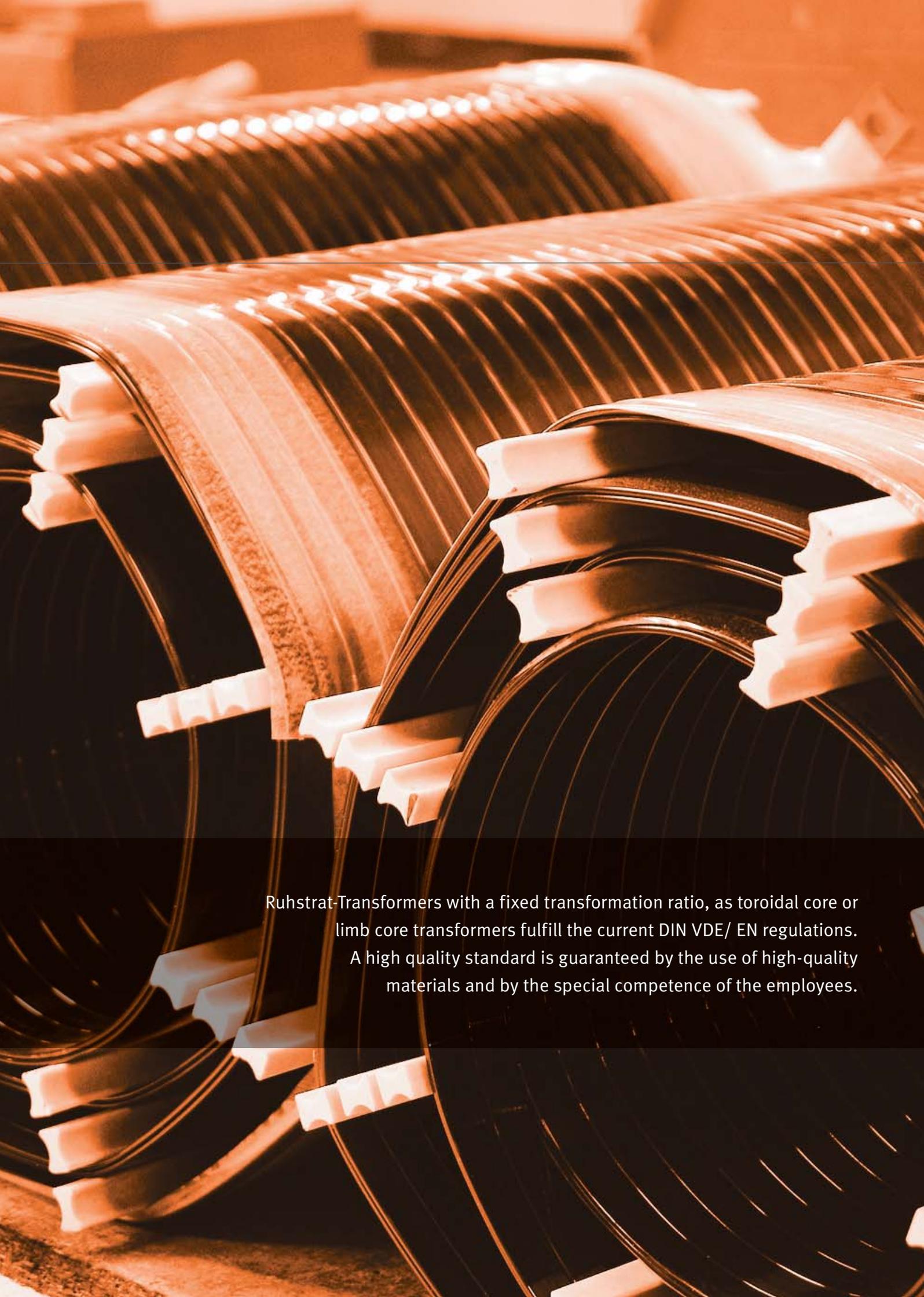




**LOW VOLTAGE DRY-TYPE TRANSFORMERS
ACCORDING TO DIN EN 61558 (VDE 0532/0570)
TECHNICAL INFORMATION**



Ruhstrat-Transformers with a fixed transformation ratio, as toroidal core or limb core transformers fulfill the current DIN VDE/ EN regulations. A high quality standard is guaranteed by the use of high-quality materials and by the special competence of the employees.

