales@au.reinhausen.com

BRAZIL

MR do Brasil Indústria Mecânica Ltda.
Av. Elias Yazbek, 465, CEP: 06803-000
Embu – São Paulo
Phone: +55 11 4785 2150
Fax: +55 11 4785 2185
E-Mail: vendas@reinhausen.com.br

CANADA

Reinhausen Canada Inc.
1010 Sherbrooke West, Suite 1800
Montréal, Québec H3A 2R7
Tél: +1 514 286 1075
Fax: +1 514 286 0520
E-Mail: m.foata@ca.reinhausen.com

INDIA

Easun-MR Tap Changers (P) Ltd.
612, CTH Road, Tiruninravur
Chennai 602 024
Phone: +91 44 26300883
Fax: +91 44 26390881
E-Mail: easunmr@vsnl.com

IRAN

Iran Transfo After Sales Services Co.
Zanjan, Industrial Township No. 1 (Aliabad)
Corner of Morad Str., Postal Code 4533144551
E-Mail: itass@iran-transfo.com

ITALY

Reinhausen Italia S.R.L.
Via Alserio, 16, 20159 Milano
Phone: +39 02 694 3471
Fax: +39 02 694 347 66
E-Mail: sales@it.reinhausen.com

JAPAN

MR Japan Corporation
German Industry Park, 1-18-2 Hakusan
Midori-ku, Yokohama 226-0006
Phone: +81 45 929 5728
Fax: +81 45 929 5741

LUXEMBOURG

Reinhausen Luxembourg S.A.
72, Rue de Prés, L-7333 Steinsel
Phone: +352 27 33 471
Fax: +352 27 33 4799
E-Mail: sales@lu.reinhausen.com

MALAYSIA

Reinhausen Asia-Pacific Sdn. Bhd.
Level 11 Chulan Tower, No. 3 Jalan Conlay
50450 Kuala Lumpur
Phone: +60 3 2142 6481
Fax: +60 3 2142 6422
E-Mail: mr_rap@my.reinhausen.com

P.R.C. (CHINA)

MR China Ltd. (MRT)
开德贸易(上海)有限公司
中国上海 浦东新区 浦东南路360号
新上海国际大厦4楼E座, PC: 200120
电话: +86 21 6163 4588
传真: +86 21 6163 4582
邮箱: mr-sales@cn.reinhausen.com
mr-service@reinhausen.com
公司主页: www.mr-china.cn

RUSSIAN FEDERATION

OOO MR
Naberezhnaya Akademika Tupoleva 15, Bld. 2
("Tupolev Plaza"), 105005 Moscow
Phone/Fax: +7 495 980 89 67
E-Mail: mrr@reinhausen.ru

SOUTH AFRICA

Reinhausen South Africa (Pty.) Ltd.
No. 15, Third Street, Booyens Reserve
Johannesburg
Phone: +27 11 835 2077
Fax: +27 11 835 3806
E-Mail: support@za.reinhausen.com

SOUTH KOREA

Reinhausen Korea Ltd.
Baek Sang Bldg. Room No. 1500
197-28, Kwanhun-Dong,
Chongro-Ku, Seoul 110-718
Phone: +82 2 767 4909
Fax: +82 2 736 0049
E-Mail: you-mi.jang@kr.reinhausen.com

USA

Reinhausen Manufacturing Inc.
2549 North 9th Avenue, Humboldt, TN 38343
Phone: +1 731 784 7681
Fax: +1 731 784 7682
E-Mail: sales@reinhausen.com

UNITED ARAB EMIRATES

Reinhausen Middle East FZE
Dubai Airport Freezone, Building Phase 6
3rd floor, Office No. 6EB, 341 Dubai
Phone: +971 4 2368 451
Fax: +971 4 2368 225
E-Mail: service@ae.reinhausen.com

THE POWER BEHIND POWER.

