

Best Available Techniques Assessment

Purpose: This Best Available Techniques (BAT) Assessment supports an Environmental Permit application to vary the bespoke installation permit, to reflect the addition of two new emission points to air; a stack from an abatement plant for a new bromination process and the addition of a second steam generator.

Operator: Purolite Ltd.

Site: Purolite Ltd. Unit C, Llantrisant Business Park, Llantrisant, Rhondda Cynon Taff, CF72 8LF

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1 Introduction

This document comprising a Best Available Techniques (BAT) Assessment, has been prepared by Shann Pitts Consulting Limited on behalf of Purolite Limited. This revised BAT Assessment supports an application to vary the bespoke installation environmental permit (permit reference EPR/AB3894ZF), which regulates the organic chemical manufacturing plant, namely the manufacture of agarose-based resin for pharmaceutical use, at Unit C, Llantrisant Business Park, Llantrisant, Rhondda Cynon Taff, CF72 8LF herein termed 'the Site' operated by Purolite Limited, herein termed 'the Operator'.

The variation application which this BAT Assessment supports is for the addition of two new emission points to air; a stack from an abatement plant for a new bromination process and the addition of a second natural gas steam generator. There are some operational changes since permit issue with respect to waste stream segregation and management.

This document discusses the changes to the operation in relation to published BAT detailed within the following document:

- How to comply with your environmental permit. Additional guidance for: Speciality Organic Chemicals Sector (EPR 4.02), Natural Resources Wales, September 2014 (herein referred to as the 'Organic Chemicals Sector BAT')¹

Any areas of indicative BAT which are not affected by the proposed changes are marked as not applicable.

A full BAT Assessment was submitted as a supporting document to the original permit application in 2017.²

The 'indicative BAT' references throughout this document, outlined in a black border, are taken directly from the Organic Chemical Sector BAT, to make it easy for the reader to assess how each BAT has been addressed. The standards within the Organic Chemicals Sector BAT document are derived primarily from the current IPPC BREF document (Integrated Pollution Prevention and Control Reference Document on the Best Available Techniques for the manufacture of Organic Fine Chemicals, European Commission, August 2006).

This BAT assessment applies to the production of organic chemicals by the Operator, who is regulated under the Environmental Permitting (England and Wales) Regulations 2016 under Schedule 1, Part 2, Section 4.1 Organic Chemicals, Part A(1). It also applies to any directly associated activities, which have a direct technical connection to the main activities and could also impact emission and pollution levels.

¹ <https://naturalresources.wales/media/2105/how-to-comply-with-your-environmental-permit-additional-guidance-for-speciality-organic-chemicals.pdf> Accessed 26th April 2022

² SPC0055/ME17.11.23/BAT Assessment/Purolite/December 17

2 Managing Activities

2.1 Environmental performance indicators

Indicative BAT.

You should where appropriate:

1. Monitor and benchmark your environmental performance, and review this at least once a year. Your plans for minimising environmental impacts should be incorporated into on-going Improvement Programmes. Indicators can be derived using the Horizontal Guidance Note H1 Environmental Risk Assessment (see GTBR Annex 1). It is suggested that indicators are based on tonnes of organics produced (tOP) as they provide a good basis for measuring performance within an installation or a single company year on year.

The Operator has in place an Environmental Management System (EMS) certified to ISO 14001:2015, which has been updated to incorporate the new bromination and cross-linking processes, the [REDACTED] abatement plant and the second proposed natural gas fired steam generator. Changes to the EMS are summarised in a 'Summary of Changes to EMS' document which supports the permit variation application.³

2.2 Accident management

The site-specific Emergency Plan has been updated to incorporate the safe handling of [REDACTED] the bromination and cross-linking processes, the [REDACTED] abatement plant and the second steam generator.

2.3 Energy efficiency

Indicative BAT

You should where appropriate:

1. Assess the environmental impact of each process and choose the one with the lowest environmental impact. (We recognise that your choice may be constrained, for example, by the integration of processes on a complex site).

The Operator has designed the new bromination and cross-linking processes to be as energy efficient as possible. The additional steam and electricity requirement has been calculated and there is no significant increase in energy requirements. The bromination process is carried out at ambient temperature and the cross-linking process at 35 degrees Celsius.

³ Summary of Changes to EMS - Variation to Permit - 30-11-2021

A new steam generator is required to ensure sufficient steam supply for all of the processes on site and to allow there to be contingency steam generation capacity. An additional steam generator of the same specification to the existing is being purchased.

The CERTUSS steam generator selected is sized appropriately to accommodate the usage and ranges of operation. It is a rapid steam-raising generator, which is highly efficient on water and energy use due to its triple outer casing construction and patented air circulation and pre-heated combustion feature, delivering a minimum thermal efficiency above 93%. The steam generator specification is included in Appendix A.

Steam generated on-site is piped to various points of use. Processes that use steam are equipped with Temperature Control Units (TCU) for more accurate and efficient process control. Heat loss to the surrounding area is minimised by keeping the steam generator and temperature control unit (TCU) in close proximity to the plant area.

All heat exchangers are sized correctly for their required duty. All pipework and vessels that are at elevated temperatures are insulated. The process follows a highly controlled recipe, with temperature being a key control parameter, which means prevention of heat loss is integral to plant design.

In order to ensure the on-going maximum efficiency of the steam generators, heat exchangers, heat transfer pipework, and insulation materials, a full preventative inspection and maintenance programme is in place in line with the technology provider's recommendations.

Opportunities for energy recovery are limited due to the batch nature of the processes and because processes that produce recoverable heat (including pumps) are not used extensively across the site. This means that heat is produced intermittently, making energy recovery problematic. The multiple air-handling system does recover heat from warm rooms (such as the quality assurance laboratory and control room).

2.4 Efficient use of raw materials and water

2.4.1 Efficient use of raw materials

The additional raw materials that are required due to the process changes are [REDACTED] and sodium formate.

Whilst there are health and safety implications with the use of [REDACTED] there are no alternatives that can be used to replace the function of the bromination process. The [REDACTED] is sourced from the Dead Sea, which is the only available source.

Sodium formate is sourced from Ireland. The supplier choice for the sodium formate was based on the provision of the chemical in a liquid form which is easier and safer to use.

A Supplier Risk Assessment (QAF-2) is carried out for all new suppliers and incorporates country of origin.

All raw materials are used in accordance with a recipe that has been refined through extensive trials and operation of pilot plant to ensure that no more than the required quantity of raw material is used.

2.4.2 Efficient use of water

Water use for the rinsing of process vessels between batches is controlled through the Supervisory Control and Data Acquisition (SCADA) system therefore water use is optimally controlled. Spray balls are used in the cleaning process that reduce water use by up to 80%. Water used as rinse water cannot be reused due to purity issues.

2.4.3 Water cooling

Indicative BAT

You should where appropriate:

1. Maximise heat transfer between process streams where water is needed for cooling. Use a recirculating system with indirect heat exchangers and a cooling tower in preference to a once-through cooling system.
2. Where water is used in direct contact with process materials, recirculate the water after stripping out the absorbed substances.

This is not applicable to the proposed changes.

2.5 Avoidance, recovery and disposal of wastes

Indicative BAT for waste recovery

You should where appropriate:

1. Demonstrate that the chosen routes for recovery or disposal represent the best environmental option. Consider avenues for recycling back into the process or reworking for another process wherever possible.
2. Provide a detailed assessment identifying the best environmental options for waste disposal where you cannot avoid disposing of waste.

2.5.1 Overview

There have been some changes to waste stream management since the original permit application and supporting BAT Assessment² which are highlighted in this section and discussed in comparison to Indicative BAT.

2.5.2 Waste reduction

Wastes cannot be treated or recycled back into the process on-site due to the complex nature of the treatment processes required and the high purity of raw materials needed in production.

2.5.3 Waste segregation

Waste Stream 'B' is now produced to handle aqueous waste with a high organic content and up to 20% ethanol. There was a previous Waste Stream B which was removed due to process efficiencies.

It is optimal to segregate Waste stream B from Waste Stream A due to the high water content in Waste Stream B that might limit the capability for solvent recovery from Waste Stream A.

It is optimal to segregate Waste Stream B from Waste Stream E due to the IMS content in Waste Stream B which would make the recovery of Waste Stream E more difficult.

Appendix B is the revised Agarose Manufacturing Waste Stream Schematic.

2.5.4 Waste recovery / disposal

Waste Stream B has a relatively low calorific value (approximately 2Mj/kg) which makes it unsuitable for recovery. Therefore it has to go for disposal. The Operator will continue to fully characterise all of the waste streams and use these data to consider options higher in the waste hierarchy calling upon the expertise of their contracted specialist waste contractors Tradebe. Each load is tested for calorific value, pH, halogens and compatibility with tank contents prior to offloading for disposal.

2.5.5 Waste storage and handling

A new gravity collection pot is installed for Waste Stream B, but unlike the other existing waste streams, this transfers directly to a new external bulk holding tank rather than via an internal buffer tank.

The bulk holding tank (25,000 litres) is located within the existing tank farm which is located outside of the main processing facility. The bulk holding tank will be connected to the existing tanker bay station for discharging waste to road tanker.

Table 1 below details the waste streams (all liquid) produced across the site processes including the process changes.

Table 1: Waste Inventory

In-house waste stream identification term	Description	European Waste Code (EWC)	Code Description	Entry Type	Form	Approx. annual tonnage (based on 2021 data)	Application of Waste Hierarchy Principles	Recovery or Disposal code
Waste stream A (ETA)	██████ and ██████	07 01 04	other organic solvents, washing liquids and mother liquids	Absolute hazardous	Liquid	████	This waste is sent for recovery via physiochemical treatment (via distillation). In this instance it is sold on by the waste contractor for use at other sites.	R02
Waste stream B (ETB)	Water and █████ from washing	07 07 04	other organic solvents, washing liquids and mother liquids	Absolute hazardous	Liquid	████	This waste stream is unsuitable for recovery via incineration as the calorific value is too low (approximately 2Mj/kg) when the threshold for the recovery process is >21Mj/kg. Disposal via incineration is currently the best available option for this waste stream.	D10
Waste stream C	Cross linking process liquid	16 05 07	discarded inorganic chemicals consisting of or containing dangerous substances	Mirror hazardous	Liquid	████	Recovery via incineration is not possible due its low calorific value and the fact that the waste is in IBCs and not a bulk waste stream. Effluent is disposed via incineration which is currently the best available option for this waste stream.	D10

In-house waste stream identification term	Description	European Waste Code (EWC)	Code Description	Entry Type	Form	Approx. annual tonnage (based on 2021 data)	Application of Waste Hierarchy Principles	Recovery or Disposal code
Waste stream D (ETD)	████████ ████████ ████████ ████████ waste	16 01 10	aqueous liquid wastes containing dangerous substances	Mirror hazardous	Liquid	██	Recovery is feasible	R05
Waste stream E (ETE)	High COD water waste	16 10 02	aqueous liquid waste other than that mentioned in 16 10 01	Mirror non-hazardous	Liquid	████	Recovery is feasible	R05
Waste stream F (ETF)	████ █████ ████ waste	07 07 04	other organic solvents, washing liquids and mother liquids	Absolute hazardous	Liquid	██	Recovery is feasible; solvents are reclaimed.	R03
Crash tank	Crash tank contents	16 10 01	aqueous liquid wastes containing dangerous substances	Mirror hazardous	Liquid	████	Recovery is feasible.	R13
Municipal sewer	Water with fine agarose	Not applicable - to sewer under Trade Effluent Consent	Not applicable	Not applicable	Liquid	████	Not applicable	Not applicable

3 Operations

3.1 Design of a new process

Indicative BAT

You should where appropriate:

1. Consider all potential environmental impacts from the outset in any new project for manufacturing chemicals.
2. Undertake the appropriate stages of a formal HAZOP study as the project progresses through the process design and plant design phases. The HAZOP studies should consider amongst other things the points noted above (*note: these 'points' have been covered by the ensuing section*)

The new processes of bromination and cross linking have been assessed in terms of the environmental aspects and impacts and a HAZOP for the modifications has been undertaken⁴, which incorporates the following points:

- Identification and characterisation. All potential releases as a result of the process changes have been identified and fully characterised in the Air Quality Assessment⁵ and there is a revised Emissions Management Plan in place to continue to control and monitor these emissions.⁶
- Segregation of all releases. The emissions to air from the [REDACTED] abatement plant are routed via a separate stack with a monitoring port. The segregation of waste streams in order to optimise recovery over disposal is described in Section 2.5.3 above.
- Treatment of waste streams at source. It is not feasible to treat waste streams at source however, they are segregated in accordance with their properties in order to optimise the potential for waste recovery operations off-site.
- Containment of spills. The containment of spillages from raw material storage, transfer and production processes have been fully considered within the HAZOP. Procedures and risk assessment have been updated in line with the process changes.
- Fugitive emissions:
 - There is a software interlock on new reactor vessel (RE09) to prevent overfilling.
 - All powder hoppers have lids.
 - [REDACTED] is fully contained. There are two [REDACTED] detectors in the [REDACTED] water make up area and one in the production area which are linked to the control panel in control room.
 - The sodium formate used in the [REDACTED] abatement plant is heated to reduce risk of crystallisation of sodium formate.
- Provision for effluent flow equalisation and for emergency discharges. There is no effluent treatment on-site. Effluent will be discharged to the sewer via a Trade Effluent consent, or if

⁴ Purolite Agarose Manufacturing Plant - Modifications HAZOP, SEP Consultants, 10005, June 2020

⁵ Earthcare Technical Ltd. (May 2022) Air Quality Assessment. Application to vary the Bespoke Installation Permit (Doc Ref: ETL663/AQA/V1.0/Purolite/May 2022)

⁶ SPC005/Variation/Emissions Management Plan/V2/May 2022

outside of the Trade Effluent consent composition conditions it will be stored on site pending recovery or disposal.