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TECHNICAL EXPLANATIONS

Ruhstrat-Transformers with a fixed transformation ratio, single-phase and three-phase types, as toroidal core or limb core transformers fulfill the current DIN VDE/ EN regulations.

General

This catalogue provides a general idea of Ruhstrat's standard programme for transformers with fixed transformation ratio, constructed as toroidal core or limb core transformers.

Applications deviating from the standard programme are our strong point! Every product can be tailor-made according to your special application.

Quality Control

During its production every transformer has to undergo an intermediate test and after its production it has to undergo a thorough final electrical test; this is always done according to the respectively valid process instructions. According to the quality standard DIN ISO 9001 the documentation of the measuring results is effected in appropriate test certificates.

A high quality standard is guaranteed by the use of high-quality materials and by the special competence of the employees.

Technical Explanations

The transformers are manufactured according to the valid relevant VDE/EN regulations. Low loss grain-oriented electrical steel is used as the core material. Depending on customer requirements and specifications the transformer windings can be produced using either copper or aluminum. Both wire and foil conductors can be wound depending on the current that is required. Insulation materials are chosen according to the required insulation coordination and the insulation class of the materials.

Power

Power is calculated as the product of secondary voltage [V] and secondary current [A], the result is [kVA]. All power specifications refer to the collected power at the secondary side with:

- continuous operation (S1)
- excitation with rated voltage
- rated frequency 50/60 Hz
- an ambient temperature of max. 40°C
- an altitude of installation up to 1.000 m above MSL
- (load) power factor (LPF) = 1

Overload

In principle, the transformers can be loaded with higher currents for a short period of time, if the average temperature limit is kept. The limit values for short-time operation (S2) arise from fig 3.1.

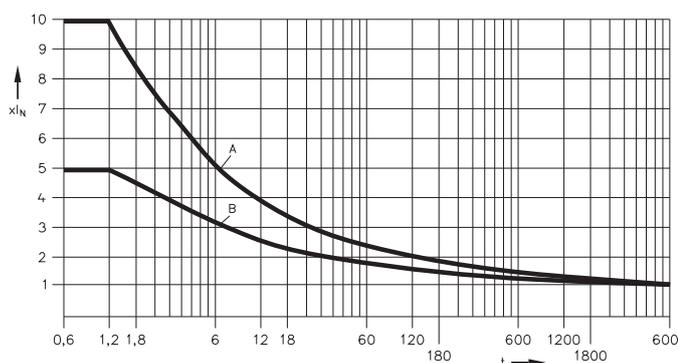


fig. 3.1
limit values for overload during short-time operation
A: overload in cold state
B: overload in warm state

Warming

The admissible temperature limits stipulated in the respective VDE/EN regulations are not exceeded, if the transformers are duly operated and if the ambient temperature does not rise above a maximum of 40 °C.

With an ambient temperature above 40 °C the transformer must not be charged with the full rated current, due to the possible

exceeding of the highest admissible overtemperature limit of the winding.

It has to be ensured that there is a sufficient ventilation resp. unhindered entry of cool air at the transformer's site of installation!

ambient temperature [°C]	40	45	50	55	60
insulant class B	1,0	0,96	0,92	0,88	0,82
insulant class F	1,0	0,97	0,94	0,90	0,86
insulant class H	1,0	0,98	0,95	0,92	0,90

table 4.1: factors for the correction of the rated power with ambient temperatures above 40 °C

Altitude of Installation

The rated powers stipulated for the transformers are valid for an altitude of installation of 1.000 m above main sea level. With an altitude of installation of more than 1.000 m above main sea level it is the same as with an excessive overtemperature: a power reduction has to be carried out. This is necessary, as the smaller atmospheric pressure leads to reduced cooling.

TECHNICAL EXPLANATIONS

altitude of installation [m] up to	1000	1500	2000	2500	3000
insulant class B	1,0	0,98	0,97	0,93	0,92
insulant class F	1,0	0,98	0,97	0,94	0,93
insulant class H	1,0	0,98	0,97	0,94	0,93

table 4.2: factors for the correction of the rated power with operation at high altitudes

Kind of Load

The standard transformers stipulated refer to pure real load. Other deviating kinds of load and thyristor power controller operation of the transformers must be considered when they are constructed.

