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Manufacturing for Clean Heat in Scotland

Factsheet 1: Heat Generation

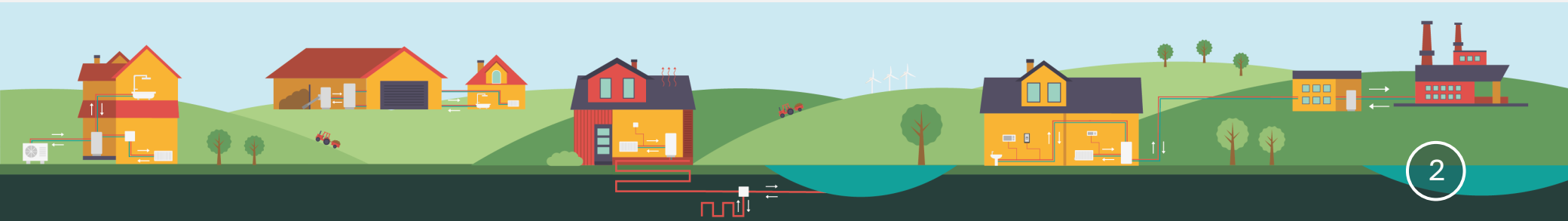
What is Clean Heat?

Clean heat refers to heat generation, distribution, and building energy efficiency technologies that provide heating and hot water with minimal environmental impact. Key technologies include heat pumps, heat networks, and direct electric systems, supported by measures to reduce heat demand and optimise usage through sensors, controls, and efficient design.

These factsheets aim to guide Scottish manufacturers to understand and enter the clean heat sector. Factsheet 1 focuses on key technologies used for Heat Generation.

Factsheet 1	Factsheet 2	Factsheet 3	Factsheet 4	Factsheet 5	Factsheet 6
Heat Generation	Heat Network Distribution	Heat in Properties	Technology Enablers	Building Energy Efficiency	Energy Centre Construction
• Industrial Heat Pumps • Domestic Heat Pumps • Electrode Boilers • Electric Boilers • Geothermal Drill Rigs	• Pipework • Circulation Pumps • Valves • Corrosion Control • Storage Buffers	• Radiators • Underfloor Heating • Infrared Panels • Hot Water Cylinders • Storage Heaters	• Control Panels • Thermostats • Sensors and Meters • Actuators • Design Apps	• Cladding • Insulation • Windows & Doors • Ventilation Systems • Offsite Manufacturing	• Large Thermal Store • Large Pumps • Structural Steel • Electrical Switchgear • Cabling

Clean heat presents significant market opportunities for Scotland, UK and internationally. Clean heat is essential for all buildings to meet Scotland's 2045 net-zero target. This will be achieved via Local Heat and Energy Efficiency Strategies regulations, and the proposed Heat in Buildings Act. Already from April 2024, all new buildings must include clean heat systems. Existing buildings will require energy efficiency upgrades and clean heat retrofits and urban areas will see new heat networks (Heat Networks Act 2021).



Clean heat generators offer benefits to decarbonising heat, making them an attractive option for both residential and industrial.

Key heat generators technologies include:

- Industrial and domestic heat pumps – pump, heat exchanger, compressor.
- Industrial Electrode Boilers – boiler, electrode heating element.
- Domestic Electric Boilers – boiler, electric heating element.
- Geothermal Drill Rig – drill bit, pipework.

Heat pump

What are heat generators

Clean heat generators are systems designed to produce heat with minimal environmental impact.

They utilise renewable or low-emission energy sources to provide heating for residential, commercial, or industrial applications.

Benefits of clean heat generators:

- Reduced Greenhouse Gas Emissions: Clean heat generators have a lower carbon footprint compared to traditional fossil fuel-based heating systems.
- Energy Efficiency: Many clean heat generators, like heat pumps are highly efficient.
- Renewable Energy Utilisation: The use of clean heat generators will tend to use renewable sources of energy which reduces dependency on fossil fuels.
- Improved Air Quality: Lower emissions of pollutants contribute to better air quality.
- Net Zero Targets: Clean heat generators are a crucial part of the transition to sustainable energy systems, helping to reduce environmental impact and promote energy efficiency.

Industrial heat pumps transfer heat from the ground, air, or water to provide heating and cooling for buildings or district networks.

