YOUR VISION FOR SUSTAINABLE GLASS MELTING – OUR TOOLS

SORG | AIGMF since 1944

sorg.de

SORG GROUP

THE WORLD LEADER IN RAW MATERIAL PREPARATION, MELTING AND CONDITIONING TECHNOLOGY, AND SERVICES FOR THE GLASS INDUSTRY.

THE POWER OF THREE

EME SORG SKS

SORG Group combines leading technologies in furnace and batch house design and engineering. We provide optimal furnace design, glass melting, glass conditioning and installation as an integral part of our services.

The global leader in batch and cullet treatment systems.

The global leader in designing ground-breaking glass furnaces.

The global leader in the installation, repair and maintenance of glass melting furnaces.

SORG GROUP IN NUMBERS

500+
EMPLOYEES

80+
COUNTRIES

45+
LARGE-SCALE PROJECTS PER YEAR

100+
PATENTS REGISTERED

50+
YEARS OF SUSTAINABLE INNOVATIONS

SCOPE OF DELIVERY

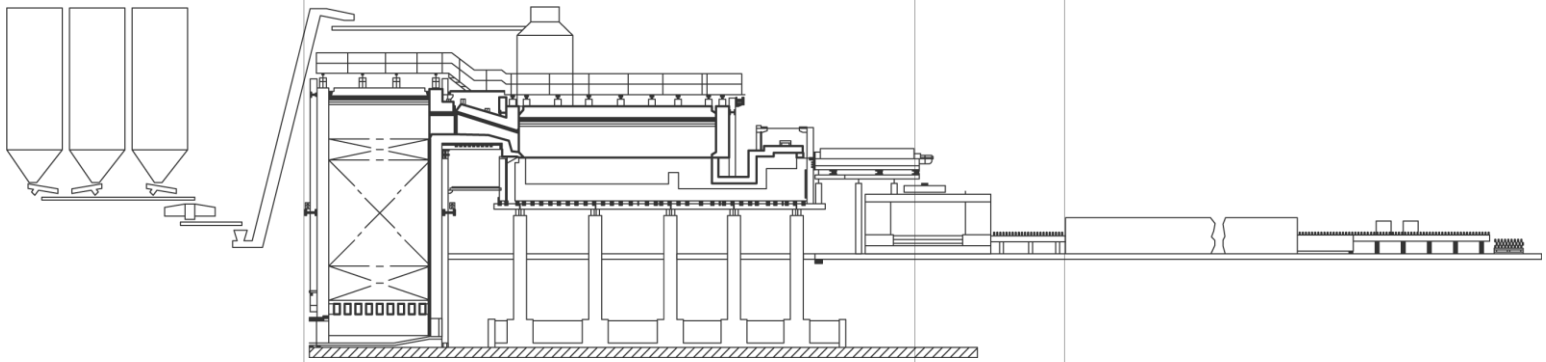
Our vision to provide glassmakers with a single source for world-leading technologies ensures optimal design and seamless delivery.

RAW MATERIAL & BATCH PREPARATION

MELTING & CONDITIONING

FORMING

COOLING, INSPECTION & PACKING



EME

SORG SKS


YOUR VISION FOR SUSTAINABLE GLASS MELTING

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The challenge for the glass industry

- Zero CO_2 emission in 2050 – in India in 2070

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- Zero CO_2 emission in 2050 – in India in 2070
- Energy saving

YOUR VISION FOR SUSTAINABLE GLASS MELTING

The challenge for the glass industry

- Zero CO_2 emission in 2050 – in India in 2070
- Energy saving
- Using green energies

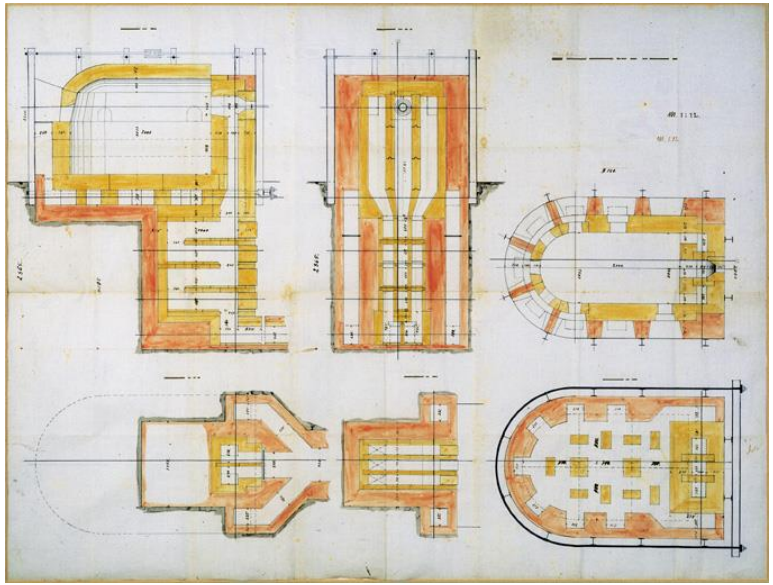
OUR TOOLS FOR THE CHALLENGE

OUR TOOLS

Experience because of long history of innovative furnace developments (mentioning only a few typical examples):

- Deep Refiner®
- LoNOx®
- OxEcon®
- Optimized regenerative end-fired furnaces

Sorg designed more than 12 different furnace types, tailor-made for customers´applications



SORG DEEP REFINER®

Introduced on the market in 1978: The use of the Deep Refiner® increases the residence time of the glass in the furnace, especially in the refining area, thus improving the glass quality. This also leads to lower glass temperatures in the throat and the working end. This concept can be applied to all types of conventional fossil-fired furnaces.

