PARAT HALVORSEN AS

HIGH VOLTAGE ELECTRODE BOILER

POWER to HEAT for Steam and Hot Water

PARAT®

Babcock Wanson Group

PARAT: Boilers since 1920

For more than a century, PARAT has developed and manufactured boiler solutions for demanding industrial and offshore applications.

Our High Voltage Electrode Boiler is engineered and produced in Flekkefjord, Norway, combining long-standing boiler expertise with advanced Power-to-Heat technology.

Electrification and Power-to-Heat

The increasing share of renewable energy in modern power systems requires flexible and fast-responding electrical loads. Our High Voltage Electrode Boiler converts electrical power directly into steam or hot water with near 100% efficiency.

By replacing fossil fuel-fired boilers with electric heat production, industries and energy providers can significantly reduce local emissions while supporting electrification strategies.

The electrode boiler is designed to operate as a controllable resistive load, making it ideal for:

- Industrial steam production
- District heating systems
- Offshore electrification projects
- Grid regulation and balancing services
- Backup and peak-load operation

PARAT uses a high-ohmic insulated zero point, so no transformer is needed.

Grid Regulation and Flexible Operation

Modern power grids require rapid frequency regulation due to variable production from wind and solar power. Our Electrode Boiler supports primary regulation with a response time of less than 30 seconds from minimum to full load.

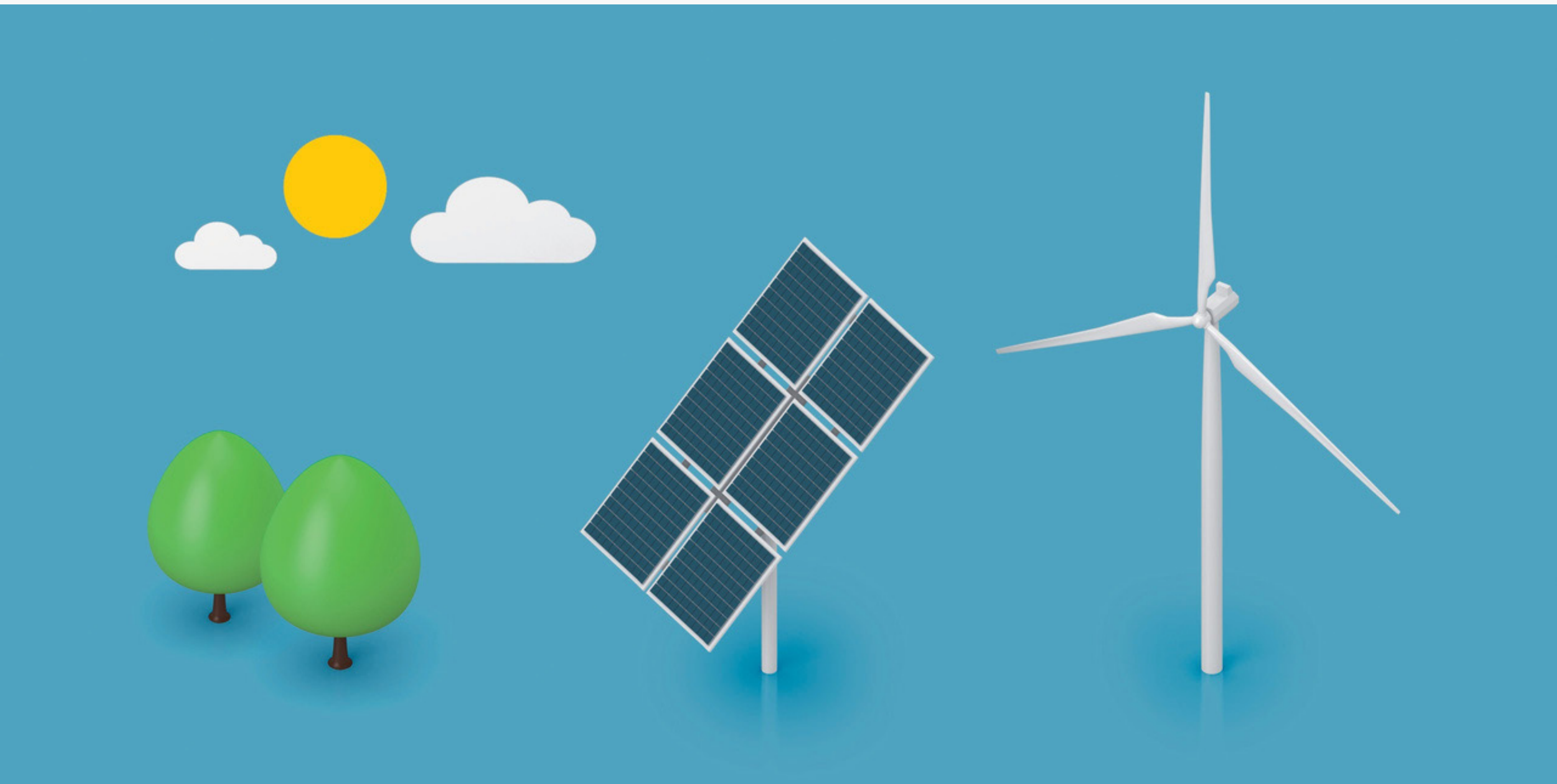
By converting excess renewable electricity into thermal energy, the system enables:

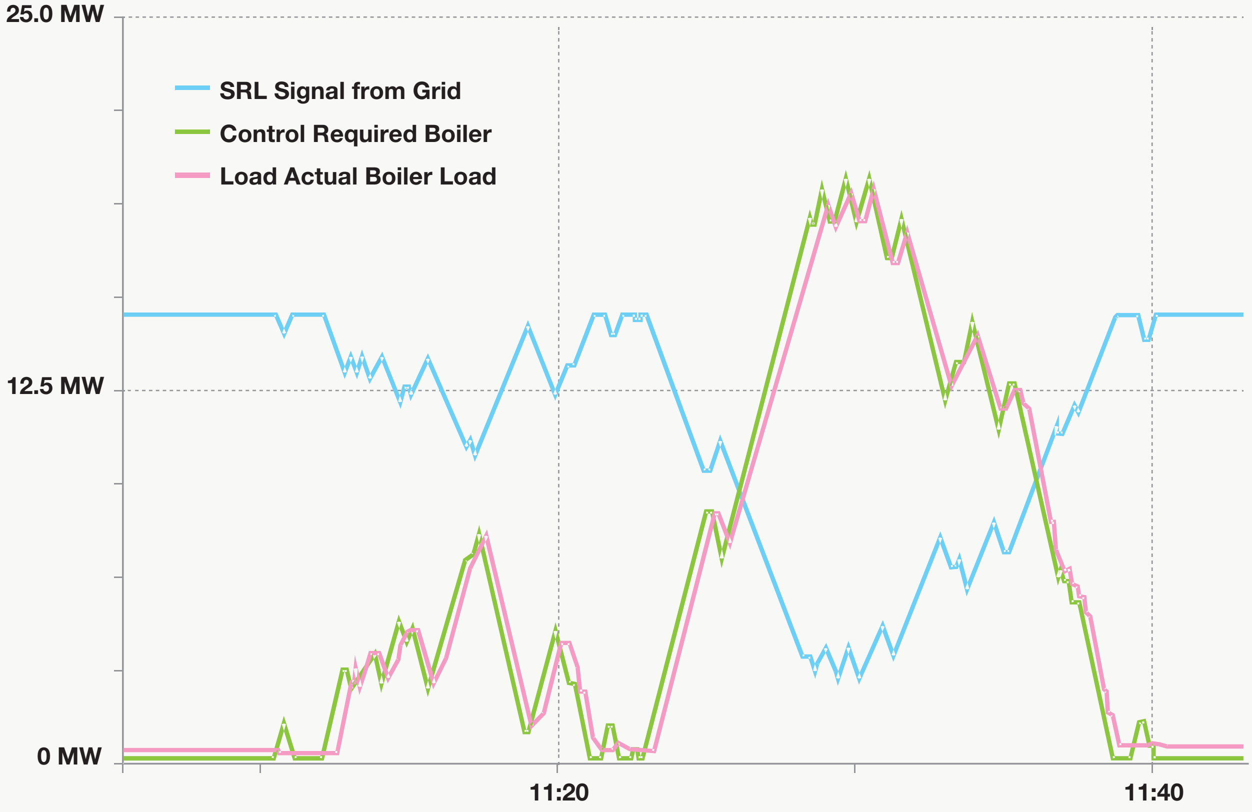
- Utilization of surplus power
- Stable grid balancing
- Reduced reliance on fossil fuels
- Cost optimization during periods of low electricity prices

Zero-Load Standby

PARAT's Zero-Load solution ensures zero power consumption during standby, even with the main switch connected.