Insulation

For long life and high operation safety of a transformer it is very important that no part takes on an inadmissibly high temperature. The insulation of the windings is most sensitive against warmth, as it can only bear a limited temperature with a normal duration of life.

The insulation structure allows the use of transformers in dry rooms. During its production the transformer has to undergo an impregnation with resin under vacuum and then it is dried in a

furnace. Through this the transformers are protected against external influences.

Admissible Winding Temperature

The winding temperature may not exceed the limit temperature which depends on the insulant class. The limit temperature is the highest admissible permanent temperature of the winding at the hottest point. The limit temperature emerges when adding the ambient temperature (40 °C), the admissible limit overtemperature and a safety addition.

insulant class	admissible limit overtemperature [K]	limit temperature of the insulant system [°C]
insulant class B	80	130
insulant class F	100	155
insulant class H	125	180

table 5.1: limit overtemperature and limit temperature of the insulant classes B, F, H

Transformers with Separate Winding

With these transformers there is no electrically conducting connection between the primary and secondary winding, as these are galvanically separated from each other.

Taps

Transformers can be constructed with taps on the primary as well as on the secondary side. Taps on the primary side serve for the adaptation of the transformer to different mains voltage tolerances.

Transformers with Autowinding

Autotransformers have a winding which consists of two parts. Both winding parts of the series winding and the parallel winding, are connected in series and are interspersed by the same magnetic flux. The autotransformer has the same mode of operation as the transformer with separate winding, which is also called transformer and also allows to step up and down voltages, but no physical separation.

In contrast to the complete transformer, there is only a part of the output power transferred from the input winding to the output winding with the autotransformer, by means of magnetic induction. The transfer of the other part of the output power is effected by means of direct current conduction. Therefore, referring to the autotransformer one distinguishes between trans-circuit power and structural power.

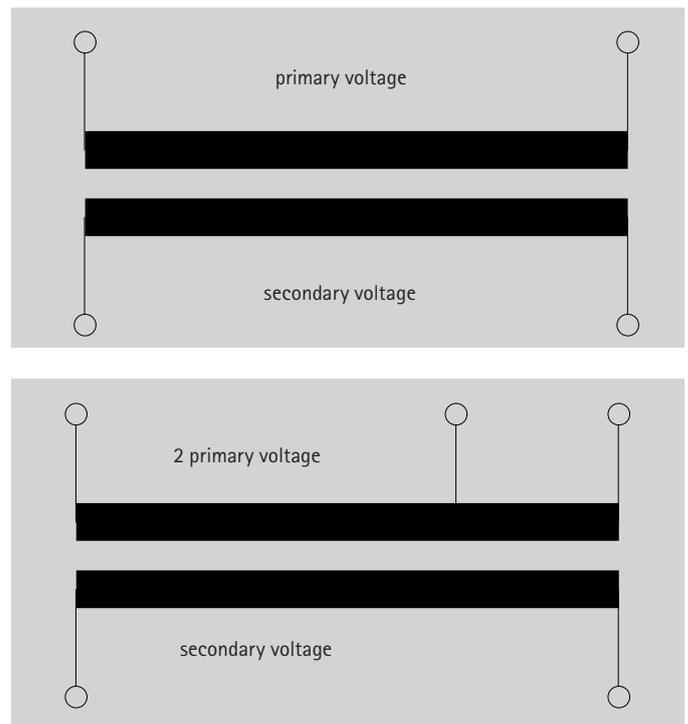


fig. 5.1:
wiring diagram transformer with separate winding and tap on the primary side

TECHNICAL EXPLANATIONS

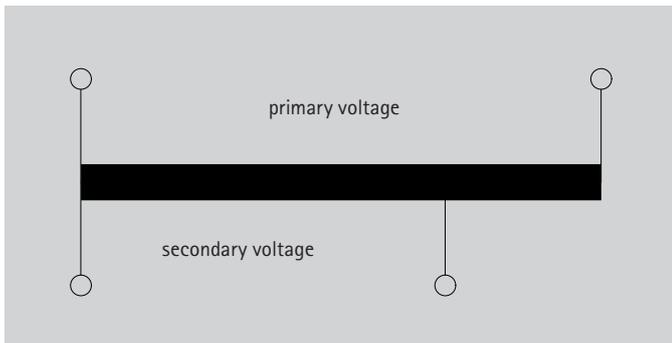


fig. 5.2:
wiring diagram transformer with autowinding

The structural power and consequently the size of the transformer diminishes considerably compared to transformers with separate winding, due to the saving of core iron and winding copper. The smaller the difference between input voltage and output voltage, the larger is the structural power.