- Emergency effluent storage. The crash tank and bund are sized appropriately to contain catastrophic spillages and foam used to suppress any fire.
- Abatement system reliability:
 - The [REDACTED] abatement plant stack fan is subject to a planned preventative inspection and maintenance programme. In the case of the fan breaking down, the system will go into 'hold' mode and the vent line would close. There is provision to add in a stand-by pump to be installed when frequency of bromination is higher.
 - The sodium formate recirculation pump is subject to a planned preventative inspection and maintenance programme. In the case of the pump breaking down, the system will go into 'hold' mode and the vent line would close. Spare parts are stored on site.

3.2 Storage and handling of raw materials, products and wastes

Indicative BAT

You should where appropriate:

1. Store reactive chemicals in such a way that they remain stable, such as under a steady gas stream, for example. If chemical additions are necessary then tests should be carried out to ensure the required chemical composition is maintained. Inhibitors may also be added to prevent reactions.
2. Vent storage tanks to a safe location.
3. Use measures to reduce the risk of contamination from large storage tanks. In addition to sealed bunds, use double-walled tanks and leak detection channels.
4. Use HAZOP studies to identify risks to the environment for all operations involving the storage and handling of chemicals and wastes. Where the risks are identified as significant, plans and timetables for improvements should be in place.

[REDACTED] is a reactive element which is stored in specialist lead lined drum within a water filled bund in accordance with best practice. Procedures in place to ensure [REDACTED] drum remains closed at all times (except for short window where used). This ensures that all bromine on site is fully contained. The pipework for [REDACTED] water is PTFE or PVDF which are non-reactive to [REDACTED]

Sodium formate is stored in liquid form (30% solution in water) in IBCs within bunds within an area which drains to the crash tank. There are no special storage requirements. The sodium formate solution used in the [REDACTED] abatement plant is heated to prevent crystal formation which would impair pumping.

A HAZOP has been carried out with respect to the process changes⁴ which assessed risks arising from all of the new processes including the storage and use of [REDACTED] and the handling of Waste Stream B.

Table 2 below details the raw materials used across the site processes, incorporating the process changes.

Table 2: Raw material description, tonnages and storage locations

Raw materials	Description of raw material and composition	Maximum quantity on site at any one time (tonnes)	Location stored on-site	Annual throughput (tonnes per year)	Description of how raw material is used
BULK LIQUIDS					
██████	-	15	Tank Farm	██████	Emulsification component
██████ ██████ ██████	██████ ██████	35	Tank Farm	██████	Solvent for washing resin
LIQUIDS					
██████ ██████	-	2.4	Flammable Store	██████	Crosslinking reagent
██████ ██████	██████ ██████	6.3	Flammable Store	██████	Storage for final product/intermediate
██████	-	15	Tank Farm	██████	Activation reagent
██████	██████	2.27	Warehouse	██████	Neutralisation reagent
██████ ██████	██████	5	Warehouse	██████	Activation reagent
██████ ██████ ██████	-	15	Tank Farm	██████	Activation reagent
██████	Concentrated solution	12.3	Warehouse	██████	Washing solution
██████	Elemental ██████	0.2	██████ store – metal drum	██████	██████ process
Sodium formate	Solution in water (30%)	2	██████ store	██████	Reduction of ██████
DRY POWDER					
██████ ██████	Granular solid	0.05	Dispensary	██████	Bleaching agent
██████	Powder	0.5	Warehouse	██████	Resin starting polymer
██████ ██████	Powder	0.71	Warehouse	██████	Viscosity modifier
██████ ██████	Powder	1.9	Warehouse	██████	Activation reagent
██████ ██████	Powder	10.88	Warehouse	██████	Activation reagent
██████ ██████	Powder	0.2	Warehouse	██████	Buffering agent
FINISHED GOODS					
FINISHED PRODUCT (20% Ethanol)	Solid resin beads in water (20% ethanol from total volume)	15	Flammable (finished) store	██████	This storage solution is provided to prevent microbial growth.

3.3 Plant systems and equipment

Indicative BAT

You should where appropriate:

1. Formally consider potential emissions from plant systems and equipment and have plans and timetables for improvements, where the potential for substance or noise pollution from plant systems and equipment has been identified.
2. Carry out a systematic HAZOP study for all relief systems, to identify and quantify significant risks to the environment from the technique chosen.
3. Choose vacuum systems that are designed for the load and keep them well maintained. Install sufficient instrumentation to detect reduced performance and to warn that remedial action should be taken.

A systematic HAZOP study on all plant systems and equipment, including valve performance, vessel and piping selection has been conducted to identify potential health and safety and environmental impacts. Through appropriate design, in addition to the operation being under an accredited Environmental Management System incorporating a planned preventative maintenance programme, fugitive emissions are minimised across the plant.

There are no changes to vacuum systems as a result of the process changes.

3.4 Over-pressure protection systems

Indicative BAT

You should where appropriate:

1. Carry out a systematic HAZOP study for all relief systems, to identify and quantify significant risks to the environment from the technique chosen.
2. Identify procedures to protect against overpressure of equipment. This requires the identification of all conceivable over-pressure situations, calculation of relief rates, selection of relief method, design of the vent system, discharge and disposal considerations, and dispersion calculations. In some cases careful design can provide intrinsic protection against all conceivable over-pressure scenarios, so relief systems and their consequential emissions can be avoided.
3. Maintain in a state of readiness all equipment installed in the venting system even though the system is rarely used.

There are no changes to over-pressure protection systems as a result of the process changes.

3.5 Heat exchangers and cooling systems

Indicative BAT

You should where appropriate:

1. Consider leak detection, corrosion monitoring and materials of construction, preferably in a formal HAZOP study. Plans and timetables for improved procedures or replacement by higher integrity designs should be in place where the risks are identified as significant.
2. If corrosion is likely, ensure methods for rapid detection of leaks are in place and a regime of corrosion monitoring in operation at critical points. Alternatively, use materials of construction that are inert to the process and heating/cooling fluids under the conditions of operation.
3. For cooling water systems, use techniques that compare favourably with relevant techniques described in the Industrial Cooling Systems BREF.

There are no changes to the heat exchangers and cooling systems as a result of the process changes. The second steam generator will use same systems as per existing steam generator as described in the original BAT Assessment.²

3.6 Purging facilities

Indicative BAT

You should where appropriate:

1. Assess the potential for the release to air of VOCs and other pollutants along with discharged purge gas and use abatement where necessary.

Gravity is used initially to drain the [REDACTED] from the pipework back to storage drum. Then air is used to purge the pipework. The air used in purging is routed through the [REDACTED] abatement plant for treatment prior to discharge through the abatement plant stack (A6). The potential for releases to air of [REDACTED] has been assessed as part of the Air Quality Impact Assessment which is a supporting document to this permit variation application.⁵

3.7 Reaction stage

Indicative BAT

You should where appropriate:

1. With a clear understanding of the physical chemistry, evaluate options for suitable reactor types using chemical engineering principles.
2. Select the reactor system from a number of potentially suitable reactor designs - conventional STR, process-intensive or novel-technology - by formal comparison of costs and business risks against the assessment of raw material efficiencies and environmental impacts for each of the options.
3. Undertake studies to review reactor design options based on process- optimisation where the activity is an existing activity and achieved raw material efficiencies and waste generation suggest there is significant potential for improvement. The studies should formally compare the costs and business risks, and raw material efficiencies and environmental impacts of the alternative systems with those of the existing system. The scope and depth of the studies should be in proportion to the potential for environmental improvement over the existing reaction system.
4. Maximise process yields from the selected reactor design, and minimise losses and emissions, by the formalised use of optimised process control and management procedures (both manual and computerised where appropriate).
5. Minimise the potential for the release of vapours to air from pressure relief systems and the potential for emissions of organic solvents into air or water, by formal consideration at the design stage - or formal review of the existing arrangements if that stage has passed.

██████ is a reactive element which is stored in specialised 140 lead lined drums within a water filled bund in accordance with best practice. Procedures in place to ensure ██████ drum remains closed at all times (except for short window where used). This ensures that all ██████ on site is fully contained. The pipework for ██████ water is PTFE or PVDF which are non-reactive to ██████. The reaction vessel (██████) is glass lined.

The ██████ and crosslinking processes were designed in consultation with specialist design engineers to be as safe and resource efficient as possible, and design of the reaction stages was considered in detail, including formally through a HAZOP assessment. Processes were evaluated and developed on an R&D and pilot scale. The use of ██████ has been minimised as far as possible such that only the quantity required is used. The operation focuses on producing high purity products rather than high yields, which informs how the process is designed.

The ██████ is a batch process and, as such, requires lengthy process steps to carry out the reactions. This limits the types of reactors available for the plant. The reactors and vessels selected have been optimised for heat transfer and agitation to ensure the process steps do not need to be repeated. Heating does not apply to bromination step; only to the condense crosslink step.

3.8 Minimisation of liquid losses from reaction systems

Indicative BAT

You should where appropriate:

1. Use the following features that contribute to a reduction in waste arising from clean-outs:
 - Low-inventory continuous throughput reactors with minimum surface area for cleaning
 - Minimum internals such as baffles and coils in the reactor
 - Smooth reactor walls, no crevices
 - Flush bottom outlet on reaction vessels
 - All associated piping to slope back to the reactor or to a drain point
 - Sufficient headroom under the reactor for collection of all concentrated drainings in drums or other suitable vessel, if necessary
 - Minimal pipework, designed to eliminate hold-up and to assist drainage
 - Pipework designed to allow air or nitrogen blowing
 - System kept warm during emptying to facilitate draining
 - HAZOP studies used to assess the potential for the choking of lines by high-melting-point material
 - Campaigns sequenced so that cleaning between batches is minimised
 - Campaigns made as long as possible to reduce the number of product change-overs
 - Where a complete clean is necessary, use cleaning methods that minimise the use of cleaning agents, (e.g. steam-cleaning, rotating spray jets or high-pressure cleaning) or use a solvent which can be re-used
 - Carry out HAZOP studies to minimise the generation of wastes and to examine their treatment/disposal
 - Consider use of disposable plastic pipe-liners
 - Eliminate or minimise locations for solids to settle-out
 - Consider duplicate or dedicated equipment where it can reduce the need for cleaning that is difficult.

Many of the features listed above are utilised by the Operator to reduce the waste arising from clean-outs. There is no change to the original BAT Assessment in this respect.

Spray balls are used for cleaning out the reactors used for bromination and crosslinking processes, reducing the amount of water used for cleaning and therefore the quantity of wash water produced.

3.9 Minimisation of vapour losses

Indicative BAT

You should where appropriate:

1. Review your operating practices and review vent flows to see if improvements need to be made.
2. Consider opportunities to enhance the performance of abatement systems.