This allows the boiler to remain instantly available for regulation services without unnecessary energy use, maximizing operational flexibility.





Typical SRL regulation curves at Infraserv Höchst, Frankfurt.

Steam Solutions

The PARAT High Voltage Electrode Boiler delivers electric steam production in a pressure range from 6 to 85 barg. Designed for medium voltage supply (typically 6–24 kV), the system supports high-capacity steam production for demanding industrial and offshore applications.

Steam Generation Principle

Steam is generated directly in the water between the electrodes. Heat is produced by ohmic resistance in the water, and the boiler operates as a pure resistive load in the electrical circuit.

An internal circulation system ensures stable evaporation and controlled output. Boiler capacity is regulated by adjusting the water level in the upper chamber.

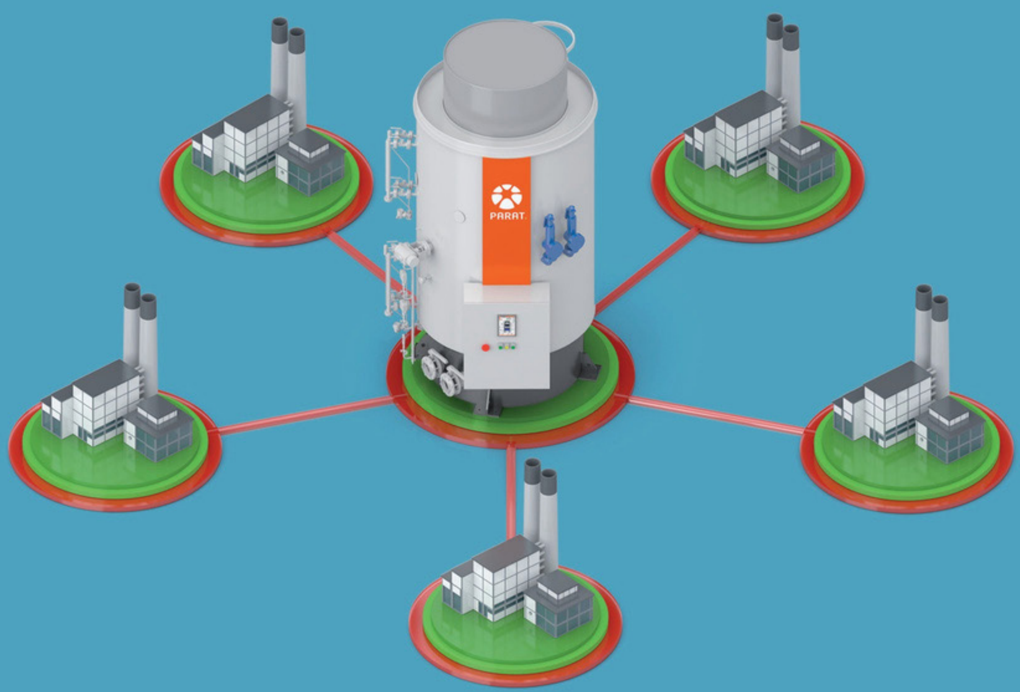
Steam pressure is continuously monitored and electrical input is automatically adjusted to maintain stable operation. Water conductivity is continuously monitored and controlled to ensure optimal performance and reliable output.

