COMPLETE SOLUTIONS

FOR THE FERRO ALLOY INDUSTRY

Vatvedt Group
NORWAY

A complete supplier

The Vatvedt Group is a world leading producer of equipment for submerged arc furnaces. Our experience and know-how has been established from serving the industry for more than five decades.

Our pride has always been to make high quality equipment. Years of repair and replacement of worn and used parts, has given us a unique background and experience for improving our solutions.

Our core equipment is the true result of working in the field for a long time, and through gradual development we have been able to reach a unique quality, which is a necessity for long term problem free production.

Our challenges for the future are the same as always: To fulfil our customer's demands. To make use of new technology in our solutions. To keep working hard for our clients, and to offer them new ways of profitable production.

The Vatvedt Group is capable of taking care of most types of contracts, and offers a variety of equipment and services:

Ole Chr. Vatvedt,
president and general director
of the Vatvedt Group

- Electrode columns
- Secondary conductor systems
- Furnace covers
- Furnace smoke hoods
- Forged pressure rings
- Forged contact clamps
- Furnace linings and lining technology
- Tapping equipment
- Other furnace equipment
- Furnace control systems
- Bag filters
- Wet scrubber systems
- Furnace charging systems
- Raw material handling systems
- Transformers
- Equipment for producing special alloys
- Erection and erection supervision
- Process technology and experience

Places where the Vavedt Group has installed furnace equipment

Consulting and evaluation

Based on Vatvedt's wide experience in production of ferro alloys, furnace design and dimensioning, we are offering consultancy services within this field.

We are able to evaluate and propose improvements to an existing furnace process, consider and propose possibilities for capacity expansion and measures to obtain a more profitable operation.

In some cases, only moderate investments may result in increased production capacity or production cost savings and hence represent a good return on the investment. In other cases, it will be more profitable to go for a complete furnace upgrading or to build a completely new furnace.

Engineering and manufacturing

Planning and design of submerged arc furnaces is done by our highly competent team of engineers. Since we are able to carry out engineering and equipment manufacture in parallel, the lead time for project implementation can be much reduced.

Our certified welders and metal workers are a stable crew of highly skilled craftsmen, with long experience in furnace equipment and with unique production methods for this type of equipment. They hold understanding and skills in relevant steel materials and special alloys, and their personal working moral is reflected in the strength and durability of our products.

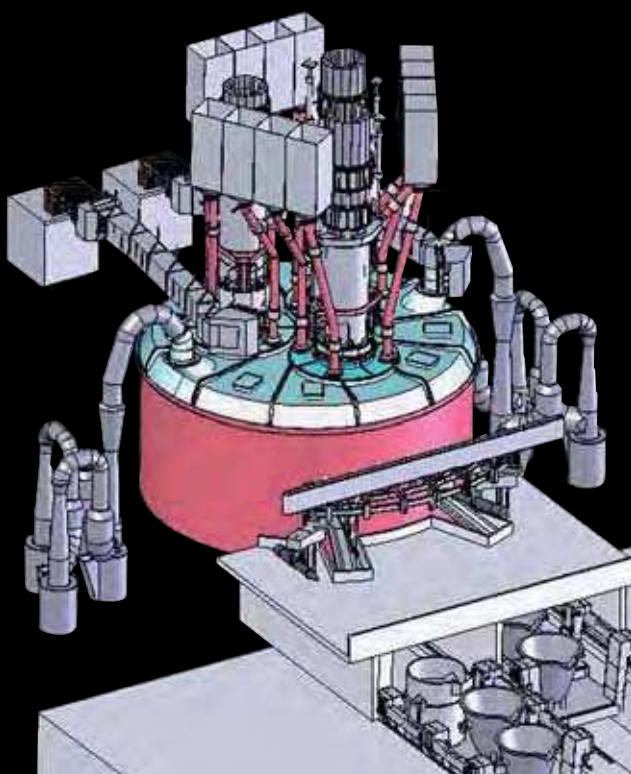
Our production facilities are equipped and well suited for the fabrication of tailor made equipment for submerged arc furnaces and related equipment. Our suppliers and partners are carefully selected after long term responsible cooperation.

Supervision and erection

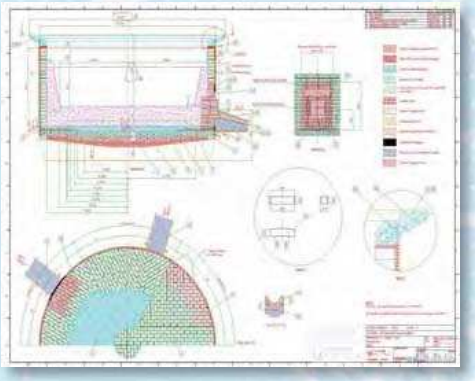
Experience has shown that in order to save time and cost during the erection period, it is beneficial if our engineers, who design and manufacture the equipment, are involved in the final on site erection.