Degrees of Protection

Depending on the site of installation and the intended purpose the parts of the transformer which are under voltage have to be protected against accidental touching and against penetration of water and foreign bodies. For this reason, different kinds of

protection are distinguished. The kinds of protection are indicated by a short sign which consists of two reference numbers for the degree of protection. The first reference number gives an information about the protection degree against touching and penetration of foreign bodies. The second reference number marks the protection against the penetration of water.

Vector Groups of Three-Phase Transformers

The combination of the different connection systems for high-voltage winding and low-voltage winding is called vector group of the three-phase transformer. The vector group consists of at least one capital letter and one small letter as well as of a reference number. If three-phase transformers have a neutral point (star point) which is lead outside, the vector group is completed by an "N" or "n". The capital letter stands for the input winding, the small one for the output winding. Depending on the connection of the consumer to the winding's beginning or end of the low-voltage side phase displacements from 0° resp. 180° and 150° resp. 330° arise between high voltages and low voltages. This phase displacement is stated by the reference numbers 0, 5, 6 and 11, whereas the phase displacement angle is the product of the reference number and the angle of 30° .

designation / ref. number	vector group	vector diagram	wiring picture	secondary / neutral point (star point)
0	Dd0			not available
	Yy0			10 % loadable
	Dz0			fully loadable
5	Dy5			fully loadable
	Yd5			not available
	Yz5			fully loadable
6	Dd6			not available
	Yy6			10 % loadable
	Yz5			fully loadable
11	Dy11			fully loadable
	Yd11			not available
	Yz11			fully loadable
0	Ya0			10 % loadable

table 6.1:
vector groups of three-phase transformers

TECHNICAL EXPLANATIONS

Low Voltage Dry-Type Transformers according to DIN EN 61558 (VDE 0532/0570)

1. Structure

Ruhstrat dry-type transformers are manufactured according to the valid regulations DIN EN 61558 (VDE 0532/0570). Low loss and cold-rolled sheets for the electrical industry, with privileged magnetic direction, are used as core material. The windings are made of insulated copper wire. With high rated currents streamlined copper wire and strip copper wire are used. The other insulations, materials are chosen according to the corresponding temperature stability class.

- As single-phase or three-phase construction, with separate winding or autowinding (autotransformer).
- Plants conceived according to customer's requirements as single and special production with a power range from 0.04 kVA up to 1.2 MVA and a voltage range up to 10 kV and as high-current transformer up to 10 kA.
- As transformer aggregate in combination with a variable transformer connected in series, in order to regulate voltages in the output steplessly from 0 to 100 %.

2. Advantages

During the production process Ruhstrat Dry-Type transformers undergo a resin impregnation under vacuum with following furnace drying. This insulation makes a higher protection against external mechanical influences possible as well as a long service life and high operation safety of the transformers.

3. Winding

If not indicated otherwise, Ruhstrat Dry-Type transformers are delivered with galvanically separated windings. In case of a construction with autowinding (autotransformer) the structural power is reduced. The autotransformer is mechanically smaller and therefore it can be produced at lower costs.

4. Degrees of Protection

The following standard degrees of protection are possible:

- a) Degree of protection IP00 – open design for indoor installation, protection class 1, suitable for fitting up to IP23
- b) Degree of protection IP23 – designed with steel sheet enclosure, protection class 1, colour RAL 7032 or according to customer's requirements
- c) Degree of protection IP54 – designed with steel sheet enclosure, protection class 1, colour RAL 7032 or according to customer's requirements

5. Voltages

Ruhstrat Dry-Type transformers can be offered with voltages up to 10,000V.

6. Frequency

Ruhstrat Dry-Type transformers are designed for an operation frequency of 50/60 Hz. Other frequencies like 16 2/3 Hz and 400 Hz please indicate at request.

7. Regulations

Ruhstrat Dry-Type transformers are manufactured according to the current DIN VDE- and EN regulations. Further regulations, as for example certain marine classifications, can be considered upon request.