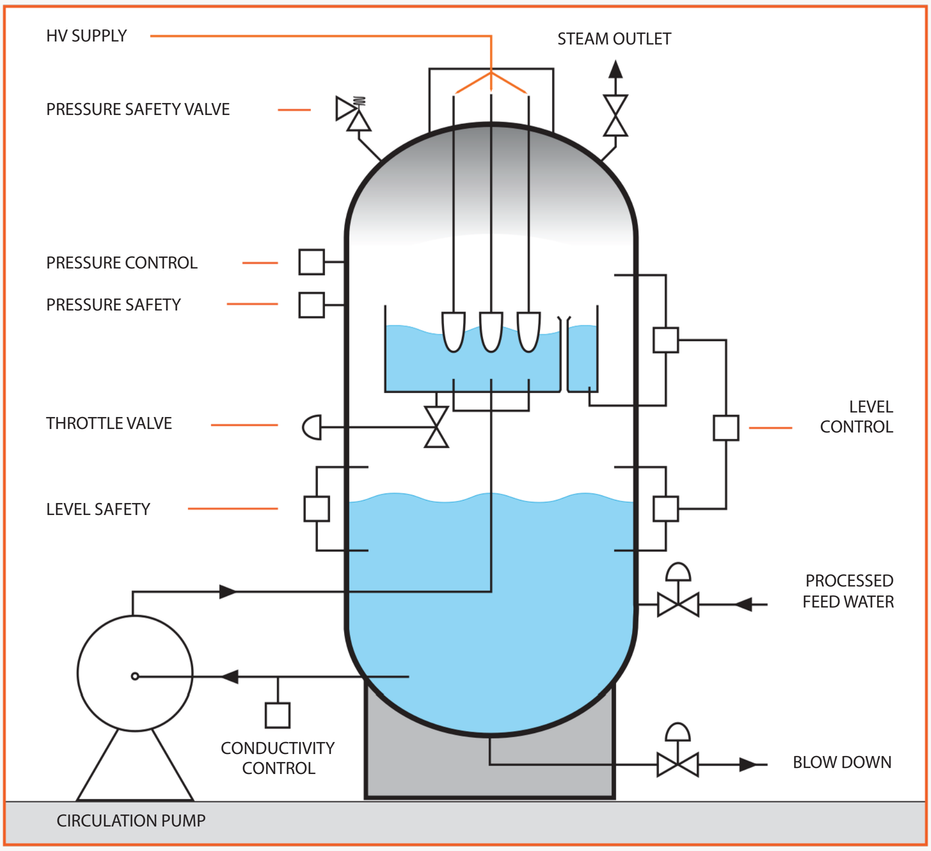
High-Pressure Steam

The electrode boiler is available with design pressures up to 85 barg, enabling electrification of high-capacity steam systems traditionally served by fossil fuel boilers.

Electrical Superheaters

Electrical steam superheaters can be delivered as separate low-voltage units where superheated steam is required.





Principle diagram of Electrode Boiler Steam generation system.

Currenta Chempark, Leverkusen

Hot Water Solutions

The PARAT Electrode Boiler is well suited for district heating networks and industrial hot water systems. By utilizing electricity, including excess renewable power, the system enables replacement of fossil fuel-fired hot water boilers with electric heat production.