ADVANTAGES

- Increases the residence time and improves the refining
- Improves also the homogeneity of the glass

RESULT

- The Deep Refiner® improves the glass quality by reduced energy input

SORG LoN0x®

The SORG LoNOx® is a special kind of recuperative furnace concept developed at the beginning of the 1980s to operate with unusually low NO_x emisson levels from primary measures.

NO_x values lower than 400mg/Nm^3 are possible.

This was achieved by an external cullet preheater and an internal batch preheat in combination with a special furnace design that ensures a post-combustion of the waste gases in the furnace before they are leaving the furnace.

First installation at Wiegand Glas Steinbach in 1986 for 180 tpd soda lime glass; tonnages up to 450 tpd are realized.

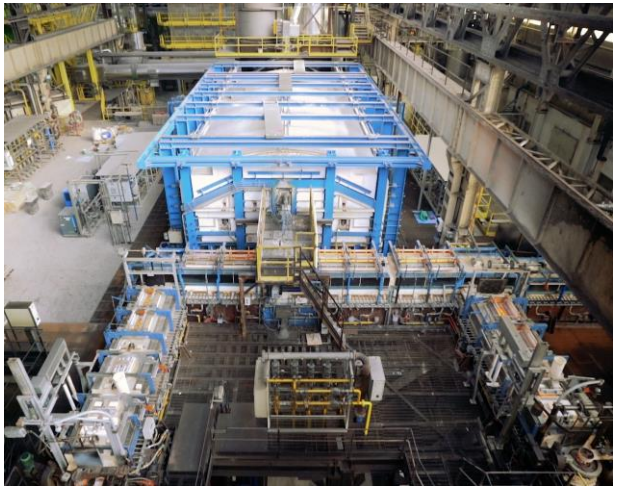
SORG OxECON®

- Energy savings of up to 10 % compared to a conventional oxy-fuel melter
- Lower NO_x emissions and carbon footprint
- Low waste gas temperature

- The innovative OxEcon® melter incorporates conventional oxy-fuel firing and combines it with the advantage of internal batch preheating to reduce energy consumption
- Just like the FlexMelter and the LoNOx® melter, this furnace design is also based on a special internal radiation wall inside the combustion chamber

Characteristics:

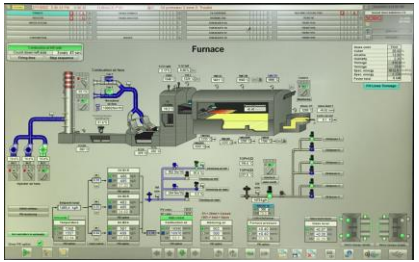
50 – 300 tpd, soda-lime glass
for containers (bottles, jars, flacons) and tableware

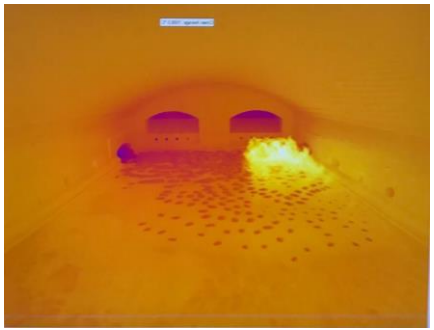


OPTIMIZATION OF REGENERATIVE END-FIRED FURNACES

Some keywords to show the continous improvements:

- Tank design ***(Deep Refiner® 1978)***
- Regenerator design
- Minimized heat losses by optimized wall insulation
- Crown design
- Burner neck design
- Burner technology
- Innovated combustion control system
- Large scale up to 189m²
- Optimized batch charging
- High boosting share
- ……





OUR TOOLS - SORG BATCH3 CONCEPT

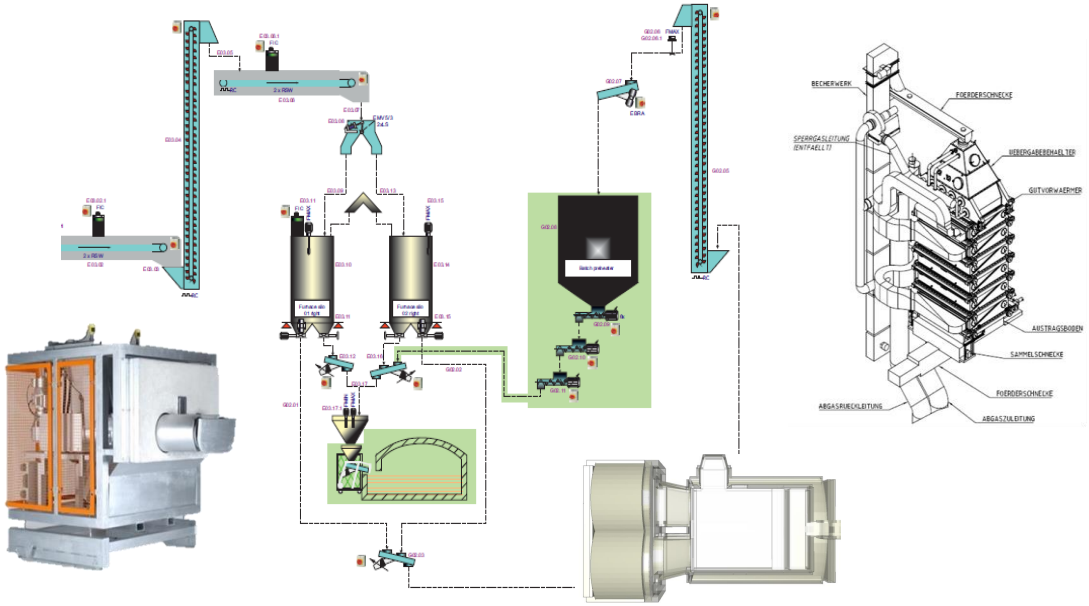
SORG Batch3 concept

Based on the idea to recover the energy in the waste gas and to keep it in the system:

