BETONBAU

UNDERGROUND TRANSFORMER STATIONS

BETONBAU Underground Transformer Station

is mostly involved in upgrades of electrical distribution systems in historical city centres. They preserve the original architectural value of a city, and allow pedestrians to move around the location of the transformer station continuously.

Underground, the transformer stations are affected with various impacts, which are not present in surface transformer stations. In almost 60 years, it has been proved that our transformer stations safely resist these impacts, and provide our customers with long-term reliable operations.

RESISTANCE AGAINST EXTERNAL INFLUENCES

+ **Resistance Against Underground Water**
  Seamless concrete body of the transformer station is perfectly watertight. The concrete with the given exposure class can resist both chemically aggressive environment influences, and the pressure of the underground water. If the station is exposed to the effects of the underground water under pressure, and the water level is above its basement joint, the concrete body is welded through stainless steel pads to the foundation ballast slab. The cable transits are sealed with special sealing grommets and sealants.

+ **Resistance Against Rain Water and Snow**
  The rain water is drained from ventilation shafts to sewerage or a seepage sump. When connected to the sewerage, a clack valve is installed accessible from outside of the station. Snow and ice in the ventilation shafts melt due to the waste heat flow from the transformer.

+ **Protection Against Rodents and Burglary**
  We use special ventilation elements manufactured in our own locksmith's shop. Within the design and production phase of the elements, we focus on their increased protection against rodents and insects. In order to replace the transformer, the cover can only be lifted with a crane due to its great weight. An integrated operating personnel entrance is secured with a lock.

+ **Protection Against Noise**
  The underground installation of the station is the most suitable for noise reduction.

+ **Carrying Capacity**
  The 200 mm thick cover reinforced concrete slab has sufficient load carrying capacity for a travelling truck. Optionally, we can design the cover slab for an extreme load, as defined by the customer.

ELECTRICAL TECHNOLOGY

We generally install **transformers** in under- ground stations, with an output up to 2.5 MVA. In special design cases, the transformer output can be even higher. Both oil and dry transformers are usually placed on a concrete floor, allowing for oil drainage, and in case of their replacement, if applicable, they can be replaced after removing the cover. There is an oil sump ready below the transformer.

HV and LV switchgears are located on an intermediate floor of a switching station, which can be separated from the transformer chamber with a partition wall. HV switchgears with a voltage of up to 35 kV can be compact or modular units, insulated with SF6 gas or air. LV switchgears are cabinet or wall structures and they can be used for high nominal currents up to 3612 A.

Robust patented cable **grommets** allow for routing all standardized cables used in electrical engineering. Optionally, grommets of other manufacturers can be supplied.

SAFETY

Health and property protection is of high priority to us. Our products meet all the requirements, as set by standards and regulations. Thanks to our innovative solutions, we are able to offer even greater protection and safety as an option.

ELECTRICAL EQUIPMENT SAFETY

- The minimum IP rate 23 DH, optionally IP 33 DH or IP 43 as per SN EN 60529
- Temperature rise test, and cover rate test as per SN EN 62271-202
- Electromagnetic field protection (EMC) in compliance with Government Regulation No. 291/2015 Coll. and SN EN 50499
- Other tests and certificates as required

FIRE PROTECTION

The concrete body provides fire grading EI90, or up to EI120, if required as an option. Depending on the situation and design, we also install fire-protection grates, and the transformer space can be completely separated from any other parts of the station.

NOISE PROTECTION

The underground installation of the station is very effective in terms of noise reduction. We manufacture walls, doors, and ventilation elements with high to very high level of noise reduction. Optionally, we can make double walls, or provide internal lining made of perforated sheets and sound insulation. We use sound-insulated metal sheet ducts, or concrete channels with an integrated damping background.

GROUND WATER PROTECTION

The seamless concrete body prevents potential oil leaks from the transformer to the ground.

CONSTRUCTION TECHNICAL CERTIFICATES

We provide a declaration of conformity, construction technical certificates, and product certificates for the market as required.

Fire protection assessment of civil structures

	REQUIRED RESISTANCE AS PER EN 730802	REQUIRED RESISTANCE AS PER EN 61936-1	USED MATERIAL	REAL RESISTANCE	EVALUATION
Enclosure walls	REW 15	REW 60	Reinforced concrete, min. thickness 140 mm	REW 90	Satisfied
Fire protection ceiling	REI 15	REI 60	Reinforced concrete, min. thickness 200 mm	REI 90	Satisfied

CIVIL CONSTRUCTION SOLUTION

BETONBAU CONCRETE PRODUCTS

The body of the station is made of 4 mostly 14 cm thick enclosure walls and a usually 20 cm thick bottom. We cast it as a single piece, using a process of called bell casting. This method of production provides the body with the following properties:

- exceptional mechanical resistance; the body is a self-supporting box element, which does not require any basement in most cases,
- perfect tightness; the monolithic and seamlessly casted concrete body is watertight, and at the same time, it is used as an oil leak-proof sump in case of transformer failure,
- easy transportability, resulting again from the body's mechanical stability,
- long-term lifetime and reliability.