8. Possibilities of application

e. g. test fields, machine controls, marine engineering (pre-charging transformers for the reduction of the inrush current), resistance heated industrial furnaces, glass melting plants, neutral earthing transformers etc.

THREE-PHASE LOW VOLTAGE DRY-TYPE TRANSFORMERS

■ POWER RANGE 1–30 KVA / TYPE OF PROTECTION IP00

Technical data	
Type:	T-SFD_GAE
Power range:	1 – 30 kVA
Rated voltage (primary):	200 V – 800 V (other voltages on request)
Rated voltage (secondary):	200 V – 800 V (other voltages on request)
Output current at: - screw-type terminal - bolt connection - copper bar	max. 125 A max. 520 A from 520 A – 2500 A
Rated frequency:	50/60 Hz
Vector group:	YNyn(x) or Dyn(x), galvanically separated windings
Ambient temperature:	$t_a = 40\text{ °C}$
Type of protection:	IP00, open construction, protection class 1 suitable for fitting up to IP23
Accessories:	with positive temperature coefficient sensor for warning and shut-down, led on terminals

Type	Power [kVA]	Cu content [kg]	Total weight [kg]	Dimensions (mm)		
				B	T	H
T-SFD_GAE 1	1,0	3,0	11	125	210	215
T-SFD_GAE 2,5	2,5	8,5	26	150	240	230
T-SFD_GAE 5	5,0	15,5	42	180	300	320
T-SFD_GAE 6,3	6,3	17,5	52	175	340	345
T-SFD_GAE 8	8,0	18,5	85	195	360	365
T-SFD_GAE 10	10,0	23,0	95	175	425	405
T-SFD_GAE 12,5	12,5	29,0	120	205	425	405
T-SFD_GAE 16	16,0	41,0	150	235	425	405
T-SFD_GAE 20	20,0	52,5	170	220	485	455
T-SFD_GAE 25	25,0	52,5	170	220	485	455
T-SFD_GAE 30	30,0	64,0	205	250	485	455

Deviating voltages, taps, ambient temperatures and degrees of protection, construction as autotransformers, thyristor power controller operation etc. upon request. When ordering please indicate your required primary and secondary voltage, required taps as well as the frequency.