- Preheater with inside mechanical activation to avoid clumping of batch
- Completely sealed charging conditions
- Enlarged doghouse

Energy savings approx. 10-12%

Reduction of CO_2 emissions

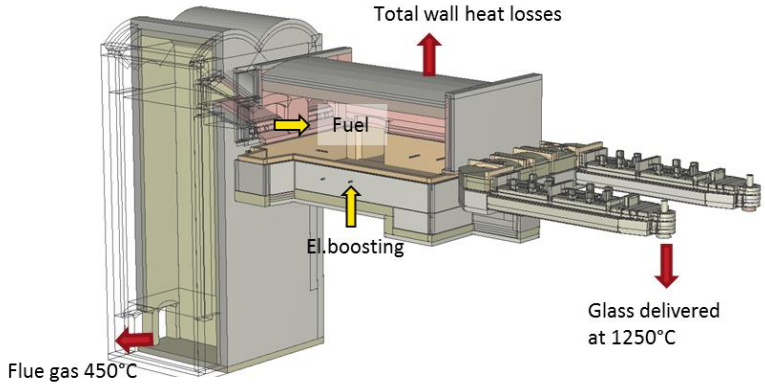


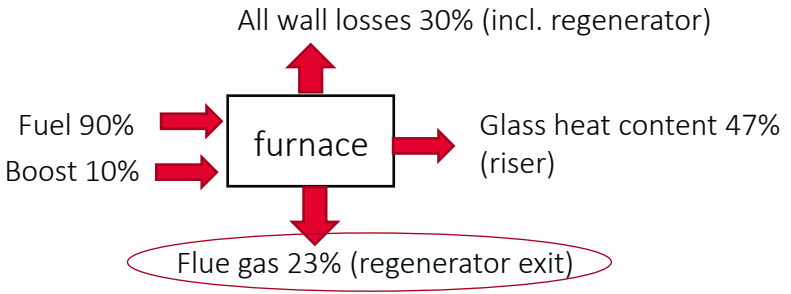
SORG BATCH3 CONCEPT

Main influenceable variables to reduce energy consumption of a furnace:

- Regenerator efficiency increase
- Insulation improvements
- Chemical heat demand (liquidus)
- Glass exit temperature

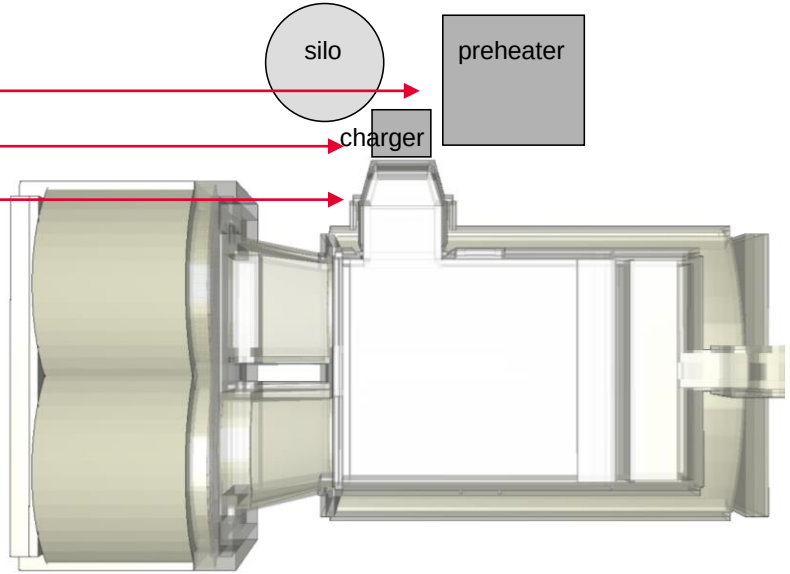
Regenerator efficiency and wall losses (insulation) already improved and at the physical limit.
Glass temperature and heat demand fixed by products and productivity.
Flue gas heat reuse with highest potential.
Available (reusable) heat in flue gas limited by the minimum allowable temperature of the flue gas cleaning device.





SORG BATCH3 CONCEPT

- *Preheater with inside mechanical activation*
- *Completely sealed charging conditions*
- *Enlarged doghouse*



Remark: Preheated batch generates dust in the furnace and around.

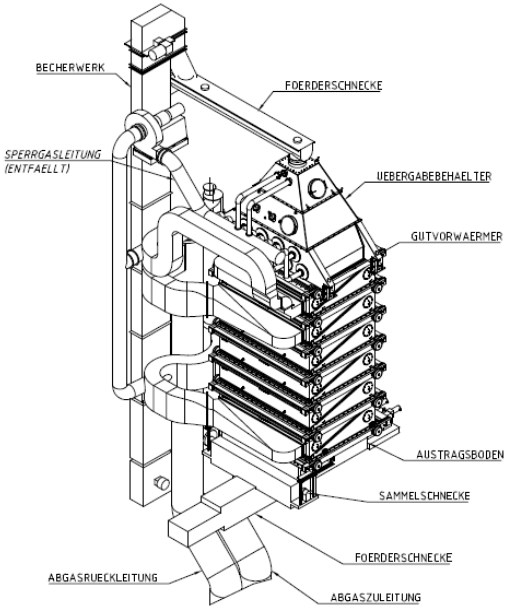
Sorg preheater **not** available without both features. Special doghouse and charger are imperative.