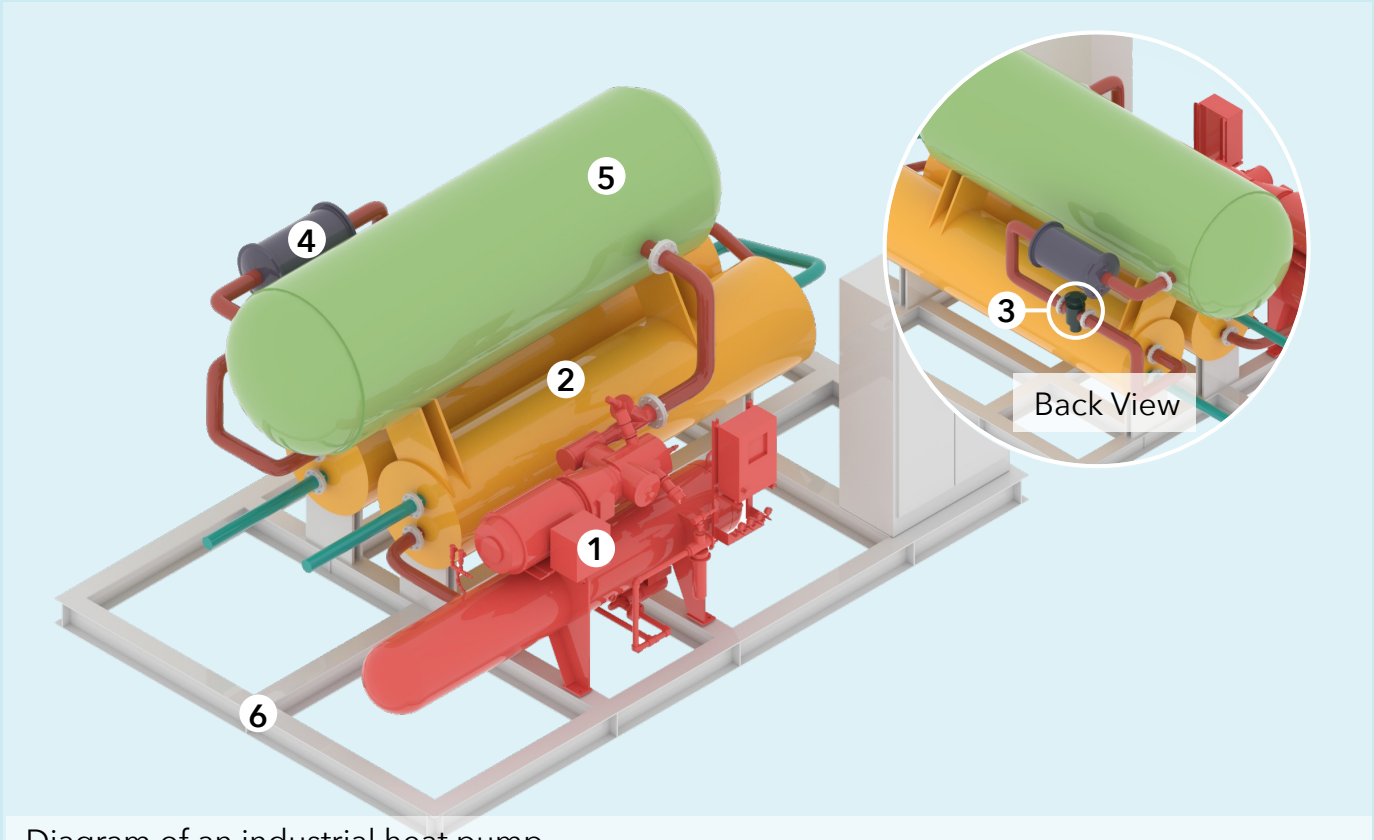


Diagram of an industrial heat pump

Key Bill of Materials

1. Compressor
2. Heat Exchanger
3. Expansion Valve
4. Filter / Drier
5. Evaporator
6. Skid

- Refrigerant Loop
- Water Services

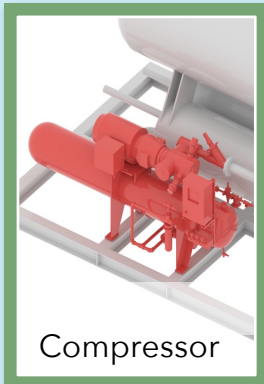
Key subcomponents of an industrial pump are the expansion valve, compressor and heat exchanger.


Heat exchanger

Heat Exchanger

Efficiently transfers the heat between two or more fluids without mixing them.

Subcomponents	Finned (fins, tubes), Shell (casing, tube plate, tubes, baffles), Plate (cover, plate, gasket, bolts)
Typical Weight	100 kg to several tonnes
Typical Dimensions	1 m up to 5 m
Standards	EN13445, PD 5500 and HEI Standards


Compressor

Compressor

Is a mechanical device that increases the pressure of a gas (refrigerant) by reducing its volume.

Subcomponents	Housing, impeller, piston, rotor, valves, bearings, motor
Typical Weight	tens of kg up to several tonnes
Typical Dimensions	dependent on system
Standards	ISO 8573, ISO 1217, EN 1012-1 & 1012-2


Expansion valve

Expansion Valve

Regulates the flow of refrigerant into the evaporator, reducing its pressure and temperature to optimise heat absorption and efficient operation.

Subcomponents	Valve body, diaphragm, sensing bulb, spring, valve seat and orifice
Typical Weight	0.5 kg to several kg
Typical Dimensions	10-20 cm (l), 5-10 cm (w), 5-15 cm (h)
Standards	ISO 5149, EN 378

Domestic heat pumps transfer heat from the ground, air, or water for heating and cooling for buildings using renewable energy.

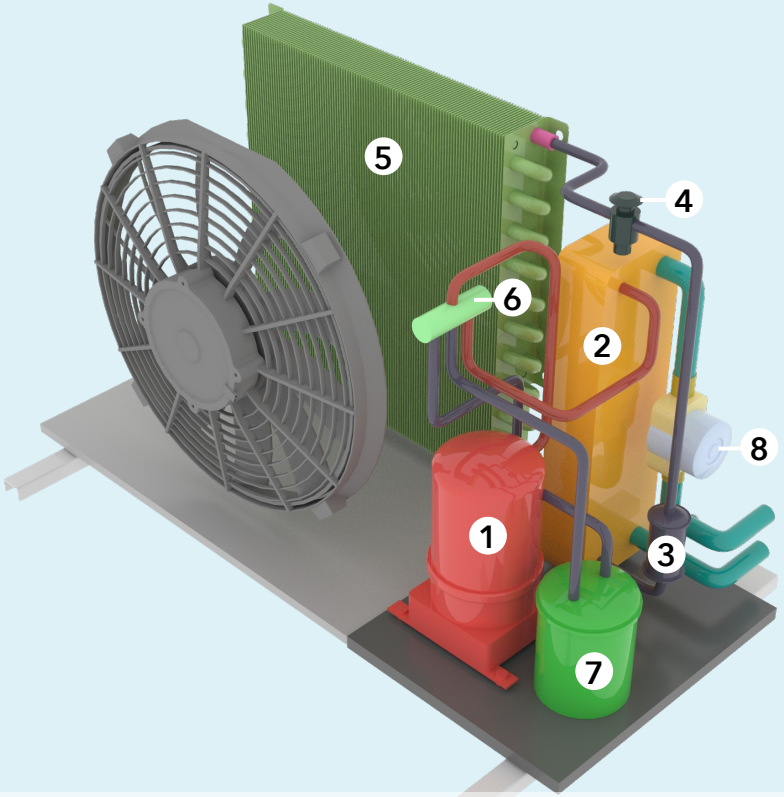
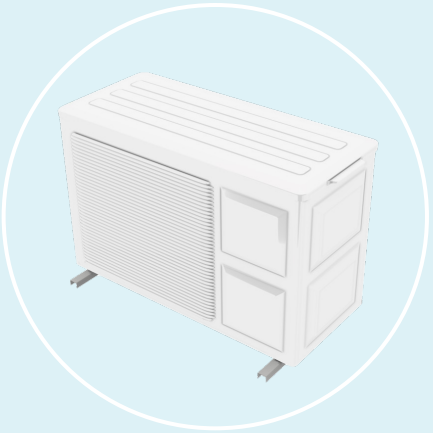