THREE-PHASE LOW VOLTAGE DRY-TYPE TRANSFORMERS

■ POWER RANGE 1–30 KVA / TYPE OF PROTECTION IP23

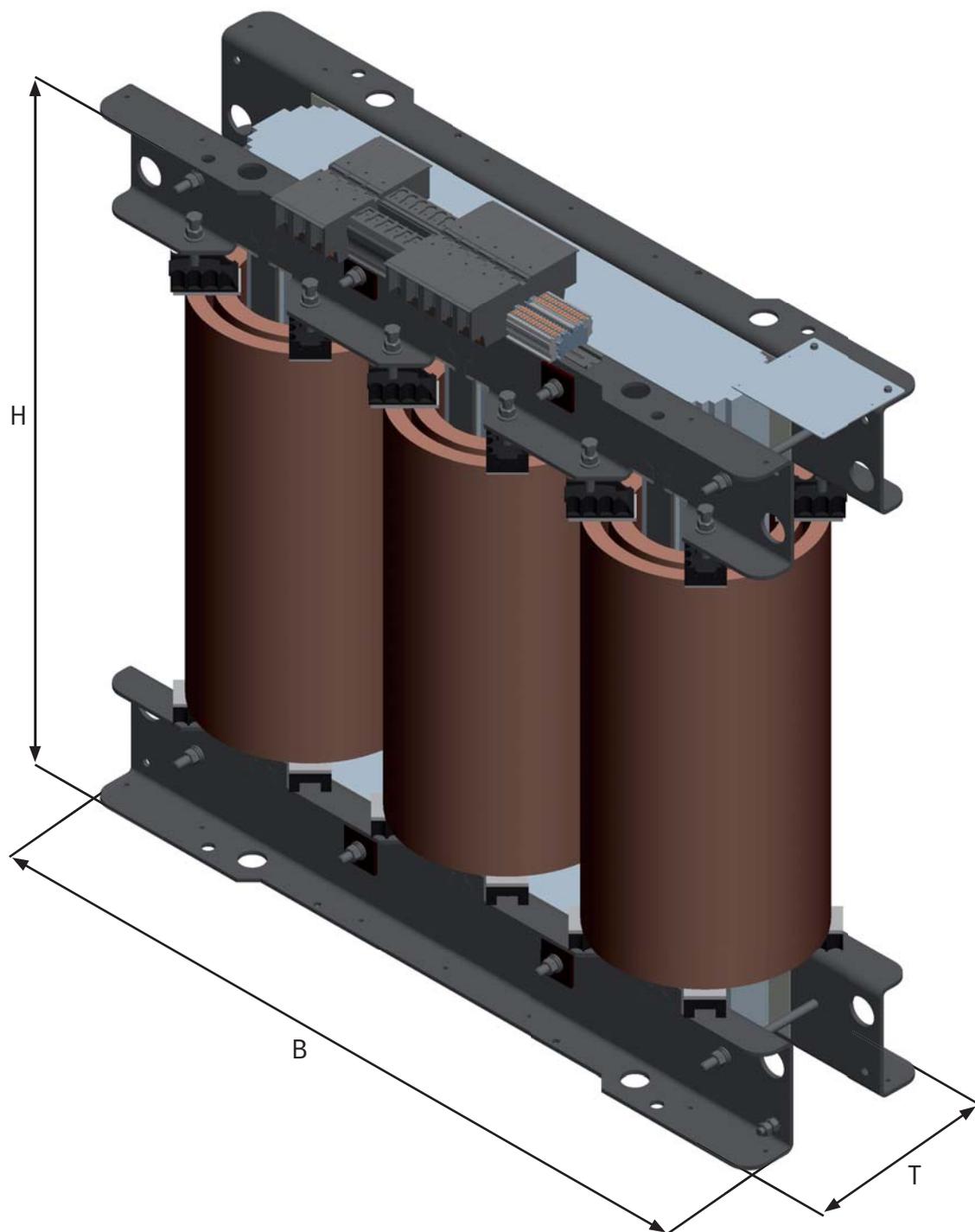
Technical data	
Type:	T-SFD_GAG
Power range:	1 – 30 kVA
Rated voltage (primary):	200 V – 800 V (other voltages on request)
Rated voltage (secondary):	200 V – 800 V (other voltages on request)
Output current at: - screw-type terminal - bolt connection - copper bar	max. 125 A max. 520 A from 520 A – 2500 A
Rated frequency:	50/60 Hz
Vector group:	YNyn(x) or Dyn(x), galvanically separated windings
Ambient temperature:	$t_a = 40\text{ °C}$
Type of protection:	IP23, protection class 1
Accessories:	mit Kaltleitertemperaturfühler, zur Wartung und Abschaltung, auf Klemmen geführt

Type	Power [kVA]	Cu content [kg]	Total weight [kg]	Dimensions (mm)		
				B	T	H
T-SFD_GAG 1	1,0	3,0	14	220	298	220
T-SFD_GAG 2,5	2,5	8,5	30	250	358	300
T-SFD_GAG 5	5,0	15,5	48	350	478	300
T-SFD_GAG 6,3	6,3	17,5	60	350	478	300
T-SFD_GAG 8	8,0	18,5	95	380	558	300
T-SFD_GAG 10	10,0	23,0	107	400	460	480
T-SFD_GAG 12,5	12,5	29,0	130	400	460	480
T-SFD_GAG 16	16,0	41,0	165	400	460	480
T-SFD_GAG 20	20,0	52,5	190	450	520	560
T-SFD_GAG 25	25,0	52,5	190	450	520	560
T-SFD_GAG 30	30,0	64,0	230	450	520	560

Deviating voltages, taps, ambient temperatures and degrees of protection, construction as autotransformers, thyristor power controller operation etc. upon request. When ordering please indicate your required primary and secondary voltage, required taps as well as the frequency.