Special charger or special Sorg doghouse design also available and reasonable for operations without preheating. It is recommended to be prepared for the later installation of the preheater.

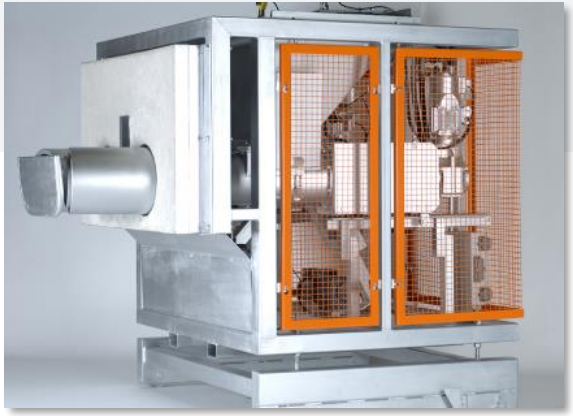
SORG BATCH3 CONCEPT

1. The batch preheater

- Cross counter-flow heat exchanger between waste gas and batch
- Heat exchanger separated into several sections (modular assembly)
- Each section can be activated mechanically
- Clumping will be destroyed by activation
- Self-cleaning design with open flue gas ducts [1)]
- Batch humidity will be carried away
- Vacuum dense installation. Charging and discharge dense. No pollution.

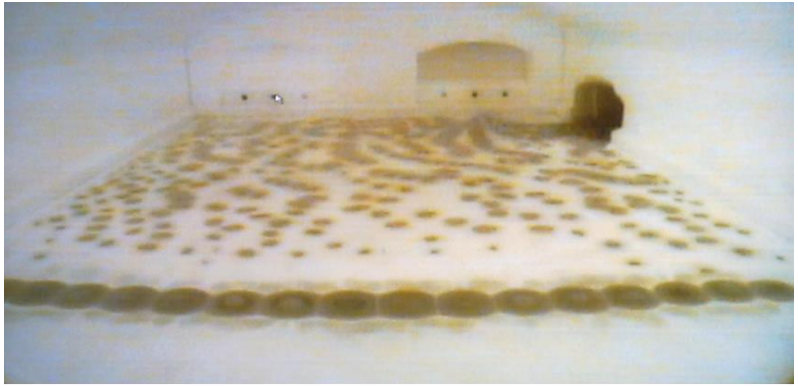


SORG BATCH3 CONCEPT



2. The charger

- Machine invented and first installation in March 2010 on a 340 tpd furnace (80% cullet)
- Completely sealed. No dusting in charging area.
- No radiation heat losses. No cold air ingress. This reduces energy consumption and stabilizes combustion resulting in up to 10% less NO_x.
- Thin batch layer due to twin screws (or triple); the pusher separates the batch into plies and pushes them forward. Screws can be controlled separately.

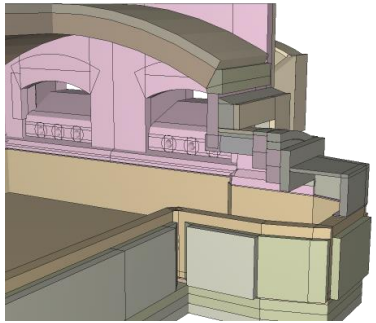


270t/d endport furnace with EME-NEND 3 charger- batch clamps separated.

SORG BATCH3 CONCEPT

3. The doghouse

- Completely sealed charging pocket
- Wider and deeper charging compared to a standard doghouse
- No radiation heat losses, no false air ingress
- High entrance arch for radiation heat transfer into the charging area. Batch surface glazing due to high radiation energy transfer.
- Batch surface glazing prevents carry-over. Loose batch components cannot be raised by combustion gases.
- Less carry-over into the regenerator



OUR TOOLS

OUR TOOLS

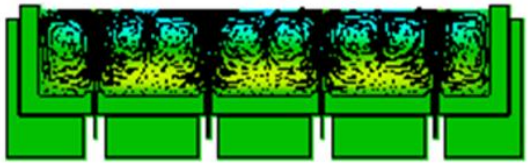
More than 50 years experience in

ELECTRIC HEATING

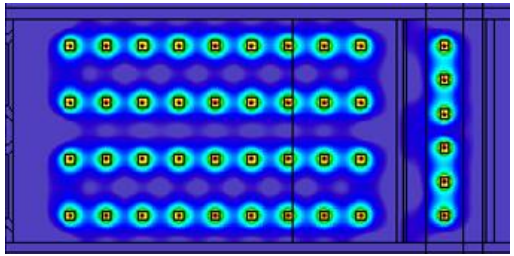
- Boosting systems
- Fully electric melter VSM®