In accordance with the HAZOP⁴:

- The [REDACTED] water is made up by transferring [REDACTED] L water to the [REDACTED] water tank ([REDACTED]) then transferring [REDACTED] L [REDACTED] in through a dip pipe below the water level to minimise vapour.
- A dip pipe is used to introduce [REDACTED] water below the liquid level within the reactor vessel ([REDACTED]) to minimise vapour loss to atmosphere.
- Vessel [REDACTED] is operated with a slight positive pressure – nominally 100 mbar to minimise vapour release.
- The use of sodium formate in the [REDACTED] process neutralises any residual [REDACTED] that may be lost as vapour.
- All off gas from the [REDACTED] process is passed through the [REDACTED] abatement plant which is designed to minimise the loss of [REDACTED] to the atmosphere as described in Section 4.1.2.1.

3.10 Separation stages

3.10.1 Overview

Liquid-vapour and liquid-liquid separations are not used in any of the plant processes so have not been reviewed as part of this BAT.

3.10.2 Solid-liquid separations

Indicative BAT

You should where appropriate:

1. Use the techniques to minimise, re-use and/or recycle rinse water, and to prevent breakthrough of solids.
2. Install instrumentation or other means of detecting malfunction as all of the techniques are vulnerable to solids breakthrough.
3. Consider installing "guard" filters of smaller capacity downstream, which, in the event of breakthrough, rapidly 'clog' and prevent further losses.
4. Have good management procedures to minimise loss of solids, escape of volatiles to air and excessive production of waste water.

There are no changes to solid-liquid separations as a result of the process changes.

3.11 Purification stage

Purification of chemicals or wastes, such as by distillation, is not carried out in this plant so has not been addressed further by this BAT.

3.12 Chemical process control

Indicative BAT

You should where appropriate:

1. Monitor the relevant process controls and set with alarms to ensure they do not go out of the required range.

There are a new set of process controls for the bromination and cross-linking processes. These have been linked to the existing Supervisory Control and Data Acquisition (SCADA) control system.

For process vessels, the SCADA:

- runs the process as per the design requirements and prompts the operator where necessary; and
- monitors and displays information on the temperature, pressure, agitation speed, flow and time. These are all displayed and set to predetermined ranges. Alarms will sound if the parameter is out of range or has been exceeded.

There are hundreds of control loops (i.e. a fundamental building block of the SCADA system) across the plant. These are marked on the internal Piping and Instrumentation Diagrams (P&IDs) with step-by-step controls covered by the internal the User Requirement Specification (URS) and Functional Design Specification (FDS). The HAZOP⁴ has systematically reviewed these controls to ensure they

provide adequate health and safety protection, prevent emission breakthroughs and where these occur minimise risk of harm to human health and the environment.

These internal documents are confidential and commercially sensitive as they contain the recipe for the process and therefore cannot be shared in full with Natural Resources Wales (NRW) during the permit determination period. The updated Emissions Management Plan⁶, also submitted in support of the permit variation application, provides an overview of these key process controls.

3.13 Analysis

Indicative BAT

You should where appropriate:

1. Analyse the components and concentrations of by-products and waste streams to ensure correct decisions are made regarding onward treatment or disposal. Keep detailed records of decisions based on this analysis in accordance with management systems.

See Section 2.5 Avoidance, recovery and disposal of wastes.

All waste streams are subject to compositional analysis by the waste contractor to ensure each waste stream is handled with regards to the best environmental option. Sampling arrangements for the waste streams are detailed in Table 3 below:

Table 3 – Sampling Arrangements for Waste Streams

Waste Stream Reference	Sampling arrangements
Waste Stream A	The loads are sampled when they arrive at the recovery site as part of the pre acceptance criteria. Then they are sampled every hour during the distillation process, so that the results can be documented.
Waste Stream B	Each load is sampled upon arrival and tested for calorific value, pH, halogens and compatibility with tank contents prior to offloading.
Waste Stream C	The chemist will assess physical composition to ensure fully pumpable and check waste received versus consigned/declared on load.
Waste stream D	All loads are sampled on arrival, in line with sites sampling procedure and acceptance procedure. Analysis is carried out comparing acceptance sample with pre acceptance sample. Analysis is in line with several site analysis procedures
Waste stream E	All loads are sampled on arrival, in line with sites sampling procedure and acceptance procedure. Analysis is carried out comparing acceptance sample with pre acceptance sample. Analysis is in line with several site analysis procedures.
Waste stream F	Waste accepted in bulk road tanker and have a 500 ml core sample taken from one of the top man way entry points. Multi-potted tankers have a core sample taken from each pot. If layering is present, a jar sample of each layer is also taken. The sample is then immediately taken to the laboratory for analysis of pH, water

Waste Stream Reference	Sampling arrangements
	content, XRF (metals content), colour, odour, viscosity, radioactivity, and compatibility testing before offloading commences.
Crash tank	Sampling for hazardous properties in line with waste pre-acceptance is carried out by waste collector.
Municipal sewer	Sampling carried out in accordance with Trade Effluent Consent

Logs and records of all wastes leaving site are maintained in addition to sample result records.

4 Emissions and Monitoring

4.1 Point source emissions

Indicative BAT

You should where appropriate:

1. Formally consider the information and recommendations in the BREF on Common Waste Water and Waste Gas Treatment/ Management Systems in the Chemical Sector as part of the assessment of BAT for point- source releases to air, in addition to the information in this note.
2. Identify the main chemical constituents of the emissions, including VOC speciation where practicable.
3. Assess vent and chimney heights for dispersion capability and assess the fate of the substances emitted to the environment.
4. Use the following measures to minimise emissions to air:
 - recover emissions rich in organics by fractionation and then recycle
 - recover and reuse solvents
 - continuously monitor off-gas concentration from reaction vessels, dryers, condensers, evaporators and scrubbers where off-gases are shown to be environmentally significant

4.1.1 Overview point source emissions to air

This section should be read in conjunction with the updated Emissions Management Plan (EMP)⁶, submitted as part of the permit variation application.

Point source emissions to air from the site are marked on the Emission Point Plan (see Figure 5 of the EMP). They arise from:

- A1: Main stack
- A2: Hydrogen vent routing
- A3: [REDACTED] tank venting
- A4: Steam generator A stack
- A5: Steam generator B stack
- A6: [REDACTED] abatement plant stack

Emission points A1, A2, A3 and A4 are unchanged from the original permit application and BAT Assessment. The permit variation which this BAT Assessment supports is to add emission points A6 [REDACTED] abatement plant stack and A5 Steam generator stack B. The new emission points A6 and A5 are considered in further detail in 4.1.2.2 Abatement of [REDACTED] emissions and 4.1.3 A5 Steam generator stack respectively and within the EMP.

In addition there are Tank Breather Valves (TBVs) which are not marked on the Emission Point Plan:

- TBV01: [REDACTED] tank vent
- TBV02: Waste tank (stream A) vent
- TBV03: [REDACTED] tank vent
- TBV04: Waste tank (stream B) vent

TBV01, TBV02, TBV03 are existing. TBV04 is new and is associated with the storage of a new waste stream B. The controls with respect to emissions from the TBVs are not discussed further as they are unchanged from the original permit application and are detailed within the EMP.

4.1.2 Control of emissions of [REDACTED]

4.1.2.1 Control at source

[REDACTED] is a halogenated compound. It is controlled at source as far as possible. See Section 3.9 Minimisation of vapour losses.

4.1.2.2 Abatement of [REDACTED] emissions

Air from the [REDACTED] reactor vessel and associated pipework is drawn through the packed media column within the [REDACTED] abatement plant. Simultaneously droplets of sodium formate move down through the packed media column. There is a reservoir containing sodium formate beneath the column from which sodium formate is pumped to the top of the column. The residual [REDACTED] in the air reacts with the sodium formate droplets moving down through the media to form hydrogen [REDACTED] and carbon dioxide.

The pH in the reservoir tank is monitored in real time and any excursions are flagged by a SCADA alarm. Sodium formate has a pH of 6.3. As [REDACTED] reacts with the sodium formate, hydrogen bromide solution is formed which causes the pH in the reservoir tank to drop. There is an alarm connected to the SCADA system which is triggered at pH 5.8. Fresh sodium formate is added to the reservoir every day and every 90-100 days the sodium formate liquid is completely replaced.

The [REDACTED] abatement plant stack has a monitoring port for monitoring of emissions to air.

4.1.3 A5 Steam generator B stack

The existing steam generator is subject to a planned preventative maintenance programme in accordance with manufacturers requirements which is controlled using the Q-Pulse system. The new steam generator will be subject to the same maintenance schedule.

The steam generator has a water treatment unit for incoming water. This is tested weekly by Purolite staff and also maintained under the service contract with the equipment supplier.

4.1.4 Air Quality Impact Assessment

Emissions from the new [REDACTED] abatement plant stack have been quantified via stack emission testing carried out during bromination processes. This data has been evaluated in the Air Quality Assessment (AQA) to quantify the potential impact of the substances emitted to the environment.

4.1.5 Monitoring of point source emissions to air

Monitoring of point source emissions to air has been carried out to inform the AQA and also to comply with Improvement Condition 1 of the permit with respect to monitoring of AGE and Epichlorohydrin at the main stack to test assumptions made within the original permit application.

Ongoing stack emission testing will be carried out as required subject to the assessment of the AQA by Natural Resources Wales (NRW) during the permit variation application determination process.

4.1.6 Point source emissions to water

There is no change to the point source emissions to water as a result of the permit variation.

4.1.7 Point source emissions to land

There are no point source emissions to land arising from the Purolite process.

4.2 Fugitive emissions

4.2.1 Fugitive emissions to air

Indicative BAT

You should where appropriate:

1. Identify all potential sources and develop and maintain procedures for monitoring and eliminating or minimising leaks and releases of VOCs from all non-process stream sources.
2. Choose vent systems to minimise breathing emissions (for example pressure/ vacuum valves) and, where relevant, should be fitted with knock-out pots and appropriate abatement equipment.
3. Use the following techniques (together or in any combination) to reduce losses from storage tanks at atmospheric pressure:
 - maintenance of bulk storage temperatures as low as practicable, taking into account changes due to solar heating etc.
 - tank paint with low solar absorbency
 - temperature control
 - tank insulation
 - inventory management
 - floating roof
 - bladder roof tanks
 - pressure/vacuum valves, where tanks are designed to withstand pressure fluctuations
 - specific release treatment (such as adsorption condensation).

The potential for fugitive emissions as a result of the process changes has been considered as part of the risk assessment and HAZOP process.

The controls which are described in the original BAT Assessment are applied as appropriate with respect to the process changes.

4.2.2 Fugitive emissions to surface water, sewer and groundwater

Indicative BAT

You should where appropriate:

1. Provide hard surfacing in areas where accidental spillage or leakage may occur, e.g. beneath prime movers, pumps, in storage areas, and in handling, loading and unloading areas. The surfacing should be impermeable to process liquors.
2. Drain hard surfacing of areas subject to potential contamination so that potentially contaminated surface run-off does not discharge to ground.
3. Hold stocks of suitable absorbents at appropriate locations for use in mopping up minor leaks and spills and dispose of to leak-proof containers.
4. Take particular care in areas of inherent sensitivity to groundwater pollution. Poorly maintained drainage systems are known to be the main cause of groundwater contamination and surface/above-ground drains are preferred to facilitate leak detection (and to reduce explosion risks).
5. Additional measures could be justified in locations of particular environmental sensitivity. Decisions on the measures to be taken should take account of the risk to groundwater, taking into consideration the factors outlined in the Agency document, Policy and Practice for the Protection of Groundwater, including groundwater vulnerability and the presence of groundwater protection zones.
6. Surveys of plant that may continue to contribute to leakage should also be considered, as part of an overall environmental management system. In particular, you should consider undertaking leakage tests and/or integrity surveys to confirm the containment of underground drains and tanks.

The bulk holding tank for Waste Stream B (25,000 litres) is located within the existing tank farm which is located outside of the main processing facility.

The [REDACTED] water tank (500l) sits within its own bund within a building. The [REDACTED] bund is part filled with water to contain any spillages of [REDACTED] in accordance with industry best practice. The area external to the [REDACTED] water tank bund is within the drainage area of the crash tank thus providing tertiary containment.