We manufacture the body, the covering ceiling slab and partition walls from watertight construction concrete with C35/45 strength class, and XC4 and XF1 exposure class as per EN 206+A1.

There is an **inspection and installation entrance** in the **cover slab**. The operating personnel can enter the station through the access cover, which has integrated railings on the inside to provide protection against anyone falling in. The station is also equipped with a steep stairway, or more frequently, with a ladder. The installation cover to replace the transformer is equipped with eyes to grip ropes.

Ventilation shafts are also made from monolithic concrete as part of the body. The shafts can be terminated at terrain level with a horizontal grid, or they can be routed above terrain level using so called necks, and equipped with vertical grids on their sides.

We make a concrete **intermediate base** in underground stations, either across the whole area, or in the transformer replacement route only. The concrete intermediate floor can be combined with an aluminium profiled floor on less loaded parts. The advantage of the concrete intermediate floor is its incombustibility and high carrying capacity, the aluminium profile system is excellent with its high flexibility. We install the aluminium profiles on adjustable zinc-coated steel supports. The stepping layer is made from plywood provided with a slip-resistant finish. These boards are equipped with a key operated latch to prevent them from being lifted.

The partition walls can be removed, or mobile, and equipped with a door, too. We make these partition walls from aluminium alloys.

METALLBAU LOCKSMITH PRODUCTS

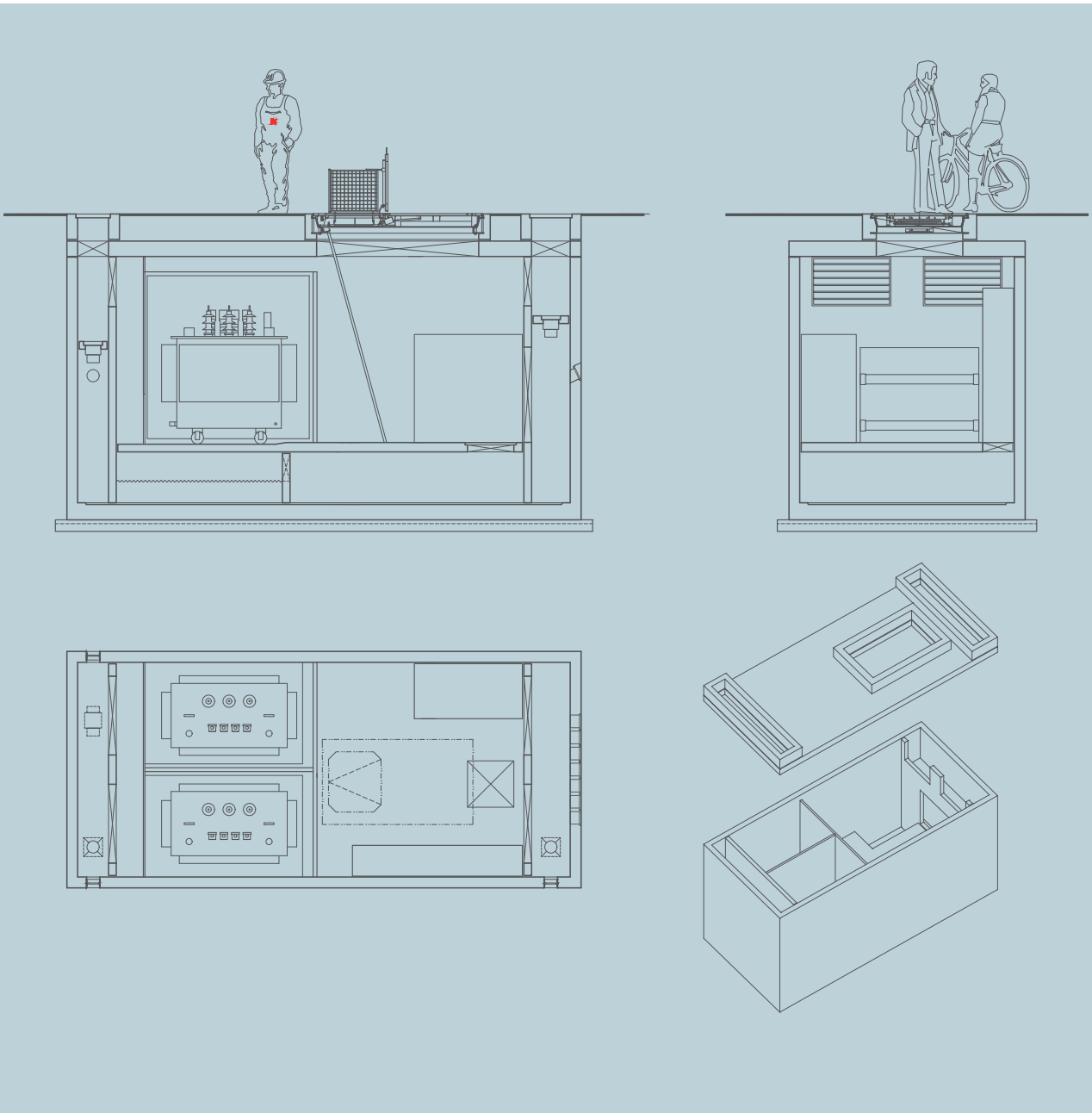
We make the **ventilation elements** in our own METALLBAU locksmith shop from anodized aluminium. This material has a corrosion resistance, and similar stability as the concrete used for the structure body.