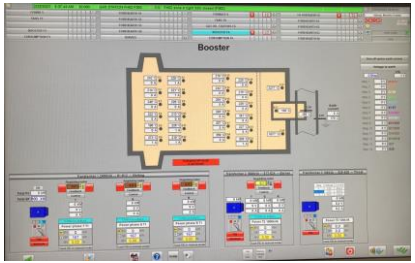
SORG BOOSTING SYSTEMS

Since 1960 several hundred systems worldwide supplied



- Modelling
- Technological specification
- Electric and control design



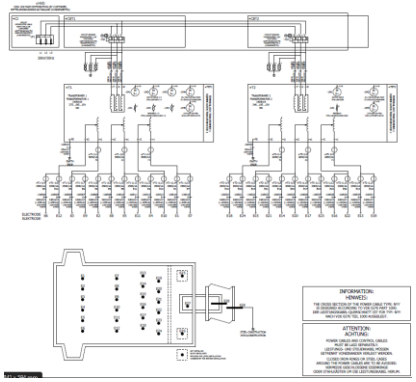


SORG BOOSTING SYSTEMS

Since 1960 several hundred systems worldwide supplied

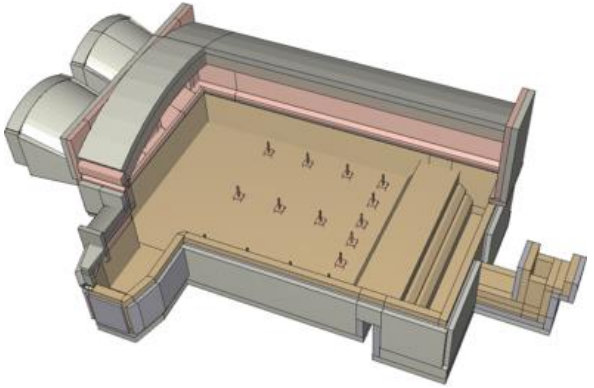
From single electrodes and electrode rows
to highly efficient and economic energy source

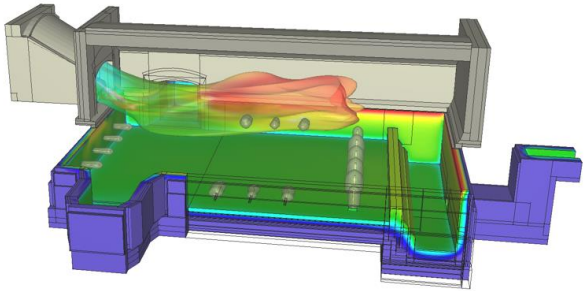
- Up to 4 MVA per single heating zone
- Up to 60 bottom electrodes in total



SORG BOOSTING SYSTEMS: FOSSIL FIRED FURNACE WITH HIGH BOOSTING SHARE

- Proven technology
- Up to 500tpd
- Boosting share up to 30%
- Nearly all kind of glasses
- High glass quality
- No limitation in pull and glass colour
- Flexible in choice of energy source (limited)
- Reduced CO_2 emission from combustion (depending on boosting share)





SORG ALL-ELECTRIC MELTER VSM®

Sorg all-electric melter VSM®

Long history and a great future

SORG ALL-ELECTRIC MELTER VSM®

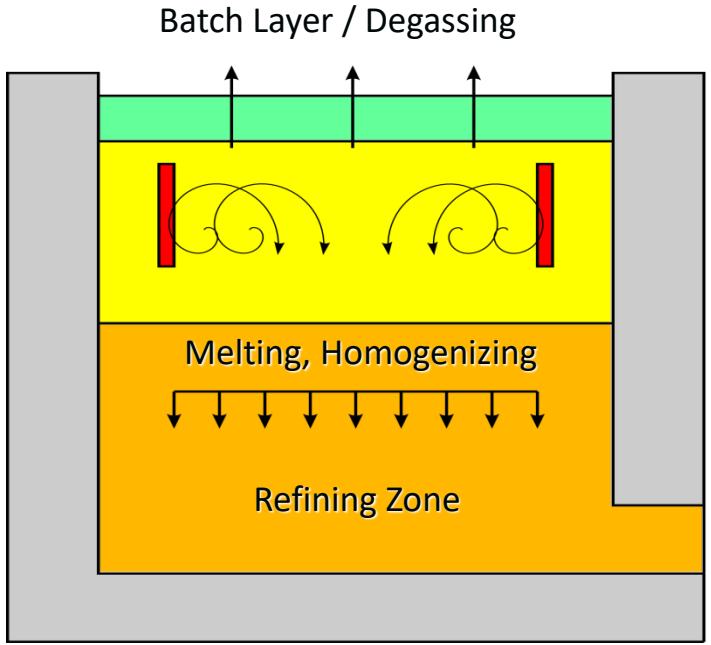
Over 100 VSM®s built since 1971

- From 5 up to 200tpd
- From 1,4m² to 80m²
- 100% electric melting
- Nearly all oxidized glasses
- High glass quality
- Easy to operate
- Low specific energy consumption
- Zero CO_2 emission from melting
- Relatively low cost and time for repair

SORG ALL-ELECTRIC MELTER VSM®

Electric vertical melting principle

- Electrical energy is the only energy source for melting
- The complete surface is covered by a batch layer whose function is to thermically insulate the melt
- Electrical energy is introduced by Top electrodes penetrating the batch layer from above
- Because of the insulating batch layer, the superstructure temperatures are as low as 50-300°C, so-called cold-top-melting
- Main process steps of glass melting (melting, fining, refining) take place vertically or semi-vertically

