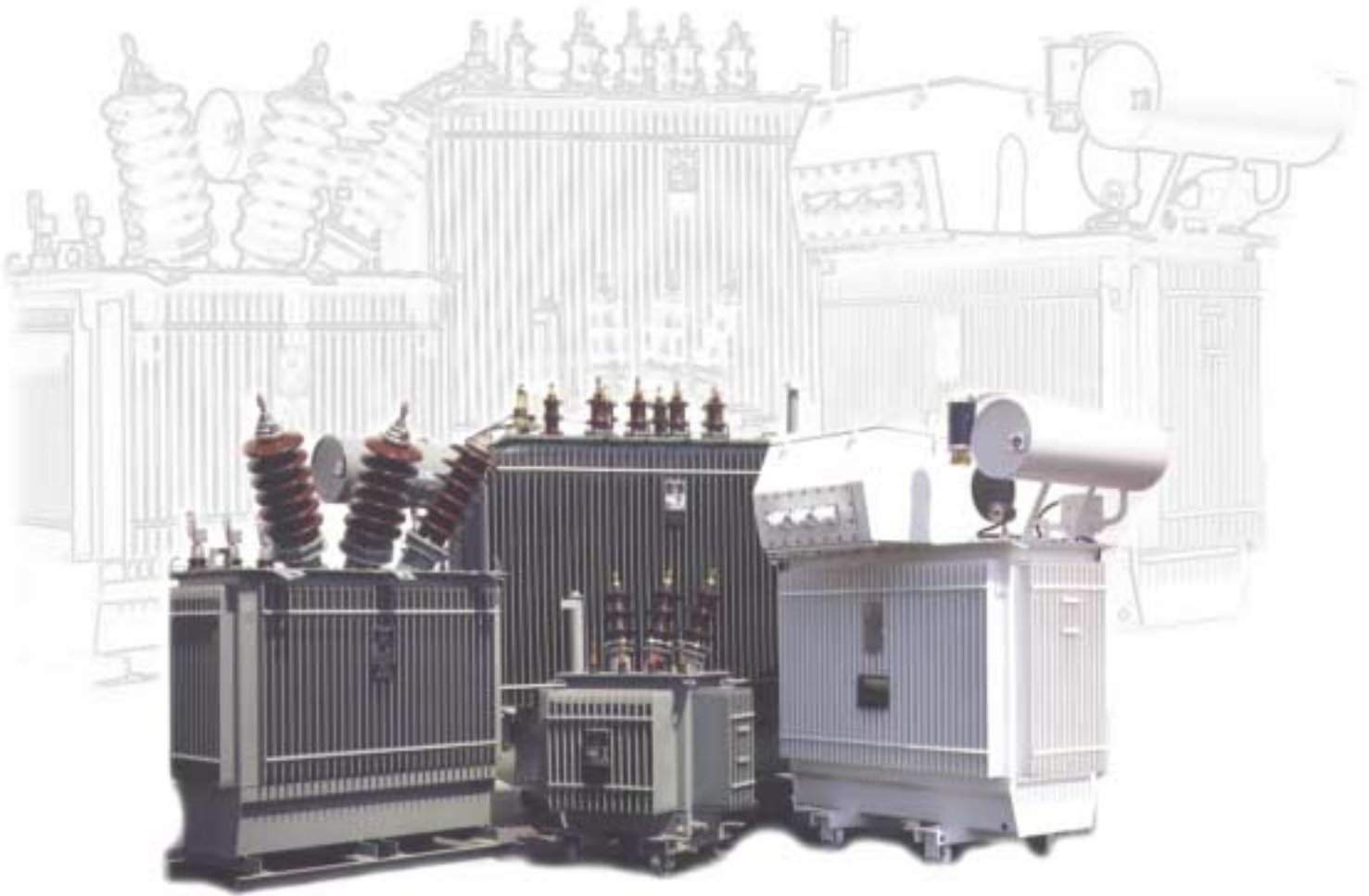




Partners in Power



Distribution Transformers

Technical Information

Custom-made for your requirements

Global Quality

Markets

SGB group manufactures and tests transformers for the world market. We meet the following standards:

- DIN/VDE
- IEC 76
- British Standard
- ANSI/IEEE
- CAN/CSA
- NEMA
- UL
- ENEL
- ÖVE
- SVV
- and others

Products

- distribution transformers 50 – 4000 kVA up to a High Voltage of 36 kV ONAN 50 or 60 Hz
- oil-immersed coils
- earthing transformers
- neutral grounding transformers
- earth-fault neutralizer
- single-phase transformers

Quality management

The whole internal process is controlled by an efficient ERP system. (Enterprise Resource Planning)

The SGB group is certified according to:

- ISO 9001
- Federal Railway welding license



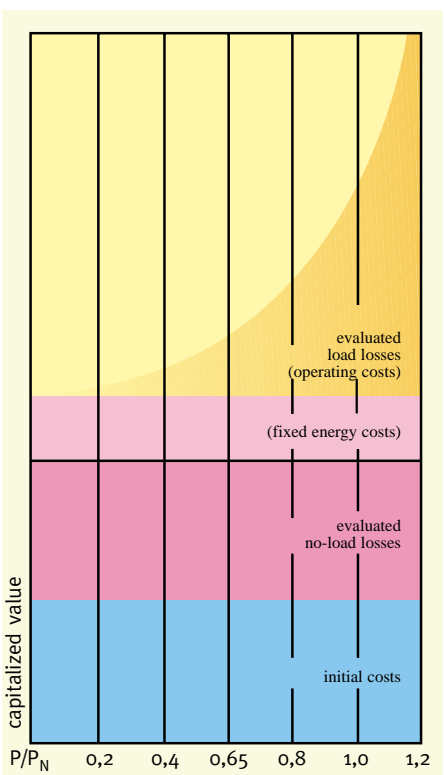
Decades of economic efficiency

Transformers are capital goods with a life expectancy of several decades. For this reason the buyer should not only consider the initial costs of the transformer but also the estimated maintenance costs as well as the costs of no-load losses of the iron core and load losses of the windings.

In order to determine the most economical design for the respective application it is important to know which capitalized value results from determined losses. This value can then be set in relation to the initial cost. Higher initial costs caused by the increased amount of core sheets and winding materials result in lower operating costs. Evaluating no-load losses is relatively simple because they accrue at a constant rate during the total operating time of 8760 hours annually.

It is more difficult to evaluate load losses because they increase and decrease squarely to the load. The lower limit of the load-loss evaluation, however, is easily calculated because only the constant factor, determined by the energy cost, is taken into consideration. This computes to a price range of € -,50 to € 3,50 per watt. The average value is approx. € 1,30 per watt.

The table shows a model evaluation based on various realistic assumptions. It proves that it pays to use SGB oil transformers with reduced losses. In the event of special operating conditions and electricity costs one must deviate from the values given in the selection tables. Optimized designs which meet individual requirements are available and are supplied on request.



Principle diagramm (400 kVA)
Capitalized value vs.
 P/P_N characteristic

SGB oil transformers are manufactured of only the highest quality materials and using the most modern and reliable methods. Thus the transformers have a high availability and require little maintenance. In this connection hermetic-type transformers which require even less frequent maintenance are standard these days.

The values fluctuate between € 3,00 and € 9,00 per watt, depending on local electricity costs. The average price is approx. € 6,00 per watt. Transformers with reduced no-load losses are recommendable, too, because of the related reduction of noise emission.

Initial costs	KA
No-load losses	P ₀
Load losses	P _k

Loss evaluation no-load losses	6,00 € per watt
Loss evaluation load losses	1,30 € per watt

KP ₀	=	6,00 €/watt x P ₀
KP _k	=	1,30 €/watt x P _k

Loss values acc. to DIN 42 500						
	P ₀ W	P _k W	KA €	KP ₀ €	KP _k €	Total €
DOTN	750	6000	3.600,00	4.500,00	7.800,00	15.900,00
DOTNL						
P ₀ reduced	652	6000	3.870,00	3.910,00	7.800,00	15.580,00
DOTE	930	4600	3.530,00	5.580,00	5.980,00	15.090,00
DOTEL						
P ₀ reduced	600	4600	4.200,00	3.600,00	5.980,00	13.780,00

Details of design

We won't wind you up.