4.3 Odour

Indicative BAT

You should where appropriate:

1. Manage the operations to prevent release of odour at all times.
2. Where odour releases are expected to be acknowledged in the permit, (i.e. contained and treated prior to discharge or discharged for atmospheric dispersion):
 - for existing installations, the releases should be modelled to demonstrate the odour impact at sensitive receptors. The target should be to minimise the frequency of exposure to ground level concentrations that are likely to cause annoyance.
 - for new installations, or for significant changes, the releases should be modelled and it is expected that you will achieve the highest level of protection that is achievable with BAT from the outset.
 - where there is no history of odour problems then modelling may not be required although it should be remembered that there can still be an underlying level of annoyance without complaints being made.
 - where, despite all reasonable steps in the design of the plant, extreme weather or other incidents are liable, in our view, to increase the odour impact at receptors, you should take appropriate and timely action, as agreed with us, to prevent further annoyance (these agreed actions will be defined either in the permit or in an odour management statement).
3. Where odour-generating activities take place in the open, or potentially odorous materials are stored outside, a high level of management control and use of best practice will be expected.
4. Where an installation releases odours but has a low environmental impact by virtue of its remoteness from sensitive receptors, it is expected that you will work towards achieving the standards described in this guidance note, but the timescales allowed to achieve this might be adjusted according to the perceived risk.
5. Where further guidance is needed to meet local needs, refer to Horizontal Guidance Note H4 Odour (see GTBR).

In accordance with BAT with respect to the process changes, odour releases have been modelled and BAT has been applied. The odour impact assessment carried out by Ricardo in 2016⁷ has been superseded and the new Air Quality Assessment⁵ looks at the combined effect of the existing production process and the new bromination and crosslinking processes with respect to potential odour impact. The AQA concludes that there are no predicted significant impacts from odour emissions upon human receptors.

There have been no odour complaints received since operations began.

⁷ Air quality and impact assessment, Ricardo, ED 62380131, Issue Number 1, 28/11/2016

4.4 Noise and vibration

Indicative BAT

You should where appropriate:

1. Install particularly noisy machines such as compactors and pelletisers in a noise control booth or encapsulate the noise source.
2. Where possible without compromising safety, fit suitable silencers on safety valves.
3. Minimise the blow-off from boilers and air compressors, for example during start up, and provide silencers.

The new bromination and crosslinking processes are carried out inside the building. The steam generators benefit from anti-vibration mounting to reduce noise emissions and share the same (existing) compressor.

4.5 Monitoring and reporting of emissions to air and water

Indicative BAT

You should where appropriate:

1. Carry out an analysis covering a broad spectrum of substances to establish that all relevant substances have been taken into account when setting the release limits. The need to repeat such a test will depend upon the potential variability in the process and, for example, the potential for contamination of raw materials. Where there is such potential, tests may be appropriate.
2. Monitor more regularly any substances found to be of concern, or any other individual substances to which the local environment may be susceptible and upon which the operations may impact. This would particularly apply to the common pesticides and heavy metals. Using composite samples is the technique most likely to be appropriate where the concentration does not vary excessively.
3. If there are releases of substances that are more difficult to measure and whose capacity for harm is uncertain, particularly when combined with other substances, then "whole effluent toxicity" monitoring techniques can be appropriate to provide direct measurements of harm, for example, direct toxicity assessment.

The purity of the raw materials which are used in the manufacturing process and a comprehensive understanding of the chemical processes allows the Operator to predict emissions to air and water. The current permit doesn't require any routine monitoring however Improvement Condition 1 with respect to emission testing of AGE and Epichlorohydrin from the main stack (A1) has not yet been fully discharged.

The permit variation reflecting the addition of two new emissions points to air, namely the XXXXXXXXXX abatement plant stack (A6) and the second steam generator (A5) may trigger a requirement for periodic emissions to air monitoring.

Any required monitoring will be conducted in accordance with Environment Agency guidance 'Monitoring stack emissions: techniques and standards for periodic monitoring'⁸ Technical Guidance Note M1 'Sampling requirements for stack emission monitoring.'⁹

4.6 Monitoring and reporting of waste emissions

Indicative BAT

You should where appropriate:

1. Monitor and record:

- the physical and chemical composition of the waste
- its hazard characteristics
- handling precautions and substances with which it cannot be mixed

All liquid waste streams are managed by a specialist waste contractor. Initially for a new waste stream the operator generates a lab scale "synthetic" sample or from sampling an R&D/pilot batch. Then submit to Tradebe for analysis. Meanwhile, the Material Assessment Questionnaire (MAQ) is completed detailing the composition of the waste and the relevant hazardous properties.

Subsequent samples are taken to verify laboratory samples when production commences. Initial sampling is to identify suitable routes alongside MAQ. The sampling of the individual waste streams is detailed in Table 1 – Waste Inventory in Section 2.5.5 Waste Storage and Handling. The ongoing testing of the waste allows full characterisation to ensure an optimum recovery or disposal route in accordance with the waste hierarchy as well as safe handling.

⁸ <https://www.gov.uk/government/publications/monitoring-stack-emissions-techniques-and-standards-for-periodic-monitoring/monitoring-stack-emissions-techniques-and-standards-for-periodic-monitoring> Accessed 24th November 2021

⁹ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/635269/LIT_4736.pdf Accessed 24th November 2021

Appendix A Steam Generator Specification

CERTUSS

Steam Generators



T H E F U T U R E O F
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CERTUSS Company History

W H O W E A R E

When Hans Joachim Schroder founded his company CERTUSS Warmetechnik GmbH in 1957, his primary goals were to manufacture reliable, low-noise Steam Generators, easy to maintain and for continuous operation. These objectives formed the basis of a successful company, which is now operating world-wide. The concentration on a clearly defined product line, systematic research, development and a highly trained team of professionals, enables equipment production of the highest standard aligned with a Certified Quality Management system according to DIN EN ISO 9001:2008.

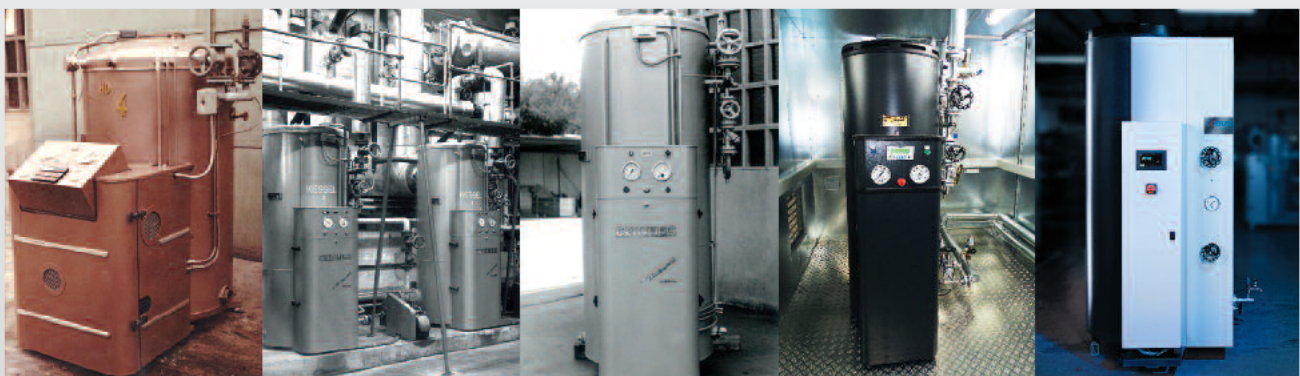
All CERTUSS Steam Generators are type tested according to European Pressure Equipment Guideline DGRL 97/23/EC, along with ASME and UL regulations for the US market. CERTUSS offer seven construction groups within their range of fossil fuel Generators with outputs ranging from 80kg/hr to 2000kg/hr and operating pressures up to 32 bar G. To accompany the Generator, CERTUSS also offer their CVE Package Plant Module, where all of the associated ancillary items are pre-piped, pre-wired and factory tested.

Fuel types offered are Gas, Light Oil, LPG and Bio Fuel, with combination burners offered on all units from 500kg/hr upwards. Also available are a range of Electric Steam Generators from 6kW to 120kW.

CERTUSS also hold full electronic documentation of every Generator manufactured over the past 30 years, with full spares support for each Generator guaranteed for up to 20 years after commissioning. With their UK service centre, the main German manufacturing base, and USA Group members along with 34 other agencies worldwide CERTUSS offer the latest steam technology and exemplary service.

"Our history is the cornerstone that supports our current success, continued growth allows us to push innovation in the future"

Mathias K. Brauner, CEO, CERTUSS Germany



W H O W E W O R K W I T H

Thanks to our long company history we have had the privilege of working with many large and well-known companies and establishments from various industries.

CERTUSS Steam Generators have the advantage of being applicable in nearly **all industries**. We choose to keep our product line **clearly defined and scalable**.

We have gathered experience in **over 80 different sectors**, some of which are listed below, and have worked with diverse applications.

We have many customers in **service and hospitality** who use our Generators for chemical cleaning, disinfecting, laundering and other service purposes. For example we have installed Generators in many **Hyatt, Kempinski, Four Seasons** and **Holiday Inn Hotels**.

Another major sector we serve is the **healthcare sector**, including the chemical and pharmaceutical industry. CERTUSS Generators are applied in hospitals, cosmetics, plastics, mineral oil processing, pharmacies, and other chemical processes. Besides hospitals we have also worked with chemical and pharmaceutical companies, for example **B.Braun, Evonik, BASF, Merck, Procter & Gamble** or **Unilever**.

Additionally the **food and beverage** industry offers many applications for our Steam Generators. Examples are meat, milk, mineral water, soft drink, flavor, oils and sugar processes as well as alcoholic beverage, juice, coffee, tea productions or luxury food goods like candy, tobacco products or pralines. In this sector CERTUSS Generators are used by, for example, **Coca-Cola Companies, Dr. Oetker Frozen Foods** as well as **Nestle Group**.

Finally, diverse companies from the **automotive, construction and mechanical engineering** sector have purchased CERTUSS Generators for use in sanitation, ceramics and glass, cement production, heating, and woodworking. **Samsung Germany, Siemens, Philips Components** are customers we have served to this day.

With all the German **car manufacturers** located in our manufacturing home country, CERTUSS has had the privilege to work for **Volkswagen, Mercedes Benz** and **BMW**.

All that is left to say now is that if you like German cars, you'll **love** our Generators!

B|BRAUN
SHARING EXPERTISE

3M



HYATT

BACARDI

Kempinski
HOTELS & RESORTS



PHILIPS



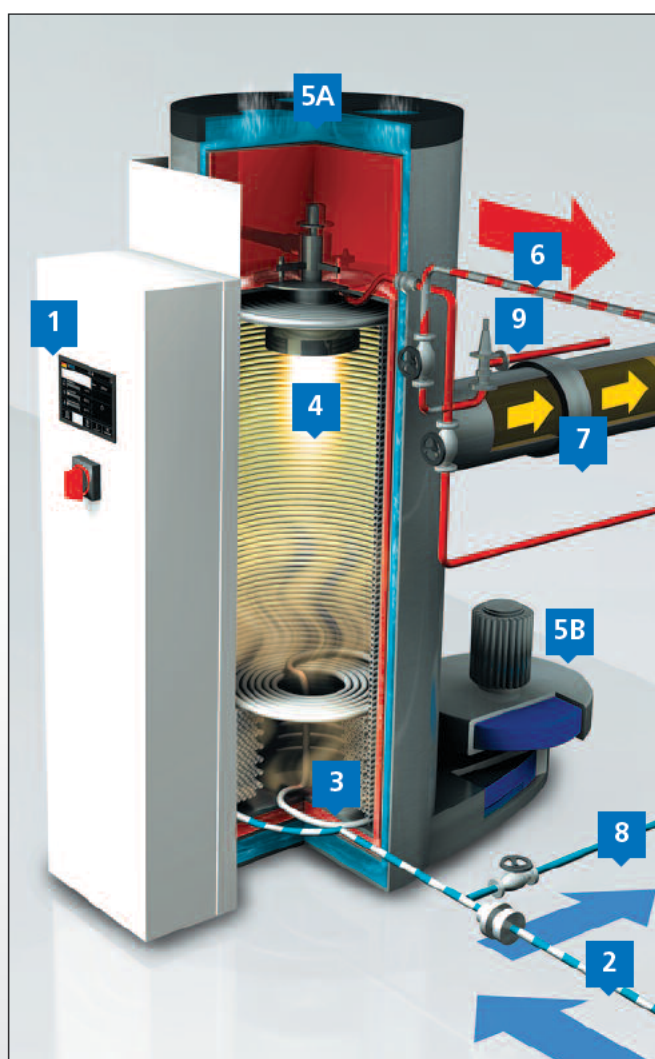
Mercedes-Benz



FEATURES

By using the **water tube boiler** principle, the CERTUSS technology for generating steam offers **maximum safety, reliability and instant availability of high quality steam**.