Diagram of a domestic heat pump



External View

Key Bill of Materials

1. Compressor
2. Heat Exchanger
3. Filter / Drier
4. Expansion Valve
5. Evaporator Coil
6. 4 Port – Reverser Valve
7. Accumulator
8. Circulation Pump

Refrigerant Loop

Water Services

Key subcomponents of a domestic heat pump are shown below.

Heat exchanger

Heat Exchanger

Allows efficient operation of the heat pump, transferring the heat between two or more fluids without mixing them.

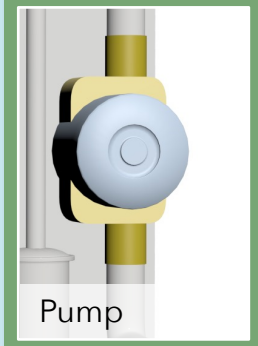
Subcomponents	Finned (fins, tubes), Shell (casing, tube plate, tubes, baffles) and Plate (cover, plate, gasket, bolts)
Typical Weight	5 kg to 25 kg
Typical Dimensions	15 cm to 30 cm (l), 20 cm to 50 cm (h)
Standards	EN13445, PD 5500 and HEI Standards

Compressor

Compressor

Is a mechanical device that increases the pressure of the refrigerant to enable the efficient heat transfer process.

Subcomponents	Housing, impeller, piston, rotor, valves, bearings, seals, motor
Typical Weight	5 kg to 25 kg
Typical Dimensions	20 cm to 50 cm (l), 15 cm to 30 cm (diam)
Standards	ISO 8573, ISO 1217, EN 1012-1, EN 1012-2



Pump

Pump

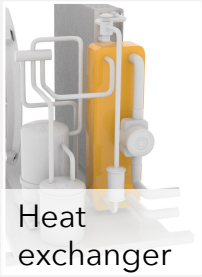
It is a key component and plays a crucial role in circulating the refrigerant through the heat pump system.

Subcomponents	Housing, impeller, shaft, bearings and electric motor
Typical Weight	5 kg to 25 kg
Typical Dimensions	20 cm to 50 cm (l), 15 cm to 30 cm (diam)
Standards	ISO 5199, ISO 9906, BS 5257

Manufacturing processes for the assembly of a heat pump and the fabrication of the major components that make up the product.

Component Manufacture → **Casing Manufacture** → **Subassembly** → **Final Assembly** → **Cleaning and Surface Treatment** → **Testing and Quality Control**

Heat Exchanger and Compressor: Manufacturing Process



Heat exchanger

Cutting and Shaping: Materials cut and shaped into components, *e.g.*, plates, tubes, and shells

Forming: Components formed into final shapes using bending, rolling, and stamping

Welding: Components brazed / soldered to form assemblies, such as tube bundles or plate packs

Assembly: Assembled into heat exchanger. Including gaskets, seals, and critical components, with washing / flushing

Testing: Quality checks determine if specifications and performance standards are met

Compressor

Casting: Casing and rotors are cast from metals such as stainless-steel cast iron or aluminum

Machining: After casting, components are machined to precise dimensions. To include drilling, milling

Forming: Components formed into final shapes using bending, rolling, and stamping

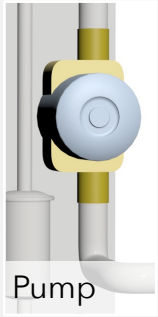
Assembly: Parts assembled into subassemblies, such as compressor / pump housing and rotor assembly

Testing: Tested under operating conditions to verify performance, efficiency, and reliability

Manufacturing processes for assembly of a heat pump and the fabrication of the major components that make up the product.

Component Manufacture	Casing Manufacture	Subassembly	Final Assembly	Cleaning and Surface Treatment	Testing and Quality Control

Pump and Expansion Valve: Manufacturing Process

	Component Manufacture	Casing Manufacture	Subassembly	Final Assembly	Cleaning and Surface Treatment	Testing and Quality Control
 Pump	**Casting:** Pump casing and impeller are cast from metals such as stainless steel or cast iron	**Machining:** After casting, components are machined to precise dimensions. To include drilling, milling	**Subassembly:** Machined parts are assembled into subassemblies, such as the pump housing and rotor assembly	**Assembly:** Subassemblies are put together to complete the pump. Includes installing seals, bearings, and other critical components		**Testing:** The assembled pump is tested under operational conditions to verify performance, efficiency, and reliability
 Expansion valve	**Casting:** The expansion valve body is created using casting or forging methods	**Machining:** Precision machining, *e.g.*, CNC, are used to create intricate valve parts, including the orifice, stem and seat	**Assembly:** This includes fitting the diaphragm, spring, and components that regulate the valves' operation	**Cleaning and Surface Treatment:** Valves are cleaned. Electroplating or passivation may be applied to enhance corrosion resistance		**Testing:** For leaks, pressure tolerance, and operation. Calibrati on so valve opens and closes at correct pressure and temperature

Main materials and characteristics used in industrial and domestic heat pump manufacturing.

