



COMPACT KIOSK SWITCH -TYPE TRANSFORMER STATION GRÄPER T-STATION

Basic technical specifications:

- HV nominal voltage: 3 AC 22 kV 50 Hz
- Frequency: 50 Hz
- HV bus-bars nominal current: regarding to HV switchgear type to 630 A
- Whole station cover: IP 23D
- External dimensions (LxWxH): 1 750x1 350x2 400 mm
- Empty skeleton weight: cca 3 900 kg
- Environment: 3.1.1. basic (inside the kiosk-type TS room),
4.1.1. external, ordinary (outside the TS room)
- Exposure class: for internal components: XC1; for external components: XC4, XF1, XA1.
- Operating conditions: ambient temperature $-40^{\circ}\text{C} \leq t \leq +40^{\circ}\text{C}$
altitude up to 1 000 m asl.

Note: If the transformer substation is used in different climate and operating conditions, the TS supplier has to be consulted.

Electrical current injury prevention:

(STN EN 33 3201, STN EN 33 2000-4-41)

- in normal operation mode (of the live parts):

in HV system:	out of reach placement live parts insulation barrier, cover
in LV system:	412.1. live parts insulation 412.2. barrier, cover 412.4. out of reach placement

- in case of failure (of dead parts):

in HV system:	automatic feed disconnection with quick IT networks disconnections
in LV system:	automatic feed disconnection additional protection by residual current device





Station construction:

Externally controlled compact kiosk-type transformer substation is partially flush-mounted, with external dimensions of 1 750x1 350 mm, total height of 2 400 mm, clear height of 2 180 mm, ground sinking depth of 700 mm, over ground height of 1 700 mm (with flat roof). Self-supporting construction of the TS is by default made of reinforced concrete Gräper LC 30/37, with 8/12 granularity. Steel reinforcement frame is composed of steel bars and mats, it is bilaterally welded and conductively connected together and takes part in bonding, grounding, or even lightning protection system. The installation of the station skeleton does not require any foundations, but only a well flushed and rammed out cut. The transformer substation is type-approved, conforming to the STN EN 62271-202 norm and meets the resistance tests against internal arcing fault of the German PEHLA directive.

Station construction forms a compact unit comprised of two monolithic parts: basement tank with sidewalls and a flat roof.

Basement tank with sidewalls: made of waterproof and oil proof concrete (crack width up to 0,2 mm guaranteed) as an oil catch tank. The construction resistance against strong chemical action of liquids, soils and vapours conforms to the DIN directive. The tank serves as the foundation for the non-freezing part of the TS and for lifting the whole station by means of 4 anchor points (sealed chasing nuts) RD24, placed in the longer sides of the TS (as viewed on „A”, “C”). In order to join the external grounding two M12 points of HV switchgear are led from the sidewalls of the station. The bell casting method was used to construct the tank and door frames, thus creating a monolithic unit which meets requirements for the impermeability of water and oil substances. All surfaces of the transformer substation touching the ground and cable feeder entry and exit seals are painted by two layers of black penetrating insulation paint, and the basement tank can be treated with waterproof and impermeable coating from inside upon customer request.

HV and LV cable entry holes are made on production in the lower part of the body (HV or LV distributor's side). After cable installation, the entry holes are sealed by Hauff press fittings his 150. After installation, the cables are sealed against water penetration with default lids with corresponding number and diameter of cable entry necks (corresponding to cable type), which are closed by a bayonet lock and the neck is sealed by a thermal shrinking plastic sleeve(FXKV...). Optionally, the thermal shrinking sleeve may be substituted by cold shrinking sleeves. Unoccupied inlets are sealed by default lid with bolt sealing and bayonet lock.

Internal walls are by default treated with white washable paint, surface finish is by exposed aggregate concrete with 8/12 granularity, other finish types are available on client demand.

- concrete with bare filler (exposed aggregate concrete) with 8/12 granularity,
- raw concrete in final finish colour according to the RAL colour palette,
- from plastered concrete with material (scraped finish), or material Rollputz (rolled-on plaster), in final finish colour according to the RAL colour palette,
 - stone facing (for example Dupa-Stone), facade bricks, wood of other material as required by customer.

Roof: Connected to the walls by 4 bolts from inside, overlapping the wall contours by 10 cm. The roof can be lifted by 4 anchor points (sealed chasing nuts) RD 16. In order to increase the protection of the concrete





surface against humidity, the upper roof is covered with additional hydrophobic coating, which fills capillary pores and acts against the hygroscopic properties of the concrete.

Surface finish of the roof can be made of exposed aggregate concrete, or fair-face concrete with rough surface and paint according to the RAL colour palette. The shape of the roof (flat, saddle, semicircular) is optional as well.