- 1** The **touch screen control panel** simplifies operation and control of the generator. All configurations and settings of steam pressure are made here.
- 2** The **pre-heated feed water** is delivered to the Generator at approx. 85 to 95°C. The heat frees the oxygen from water and reduces the risk of oxygen corrosion.
- 3** The **heat exchanger** coil is supplied with water through the feed water inlet. The change of phase from water to steam begins.
- 4** The modulating, **integral burner** with the fastest response time, provides precise steam pressure control down to **0.01 BAR G**.
- 5A** Insulation material is made obsolete by guiding the **combustion air** from the top of the Generator through an outer shell, and from there into an inner, secondary shell.
- 5B** The **combustion air intake & fan** draw in warm air through the triplex system to preheat the combustion air and keep the outer jacket cool.
- 6** When the steam has been produced, it leaves the generator through the **steam outlet** and is then ready for use.
- 7** The **flue gas outlet** connects to the chimney with or without an Economizer.
- 8** Sediment is flushed out through the **steam generator coil blowdown valve**.
- 9** The **safety relief valve** opens automatically to discharge excess steam when the pressure is too high.



The Junior TC series includes the smaller sized Generators for customers who require low amounts of steam. All Junior TC Generators are equipped with an easy to use **touchscreen panel** that simplifies operation. They are our most space saving steam solutions. They can serve constant and fluctuating demands in steam, with steam available in **under 5 minutes**.

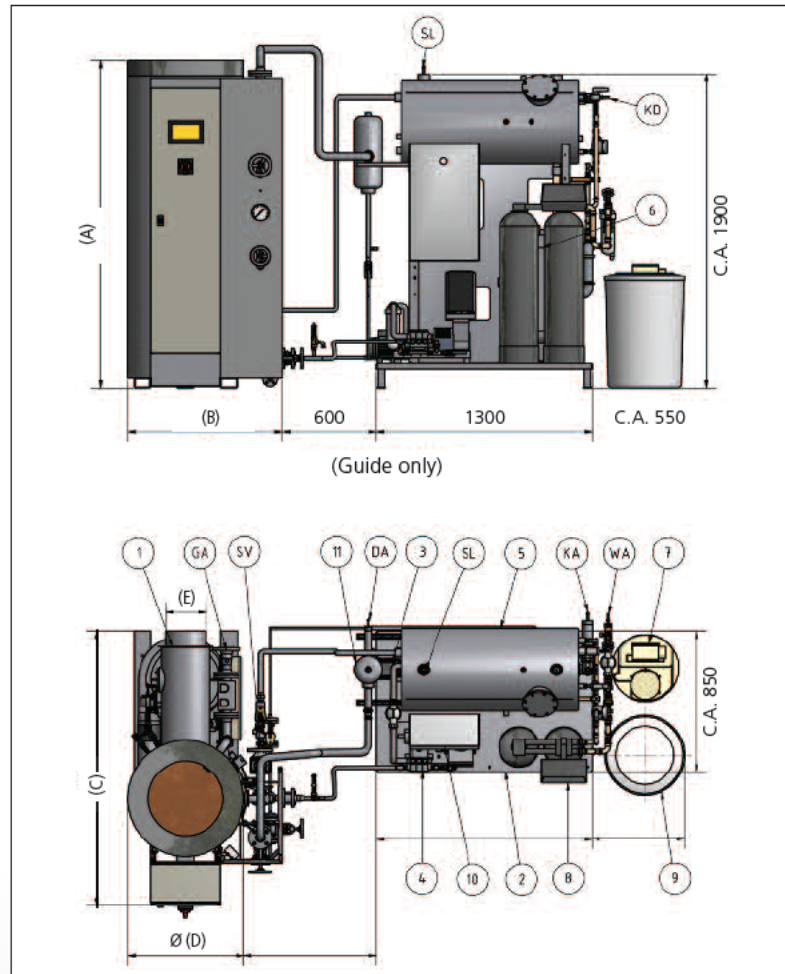
FEATURES

- Space saving
- Installation without foundation support
- Robust steel construction
- Triplex air insulation creates good air circulation within the generator and preheats the combustion air
- Integrated, 1st stage CERTUSS burner system (NG, LPG, Light Oil)
- Noise and vibration reduction, anti-vibration mountings
- Economical fast energy transfer reducing radiation losses
- Vertical expansion free centrally suspended heating coil with bottom blowdown
- Replaceable evaporation section
- Easy and quick cleaning of the heating system, without removal
- Fully automated operation
- Exemplary customer service and spare parts available 365 days
- Thermal Efficiency >93% (without Economiser)
- Full adjustable output of steam
- BMS compatibility with Profibus/CANbus, Modbus, BACnet etc.,
- 7" Touch Control (TC) screen



1. Junior TC Steam Generator
2. CVE Utility Unit
3. Pre Pressure Pump
4. Feed Water Pump
5. Feed Water Tank
6. Blowdown Vessel
7. Chemical Dosing
8. Water Softening Plant
9. Brine Tank
10. Control Panel
11. Steam Separator
12. Water Filter

- DA. Steam Connection
 WA. Water Connection
 SL. Tank Vent (To Atmos)
 SV. Safety Valve (To Atmos)
 KA. Drain Connection
 KD. Condensate Connection
 BA. Fuel Connection



CERTUSS Junior Steam Generator

Construction Group	Capacities			Firing Stages	Pressures		Consumption			Measurements (mm)			Steam Generator Ø (D)	Flue Gas Tube Ø	Flue Gas (Centre)	Weight kg	Connections						Free Air cm²	
	Steam Output kg/h	Heat Output kW	Heat Input kW		Max. WP BarG	Max. AP BarG	Light Oil kg/h	Natural Gas m³/h	Liquid Gas m³/h	Height (A)	Width (B)	Depth (C)					Electrical Connection kW	Oil Connection DN	Natural Gas DN	Liquid Gas DN	Feed Water Connection DN	Steam Connection DN	High	Low
1	80	53	58	1	(8-14-22-29)	(10-16-25-32)	4.9	5.47	2.2	1500	700	1210	500	180	1050	320	1.2	¾"	20	20	1¼"	15	116	232
	120	79	87				7.4	8.2	3.4														174	348
2	150	99	109	1	(8-14-22-29)	(10-16-25-32)	9.2	10.2	4.2	1580	740	1375	560	200	1120	420	1.35	¾"	32	20	1¼"	20	218	436
	200	131	145				12.3	13.67	5.6														290	580
3	250	164	182	1	(8-14-22-29)	(10-16-25-32)	15.3	17.16	7.1	1850	830	1510	640	250	1360	520	1.45	¾"	40	20	1¼"	25	364	728
	300	196	218				18.4	20.56	8.4														436	872
	350	230	255				21.5	24.05	9.9														510	1020
	400	262	291				24.5	27.45	11.3														582	1164

The Universal TC series is equipped to serve constant, as well as fluctuating, **high steam** demands making these Generators our most high performing solutions. Due to an extremely short heat up time, steam is available after **less than 5 minutes**. The touch screen control panel facilitates operation and gives a bundled overview of current pressures and configurations. Additionally the Generator can easily be operated remotely.

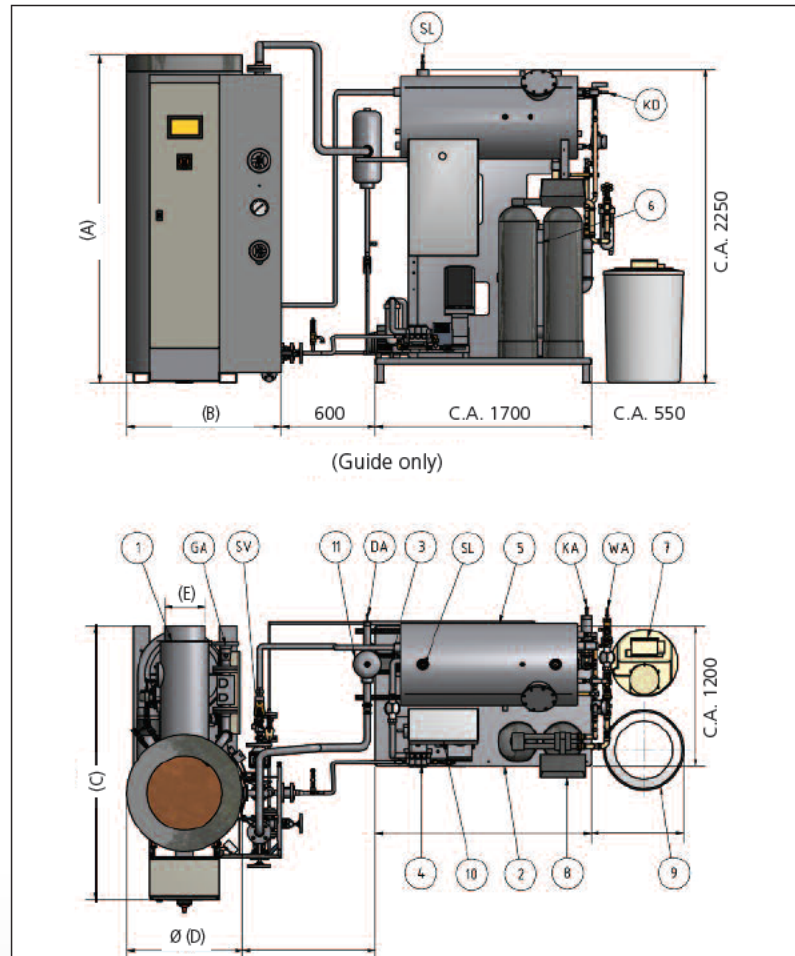
FEATURES

- Space Saving
- Installation without foundation support
- Robust steel construction
- Triplex air insulation creates good air circulation within the generator and preheats the combustion air
- Integrated, 2 stage modulating* CERTUSS burner system (NG, LPG, Light Oil and Dual Fuel)
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- Vertical expansion free centrally suspended heating coil with bottom blowdown
- Replaceable evaporation section
- Easy and quick cleaning of the heating system, without removal
- Fully automatic operation
- Exemplary customer service and spare parts available 365 days
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- Full modulation from 50% to 100% (NG, LPG)*
- BMS compatibility with Profibus/CANbus, Modbus, BACnet etc.,
- 7" Touch Control (TC) screen



1. Universal TC Steam Generator
2. CVE Utility Unit
3. Pre pressure pump
4. Feed Water Pump
5. Feed Water Tank
6. Blowdown Vessel
7. Chemical dosing
8. Water softening plant
9. Brine Tank
10. Control panel
11. Steam separator
12. Water filter

- GA. Fuel
SV. Safety Valve
DA. Steam
SL. Tank Vent
KA. Drain
WA. Water
KD. Condensate



CERTUSS Universal TC (Touch Control) Steam Generator

Construction Group	Capacities			Firing Stages	Pressures		Consumption			Measurements (mm)			Steam Generator Ø (D)	Flue Gas Tube Ø	Flue Gas (Centre)	Weight kg	Connections						Free Air cm ²	
	Steam Output kg/h	Heat Output kW	Heat Input kW		Max. WP BarG	Max. AP BarG	Light Oil kg/h	Natural Gas m ³ /h	Liquid Gas m ³ /h	Height (A)	Width (B)	Depth (C)					Electrical Connection kW	Oil Connection DN	Natural Gas DN	Liquid Gas DN	Feed Water Connection DN	Steam Connection DN	High	Low
4	500	328	364	2	(8-14-18-22-29)	(10-16-20-25-32)	30.6	34.33	14.1	1980	930	1600	700	250	1460	950	5.0	¾"	50	25	1¼"	32	728	1456
	600	393	436				36.8	41.13	16.9														872	1744
	650	427	485				39.8	45.75	18.3														970	1940
5	700	459	510	2	(8-14-22-29)	(10-16-25-32)	42.9	48.11	19.7	2290	1160	1870	870	300	1750	1100	5.5	¾"	65	40	1¼"	40	1020	2040
	850	557	619				52.1	58.39	24.0														1238	2476
6	1000	656	728	2	(8-14-22-29)	(10-16-25-32)	61.3	68.67	28.2	2535	1260	2125	1000	350	1940	1500	9.5	¾"	65	40	1¼"	50	1456	2912
	1300	853	947				79.8	89.33	36.7														1894	3788
7	1500	984	1093	2	(8-14-22-29)	(10-16-25-32)	92	103.11	42.3	2675	1380	2310	1100	500	2025	2300	13.0	½"	80	50	1¼"	65	2186	4372
	1800	1180	1311				110.4	123.67	50.8														2622	5244
	2000	1312	1457				123.0	137.45	56.5														2914	5828