	Component	Material	Dimensions*	Weight*	Standards
Pump	Pump Casing	Stainless Steel or Cast Iron	0.1 to 0.6 m (d), 0.15 to 1.5 m (l)	1 kg to 3 tonnes	ISO 5199, ANS/HI 9.6.1
	Impeller	Bronze or Stainless Steel	0.5 to 0.4 m (d), 0.05 to 0.3 m (l)	0.2 kg to 500 kg	ISO 9906
	Motor	Copper, Steel and Carbon	0.1 to 0.5 m (d), 0.15 to 1 m (l)	2 kg to 3 tonnes	IEC 60034
	Shaft	Carbon or Stainless Steel	0.1 m (d), 0.1 to 0.3 m (l)	0.1 kg to 500 kg	ISO 1940
Heat Exchanger	Shell	Stainless Steel or Cast Iron	0.01 to 1 m (d), 0.5 to 6 m (l)	5 kg to 3 tonnes	ASME Section VIII
	Tubes	Copper, Stainless Steel or Titanium	0.01 to 0.04 m (d), 0.5 to 6 m (l)	0.1 kg to 500 kg	ASTM B75, ASTM A213
	Tube Sheets	Carbon or Stainless Steel	0.01 to 1 m (d), 0.01 to 0.05 m (t)	2 kg to 3 tonnes	ASME Section VIII
Compressor	Casing	Stainless Steel or Cast Iron	0.15 to 0.08 m (d), 0.2 to 1.5 m (l)	5 kg to 3 tonnes	ASME Section VIII
	Impeller	Stainless Steel or Aluminium	0.05 m (d), 0.05 m (l)	0.5 kg to 500 kg	API 617
	Pistons	Aluminium or Cast iron	0.025 to 0.15 m (d), 0.05 m (l)	0.2 kg to 500 kg	API 618
	Rotors	Stainless Steel or Aluminium	0.05 m (d), 0.1 to 0.6 m (l)	1 kg to 500 kg	ISO 10440
Expansion Valve	Valve Body	Stainless Steel or Brass	0.01 to 0.15 m (d), 0.05 to 0.3 m (l)	0.2 kg to 2 kg	ISO 5149, EN 378
	Diaphragm	Rubber or Synthetics	0.025 to 0.15 m (d), 0.0025 to 0.005 m (t)	0.02 kg to 0.2 kg	ISO 5149, EN 378
	Orifice	Stainless Steel or Brass	0.0005 mm to 0.01 m (d), 0.005 m (l)	0.005 kg to 0.05 kg	ISO 5149, EN 378

*The dimensions and weights are approximate and can vary based on the specific requirements of the materials and the manufacturer's design standards.

Industrial Electrode Boilers offer high efficiency, reduced emissions, and enhanced safety, whilst minimising maintenance.

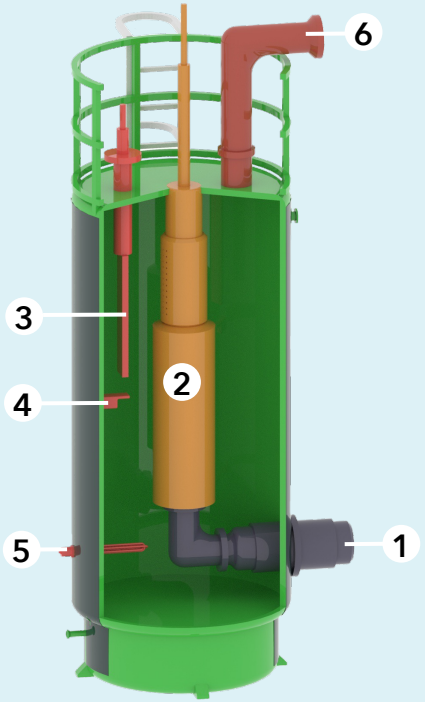
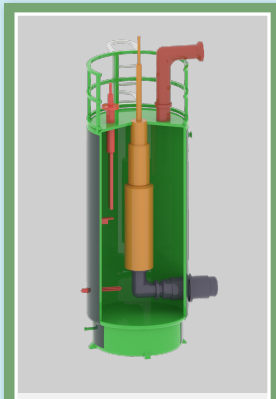


Diagram of an industrial electric boiler

Key Bill of Materials

1. Cold water feed & circulation pump
2. Control sleeve, jet column & control cylinder rod
3. Insulator & electrode
4. Counter electrode
5. Backup immersion heating element
6. Steam outlet

Key subcomponents of industrial electrode boilers are shown below.

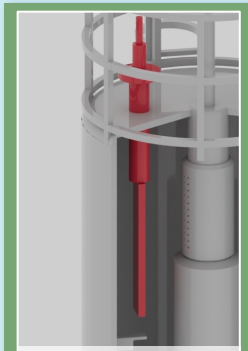


Boiler vessel

Boiler Vessel

The outer casing of the boiler system containing the water and steam. It can withstand the high pressures and temperatures generated within the vessel under operation.

Typical Weight	A few hundred kilograms to several tonnes
Typical Dimensions	0.5 m to 2 m (d), 1 m to 5 m (l)
Typical Capacity	Over 4 MW
Standards	ASME Section I for power boilers

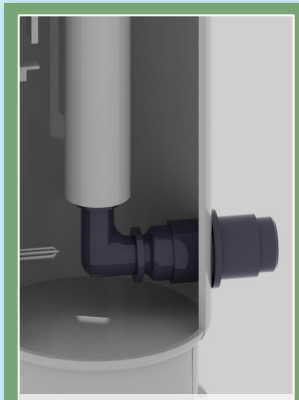


Heating element

Heating Element

Electrodes are solid steel plate with machined holes matching the holes in the bottom of the electrode box for smooth flow to avoid splashing.