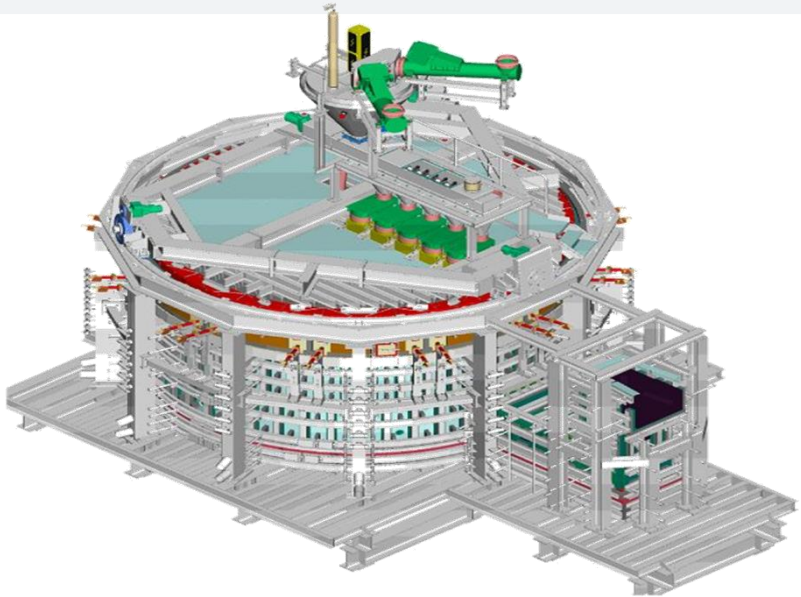


SORG ALL-ELECTRIC MELTER VSM®

Electric vertical melting principle

Benefits:

- Low specific energy consumption due to missing combustion (only flue gases are the batch gases)
- Small footprint of the furnace (no regenerators/quench chamber required)
- Batch blanket works as thermal insulation, as an integrated batch preheater and adsorption for the batch gases
- Easy to control – melting power is the only control loop.

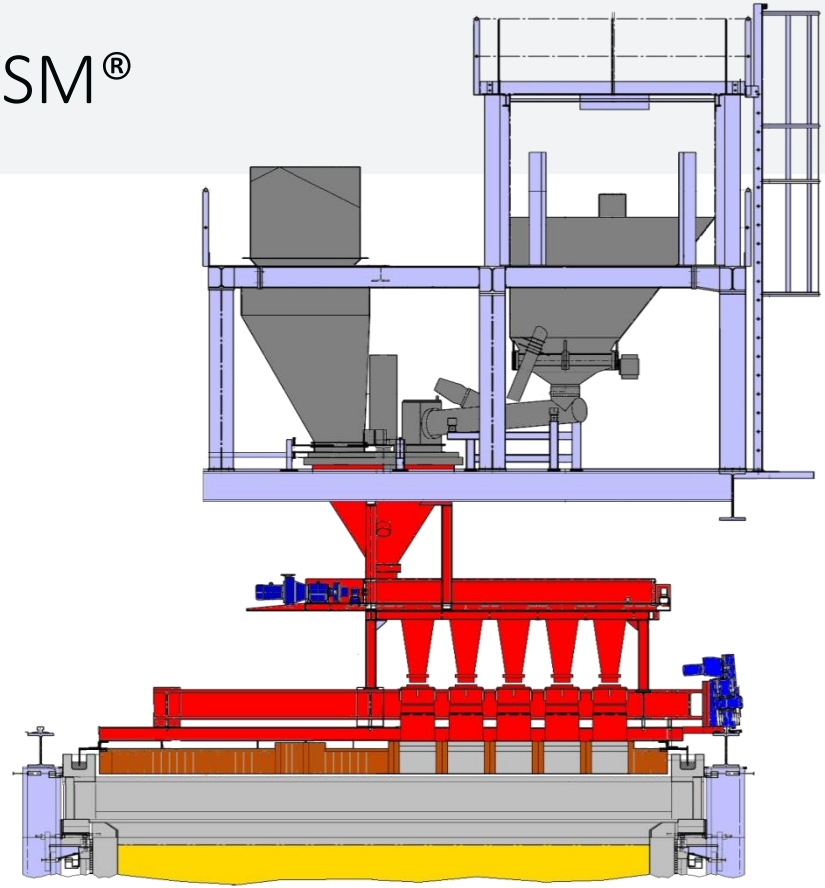


SORG ALL-ELECTRIC MELTER VSM®

Batch charging system

Requirements:

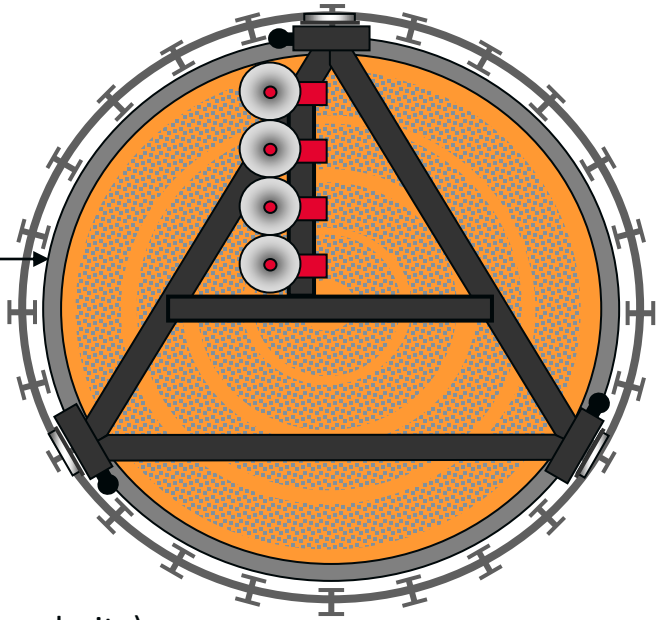
- Even distribution of the batch over the complete melting area
- Good sealing of the superstructure to prevent dusting and pollution and it enables removal of waste gases (melting loss) with optional waste gas treatment
- Charging should be possible at higher temperatures (emergency situation)



SORG ALL-ELECTRIC MELTER VSM®

Batch charging system – Rotating crown

concentric batch rings on the glass bath surface



(suspended crown omitted for clarity)