Hot Water Generation Principle

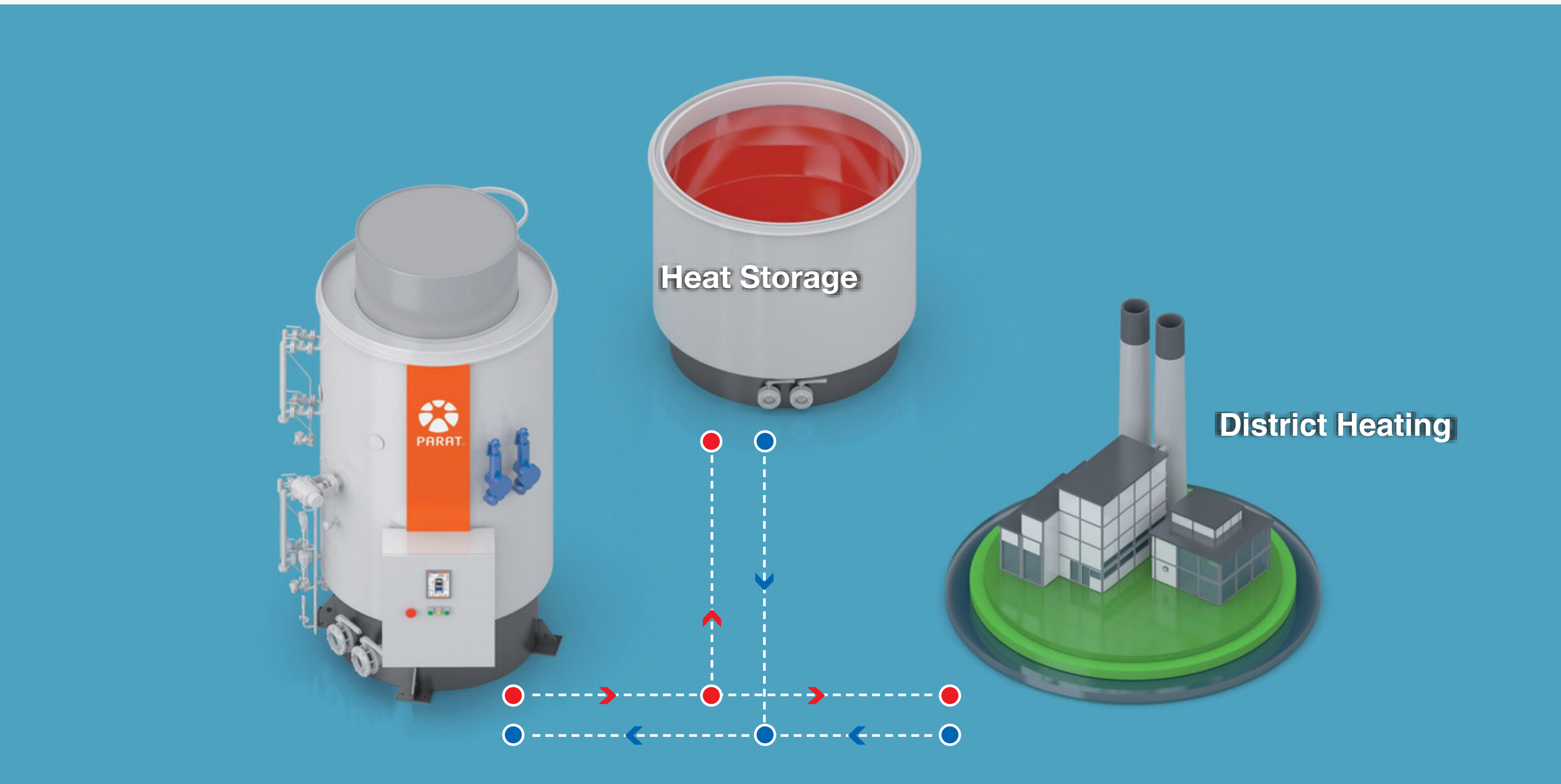
Hot water is produced by circulating boiler water through the electrode chamber. The pressure vessel is nitrogen-pressurized, and due to the relatively low internal water volume, the unit can also function as an expansion vessel. Output is automatically regulated. If delivered temperature exceeds the setpoint, electrical input is reduced accordingly.