Subcomponents	Sensors, control unit, user interface, power supply
Typical Weight	Varies widely, typically a few kilograms each.
Typical Dimensions	Generally small and lightweight
Standards	NEC Article 425



Boiler pump

Boiler Pump

Ensures the water circulates through the boiler and heating system.

Subcomponents	Casing, impeller, shaft, bearings
Typical Weight	20 kg to several hundred kg
Typical Dimensions	Dependent on system requirements
Standards	ISO 5199 for technical specifications for centrifugal pumps.

Domestic electric boilers offer high efficiency, reduced emissions, and enhanced safety, whilst minimising maintenance.

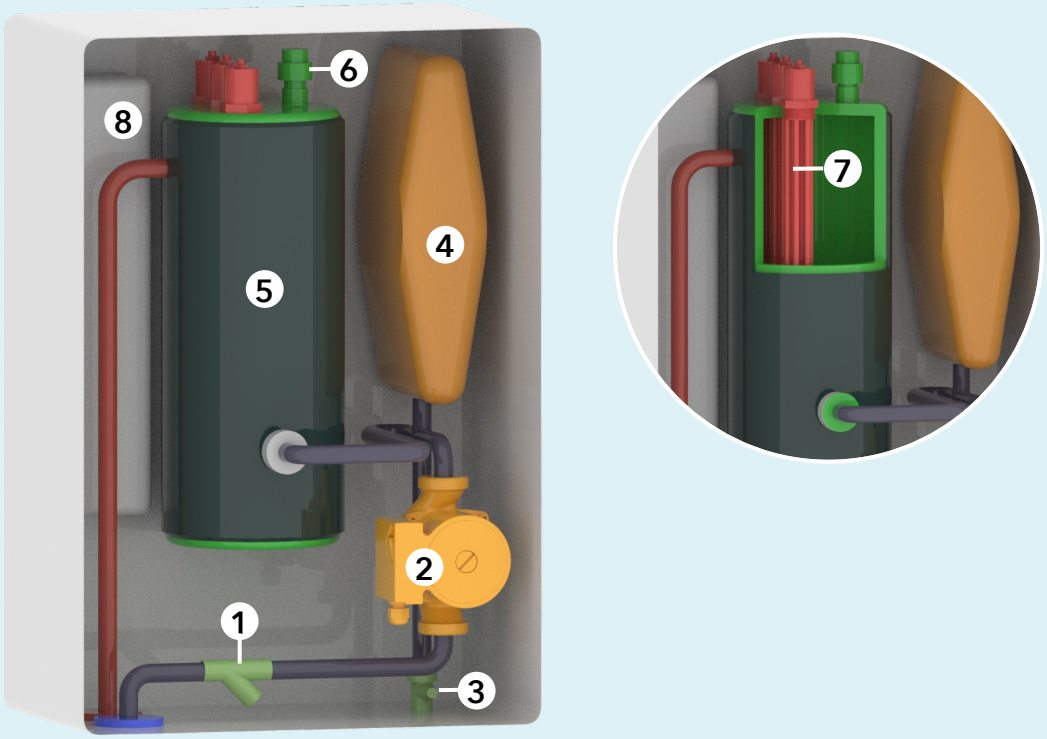


Diagram of a domestic electric boiler

Key Bill of Materials

1. Magnetic Filter
2. Circulation Pump
3. Pressure Relief Valve
4. Expansion Tank
5. Hot Water Cylinder with Insulation Jacket
6. Auto Air Vent
7. Electric Heating Element
8. Electronics and Controls

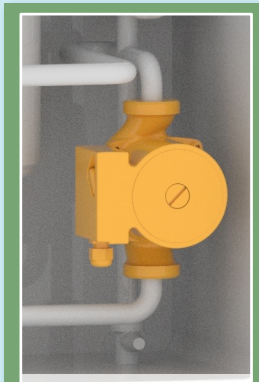
Key subcomponents of domestic electric boilers are shown below.

Heating element

Heating Element

Immersion heaters or electrode elements that convert electrical energy into heat.

Subcomponents	Metal sheath, resistance wire, insulation, safety sensor, thermostat
Typical Dimensions	Generally small and lightweight. Typically, a few kilograms each.
Standards	IEC 60335-2-73 safety of electric heating elements.



Pump

Pumps

The boiler circulating pump is rated for continuous duty at the boiler operating pressure and temperature. Centrifugal type pumps are widely used.

Subcomponents	Housing, impeller, shaft, bearings and electric motor
Typical Weight	2 kgs to 5 kgs.
Standards	BS EN 12828, BS EN 60335-2-51

Vessel

Vessel

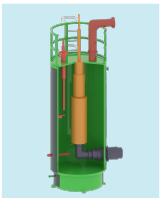
Closed expansion vessels with variable pressure to protect from excessive pressure.

Subcomponents	Expansion vessel, control system, safety devices
Typical Weight	25 kg to 60 kg
Typical Dimensions	0.5 m to 2 m (d), 1 m to 3 m (l)
Typical Capacity	Less than 45 kW
Standards	ASME Boiler and Pressure Vessel Code, BS EN 12828

The typical manufacturing processes for assembly of an industrial electrode boiler.