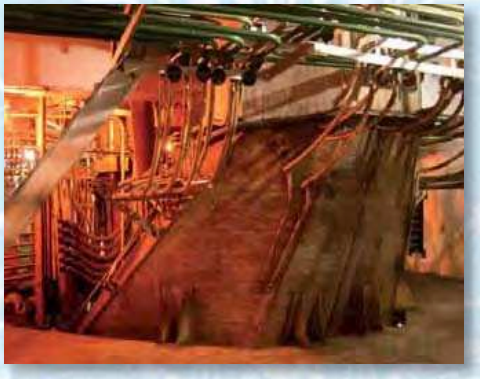
We have a highly competent staff of engineers and metallurgists who serve our customers in different projects of various sizes. No project is too small or too big.

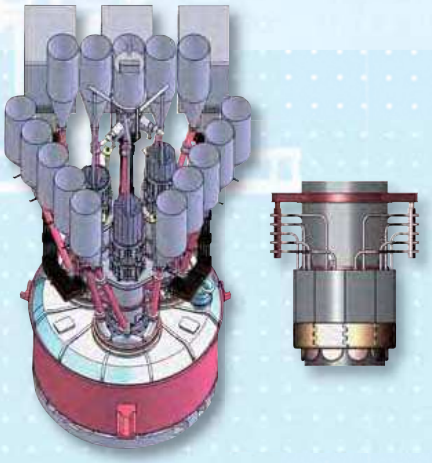
We also have our own well qualified staff of erection personnel who have carried out erection work world wide over the past years, with great success and good economical results for the customers.



Process experience and technical solutions







The Vatvedt approach

Producers of submerged arc furnace products continuously need to improve their competitive strength. They meet increasing challenges in the following areas:

- Improve productivity
- Make use of best available technology
- Energy costs
- Raw material costs
- Labour costs
- Finished product quality requirements
- Demands on working environment
- Demands on external environment

The needs of producers vary depending on their location, existing installations and local conditions. Vatvedt is able to cover a variety of needs, such as:

- Greenfield projects for production of ferro alloys and related products
- Installation of new furnaces in an existing plant
- Overhaul, upgrading and capacity increase of existing furnaces
- Capacity expansion studies
- Evaluation of furnace operation and performance improvement
- Process automation and process control

We cover the following processes:

- Ferromanganese and silicomanganese
- Ferrosilicon and ferrosilicon based alloys
- Silicon metal
- Ferrochrome
- Ferronickel
- Calcium carbide

Furnace types:

- Closed, semiclosed and open furnaces
- Stationary and rotating furnaces

Vatvedt offers services and equipment in the following areas:

- Furnace design and dimensioning
- Operating assistance, process optimization and bottleneck evaluation
- Furnace linings and lining technology
- High tension supply systems including furnace transformers
- Cooling water systems
- Furnace instrumentation and control systems
- Gas cleaning plants for furnace offgas
- Equipment for metal tapping and casting
- Raw material supply and handling
- Finished product processing
- Dedusting systems for subsystems such as raw material handling, tapping fume, finished product plants etc.
- Energy recovery systems

Furnace design and dimensioning

Based on the desired product type, available raw materials and required production capacity, we recommend the suitable furnace type, furnace dimensions and transformer capacity.

Operating assistance, process optimation and bottleneck evaluation

In many cases, furnace performance and production capacity of existing furnaces can be improved by adjusting raw material quality or by removing bottlenecks, sometimes by only minor changes or marginal investments.

Furnace linings and lining technology

By selecting the appropriate lining design, the lifetime of furnace linings can be considerably improved, and unforeseen lining failures can be avoided.
Depending on furnace product and customer wish, we offer conventional linings as well as freeze linings, including appropriate furnace shell cooling systems.

Vatvedt core equipment

Furnace charging systems

- Charging tubes for proper charge distribution with forced air cooling and tube feeders
- Stationary charging tubes with rod gates and charging chutes
- Furnace bins with piston flow (segregation free)
- Conveyor belts for distribution of charge mix to furnace bins

Furnace foundations

- Concrete foundations with drain system and steel beams on top. Steel beam structure can be used for forced air cooling of furnace bottom and furnace shell sidewalls
- Foundations for stationary and rotating furnace shells

Furnace shell

- Shells with forced air cooling
- Shells with vertical cooling fins for natural convection
- Shells with water film cooling system

Furnace covers

- Closed furnace covers with inspection and explosion hatches, produced in stainless steel or normal steel
- Semi closed furnace smoke hoods with furnace roof, sidewalls and doors, produced in stainless steel or normal steel
- Seal rings for closed and open furnaces in stainless steel or normal steel

Electrode columns

- Hanging hoist cylinders
- Pneumatic membrane- or fail-safe slipping system
- Water-cooled or non water-cooled copper flexibles conduct the power from the secondary conductor system to the electrode column
- Copper bus tubes conduct the power to the contact clamps
- Water cooled contact clamps in copper of cast or forged type
- Pressure ring segments in aluminium bronze or pure copper. The segments are of cast or forged type and are water cooled. The pressure ring segments are operated by high pressure water
- Pressure ring membranes in stainless steel or rubber
- Water-cooled shields in stainless steel