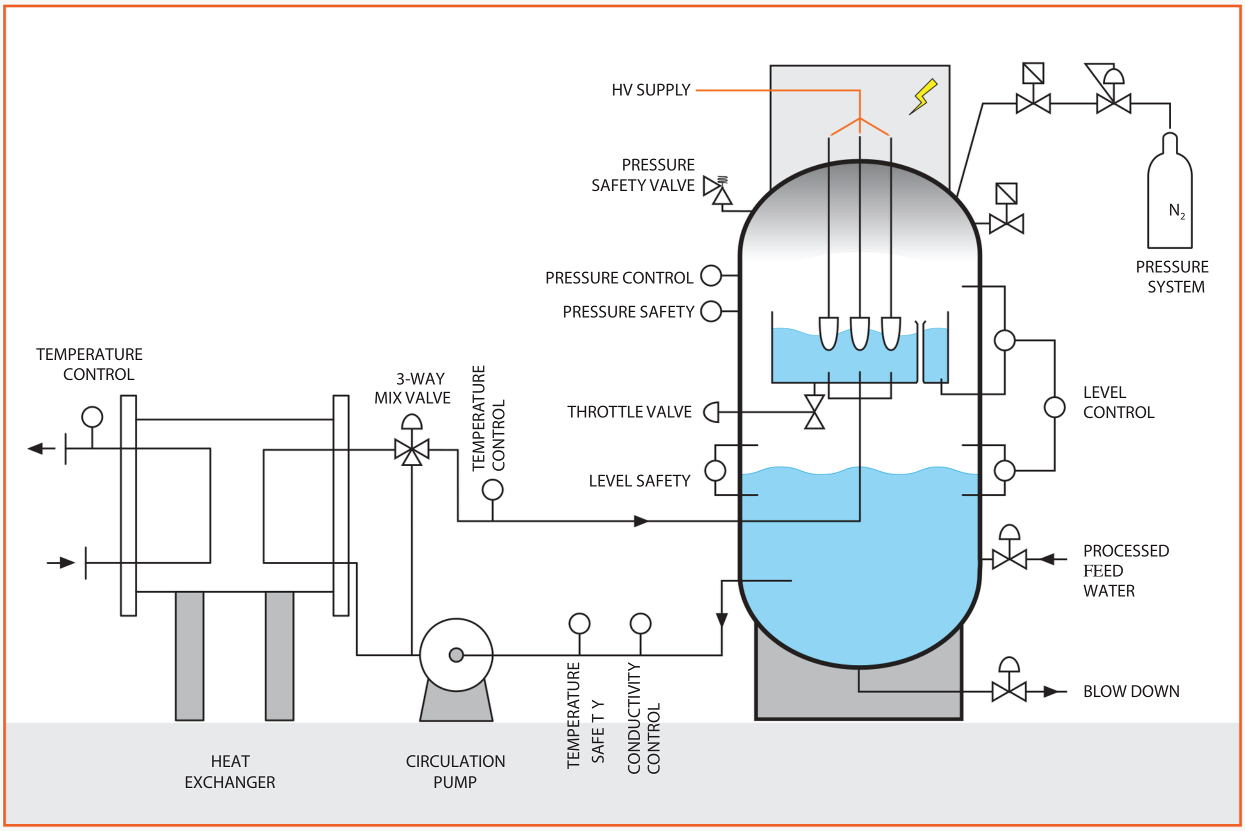
Thermal Energy Storage Integration

When combined with a thermal storage tank, the boiler can absorb large amounts of electrical energy during periods of surplus power.Stored thermal energy can later be released according to demand, enabling flexible operation and participation in grid regulation services.

Combined Hot Water and Steam

The electrode boiler is available as a combined hot water and steam solution in one unit, with automatic switching between operating modes. This provides flexibility for energy centres requiring both steam and hot water production.





Principle diagram of Electrode Boiler hot water system.

Technical Specifications

Design Codes and Compliance

- CE-marked in accordance with PED 2014/68/EU
- Designed according to EN 12953/EN 13445
- Medium-voltage systems designed in accordance with EN 61936
- EX-certified versions available for hazardous areas
- Other international design codes available upon request

Electrical and Mechanical Characteristics

- Voltage range: typically 6–24 kV
- Design pressure: up to 85 barg
- Fast response: < 30 seconds from minimum to full load
- From cold condition to full load within minutes
- Zero-Load standby with no power consumption
- No earth current due to insulated neutral point design
- Compact footprint suitable for retrofit installations
- High-capacity configurations available
- No separate step-down transformer required

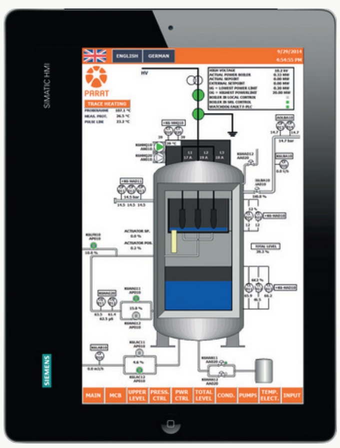
The boiler shell is insulated with mineral wool and clad with powder-coated aluminium sheets. Visible components are painted.

Control system

The boiler is equipped with a Siemens S7-1500 Fail-safe PLC-based control system designed for robust and user-friendly operation.

PARAT remote monitoring is available, enabling secure web-based monitoring, diagnostics and software updates from the PARAT service centre in Norway.