Component Manufacture → **Subassembly** → **Electrical Component Assembly** → **Testing and Quality Control** → **Finishing and Packaging**

Electrode Boiler and Heating Electrode: Manufacturing Process



Electrode boiler

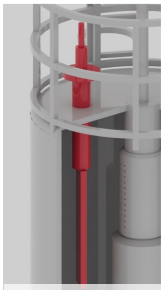
Cutting and Shaping: Raw materials are cut and shaped into the required components, such as casings

Forming: Components formed into final shapes using bending, rolling, and stamping

Assembly: Machined parts, such as the heating element assembly and control panel

Testing: Boiler is tested under operational conditions to verify performance, efficiency, and reliability

Finishing and Coating: Surface treatments such as painting or coating protect against corrosion and wear



Heating electrode

Material Selection: Conductive & insulating materials withstand high temperatures & corrosion, and prevent electrical leakage

Fabrication: Electrode is cut to shape and surface treatments such as polishing & coating enhance conductivity and resistance to corrosion

Assembly: Electrode is mounted into the boiler system and insulated to prevent electrical short circuits

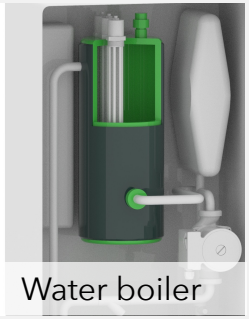
Quality Control & Testing: Tested for conductivity, thermal performance and structural integrity to ensure operational performance

Final Assembly and Integration: Integrated into boiler system, properly connected and aligned with other components

The typical manufacturing processes for the assembly of a domestic electric boiler.

Component Manufacture → **Subassembly** → **Electrical Component Assembly** → **Testing and Quality Control** → **Finishing and Packaging**

Water Boiler and Heating Element: Manufacturing Process



Water boiler

Cutting and Shaping: Raw materials are cut and shaped into the required components, such as casings

Forming: Components formed into final shapes using bending, rolling, and stamping

Assembly: Machined parts, such as the heating element assembly and control panel

Testing: Boiler is tested under operational conditions to verify performance, efficiency, and reliability

Finishing and Coating: Boilers undergo surface treatments such as painting or coating to protect against corrosion and wear

Heating element

Cutting and Shaping: Raw materials are cut and shaped into the required components, such as heating elements

Forming: The heating element wire wound into a coil shape. Ensures even heat distribution and efficient performance

Assembly: Element component obtained by insulating, sheathing, compaction, sealing and annealing

Testing: Element tested for electrical compliance: Electrical Resistance Insulation Resistance High Voltage

Finishing and Coating: Fittings/connectors to integrate into boiler system. To include mounting brackets or other hardware

Main materials and characteristics used in electric and electrode boiler manufacturing.

Component	Material	Dimensions	Weight	Standards
Boiler Shell	Stainless Steel, Carbon Steel	0.5 to 2 m	500 kg to several tonnes	ASME Section for Power Boilers
Electric / Electrode Heating Elements	Copper, Stainless Steel	0.5 to 2 m	Few kg to several hundred kg	IEC 60335-2-73 for safety of Electric Heating Elements
Circulation Pump	Stainless Steel, Cast Iron	0.5 m	20 kg to several hundred kg	ISO 5199 for technical specifications for Centrifugal Pump
Safety Valves	Stainless Steel, Brass	0.1 m	Few kg	ASME Section I for Safety Valves
Water Level Gauge	Glass, Stainless Steel	0.5 m	Few kg	ASME Section I for Water Level Indicators

***The dimensions and weights are approximate and can vary based on the specific requirements of the materials and the manufacturer's design standards.**

Drill rigs for geothermal clean heat systems enable access to deep, high-temperature geothermal reservoirs.

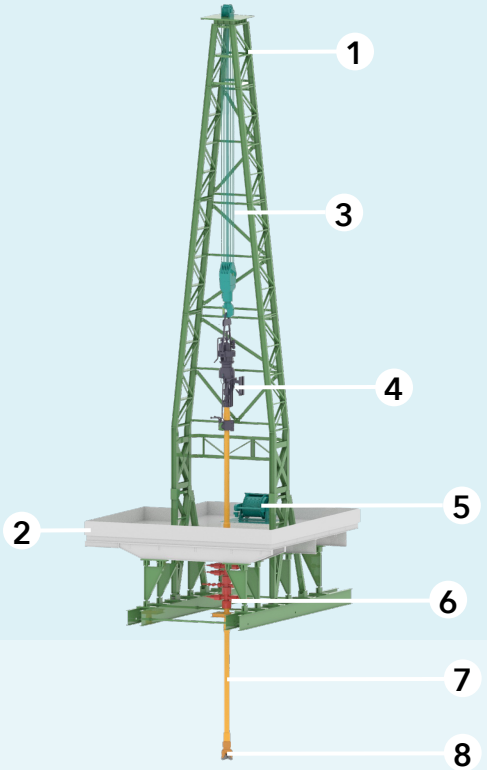


Diagram of a geothermal drill rig

Key Bill of Materials

1. Derrick steel framework
2. Rig floor
3. Pulley system
4. Top drive
5. Draw-works (hoist)
6. Blowout preventer
7. Drill string
8. Tool (drill bit)

Key subcomponents of a generic geothermal drill rig are shown below.

Drill bit

Drill Bit

A specialised tool designed to withstand the extreme conditions of up to 260 °C encountered.

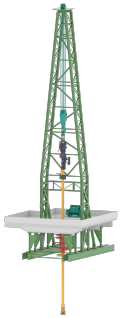
Subcomponents	Cutting elements, Body, Nozzles, Bearings, Gauge Protection, Shank, Flow Channels, Backreamers
Typical Weight	500 kg (small) to 10,000 kg (large)
Typical Dimensions	10 cm to 50 cm (d), 30 cm to 60 cm (l)
Standards	ISO 10424-1, ISO 9001

Drill pipe

Drill Pipes

They can withstand the harsh conditions encountered, such as high temperatures, high pressures, and abrasive rock formations.

Subcomponents	Drill pipe, Drill Collars, Tool Joints
Typical Weight	Between 20 kg/m (standard) up to 100 kg/m (heavy)
Typical Dimensions	9cm to 14cm (diam), 9.45 m (l)
Standards	ISO 11961



Geotherma l drill rig

Additional Subcomponents

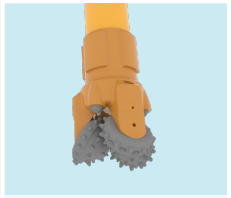
A geothermal drill rig includes several other key components that are essential for efficient and safe drilling operations.

