17. Technical data

17.1 Technical annotations

***Short-time power at control transformers**
This is an important criterion for the choice of control transformers. It is the short-term delivered maximum demand the transformer is able to dispense with an efficiency factor of cos φ =0.5 (inductive) whereat the output voltage may decrease maximum 5 % below the nominal value. The Short-time corresponding to IEC is defined for a period of 20 ms at an approximate time of 6 seconds. This is required to guarantee safe switching of contactors (inductive load with high pull-in power compared to the holding power). This characteristic refers exclusively to control transformers.

***Uk Short circuit voltage**
That is the characteristic of the power transformer's internal resistance und gets declared in percentage of the primary nominal voltage. It is the voltage laying against the primary winding of a transformer when nominal current flows in secondary short-circuited winding. The short circuit voltage shall normally be as small as possible so that even at high loads the voltage on the secondary coil only falls slightly. Contrary to that there is the increase of the short circuit current with decreasing short circuit voltage.

***P_{Fe} Iron losses**
The losses caused by the reversal of magnetism are called hysteresis losses; the losses caused by turbulent flows are called eddy current losses. Hysteresis losses and eddy current losses are abstracted with the term iron losses. The iron losses are not load-dependent. They appear in service and at rest. The iron losses are proportional to the input voltage squared. The losses given in our catalogue refer to the operating temperature and are calculated approximate values by computing.

***P_{Cu} Copper losses**
They are joule effect losses. They depend on the load and increase squared with it.
We also use this term for aluminium windings.

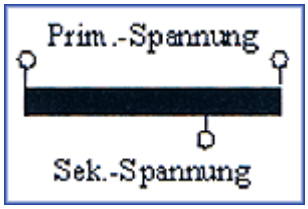
Transformers
are electric equipment transmitting electric energy from a system with given characteristics to a system with desired characteristics corresponding to the principle of electro-magnetic induction.

Control transformers
are transformers with electrically separated windings for supply of control and indicating circuits. The control transformers are built corresponding to VDE 0570/ DIN EN 61558-2-2 DIN EN 61558-2-4. They have to be furnished with beheadings (preferable 5 %).

Isolation transformers
are transformers with electrically separated windings to comply with the requirements of the safety measures "Schutztrennung" for the connection of a single current consumer (VDE 0570/ DIN EN 61558-2-4).

Safety isolating transformers
are transformers whose input and output windings are electrically separated and which are destined to power a current distribution circuit an attachment or other devices with safety extra-low voltage up to 50 V AC voltage (effective value) and/or 120 V unpolished DC voltage between the conductors or every conductor and ground (VDE 0570/ DIN EN 61558-2-6).

Autotransformers
are transformers with partly common input and output winding. The winding with the low voltage is part of the winding with the higher voltage. Hereby the design size decreases compared to transformers with separated windings



Type power NT = Nominal load x (1-low voltage: high voltage)

Operating mode

Continuous duty (DB)
The operating time is so long it reaches the steady operating temperature.

Intermittent duty (AB)
The operating time declared as allowable is so short it does not reach the steady operating temperature. The successive stoppage in which the transformers on the input side become separated from the network is however not long enough to reach a cooling-down to the ambient temperature.
The indication of nominal power in this catalogue refers to operating mode DB. Operating mode AB possibly offers smaller types. The duty factor is calculated like that:
ED = (Load period in min/ approximate time in min) * 100 %.
The approximate time (length of break + length of load) must not exceed 10 min though. The type power is calculated as follows:

$$NT = N\sqrt{\frac{ED\%}{100}}$$

Isolation
The transformers listed in our catalogue are built up with insulants of class E or B or F and may basically assembled in dry rooms only. For the charge in abrasive environments transformers may subjected to special resin impregnation on request. So humidity's impacts get largely eliminated. E.g. repeated suchlike impregnations with curing in a protective paint containing a special active agent against mould and the attack of dry rot (fungus attack) serve to attainment of resistance to tropical influence.

Nominal primary voltage (Rated input voltage)
The nominal primary voltage is the transformer's dedicated supply voltage for the determined operating conditions by the producer (For multiphase systems phase voltage).

Nominal secondary voltage (Rated output voltage)
Nominal secondary voltage or secondary load voltage is characterised as a voltage that adapts under load with nominal power at nominal frequency and efficiency factor cos Ч = 1 after reaching the steady operating temperature on the output terminals. It is always that smaller than the secondary open-circuited voltage the fall of potential comes out in no-load condition.

Nominal frequency
Every represented transformer is suitable for the use in mains power supplies with frequencies 50/60 Hz. The contemplated losses falls of potential and efficiency factors refer to the nominal frequency of 50 Hz. Dimensioning the transformers for other frequencies changes the nominal power corresponding to the following table:

Frequency Hz	162/3	40	42	50	60	75	100	200	300
N in % of type power	35	80	84	100	110	115	130	135	140

In case of using a standard transformer with the specification of frequency 50/60 Hz in a 60 Hz mains power supply the indicated nominal power must not be crossed. Other frequencies have to be considered while dimensioning.

Nominal power
The nominal powers indicated in our catalogue are the extractable performances in VA or KVA on the output side. They apply for:

- Separate windings with a conversion
- Continuous duty
- Nominal frequency 50/60 Hz
- Ambient temperature + 40° C

Ambient temperature
If an unimpeded access of cooling air is assured the allowable excess temperatures corresponding to VDE 0550 or 0532 (e.g. 80° C for insulation class T 40/b) at max. 40° C ambient temperature are not crossed by the heating during operation. In case of different ambient temperatures the nominal power changes corresponding to the following table:

Ambient temperature in degree C	45	50	55	60	65	70
Nominal power in % of type power	95	85	80	75	70	60

Connection symbol
If there is no special connection symbol three-phase transformers are crafted in star-star connection (YyO) with led through zero point on the secondary side. The connection symbols are Yyn0 for transformers with separate windings und Ynab0 for autotransformers. The neutral point may be loaded by ca. 10 % of the line current without particular measures. The connection symbol marks the circuit of the windings and their phasing to each other. The big letter is assigned to the primary winding the small letter to the secondary winding.

Type protection
The IP – type protection names the protection against contact foreign object protection and waterproofing of electrical equipment. Corresponding to DIN 40 050 single type protections are defined e.g. as follows:

IP 00 No particular protection

IP 20 Protection against intrusion of contaminants with an aperture of more than 12 mm

IP 23 Protection against intrusion of contaminants with an aperture of more than 12 mm and protection against spray up to 60 degrees to the perpendicular line.

IP 54 Entire protection against contact and protection against dust deposit and spray.

Protection class
Protection class expresses for what kind of precaution against incorrect contact voltage the attachments are prepared or in which ones they are involved.
To **protection class I** belong transformers and inductors whose complete tangible metal parts being able to get charged in case of operational insulation errors are connected permanently and well conducting among themselves to the device for the connection of an earthing equipment conductor. They become compromised to the precaution protective grounding by connecting the earthing equipment conductor.
To **protection class II** belong transformers whose complete tangible conductive parts are separated from those that may be charged in case of operational insulation errors by additional insulation (protective insulation). They have no device for the connection of an earthing equipment conductor.

To **protection class III** belong transformers whose complete tangible conductive parts are separated from those that may be charged in case of operational insulation errors by additional insulation (protective insulation). They have no device for the connection of an earthing equipment conductor. They work exclusively with safety extra-low voltage.

We prepare every described transformer inductor or power supply unit for protection class I.