Secondary conductor systems

- Copper bus tubes or bus bars conduct the power from the transformers to the electrode columns

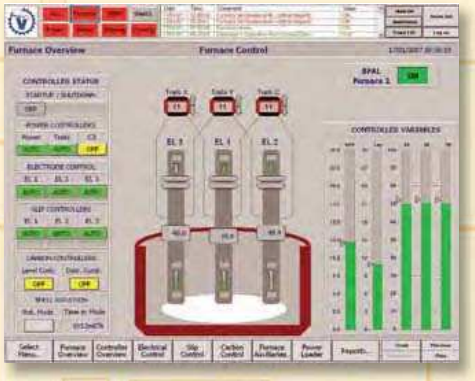
Tapping equipment

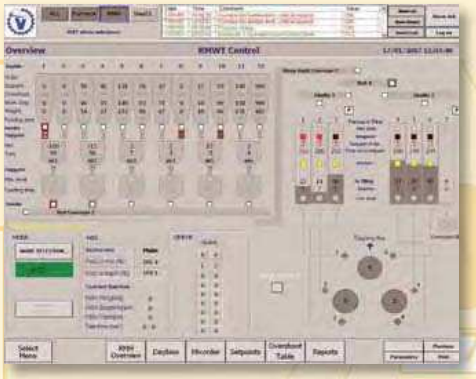
- Electrical taphole opening device
- Drilling machine
- Rabbling machine
- Mud gun
- Mobile or stationary tapping systems
- Ladle cleaners
- All equipment is radio controlled and hydraulic operated
- The equipment is being designed for each specific process and according to the customer's requirements and demands

Gas cleaning plants

- Bag filters
- Venturi wet-scrubber systems
- Dedusting systems for subsystems

Power distribution and control systems





Electrical engineering and system design

Depending on the customer's requirements we provide the full range of project disciplines for electrical, instrumentation and control systems including:

- Project management
- Furnace power system design and specification
- Electrical and instrumentation engineering
- Control system design and functional specifications
- Tender specifications. Procurement and subcontractor administration
- Erection
- Supervision
- Commissioning
- Start up and fine-tuning assistance
- Training

Instrumentation

- Electrode column instrumentation such as electrode voltage measurement, holder position, slip counter and electrode tip position measurement
- Cooling water surveillance
- Furnace shell temperature measurement
- Weighing and transport system
- Gas cleaning plant and dust treatment systems

The philosophy of Vatvedt is to work closely with our customers in order to offer optimal solutions for minor upgrading projects as well as for fully turnkey systems. No assignment is too small or too large.

Our knowledge and experience with submerged arc furnaces for more than 50 years enable us to deliver well proven technology and solutions for the following fields:

High tension supply systems

We are able to design high tension supply systems including furnace transformer specifications, and can offer the relevant components including:

- High tension switchboard
- Power factor compensator and capacitor banks
- Furnace transformers
- Protective relay specification and settings
- Measuring

Low tension distribution

- Motor control centres
- Auxiliary systems
- Emergency systems

Control and information systems

Vatvedt is offering complete control and information systems for efficient and safe furnace operation based on state-of-the-art PLC and PC technology.

Furnace control

Control system for optimal furnace operation, including:

Electrical control

- Current / resistance electrode controllers
- Power / C3 control
- Automatic start up and shut down controls

Slip control and monitoring, including automatic slip sequence controllers

Integrated Carbon Control

- Total carbon level
- Carbon distribution

Automatic data logging

Raw material handling

Control system for optimal raw material handling, including:

- Automatic batch queuing
- Differential overshoot compensation
- Automatic moisture correction for raw materials
- Multiple setpoint selection
- Furnace hopper zone correction
- Carbon controller integration
- Automatic restart in case of equipment failure
- Report system including shift, day and week consumption reports
- Historical report system

Gas cleaning plants

The control system for bag filter and powder treatment contains the following functions:

- Automatic filter start up and shut down sequence
- Automatic handling of extreme temperature and pressure values
- Main fan automatic gas flow and power control
- Automatic cleaning sequence for filter bags
- Automatic cleaning pressure control system
- Totally automated dust transport from filter hoppers to silos
- Powder densification system

Common control system features

- Multiple, integrated operator stations
- Integrated alarm system for all processes
- Flexible, graphical trend system and historical logging.

Plant integration

Plant information system integrated with control system:

- Material control from reciept to shipment
- Consumption and production handling
- Analysis handling of raw materials and products
- Yield calculations for process
- Cost and budget measures for process
- Integration with other management systems

Basic modules

- Material recipes, production and sales
- Analysis management
- Operational data system
- Down time analysis

Optional modules

- Statistical process control
- Advanced query and report system

The Vatvedt Group holds unique experience as a supplier to the ferro alloy industry. Formerly a supplier and subcontractor to Elkem, the Vatvedt Group is today an independent supplier. The mother company Vatvedt Heavy Industries Ltd. was established in 1910.

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