Subcomponents	Derrick, Mud Pumps, Blowout Preventer, Rotary Table, Drawworks, Drilling Fluid System, Casing Equipment, Instrumentation, Power Generation, Well Controls

Typical manufacturing processes for the assembly of a geothermal drill rig.

Component Manufacture → **Major Component Assembly** → **Systems Integration** → **Quality Control and Testing** → **Final Assembly and Inspection** → **Packaging and Shipping**

Drill Rig and Drill Pipes: Manufacturing Process



Drill bit

Cutting and Shaping: Materials cut and shaped into components, such as drill bits using CNC machining

Forming: Components formed using CNC machining and heat treatment using carbide tool bits

Assembly: To form complete drill rig. Includes installing hydraulic systems, control panels, and other critical components

Test: Drill rig tested under operational conditions to verify its performance, efficiency, and reliability

Drill pipe

Cutting and Shaping: Materials cut and shaped into components, such as drill pipes

Forming: Components formed into final shapes using bending, rolling, and stamping

Assembly: To form complete drill rig. Includes installing hydraulic systems, control panels, and other critical components

Test: Drill rig tested under operational conditions to verify its performance, efficiency, and reliability

Main materials and characteristics used in geothermal drill rig manufacturing.

Component	Material	Dimensions	Weight	Standards
Drill Bit	Diamond, Tungsten Carbide, High Strength Steel	21 cm to 45 cm	100 kg to 300 kg	API Spec 7-1, API RP 7G, ISO 10424-1, ISO 9001, ASTM Standards
Drill Pipe (String)	High Strength Steel Alloys	90 cm to 130 cm (w), 9.45 m (l)	20 kg/m to 38 kg/m	API Spec 5DP, API Spec 7-1, ISO 11961, ISO 104-1, ASTM A106/A106M
Derrick	Structural Steel	30 m to 45 m (h), 10 m x 10 m (footprint)	-	API Spec 4F, API RP 4G, ISO 13626, ISO 9001, ASTM Standards
Blowout Preventer	High Strength Steel Alloys, Elastomers	18 cm to 50 cm (bore)	10 tonnes to 20 tones	API Standard 53, API Spec 16A, API Spec 16C, API 16D, ISO 13533, ISO 9001
Rotary Table	High Strength Steel	49 cm to 76 cm (central opening)	-	API Spec 7K, API RP 7L, ISO 14693, ISO 9001, ASTM Standards
Drawworks	High Strength Steel	3 m to 4.5 m (l), 2.4 m to 3 m (w), 24 m to 35 m (h)	9 tonnes to 23 tonnes	API Spec 7K, API RP 500, ISO 13535, ISO 10423, ASME B30.7
Casing Equipment	High Strength Steel, Corrosion Resistant Alloys	50 cm to 250 cm (d)	60 kg/m to 110 kg/m	API Spec 5CT, API RP5C1/5C5, ISO 11960, ISO 10400, ASME B31.3 & 8

*The dimensions and weights are approximate and can vary based on the specific requirements of the materials and the manufacturer's design standards.

Summary of the key processes and equipment required for manufacturing heat pump components.

Process	Equipment/Facilities	Expansion Valve	Pump	Heat Exchanger	Compressor
Casting, Milling, Drilling	Furnaces, CNC Machining, Drilling Machines	X	X		X
Tube/Metal Forming, Bending	CNC Tube Benders, Roll Bending Machines, Stamping Presses			X	X
Welding, Brazing, Soldering	Welding Machines, Cutting Torches, Fabrication Tools		X	X	X
Hardening, Tempering, Annealing	Furnaces, Quenching / Induction / Tempering Equipment		X	X	X
Painting, Powder Coating, Plating	Spray Booths, Curing Ovens, Electroplating Equipment	X	X	X	X
Assembly Line	Conveyors, Robotic Systems, Assembly Machines	X	X	X	X
Clean Room	Air Filtration, Ventilation, Environmental Control Systems	X		X	X
Refrigerant Fill	Pumps, Refrigerant Filling Stations, Leak Detectors			X	X
Final Test and Quality Control	Vision Inspection, EOL testing	X	X	X	X

Summary of the key processes and equipment required for manufacturing electric and electrode boilers.

Process	Equipment/Facilities	Electric Boiler	Electrode Boiler
Tube / Metal Forming and Bending	CNC Tube Benders, Roll Bending Machines, Stamping Presses	X	X
Welding, Brazing and Soldering	Welding Machines, Cutting Torches, and Fabrication Tools, Furnace	X	X
Heat Treatment	Furnaces, Quenching Equipment, Induction Hardening Machines, Tempering Furnaces	X	X
Painting including Powder Coating and Plating	Spray Booths, Powder Spray Guns, Powder Feed System, Curing Ovens, Mixing and Dispensing Systems	X	X
Assembly Line	Conveyors, Robotic Systems, Assembly Machines	X	X
Clean Room	Air Filtration and Ventilation Systems, Environmental Control Systems, Monitoring and Testing Equipment	X	X
Final Test and Quality Control	Vision Inspection, EOL Testing	X	X

Summary of the key processes and equipment required for manufacturing geothermal drill rigs.

Process	Equipment/Facilities	Geothermal Drill Rig
Tooling	CNC machining, Heat Treatment Equipment	X
Tube / Metal Forming & Bending	CNC Tube Benders, Roll Bending Machines, Stamping Presses	X
Welding, Brazing and Soldering	Welding Machines, Cutting Torches, and Fabrication Tools, furnace	X
Heat Treatment	Furnaces, Quenching Equipment, Induction Hardening Machines, Tempering Furnaces	X
Assembly Line	Conveyors, Robotic Systems, Assembly Machines	X
Material Handling	Lifting Equipment (Light Duty-Max 1T)	X
Final Test and Quality Control	Vision Inspection, EOL Testing	X

Market size and growth.