SORG ALL-ELECTRIC MELTER VSM®

Batch charging system – Rotating crown

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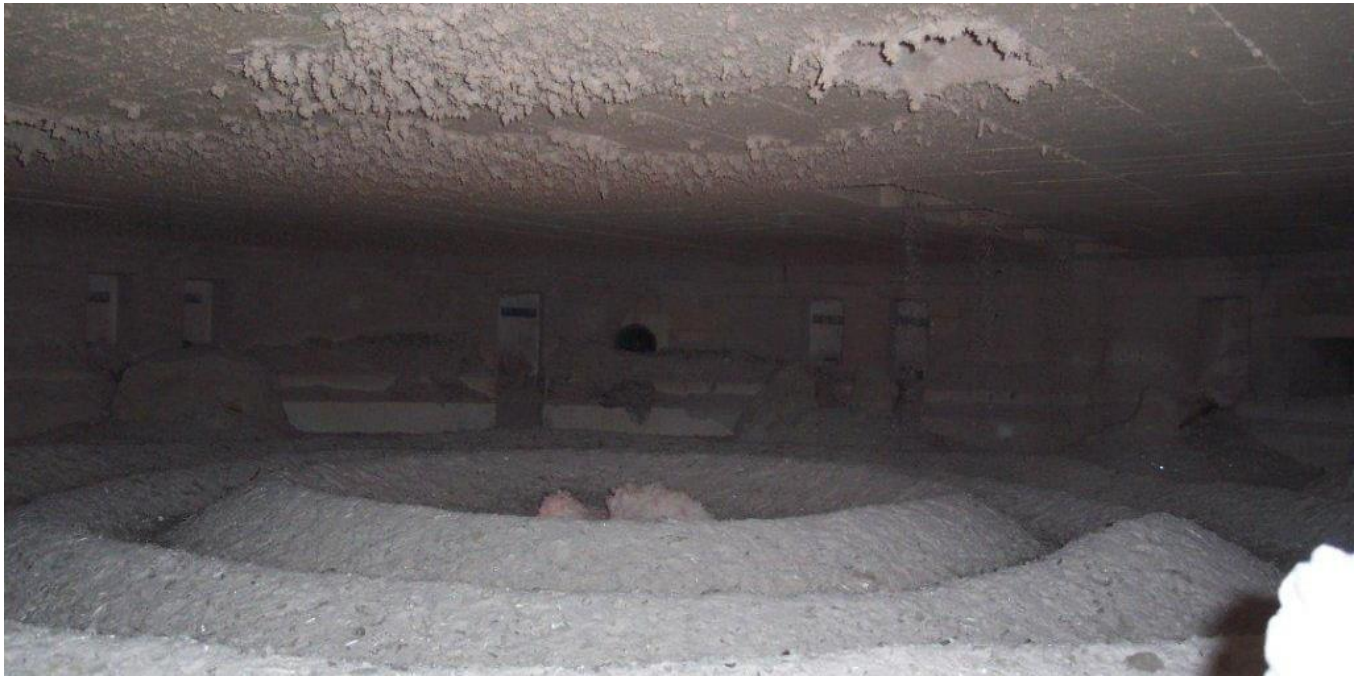
Batch charging system – Rotating crown



SORG ALL-ELECTRIC MELTER VSM®

Batch charging system – Rotating crown

- Superstructure totally enclosed
- No in-factory dusting
- No in-factory gaseous emissions
- Superstructure temperatures of < 600°C possible (emergency case) without any additional measures
- All parts of batch charging are outside of the furnace, all parts are easily accessible and easy to maintain
- Waste gases (melting loss) can be removed and treated if necessary

SORG ALL-ELECTRIC MELTER VSM®

Top electrodes

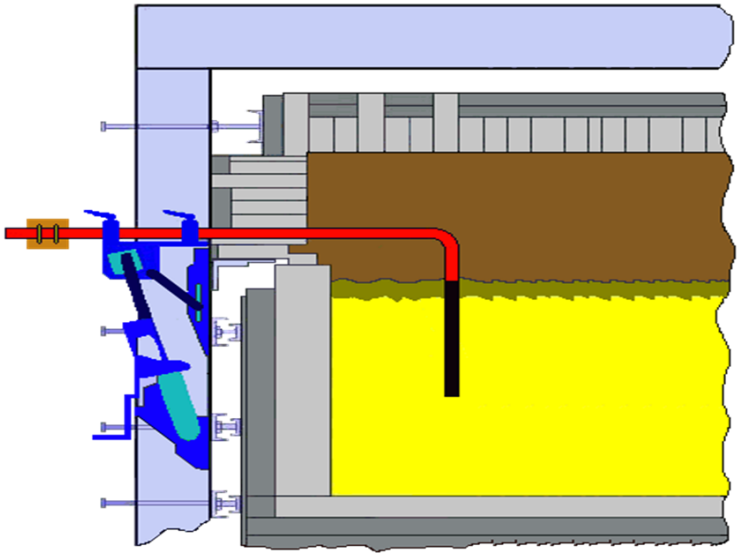
Requirements:

- Long lifetime of Mo-electrodes
- Easy to install and to maintain
- Safe installation