Door: All metal parts including doors, frames, and ventilating parts are made by default of hot-dip galvanized 1,5 mm thick sheet steel, basic paint and two layers of the finish paint in RAL colour palette. The door is equipped with armour including external knob and internal handle with plastic lock cover and a pawl for fixing the door in open position at a 95° angle. For arrestment – the locking, bob weights and point-to-point bars are used within each door wing frame (four-point locking system Gräper). The lock is adapted for standard lock inserts. The outer side of the door is covered by warning plates in terms of the valid EN.

Optionally, the door and ventilating parts can be made of anodized aluminium and 2 lock inserts can be used for double lockout.

The switch station is equipped with standard double wing door with partial ventilation with internal dimensions WxH 1 530x1 380 mm. The door is equipped with arresting pawl for fixing in open position and door wings are connected with the frame by copper conductor with 16 mm² cross-section.

Grounding:

Internal ground of the TS is made of:

- **bonding bar** (BB) Cu 30x4 mm with clips M12, located on the spreader insulator 1 kV, which is directly connected with all the technological components of the TS (vessel of the TR distributors tanks of the HV, LV, metal shield of the HV cables, branch bar PEN) and with individually mounted components (construction components – tank and roof reinforcement, frames, door, grate, conducting „U“- beam of the transformer, bearing structures of the distributors...) by the Cu conductor with S_{\min} 30 mm². Each conductor of the grounding connected to BB is labelled.

- **earth artery** implemented by strip conductor Fe with S_{\min} 125 mm², being part of the TS reinforcement and it is cast directly in the external walls and kiosk's beam, serving for connection of the common points of the grounding. Flexible parts are connected by appropriate Cu frame copper strip or grounding Cu cable with min. cross-section of 16 mm².

- **2 nodes of the grounding feeder** by Hauff HDE-M12/X to connect the external grounding (usually FeZn 30x4 mm stripe) to the bonding bar (form internal part of the node through connecting screw M12-St 37 Zn, form external part of the node through **test clips** of the **SZ1, SZ2** grounding with screw M12). Grounding feeder nodes are lead out on the opposite sidewalls of the station.

The transformer substation in standard finish does not have external lightning protection system, as it is a ground object mostly located close to other higher objects. All the metal reinforcement built-in to the corresponding parts of the TS (roof, walls, false ceiling, basement tank) are welded into a single unit using conductive joints (e.g. Cu lines 35 mm²) thus forming Faraday's cage and after roof mounting are fully connected to the grounding. If customer wishes otherwise, it is possible to equip the transformer substation with external lightning rod with one collector and two wires connected to the common TS grounding via test clips in terms of the valid STN.

For each transformer station a common grounding system for HV and LV facilities must be constructed, its design needs to take into account the operating conditions – fault current value of the distribution network in the given region, power transformer node operation mode and local soil conditions (STN 33 3201, STN 33 2000-5-54, PNE 33 2000-1).





Installation:

The switch transformer station is standardly without internal light installation. Optionally, internal lightning including an oval incandescent 60 W lamp fitted with gate switch lighting in the HV distributor's space and one-phase socket of 230 V. Circuits feeding the lighting and socket installation are led out from an external LV source, or a HV box with transformer of the required output may be installed.

Further facilities – as specified by customer.

The internal space of the switching TS space is divided into the 2 compartments on the level basement tank. The over ground part comprises one common space.

High voltage distributor:

In transformer substation it is possible to use all common types of covered HV gas insulated distributors SF6 (e.g. GA, GA-C by Moeller, 8DJH, 8DJ20 by Siemens, RM6 by Merlin Gerin,...), or type-approved vacuum distributors up to the width of 4 fields. Distributor nominal current is depending on type of the distributor and may reach up to 630A, shortcut resistance (nominal short-time withstand current 1s) up to 20kA, optionally up to 25 kA. The HV distributor may be delivered by the customer or by Gräper company including the zinc-coated supporting construction and a facility decreasing pressure at arcing fault in HV distributor corresponding STN EN 62271-200 to PEHLA standards. Max. dimensions of the HV distributor (WxHxL) are: 1 500x1 400x900 mm.

Cable connections:

Max. section of cable attachment: according to the HV distributor type and the input connectors up to 300 mm².

Transformer station construction specifications:

The station is made up according to the norms and rules of STN EN, DIN, UVV etc., directly following the bellow given normative standards:

Cellular concrete	- DIN 4219
Reinforced concrete	- DIN 1045
VDE Directives	- DIN 0141, 0101, 0100
Directive on the protection of underground waters	- GwSchV
Federal directive on waste disposal	- BimSchV
Electromagnetic radiation compliance	- BimSchV č.26

Individual structural components of the transformer substation are made of unflamable materials, fire resistance of the station construction meets STN 73 0821 (fire resistance class required is F90, class documented is F120).

Delivery, assembly, ground cut:

The kiosk-type switch station is delivered assembled and prepared for HV, LV cable connection and grounding. It is installed by crane into a prepared pit with compressed and flat surface according to the design project of the transformer substation's producer – Gräper company (dimensions of the ground cut: 235x195 cm, cutting depth: 90 cm, compressed layer thickness: min. 20 cm).