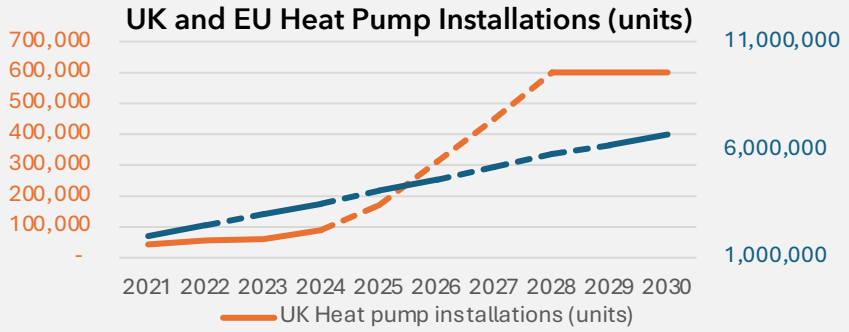
Heat Pumps (domestic)

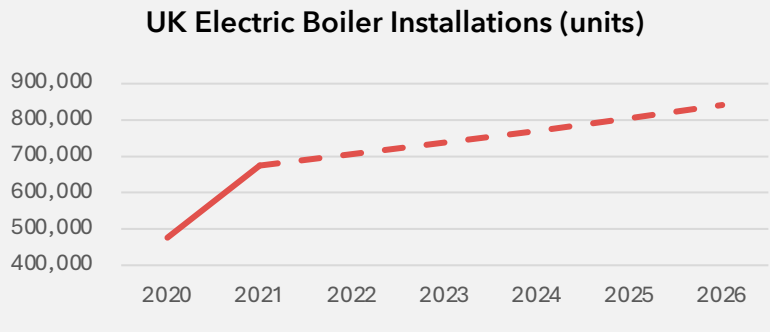
The UK heat pump market is growing rapidly, driven by government initiatives and increasing demand for energy-efficient solutions.

- Market Size: UK heat pump market is expected to have an annual growth rate (CAGR) of 11.1% from 2024 to 2029.
- Annual Deployment Rate: The UK government aims to increase the number of heat pump installations to 600,000 units per year by 2028.
- Current Deployment: UK had 60,000 heat pumps installed in 2024 (43% increase), Scotland had 7,600, up 18%.

Electric Boilers

- The Scottish Enterprise report on Market Opportunities for Scottish Direct Electric Heat Manufacturing highlights opportunities in the electric heat market.
- The UK heating equipment market, which includes electric boilers, is expected to grow at a CAGR of 4.7% from 2022 to 2027, with the UK residential boiler market projected to grow at a CAGR of 6.8% from 2023 to 2033.





Support available and competitor analysis.

Scotland

Scottish Local Authorities have a Local Heat and Energy Efficiency Strategy (LHEES) and LHEES Officers with a local view clean heat system plans.

- The Heat Network Fund provides capital funding to support development of low or zero emission district heat networks.
- Home Energy Scotland administer grants and loans for domestic properties, including a grant for installing heat pumps.
- Business Energy Scotland administer grants and loans for commercial properties, including the SME Loan Fund.

UK

From April 2025, the Clean Heat Market Mechanism (CHMM) is designed to increase the number of domestic heat pumps being deployed.

England and Wales

- The Boiler Upgrade Scheme provides a grant for householders to install a heat pump.
- The Heat Network Investment Project (HNIP) provides funds supporting deployment of heat networks, which can include geothermal projects.
- Heat Pump Investment Accelerator Competition: Up to £30 million for private sector investment in heat pump and component manufacturing.

Competitor Analysis

Heat Pumps

- The EHPA publishes a map of heat pump manufacturing facilities across Europe.
- In Scotland manufacturers include Star Renewables (industrial), Mitsubishi Electric and Likido.

Electric and Electrode Boilers

- Manufacturers are Cochran (industrial) / Thermaflow (Scotland), Worcester Bosch / Baxi (England) and Vaillant (Germany)

Geothermal Rigs

- Manufacturers are located outside the UK in USA and Europe including Geoprobe Systems, Diedrich Drill Inc, and HARDAB.
- OSSO are a Scottish company that has diversified from oil and gas into geothermal.

Scottish Enterprise can support you to explore growth in clean heat.

Clean Heat Market Opportunities

Clean heat will play a crucial role in meeting Scotland's net zero targets. There is a huge growth potential for Scottish businesses too.

- For general enquiries, and to access our Clean Heat team, please contact us
- For specialist advice on manufacturing and productivity, contact the Scottish Manufacturing Advisory Service (SMAS)
- For information on domestic and international markets contact our Market Research service
- If you are based in the Highlands and Islands, or the south of Scotland, please contact Highlands and Islands Enterprise or South of Scotland Enterprise respectively.

Newsletter

Please complete this subscription form if you would like to receive an occasional newsletter from Scottish Enterprise on market opportunities relating to clean heat.

Subscribe here

Further Reading

- Market Opportunities for Scottish Direct Electric Heat Manufacturing (2023)
- Economic Value of Clean Heat in Scotland (2024)
- Heat Pump and Heating System Components Analysis (2023)
- Heat Pumps and Heat Networks Assemblies and Key Component Analysis (2022)

External Support Services in Scotland

- National Manufacturing Institute Scotland (NMIS) world-leading manufacturing facilities for collaborative R&D projects
- Built Environment - Smarter Transformation (BE-ST) innovation and expertise for projects / materials for the built environment
- The Smart Direct Electric Heat Forum, administered by SELECT, is a new forum for manufacturers of direct electric heat solutions.