We can provide our locksmith products with patented highly efficient **ventilation system**. This system has an optimized air-flow coefficient for natural ventilation. The ventilation system has its IP rate of IP 33 DH as a standard against ingress of water, dangerous contact, and ingress of foreign matters as per EN 60529. In special projects there is an option of increasing the IP coverage up to IP 43.

TYPES AND DIMENSIONS OF UNDERGROUND TRANSFORMER STATIONS

BETONBAU underground transformer stations with UW type marking are provided in a large variety of types, which are derived from basic module lines UW 25 (width 2.58 m), UW 30 (width 3.06 m), UW 33 (width 3.36 m) and UW 36 (width 3.66 m). With a constant width, the **external length** varies **from 2.46 to 8.46 m** in a 0.6 m grid. The dimensions provided are applicable for a 140 mm thick wall.

As standard, the cell is delivered with a headroom of 3.2 m, whereas, if the intermediate floor is used, the headroom of the switching station is 2.4 m and the height of the cable space is 0.8 m including the floor. Other dimensions are available as requested.



INSTALLATION

To speed up the installation, we install the electrical technology in the station at the production plant.

We put the station itself on a prepared gravel base layer without foundations. Foundations are required only in demanding geological conditions, or for combined buildings composed from multiple bodies. We transport the underground stations as an excessive load, and install it with a crane. The underground station weight, including accessories, is 13 to 50 t.

The customer provides geological survey, excavation work including formwork, preparation of the construction base, external cables and external earthing. The excavation work must be coordinated with conservationists and archaeologists. The excavation pit formwork must be dimensioned for the movement of heavy machines in the close surroundings (min. 90 t). If the underground water level is above the construction trench, a basement load slab must be made as protection against the underground water upward pressure. Then, the station is welded to this slab using stainless steel pads.

INCORPORATION INTO THE TERRAIN

The transformer station can be covered with paving, gravel, mastic asphalt, or green grass.

OPERATION AND POST-WARRANTY SERVICE

We provide a comprehensive service for our transformer stations during maintenance, redevelopment and upgrades.

If requested, we provide the following

- electric equipment inspection and revision,
- planned inspections,
- cleaning, redevelopment, and repairs,
- reconstruction,
- relocation,
- and many others.

You can find more information in the leaflet Operation and Post-Warranty Service, or contact your sales representative.

BETONBAU

We are a leading European manufacturer of technical buildings for energy distribution and water management. We develop and manufacture prefabricated reinforced concrete buildings, we install system components to the buildings from our own locksmith shop, and install technology as appropriate for the application. We are committed to integrate the buildings into the surroundings in a suitable manner, and therefore, we offer a variety of surface finishes and technologies.

Our products are utilized in the energy industry and water management as

- transformer stations,
- switching stations,
- gas control stations,
- water tanks,
- water treatment plants, and others.

You can rely on

- **comprehensive service:** from design to implementation, maintenance, and upgrade,
- **history and experience:** in the Czech Republic since 1993, in Germany since 1963,
- **custom products and solutions:** we are capable of satisfying our customers as much as possible, and we can design an optimum solution for their projects,
- **long-term lifetime:** reliable solutions in compliance with requirements of standards,
- **human aspect:** individual approach to customers, and sensitive integration of technical buildings into their environment.

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