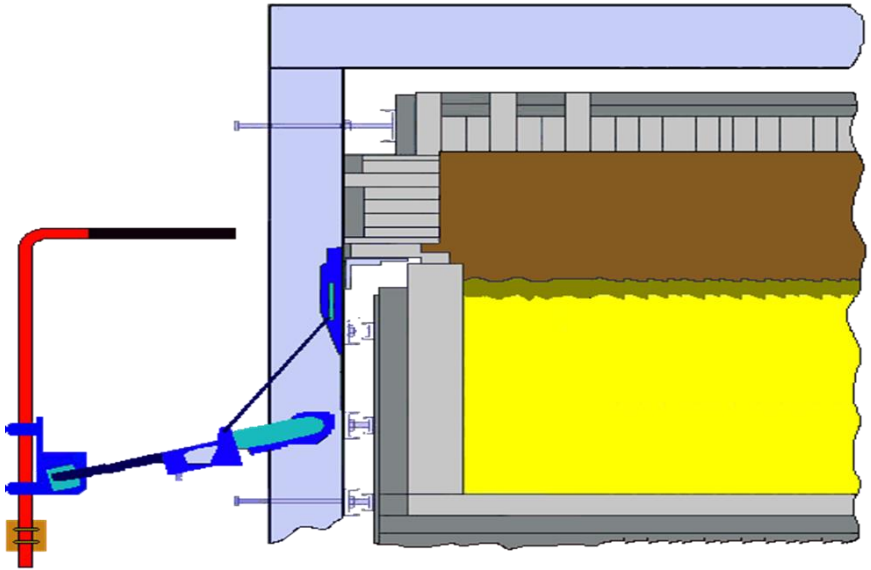
SORG ALL-ELECTRIC MELTER VSM®

Top electrodes - maintenance

The principle – operating position



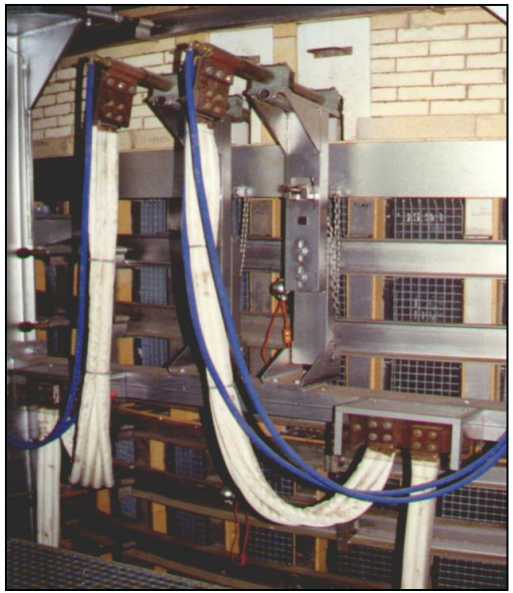
inspection and maintenance position



SORG ALL-ELECTRIC MELTER VSM®

Top electrodes - maintenance

operating position



inspection and maintenance position

SORG ALL-ELECTRIC MELTER VSM®

Applications:

Soda-Lime Glass for:

- Container
- Tubing
- Lighting ware
- Electric insulators

Lead/Crystal Glass for:

- Lighting ware
- Stemware

Flour Opal/Soda-Lime Glass for:

- Lighting ware
- Flaconage
- Tableware

Borosilicate Glass for:

- Kitchen ware
- Tubing
- Lighting ware
- Pharmaceutical containers

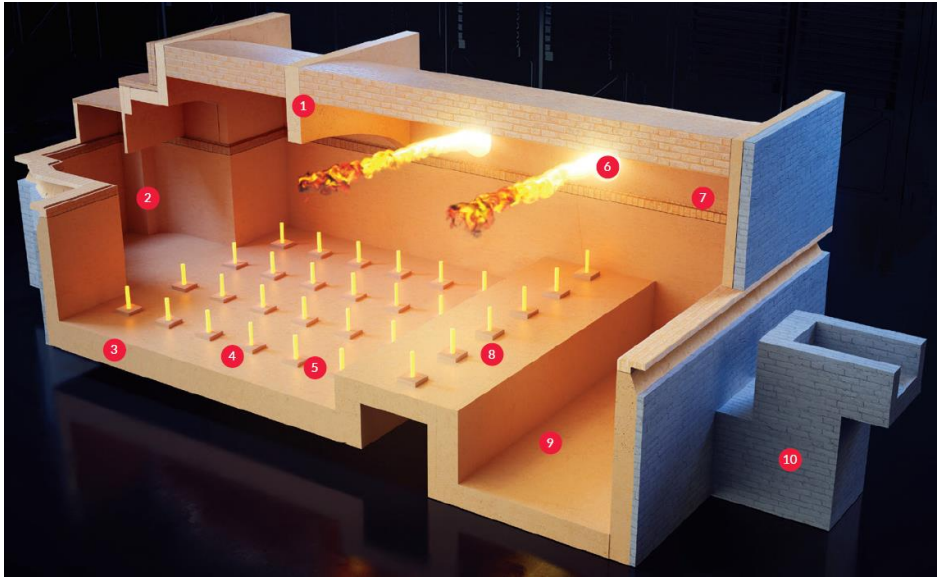
C- Glass for:

- Insulation Fiber
- Pellets – Special micro fiber

Sodium Silicate Glass

HYBRID FURNACE, SORG CLEAN MELTER®

- Up to 400tpd
- Boosting share from 20% to 80%
- Nearly all kind of glasses
- High glass quality
- No limitation in pull and glass colour
- Flexible in choice of energy source
- Reduced CO_2 emission from combustion (depending on boosting share)
- NG/Oxy firing – convertable to H_2/Oxy



SORG CONCLUSION

SORG CONCLUSION

With our tools we are prepared for the future, resulting in:

- Highly efficient and economic furnaces with highest standards
- Special furnace designs for optimal application (OxECON®)
- Special equipment for energy and emission reduction Batch3 with batch preheater, EME-NEND® charging machine and IRD® doghouse
- Boosting systems
- Fossil fired furnace with high boosting share
- Full electric melter VSM®
- Hybrid melter SORG CLEAN Melter®

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SORG | AIGMF since 1944