CERTUSS Verified Equipment for Junior & Universal TC

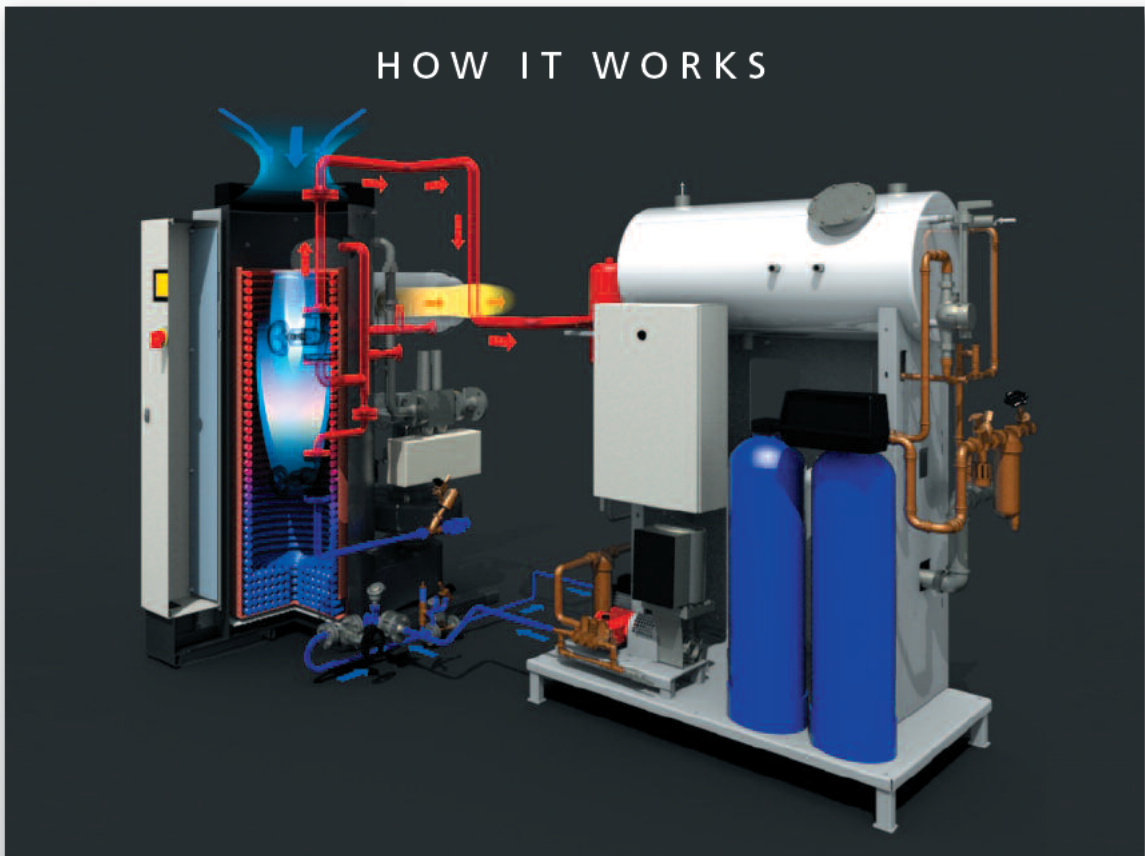
The **CVE** supply unit combines all components needed to supply the Steam Generator in one compact body. Instead of having to combine many single parts, our CVE offers all **necessary add-on's** for supply and water treatment in one. Thereby complex on-site installations are obsolete and factory-tested functional reliability is assured.

FEATURES

- Duplex or Simplex water softening plant including Automatic dosing
- Brine tank
- Feed water tank with pre-heater
- Steam separator
- Blow-Down Vessel with automatic after cooler
- Control Panel
- Blowdown heat recovery system
- Pre -Pressure Pump
- Testomat; conductivity monitor



HOW IT WORKS



A D V A N T A G E S

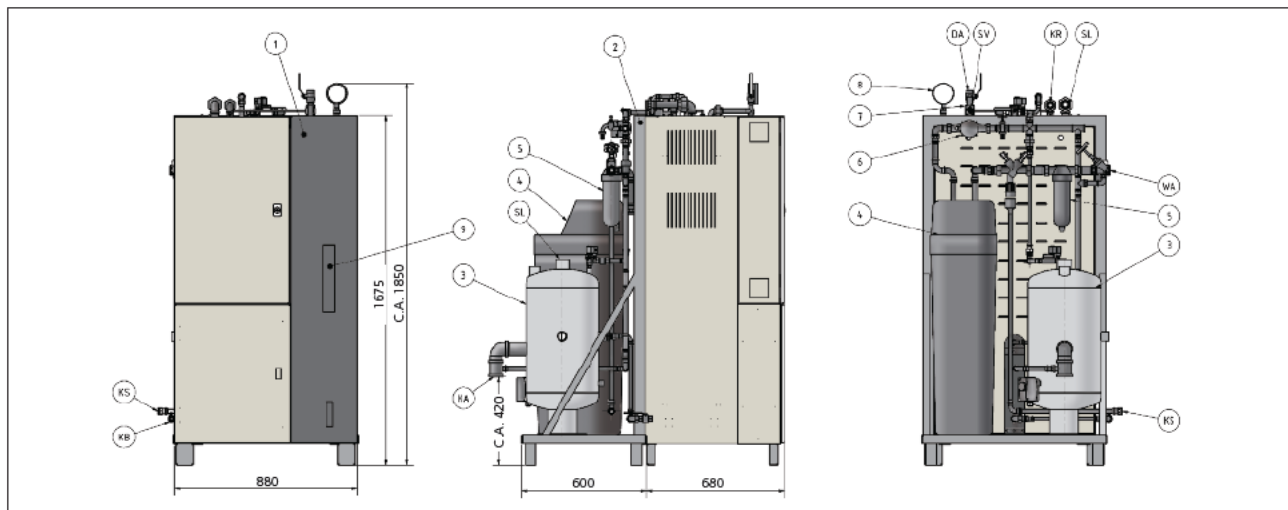
- All supply and water treatment components for CERTUSS Steam Generators are supplied as a single unit and are CERTUSS verified.
- Fast, economical commissioning, ready for operation
- Easy maintenance access
- Enhanced safety due to factory pre-installation of water, steam and electrical connections
- Less space required due to compact design
- Simple on site single point installation
- Complete with electrical sub distribution
- Durable galvanised base frame
- Use of approved, high quality materials
- 3D drawings available for easy design and layout



Type	For Steam Generators with steam output kg/h	Dimensions (mm)			Connections					Electrical Connection	Load Current (A)
		Height	Width	Depth	Raw Water DN	Waste Water DN	Rinsing Water (softening) DN	Ventilation (feed water tank) DN	Condensate DN		
Junior	80-120	1950	1300	850	1"	2"	½"	2"	1¼"	3 x 400V / 50 Hz	10
	150-200										10
	250-400										10
Universal	500-600	2300	1700	1200	1"	2"	½"	DN 100	1½"		16
	700-850										20
	1000-1300										20
	1500-1800										25
Multiple Units	2 x 80-120	2300	2200	1200	1"	2"	½"	2"	1¼"		16
	2 x 150-200										16
	2x 250-400										16
	2 x 500-600										25

*incl. Connected load of steam generators

All rights reserved to make technical changes



- | | | | |
|-------------------------------------|---|----------------------|----------------------|
| 1. Electric Steam Generator E 6-72M | 5. Water filter | DA. Steam Connection | WA. Water Connection |
| 2. Utility unit CVE E 6-72M | 6. Water meter | KA. Drain | KR. Condensate |
| 3. Mixing cooler 50 ltr. | 7. Safety valve | SV. Safety Valve | KS. Drain |
| 4. Water softening plant | 8. Manometer | SL. Vent Outlet | KB. Blowdown |
| | 9. Roller indicator level regulator / limiter | | |

E6M - 72M: The New Generation Of The Classic Generator: The electric steam generators E6M - E72M are genuine CERTUSS steam generators. They are distinguished by their short heat-up time and low space requirement. They are low-loss and extremely reliable in construction proven over decades. The E6M - E72M achieves immediate output adjustment, simplified operation and increased ease of maintenance.

Small, Complete And Safe: The E6M - E72M are complete, ready to operate, electronically controlled steam generators with built in feed water tank and water pump along with all the safety devices for pressure and temperature. Only the disposal and supply lines are to be installed by the customer.

Manual, Remote-Controlled Or Automatic: Controlling is carried out either manually by simply pressing buttons or with an optional "Thermotimat" automatic control within the unit. Controlling via a central control system / building services system or an external impulse is also possible for the display and transfer of operating and fault messages. The heart of the E6M - E72M consists of a PLC control system that displays the operating and fault messages with corresponding fault codes.

Electronically Controlled Electrical Heating: The output of the heating elements is controlled progressively through semiconductor contactors. This ensures virtually constant steam pressure under a symmetrical load of the power supply. The respective operating pressure range can be present progressively.

Optional - Output Selection Switch: On multiple stage generators the heating output can be limited

Optional - Automatic Desalination: A device for fully automatic time - controlled desalination can be integrated and guarantees constant high steam quality

Optional - Automatic Blowdown: The E6M - E72M steam generators can additionally be equipped with an automatic blowdown. The pressure vessel is then de-slimed at every shutdown

Installation Conditions: In accordance with the European Pressure Equipment Category II or III depending on the operating pressure. They have been tested in accordance with the EC type examination.

FEATURES

Operator Convenience

- Easy to service compact device, easy to operate
- Optional supply system for water treatment and water cooling
- Access possible through normal doors up to 1m wide
- Wide solid bases to ensure safe transportation on the side or front
- Direct front access to all parts for easy maintenance

Efficient

- Short heat-up time
- Fully electronic pressure and output control, immediate load adjustment
- Electrical heating elements made of stainless steel with large heating surface
- Constant network load without consumption peaks
- Output limitation by selection switch starting on model E18 M (optional)

Operation and Installation

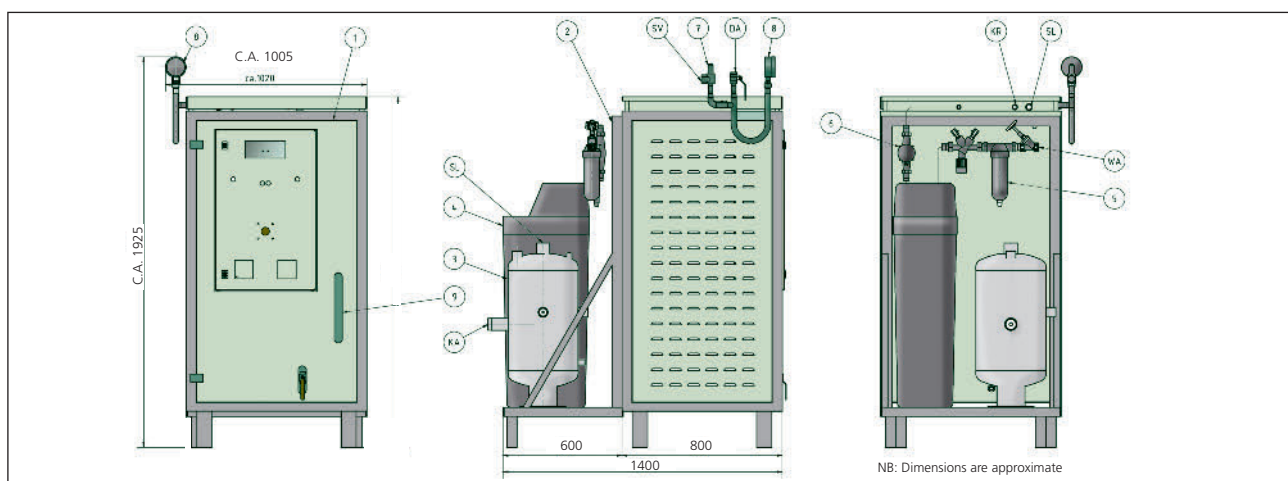
- Low space requirement, reduced and robust heavy-duty model in an elegant design
- Can be installed in work areas
- Fully automatic operation by means of time control or remote pulse (with supplementary equipment)
- Automatic blowdown (optional)
- Automatic desalination (optional)

Safety and Quality

- Function and malfunction indications can be linked to central control system / building services control system provided by customer
- Series production in the framework of the CERTUSS range
- Spare parts supply guaranteed for 20 years
- Stainless steel version of all parts in contact with water and steam for pure option