Low voltage foil winding

- axial current distribution adjusts freely
- reduced shearing forces

After winding the Prepreg is stuck over the conductor sheet to form a compact tube by a tempering process.

The mechanical quality of the foil windings is controlled by observing the tube stiffness with the help of special testing equipment and in accordance with the force-distance diagram.

High voltage winding

- fully and semi-automatic winding machines
- enamel-insulated winding wire with steady winding pull on carrier cylinder, or directly on the LV winding
- layer insulation of high-quality cable paper
- covering bandage made of shrinking foil for a compact winding with good short-circuit response and optimum impulse voltage distribution.

Quality "to the core"

Iron core

- cold-rolled grain-oriented sheets
- "step-lap"-lamination

Those measures reduce no-load losses and no-load currents as well as noise emission.



Solid workmanship

Assembly of active parts

- short-circuit-proof assembly with profile steel and support of coils
- secure fixation of the electrical connections

The active part is securely joined to the cover and supported against the bottom of the tank.

Vacuum drying

- low frequency or solvent-vapour drying
- filling of dried and degassed mineral oil



High-Quality Materials

Tank

- corrugated tank up to 4 MVA manufactured by us
- modern folding facility processes the steel sheet into high-quality corrugated walls
- after the tank has been robot-welded, it is checked for leakage with control liquid and ultraviolet light

Cover

The cover is made of doubling-free high-quality steel. It is bolted to the tank, and can also be welded to the tank on request. Beside bushings and lifting lugs the required control and monitoring devices are located on the cover.

Corrosion protection

- two component painting with min. layer thickness of 125 μm
- coatings by flooding or dipping method
- on request the tank can also be manufactured in hot-dip galvanised design



Meeting all requirements

Accessories

Monitoring devices

- dial-type thermometer
- temperature alarm device
- magnetic oil-level indicator
- pressure relief valve
- Buchholz relay protection
- hermetic protection block
- dehydrating breather

current transformers / thermal images
can also be mounted on request.

Design variations

- tap-changer
- outer and inner cone bushings
- transformer terminals and covers
- cable boxes
- terminal boxes

Insulating liquids

- mineral oil acc. to
DIN VDE 0370 / part 1
- synthetic organic ester
(Midel 7131)
acc. to DIN VDE 0375 part 1
and DIN EN 61099 (IEC 1099)



Technical efficiency

Testing warranted

Routine tests

acc. to DIN VDE 0532

- test with applied voltage (winding test)
- test with induced voltage (turn test)
- measurement of winding resistance
- measurement of voltage ratio and determination of vector group
- measurement of short-circuit voltage and of short-circuit losses
- measurement of no-load current and of no-load losses

Type and special tests

acc. to DIN VDE 0532

- temperature rise test
- impulse voltage test
- measurement of sound/noise level
- partial discharge measurement

Short-circuit strength

This test is performed within the scope of type tests, however, can also be carried out in well-known and reputable test laboratories on request.

After longstanding testing practice as well as positive experience on the part of our clients, the use of a cylinder block stuck to LV-windings in combination with the HV-layer windings has proved to be problem-free.



Quiet transformers are part of our checklist

Reducing the noise emitted by the transformer to the environment is becoming more and more important.

Therefore our distribution transformers also offer – besides the standard design acc. to DIN 42500 – reduced losses and noise levels, too.

In addition to the choice of flux density and core material, the step-lap technique of joining the legs and yoke also reduces noise levels and no-load losses in SGB transformers.

A-evaluated sound pressure level

L_{PA} in dB

Sound / noise measurements are carried out as special tests at regular intervals.

