**Electric Melting**

**Equipment for Electrically Heated Furnaces**

**Boosting Systems**

A boosting system in the melting area (Melting Booster) supplies additional energy directly to the glass bath and this leads to a higher melting capacity. Systems with bottom electrodes increase efficiency, especially in larger furnaces, and reduce electrode wear.

The installation of an electric booster around the hot spot (Barrier Booster) increases the convection currents and this raises the bottom temperature of the glass bath. This has a positive effect on the glass quality. Furthermore, additional energy is supplied to the glass bath and the temperature of the glass flowing from the hot spot to the melting area is increased.

Electrodes used as Local Booster are installed in order to heat a specific area of the glass bath. The majority of these boosters are installed in the throat and riser, where the glass can cool down too much when the melting rate is low.
**Electrodes and Electrode Holders**

**Molybdenum Electrodes** are available from stock in diameters from 32 mm to 3” and in length of 400 and 800 mm. We source electrodes from reputable manufacturers with highest quality standards. The metric standard threads are manufactured to narrow tolerances.

Ceramic **Tin Oxide Electrodes** are used for special glasses and highest quality requirements. As these electrodes can only be pushed to a limited amount, corrosion is reduced by limiting the current density.

**SORG® XD Electrode Holders** are manufactured from high-temperature resistant stainless steel based on latest production technique. They are designed for toughest conditions.

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**Advantages:**

- Universal installation
- Proven design
- Life-long after-sales service including evaluation of operational data to determine electrode corrosion and maintenance
- 50 years of experience in layout, design and service
The water-cooled holder head consists of a single piece and contains no welds in the critical hot area. The cooling water flows in a closed circuit, thus, deterioration of the cooling water quality is impossible. To monitor the operational state, every electrode holder is equipped with a replaceable NiCr-Ni thermocouple.

From stock electrode holders for electrodes of 32 mm up to 2.5" are available in the lengths of 700 and 900 mm for side wall as well as 1250 and 1500 mm for bottom installation. Differing lengths and outer diameters for the replacement of third-party products are available as a custom-made design on short call.

The accessories for electrode holders are designed for maximum lifetime and easy installation and service.

The assembly material enables the installation as a side wall or bottom electrode. For bottom electrodes, an adjustable safety support is supplied. Material for the cooling water supply is included.

The electric connection material consists of silver-plated electrode connection clamps and high-current copper belts of different rated currents.
Furnace Transformers

**Induction regulators** facilitate continuous control of the heating power under load. They operate on a non-contact principle, i.e. without moving electric contacts. Induction regulators feature high reliability and little maintenance requirements.

They are usually connected to the medium voltage network up to 36 kV and are available in a range of 500 ... 2400 kVA. As a standard, induction regulators have oil-air-cooling, water cooling is available on request.

The accessories include Buchholz and over-temperature protection, primary surge arresters as well as all necessary measurement transformers. Depending on the design, a secondary bus-bar system is installed.

Varivolt Transformers work with special high current sliders. They feature a very compact design and high efficiency, thus they cause only minor conversion losses.

The accessories are identical to the induction regulator, the power range reaches from 500 to more than 4000 kVA. Varivolt transformers are available with UL certification for use in North America.
Our **Step Transformers** feature a load tap changer, so they can be controlled without de-energizing the medium voltage supply. Due to the special dimensioning, a big power range can be adjusted in steps, where the power increase for every step is constant. Step transformers are a low-priced and efficient solution for container glass furnaces.

For **Fixed Transformer Systems**, a transformer with fixed transmission ratio is combined with an electronic power controller. Fixed transformer systems feature high flexibility and redundancy.

In addition to air-cooled transformers, we offer water-cooled fixed transformers, which can be placed close to the furnace – due to the hermetic design they are immune to hot and dirty surrounding. Shorter high-current cables to the electrodes lead to lower cable losses and considerably reduce investment cost.

The mains distortion caused by the electronic power control can be considerably reduced by installing thyristor controllers with voltage sequence control (LTC).

**Advantages:**

- Low investment and operating costs
- Flexibility and high availability
- Single-phase control possible

The **Throat Transformer Aggregate** combines a transformer, power controller and tap change switch in a compact enclosure. It is supplied ready for connection, a local control box is available.

Throat transformers are by default available with powers of 60, 100 and 150 kVA, the transformers of higher power can also be used for refiner boosting as an option.
Water Cooling System

The **pumping skid** is the heart of the cooling water supply system. It consists of two circulation pumps (one as back-up), which are installed together with a 2 m³ **cooling water tank** and all required valves on a common frame. The water tank is equipped with electronic level measurement and automatic makeup valve.

Standardized pumping skids are available with an output of 5 to 25 m³/h.

**Piping Materials:**

- Pumping skids are supplied as standard with copper piping — copper offers perfect corrosion resistance at a competitive price
- On request, stainless steel piping is available

For **re-cooling** of the water, different systems are available:

When there is a sufficient supply of cool factory water available, maintenance-free and compact **plate heat exchangers** can be used. These are installed in pair directly on the frame of the pumping skid (one as back-up).
Dry coolers with adiabatic pre-cooling are attractive for moderate climate conditions: they require low maintenance and save water, while biological control is unnecessary.

Closed loop evaporation coolers offer high re-cooling power also at high ambient temperatures. The separation of cooling water and spray water loop prevents deterioration of the cooling water quality.

To distribute the cooling water to the single consumers, a cooling water distributor skid is installed. The distributor skid contains regulation valves as well as temperature and flow measurement in the return line of every consumer. The valves for emergency infeed of city water are integrated into the distributor skid. Water distributors are available from 4 up to 24 consumers.

Depending on the quality of the raw water, water treatment can be necessary. We offer all possible makeup water preparation technologies from simple filtration, to water softening and pH correction up to deionization plants. For treatment of system cooling water or cooling tower spray water, a water treatment system with controlled dosing of biocide and/or corrosion inhibitor is available.

For small systems with a limited number of consumers, our compact cooling water system is appropriate: cooling water tank, pumps, re-cooling plant (plate heat exchanger or dry cooler) and water distributor with emergency infeed system are installed on a common frame.
Special Equipment for VSM® All-electric Furnaces

Specially developed SORG® Top Electrodes are installed in almost all VSM® furnaces. These electrodes are inserted through the furnace superstructure and enter the glass bath through the surface. They can be swung out of the furnace for inspection and exchange.

This electrode type requires neither holes nor water-cooling in the furnace side wall blocks. Thus, the refractory material is subject to much less damage caused by temperature changes.

Top Electrodes are situated further away from the side walls than conventional horizontal electrodes. Therefore, the convection currents produced by the electrodes cause less wear on the refractory material.

Advantages:
- Top Electrodes ensure longer campaign of the furnace
- Easy to inspect and exchange

The Rotating Crown Batch Charging System is a fixed component of all-electric furnaces. Several small vibratory chutes are installed above the crown at various distances from the center of the furnace. Batch is charged by the chutes through small openings in the crown, whilst the complete crown construction rotates around the vertical axis of the furnace. As a result the chutes deposit the batch in concentric rings on the glass bath surface. The thickness of the batch blanket can be influenced by adjusting the amount of batch charged by each chute.

The rotating crown batch charger as well as the completely sealed superstructure ensure a simple dust retention and almost no in-factory dusting.

Each rotating crown is individually designed to fit the specific furnace.

Advantages:
- Completely enclosed superstructure — no dust in factory building
- Can also be operated at high crown temperatures