Technical Data E6M - E27M		E6	E12	E16	E18	E22	E24	E28	E32	E36	E40	E48	E56	E64	E72
Steam Output	kg/h	8	16	21	24	29	32	37	42	48	53	64	75	86	97
Heat Output	kW	6	12	16	18	22	24	28	32	36	40	48	56	64	72
Power Stages		1 - Stage			2 - Stages							3 - Stages			
Electrical Connection up to 0.6 Mpa (6 bar) up to 1.2 Mpa (12 bar)	kW														
		6.8	12.8	16.8	18.8	22.8	24.8	28.8	32.8	36.8	40.8	48.8	56.8	64.8	72.8
		7.8	13.8	17.8	19.8	23.8	25.8	29.8	33.8	37.8	41.8	49.8	57.8	65.8	73.8
Operating Voltage		3 x 400V / 50Hz													
Admissable Pres- sure	MPa	0.6 / 1.0 / 1.2													
	bar	6 / 10 / 12													
Working Press min/max	MPa	0.35 - 0.55 / 0.35 - 0.8 / 0.35 - 1.1													
	bar	3.5 - 5.5 / 3.5 - 8.0 / 3.5 - 11													
Water Capacity	ltr	28													
Dimensions HxWxD	mm	1850 x 880 x 680 (depth including mounting approx 785mm)													
Empty weight (appx)	kg	320													
Connections	DN	Water vapour 1" / Feed water 1/2" / Steam 1/2" / Safety Valve blow-off line 1" / Condensate 3/4"													
Regulations	Germany	In accordance with PED 97/23 EC up to 0.6 MPa (6 bar) category II, above 0.6 MPa category III													



- | | | | |
|----------------------------------|---|----------------------|----------------|
| 1. Electric Steam Generator E100 | 6. Water meter | DA. Steam Connection | KR. Condensate |
| 2. Utility unit CVE E 100 | 7. Safety valve | SV. Safety Valve | KA. Drain |
| 3. Mixing cooler 50 ltr. | 8. Manometer | SL. Vent | |
| 4. Water softening plant | 9. Roller indicator level regulator / limiter | WA. Water | |
| 5. Water filter | | | |

E100: a genuine CERTUSS: The electrical steam generator E100 is a genuine CERTUSS meaning rapid heat-up time, low space requirement, easy to service, low loss, immediate output adjustment.

In accordance with the European Pressure Equipment Directive 97/23 EC the E100 is classified as Category III with a product of the water contents (l) x maximum permissible steam pressure (bar) < 1000. It has been tested in accordance with the EC type examination.

The steam generator E100 has less-restricted conditions for installation and operation in the EC member states.

E100: small, complete and safe: The E100 is a complete ready to operate electronically controlled steam generator with built-in feed water tank and feed water pump, as well as dual implementation of safety devices for pressure and temperature. Only the disposal and supply lines are to be installed by the customer. Control is carried out by means of a multifunction display, with all the functions and alarms being shown in plain text. The desired operating steam pressure can be adjusted continuously between 4 bars and the maximum steam pressure (6, 10 or 12 bar).

All the operating and fault indications can be passed on to a Building Management System provided by the customer.

Automatic Blowdown device: The steam generator E100 can be additionally fitted with an automatic blowdown facility. Whereby blowdown of the pressure system occurs after each manual shutdown or automatic operation.

Electronically controlled electric heating: Heating is carried out by means of a compact heating element with a large heating surface. The heating output is adjusted continuously by means of a pressure sensor, distributed amongst three electronic power contactors. A standard manual power selector switch can be used to limit the heating output between 1/3 and 2/3 of the load.

E100 with "Thermotimat" fully automatic operation: With "Thermotimat" as optional equipment, fully automatic start and shutdown operation by means of an integrated time clock or customer provided external pulse from machines, remote controllers, etc. is possible.

1 MPa (10 bar) = 145 psi
 10 psi = 0.069 MPa (0.69 bar)
 1 kW = 3413 BTU
 1000 BTU = 0.293 kW



FEATURES

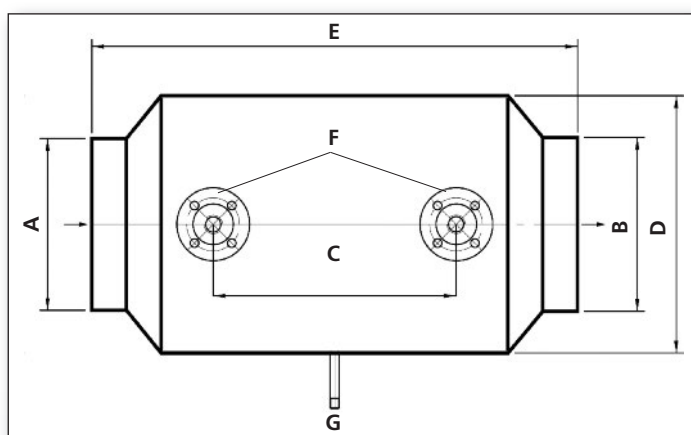
- Low space requirement, robust heavy-duty model
- Easy to service compact device, easy to operate
- Series fabrication within the total CERTUSS program
- Rapid start up time < 3 minutes to produce steam
- Fully electronic pressure and output control, immediate load adjustment
- Fully automatic operation by means of integrated time clock or remote pulse (with supplementary equipment)
- Can be installed in work areas
- Electrical heating rods of stainless steel
- Low heating area load—high durability
- Function and malfunction indications can be linked to Building Management System provided by customer
- On request, all boiler parts made of stainless steel for pure steam production
- Optional supply unit for water conditioning and waste water cooling
- Exemplary customer service and spare parts availability

Technical Data E100		Measurements, weights and further values are rounded up. Indicated pressure are overpressure values. Output values stated are related to 10°C feed water temperature and 0.6MPa (6 bar) steam overpressures. Delivery complete including stainless steel water feed tank. Rights reserved for technical alterations.	
Steam Output	kg/h	135	160
Heat Output	kW	100	120
Electrical connection	kW	105	125
Operating voltage	V/50 Hz	3 x 400, alternative voltage on request	
Admissible pressure	MPa	Optional equipment 0.6 / 1.0 / 1.2 (6 / 10 / 12 bar)	
Working Pressure max	MPa	0.5 / 0.8 / 1.0 (5 / 8 / 10 bar)	
Water capacity	ltr	38.8	
Dimensions (HxWxL)	mm	1925 x 1005 x 800	
Empty weight appr.	kg	415	
Connections	DN	Vent 1" / Feed water 1/2" / Steam 1/2" / Safety Valve blow-off line 1" / Condensate 3/4"	
Regulations	Germany	Boiler group III (PSxV<1000) does not require permit for installation, approval and TÜV monitoring	

CERTUSS Economiser **CERTECON** for Junior TC **80 – 400**

An innovative solution for saving energy during operation of the oil- or gas-heated CERTUSS Steam Generators of the Junior 80 – 400 series.

Depending on the output level, operating pressure and utilisation of the Steam Generator, the combustion-specific degrees of thermal efficiency increases to up to **5%**.



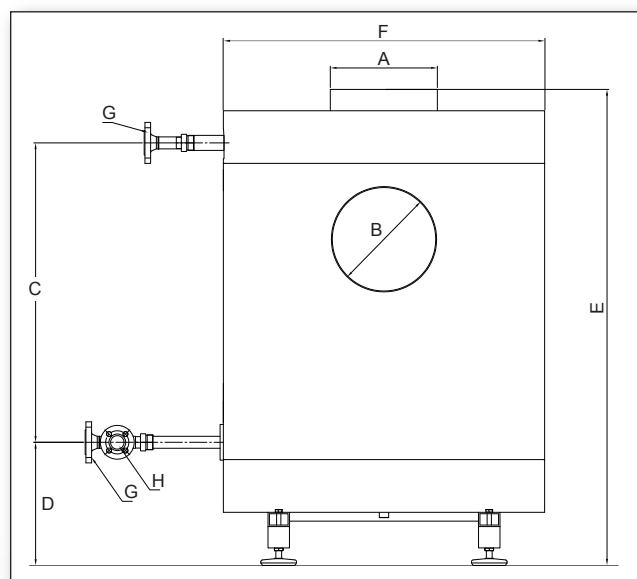
CERTECON Junior			80 – 120	150 – 200	250 – 400
A	Flue gas inlet Ø internal	mm	178	203	254
B	Flue gas outlet Ø external	mm	178	203	254
C	Connecting piece distance	mm	216	267	356
D	Height	mm	254	279	368
E	Width	mm	284	635	737
F	Water inlet / outlet	BSPT	1/2"	1/2"	3/4"
G	Drain flue gas condensate	BSPT	1/2"	1/2"	1/2"
	Heat output at full load up to	Kw	0.06 – 0.11	0.06 – 0.30	0.27 – 0.41
	Weight without water	Kg	24	33	66
	Water capacity	Lt	0.90	2.0	3.86
	Operating overpressure max.	BarG	39.98	39.98	39.98

Specifications subject to be changed

Economiser for Universal TC

CERTUSS Economiser **CERTECON** for Universal TC **500 – 2000**

The CERTUSS Economiser increases the degree of **generator efficiency** and reduces CO² emissions for generator systems fired by **natural gas or light oil**. As flue gas heat exchanger, it uses exhaust gas heat to increase the temperature of the boiler feed water and reduces fuel use by up to **5%** and gains efficiency up to 5%.



CERTECON Universal		500 – 600	700 – 850	1000 – 1300	1500 – 1800	
A	Flue gas inlet Ø internal	mm	254	305	356	508
B	Flue gas outlet Ø external	mm	178	305	343	495
C	Connecting piece distance	mm	737	850	902	940
D	Distance floor / connecting piece	mm	356			
E	Height	mm	1232	1320	1384	1448
F	Diameter	mm	787	902	1016	1092
G	Water inlet / outlet	BSPT	1 ″			1 1/4 ″
H	Blowdown	BSPT	1/2 ″			1 ″
I	Dewatering flue gas condensate		3/4 ″			
	Heat output at full load up to	Kw	0.44 – 0.67	0.89 – 1.11	1.34 – 1.86	2.08 – 3.28
	Weight without water	Kg	228	320	387	442
	Water capacity	Lt	23.88	43.11	51.59	71.58
	Operating overpressure max.	BarG	39.98	39.98	39.98	39.98

Specifications subject to be changed

The CERTUSS **fully equipped container unit** is our solution in case isolation from the rest of your plant is required. It contains all components necessary to operate an entire plant.

After connecting the main services and commissioning, steam is at your disposal in **less than 5 minutes**. The self contained unit is **flexible**, allowing permanent, as well as temporary positioning.

On inquiry we can take over full or partial installation of the steam system. If you choose to contract out to other companies, we can carry out consultation and supervision for your containerised unit.

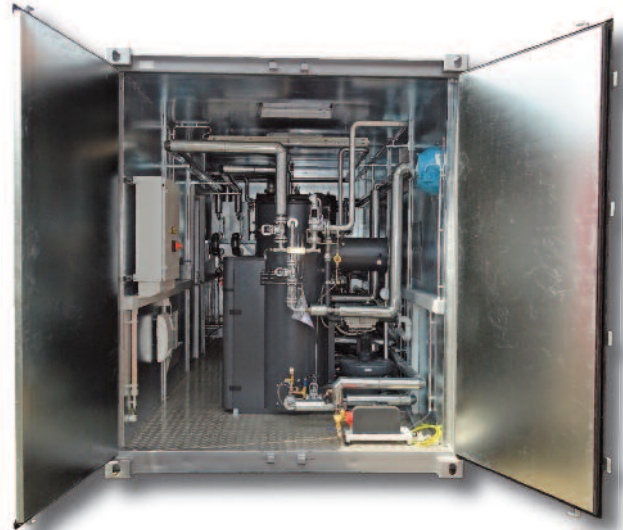
F E A T U R E S

- Steam Generator(s)
- CVE supply unit
- Softening plant
- Pressure reducing station
- Steam distribution header
- Blowdown vessel with automatic after cooler
- Steam separator
- Condensate header
- Emergency stop switch
- ...and more



A D V A N T A G E S

- Customisable
- Space saving
- Complete installation of both Mechanical and Electrical components, leaving only site service connections to be made
- Fully insulated walls for protection of equipment against adverse weather conditions
- High grade steel walls internally and externally
- European standard paint finish to customer specification
- Fully insulated pipe services internally of the container
- Optional steel door or UPVC door to suit customer specification
- Full internal lighting
- Full internal heating
- Flexible for temporary or permanent location positioning; Mobile unit
- Removes requirement for separate boiler-house
- Allows customer full usage of valuable process floor space
- Access space for maintenance work is fixed
- Reduced costs for site installation work





Western

W A T E R T R E A T M E N T

CERTUSS UK has appointed Western Environmental Limited as our approved water treatment provider for our complete range of Steam Generators. Established in 1988, Western Environmental Limited provides a wealth of expertise in the field of industrial water treatment.