THREE-PHASE LOW VOLTAGE DRY-TYPE TRANSFORMERS

- POWER RANGE 50–500 KVA / TYPE OF PROTECTION IP00



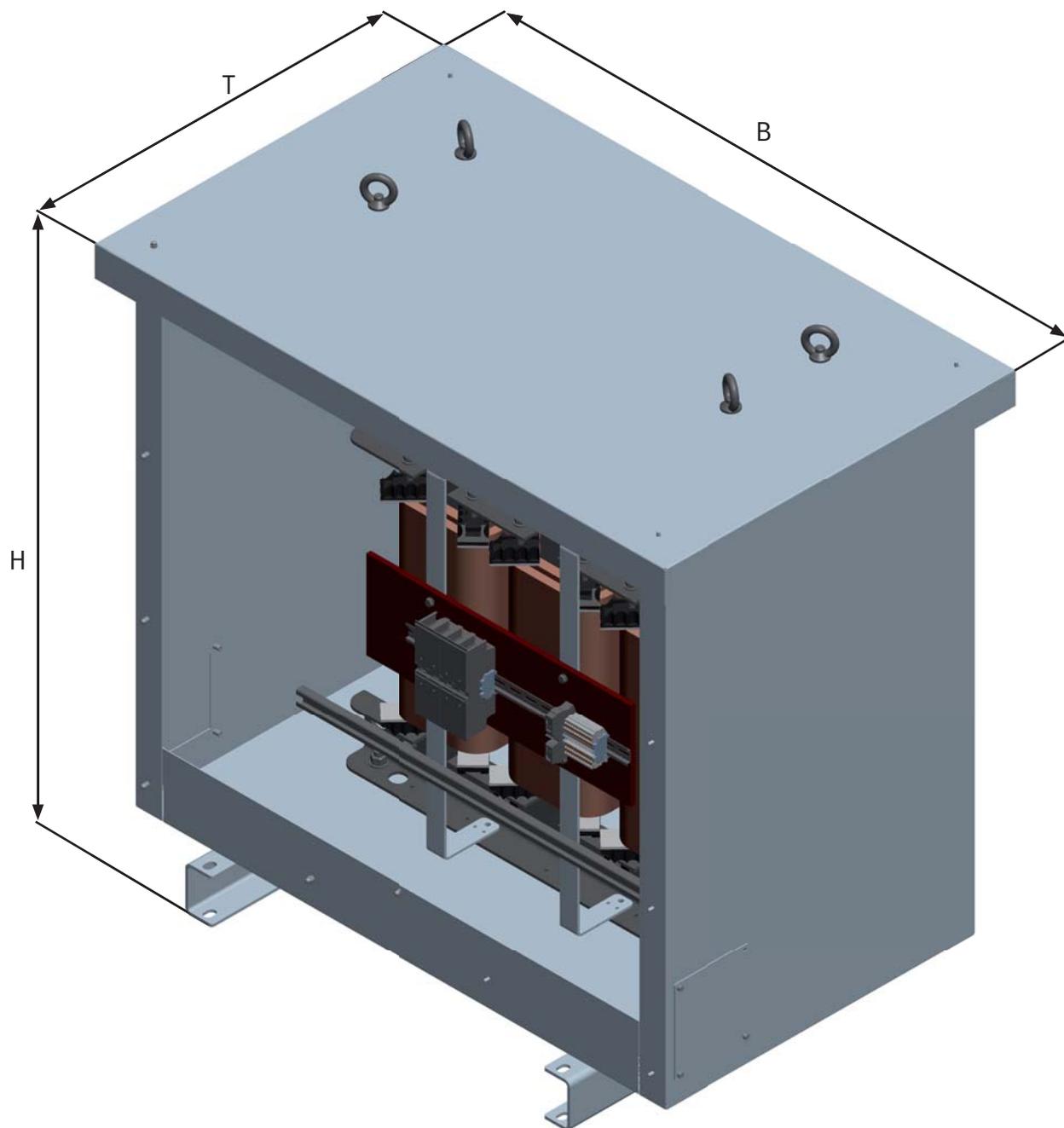
Technical data	
Type:	T-SFD_GAE
Power range:	50 – 500 kVA
Rated voltage (primary):	200 V – 800 V (other voltages on request)
Rated voltage (secondary):	200 V – 800 V (other voltages on request)
Output current at: - screw-type terminal - bolt connection - copper bar	max. 125 A max. 520 A from 520 A – 2500 A
Rated frequency:	50/60 Hz
Vector group:	YNyn(x) oder Dyn(x), galvanically separated windings
Ambient temperature:	t _a = 40 °C
Type of protection:	IP00, open construction, protection class 1 suitable for fitting up to IP23
Accessories:	with positive temperature coefficient sensor for warning and shut-down, led on terminals