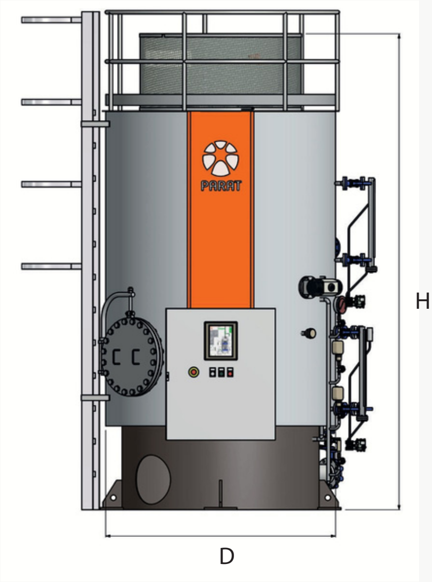
Instrumentation redundancy can be delivered as 1oo2 or 2oo3 configurations to meet project-specific safety requirements.



Mechanical Design

The Electrode Boiler is designed as a compact unit suitable for installation in existing boiler houses. The boiler shell is insulated with 2×75 mm mineral wool and clad with powder-coated aluminium sheets. Visible external components are painted.

Boiler outer dimensions given for electrode boilers including insulation mantle. We reserve the right to make changes:

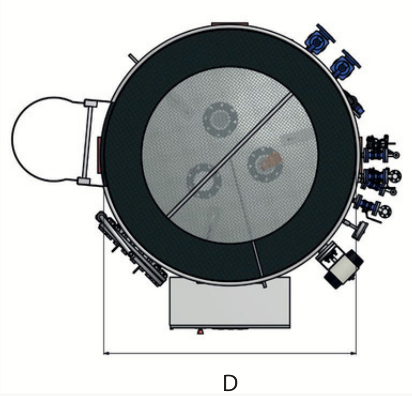


Steam boiler

Capacity (MW)	0-5	0-15	0-30	0-45	0-60
Steam (t/h)	7,5	22,5	45	67,5	90
D (mm)	2100	2350	3000	3600	3700
H (mm)*	4800	5800	6700	7000	7400
Transport weight (kg)	6500	8000	13500	20000	23000
Operating weight (kg)	8500	11000	21500	34000	38000
Test weight (kg)	13800	21000	38500	60000	66000

Weight data is given for 16 barg design pressure. Size based on 10 kV. Steam based on 100°C Feedwater temperature. Changes may occur.

* If circulation pumps are placed at same level as boiler, an additional height must be added for pump NPSH.



Hot water boiler

Capacity (MW)	0-5	0-15	0-30	0-45	0-60
D (mm)	2100	2350	2700	3100	3500
H (mm)	4500	5300	5800	6400	6550
Transport weight (kg)	4500	6000	9500	15000	16000
Operating weight (kg)	7000	9500	14000	24500	25000
Test weight (kg)	12500	17500	26500	40700	46000

Weight data is given for 6 barg design pressure. Size based on 10 kV. Changes may occur.

Global Service and Support

Parat Halvorsen supports customers worldwide with engineering, commissioning and lifecycle services.

Engineering

Multidisciplinary engineering teams cover:

- Mechanical and thermodynamic design
- Process engineering
- Electrical systems
- Control systems and PLC
- Instrumentation
- Piping and layout

Documentation

Comprehensive documentation packages include:

- Material certificates
- Test reports
- Class and third-party approval documents
- Installation, Operation and Maintenance manuals (IOM)

Full traceability is ensured throughout the project lifecycle.

Commissioning

PARAT commissioning engineers perform start-up and functional testing after installation and hook-up. All necessary performance tests are carried out in cooperation with third-party inspectors where required.

Inspections, Repairs and Modifications

Experienced and certified service teams are available worldwide for inspections, maintenance, repairs and system upgrades.

Offshore Electrification

PARAT contributes to electrification of offshore energy installations through high-capacity Power-to-Heat solutions.

Electrode boiler systems have been delivered to major North Sea projects, supporting shore-powered platforms and reducing offshore emissions.

Complete turnkey skids are designed, manufactured and assembled in Norway. Solutions are engineered for demanding environments, including EX-certified outdoor installations on offshore platforms and FPSOs.

Trusted by companies all over the world.

Take a look at our references at parat.no

PARAT®

Our mission:

”To enable the global industry to utilize sustainable energy accelerating every sector’s capability to reach net zero emissions.”

ZERO EMISSION HEATING

POWERING THE INDUSTRY OF TOMORROW

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