A-evaluated sound power level

L_{WA} in dB

and related testing surface measure

L_S in dB

L_{WA} and L_{PA} with L_S have the connection required in DIN 45 635 / part 30

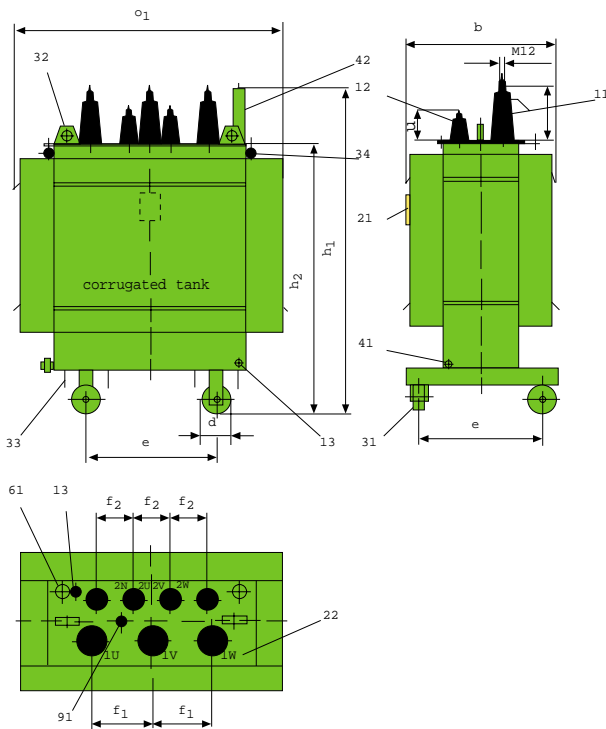
$$L_{WA} = L_{PA} + L_S$$



Selection table

SGB distribution transformers

Hermetically sealed design DIN 42 500



Standardizing

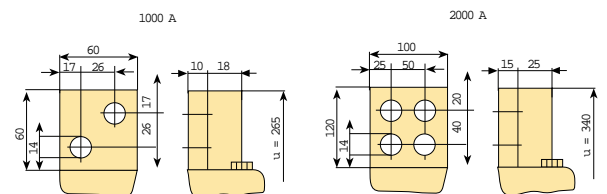
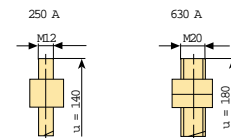
D three-phase
 O oil
 T transformer
 E losses acc. to schedule A-A'
 (L) no-load losses reduced acc. to schedule A-C'
 400 rated power
 20 series voltage

D three-phase
 O oil
 T transformer
 N losses acc. to schedule B-B'
 (L) no-load losses reduced acc. to schedule B-C'

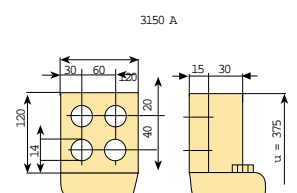
D three-phase
 O oil
 T transformer
 U losses acc. to schedule C-A'
 (L) no-load losses reduced acc. to schedule C-C'

D three-phase
 O oil
 T transformer
 Z losses acc. to schedule B-A'
 (L) no-load losses reduced acc. to schedule B-C'

- 11 HV bushings acc. to DIN 42 531 (EN 50 180) in accordance with the series voltage
- 12 LV bushings acc. to DIN 42 530 with flat terminal acc. to DIN 43 675 from 500 kVA
- 13 Earth connection BM 12 DIN 48 088
- 21 Rating plate
- 22 Terminal marking for bushings
- 31 Bi-directional roller DIN 42 561
- 32 Lifting lugs also for coil - and - core assembly, incl. cover
- 33 Hauling lugs for bi-directional shifting of the transformer
- 34 Hauling lug
- 41 Oil drain device DIN 42 551 up to 800 kVA: A 22, from 1000 kVA: A 31
- 42 Filling tube with female thread G 1 1/2 A
- 61 Thermometer pocket T DIN 42 554
- 91 Off-circuit tap changer for setting HV tapplings



Bushing		0
DT 10 Ni	250	260
DT 10 Nf	250	310
DT 20 Ni	250	310
DT 20 Nf	250	385



Manufacturing range

- Oil immersed transformers up to and including 1000 MVA, service voltage up to 525 kV in compliance with all relevant standards and for special designs
- Regulating transformers with on-load tap changers
- Cast resin transformers up to and including 24 MVA, rated voltages up to 36 kV
- System enclosures for cast resin transformers
- Transformers with line drop or parallel regulation
- Pole-mounted transformers
- Earthing transformers and Petersen coils
- Rectifier and furnace transformers
- Resonant-circuit reactances, coupling transformers and reactors for AF ripple control systems
- Shunt reactors and current limiting reactors

Subject to technical modifications

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