Type	Power [kVA]	Cu content [kg]	Total weight [kg]	Dimensions (mm)		
				B	T	H
T-SFD_GAE 50	50	61	300	750	232	620
T-SFD_GAE 63	63	87	310	800	252	620
T-SFD_GAE 80	80	82	370	800	242	710
T-SFD_GAE 100	100	104	450	800	262	760
T-SFD_GAE 125	125	121	530	900	282	760
T-SFD_GAE 160	160	156	630	900	262	850
T-SFD_GAE 200	200	196	760	1100	295	1010
T-SFD_GAE 250	250	224	890	1100	306	1050
T-SFD_GAE 315	315	284	1070	1100	314	1100
T-SFD_GAE 400	400	316	1370	1240	334	1190
T-SFD_GAE 500	500	420	1620	1300	343	1210

Deviating voltages, taps, ambient temperatures and degrees of protection, construction as autotransformers, thyristor power controller operation etc. upon request. When ordering please indicate your required primary and secondary voltage, required taps as well as the frequency.

THREE-PHASE LOW VOLTAGE DRY-TYPE TRANSFORMERS

- POWER RANGE 50–500 KVA / TYPE OF PROTECTION IP23



Technical data	
Type:	T-SFD_GAG
Power range:	50 – 500 kVA
Rated voltage (primary):	200 V – 800 V (other voltages on request)
Rated voltage (secondary):	200 V – 800 V (other voltages on request)
Output current at: - screw-type terminal - bolt connection - copper bar	max. 125 A max. 520 A from 520 A – 2500 A
Rated frequency:	50/60 Hz
Vector group:	YNyn(x) oder Dyn(x), galvanically separated windings
Ambient temperature:	$t_a = 40\text{ °C}$
Type of protection:	IP23, protection class 1
Accessories:	with positive temperature coefficient sensor for warning and shut-down, led on terminals

Type	Power [kVA]	Cu content [kg]	Total weight [kg]	Dimensions (mm)		
				B	T	H
T-SFD_GAG 50	50	61	360	1090	690	1124
T-SFD_GAG 63	63	87	390	1090	690	1124
T-SFD_GAG 80	80	82	450	1090	690	1124
T-SFD_GAG 100	100	104	530	1090	690	1124
T-SFD_GAG 125	125	121	630	1290	790	1225
T-SFD_GAG 160	160	156	730	1290	790	1225
T-SFD_GAG 200	200	196	910	1540	1050	1470
T-SFD_GAG 250	250	224	1040	1540	1050	1470
T-SFD_GAG 315	315	284	1220	1540	1050	1470
T-SFD_GAG 400	400	316	1620	1780	1090	1680
T-SFD_GAG 500	500	420	1870	1780	1090	1680

Deviating voltages, taps, ambient temperatures and degrees of protection, construction as autotransformers, thyristor power controller operation etc. upon request. When ordering please indicate your required primary and secondary voltage, required taps as well as the frequency.

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Ruhstrat in Bovenden

Eisenmann Thermal Solutions is a leading company in the market of electronics and plant construction. Our products operate world-wide in industrial and research facilities.

In 2015, Ruhstrat GmbH & Co. KG, located in Bovenden/Germany, became Eisenmann Thermal Solutions GmbH & Co. KG, a subsidiary of Eisenmann SE.

The brand name “Ruhstrat” is still used for the development and production of electrical testing technology, voltage optimizers, transformers and resistors for Eisenmann Thermal Solutions Machine and Services’.

Ruhstrat has over 80 years of experience in voltage technology and offers modern equipment for protection against voltage dips and for voltage stabilization.

Ruhstrat is an expert in voltage optimizing systems as well as for low and middle voltage transformers. Producing our own transformers with control cabinets guarantees a high and stable quality level in all electrical components.

You wish for more information regarding Ruhstrat and our products? Just visit our website:
www.ruhstrat.com



You have questions regarding Low Voltage Dry-Type Transformers and/or you require an offer? Under the link <http://tinyurl.com/dry-type> you will find various means to contact us.

It goes even quicker by scanning our QR-code (shown on the left side) using your smartphone or tablet.

Our sales team will be most pleased to consult you regarding all questions to our products.



Electrical Test Solutions



Voltage Optimization



Transformers



AC/DC Reactors

NOTES

A large grid of small dots arranged in approximately 30 columns and 40 rows, intended for taking notes.



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