This expertise and skill is delivered to the customer via a team of well trained and friendly water treatment chemists who work in a close partnership with their clients. In addition, Western Environmental Limited employ state of the art electronic dosing and monitoring equipment, advanced internet based reporting systems, provide high quality water treatment chemicals manufactured in their own production plant and skilled engineers to ensure the optimum performance from your CERTUSS generator.

Western Environmental Limited have provided water treatment solutions for numerous CERTUSS steam generators over many years and their strong relationship with CERTUSS UK facilitates effective and comprehensive protection.



Contact: info@westerngroup.co.uk or visit
www.westerngroup.co.uk

CERTUSS UK aftersales support team are always at hand to help with your general needs, along with service and installation work to accommodate all customer requirements.

Within our aftersales team we have Engineers and Technical Advisors at hand to give all our customers constant support and piece of mind. We pride ourselves on our customer relationships, catering for the UK and Ireland, we carry an extensive range of spares ensuring an efficient and professional response to our customers needs.

S E R V I C E / C O M M I S S I O N I N G



C U S T O M E R S U P P O R T



Please feel free to contact us:-

Tel: +44 (0)121 327 5362

Fax: +44 (0)121 328 2934

Email: service@certuss.co.uk

T E C H N I C A L & P A R T S



- Extensive Parts Stock
- Factory Trained Service Engineers
- Technical Advice
- Full Operator Training

THERMOTIMAT Full Automatic Control System

Functions available

- Automatic Start
- Automatic Blow-down
- Programmable start-up/shut off
- External Switching on/off
- Automatic fuel change over for combination burners
- Pressure drop cut in at Network – Lag/Lead

VOLT FREE CONTACTS - 6 OR 12

Functions available

- 6 or 12 operating or fault messages transferrable to – BMS Facility

GSM INTERFACE

Functions available

- Allows the control system of the steam generator to be placed on the internet via a mobile network using a SIM card.
- Ability to connect from a workplace to a Generator through a browser such as Internet Explorer, Safari, Firefox etc.

LAG/LEAD FACILITY

Functions available

- Changeable base load boiler
- Cut in of a Steam Generator in stand-by mode after a malfunction of a duty Generator
- Cut in of a stand-by Generator when a pre-selected steam network pressure is not reached.

INTERFACE MULTIPLE SYSTEM/NETWORK

Functions available

- Integration of 1-4 Generators into a company network without PROFIBUS. With the display of the Generator available at the assigned remote station
- With Automatic "Thermotimat" in place – Changeable base load- Cut in of a stand-by Generator on failure

PROFIBUS (SIEMENS) INTERFACE

Functions available

- Integration of Generators into a control network with PROFIBUS. With the display of the Generator available at the assigned remote station
- With Automatic "Thermotimat" in place – Changeable base load- Cut in of a stand-by Generator on failure

DSL INTERFACE

Functions available

- With an Internet access a provider available, this allows the control system of the Generator to be placed on the Internet. With the full display of the Touch Screen available



A D V A N T A G E S

- Start-up time of **3-5 minutes** with steam available
- **Minimal floor requirement**
- Up to **93%** thermal efficiency*
- Reduced corrosion due to **vertical** orientation
- Low water carrier equals **safe operations**
- **Fully automated, unmanned operation** available
- Silent operation, less than **75 dBa sound pressure**
- Reduction of piping costs due to **decentralised** plants
- **7" Touchscreen** display
- Remote access via **Ethernet, Wi-Fi or GSM (Cellular)**
- Remote maintenance and control possible with **iPad or iPhone**
- Predictive maintenance: informing of potential issues **before** they occur
- Redundancy with **multiple plant solution**
- Mildly warm operating generator due to **triplex air insulation vessel**
- Minimal and easy maintenance with spare parts available **up to 20 years**
- 365 days **after-sales support**
- **Less pollution** through low water drainage





Greggs Bakery - Manchester



Geipel Brewery - North Wales



Guys & St Thomas Hospital - London



Johnsons Laundry - Leeds



Tulip Foods - Bristol

C H E C K L I S T

- ☐ 1. Do you want **quick start-up times** and steam almost **instantaneously**?
- ☐ 2. Do you have a boiler constantly in hot **standby** mode?
- ☐ 3. Do you want to be more **environmentally friendly**?
- ☐ 4. Do you experience **fluctuations** in steam demand?
- ☐ 5. Do you have **limitations in space** or want to use your space more **efficiently**?
- ☐ 6. Do you want to operate your generator **remotely** without having an operator on site all the time?
- ☐ 7. Do you currently have an **aging** boiler?
- ☐ 8. Do you face difficulties obtaining **replacement** and **spare parts** for your boiler?
- ☐ 9. Do you experience efficiency losses due to long **distances** between the **production** and the **use** of steam?
- ☐ 10. Do you prefer a **point of use** steam source?
- ☐ 11. Do you have **maintenance** issues with your current boiler?
- ☐ 12. Do you have confidence in the **quality and reliability** of your existing boiler?

If you checked **4** or more of these questions you should consider buying a new, high efficiency steam generator by **CERTUSS!**

中华人民共和国
特种设备制造许可证
Manufacture License of Special Equipment
People's Republic of China



№ 00481

ОРГАН З ОЦІНКИ ВІДПОВІДНОСТІ
ТОВ "СВРО-ТІСК"
(призначений орган з оцінки відповідності продукції вимогам
технічних регламентів згідно наказів № 1306 від 08.11.2013 р.,
№ 204 від 24.02.2014 р. Міністерства економічного розвитку і
торгівлі України, номер призначеного органу UA.TR.089,
акредитований у Національному агентстві з акредитації України
(атестат акредитації № 10146 від 02.08.2013 р.)



СЕРТИФІКАТ ВІДПОВІДНОСТІ
CERTIFICATE OF CONFORMITY
СЕРТИФІКАТ СООТВЕТСТВИЯ/CERTIFICATE ON CONFORMITY

Certificate

Quality-Assurance System
acc. to Directive 97/23/EC

Certificate no.:

01 202 611/Q-00 0003

name and address of the manufacturer:

Certificate

Standard ISO 9001:2008

Standard

Certificate Registr. No. 01 100 76026

TÜV Rheinland Cert GmbH certifies:

Certificate Holder: Certuss Dampfautomaten GmbH & Co. KG
Hafenstraße 65

Scope:



CERTIFICATE OF AUTHORIZATION

The named company is authorized by the American Society of Mechanical Engineers (ASME) for the scope of activity shown below in accordance with the applicable rules of the ASME Boiler and Pressure Vessel Code. The use of the certification mark and the authority granted by this Certificate of Authorization are subject to the provisions of the agreement set forth in the application. Any construction stamped with this certification mark shall have been built strictly in accordance with the provisions of the ASME Boiler and Pressure Vessel Code.

COMPANY:

CERTUSS Dampfautomaten GmbH & Co. KG
Hafenstrasse 53-55
Krefeld 47809
Germany

SCOPE:

Manufacture and assembly of power boilers at the above location only

AUTHORIZED:

June 22, 2015

EXPIRES:

June 22, 2018

CERTIFICATE NUMBER:

49,570

Richard Robinson
Vice President, Conformity Assessment

Joseph L. ...
Director, Conformity Assessment



The American Society of Mechanical Engineers



www.tuv.com

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The Center for Building Energy Science
(Building 661)
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PA 19112, USA

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B-9800 Deinze

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BG-1360 Sofia

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100176 Beijing, PR China

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200000 Shanghai China

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DK-2690 Karlslunde

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14, rue de Guebwiller
Zone d'activités
F-68700 Wattwiller

LCI group – Centre Nord Ouest France
39, rue Einstein
PA du Château – BP 60129
F-62211 Carvin

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Jl. KH. Abdullah Syafi'i No. 7
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Ameed Engineering Est.
P.O. Box 1165
JO-11821 Amman

Kuwait

YOUSEF AL-AHMAD INT. GROUP
General Trading & Cont.W.L.L. Co.
P.O. Box 5168 Hawally
KW-32082 Kuwait

Lithuania

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Smilties pylimo g. 9/3
LT-92250 Klaipėda

Malaysia and Thailand

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MY-08000 Sungai Petani
Kedah Darul Aman

Netherlands

SCHARFF Techniek BV
Atoomweg 51
NL-3542 AA Utrecht

Pakistan

Dynamic Apparel Technologies
N-127 Block #14
Gulistan-e-johar
PK 75290 Karachi

Poland

SM 21 Energetyka Sp. z o.o.
ul. Zgierska 73
PL-90-960 Łódź

Romania

DEBITRON-TERMO SRL
Strada Ion Mihalache Nr. 38
Bloc 33 A Scara B AP 64 Sector 1 Interfon 64 C
RO-011192 Bukarest

Russia

KOBLENZ & PARTNER GmbH
Suschewskaja Str. 12 / 1
RU-127030 Moskau

Singapore

Wearnes Engineering & Distribution Pte Ltd
801 Lor 7 Toa Payoh #05-00, Wearnes Building
Singapore 319319

Switzerland

Josef STÖCKLI GmbH
Dampfkessel- und Pumpenanlagen
Breiten
CH-6216 Mauensee

Slovakia

DOLNY TECHNIC s.r.o.
Zimna 5
SK-0800 Presov

TONA – Tomáš Prina
Priekopská 84
SK-03608 Martin-Priekopa

Slovenia

TERMO SHOP d.o.o.
Rimska Cesta 176
SI-3311 Šempeter v Savinjski dolini

South Korea

SUNFOCUS Co. LTD
Insutrial Goods Circulating Center
Songnim 4-Dong, Dong-Gu
KR-Incheon, Südkorea

Spain

VYC Industrial
Avenc del Daví, 22
Pol. Ind. Can Petit
E-08227 Terrassa (Barcelona)

Tunisia, Morocco and Algeria (Maghreb)

Smart Technology Equipment
Rue abou yousser Chibani
BP: 42B
TN Kairouan 3100

Turkey

PERMAK Makina Tekstil
Sanayi ve Ticaret A.S.
Barbaros Bulvari 93
TR-80690 Beşiktaş -İstanbul

Ukraine

DP SLOVTERM
prospekt Shevchenka 7-A
UA-07 300 Vyshegorod
Kyievskaja oblast

United Arab Emirates

Saudi Arabia, Oman, Qatar, Bahrain
HRSFunke Heat transfers FZE
Jebel Ali Free Zone
PO Box 262243
Dubai, UAE

United States of America

Boilersource
A Division of Meilner Mechanical Sales, Inc.
19 West College Drive
Arlington Heights, IL 60004-1954

New England Applied Products
40 L Street
Boston, MA 02127

J.Lorber Plumbing
19 Dark Hollow Rd
Pipersville, PA, 18947

Cici Boiler Rooms, Inc.
7811 Baumgart Road
Evansville, IN 47725

Power&Heat Systems
10005 Whitesel Road
Ashland, VA 23005

Centurion Process. LLC
4001 Summitview Ave,
Suite 5 - 127
Yakima
WA 98908

Fluid Technology Corporation
1631 NE 55th Ave,
Des Moines
IA 50313

Buckpitt & Co Inc
88 University Ave,
Rochester NY 14605

Florida Commercial Products Corp.
7802-A Professional Pl
Tampa, Florida 33637

CERTUSS

Steam Generators



CERTUSS (UK) Ltd

Unit 45 Gravelly Industrial Park | Tyburn Road | Birmingham | B24 8TG

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TC as in
Touch Control



Steam generators **JUNIOR SC** series

Size	Steam capacity kg/h	Method of combustion
1	80 – 120	Oil or gas
2	150 – 200	Oil or gas
3	250 – 400	Oil or gas
4	500 – 600	Oil, gas or combination

Steam generators **UNIVERSAL SC** series

Size	Steam capacity kg/h	Method of combustion
5	700 – 850	Oil, gas or combination
6	1000 – 1500	Oil, gas or combination
7	1500 – 2000	Oil, gas or combination

Steam generators **ELEKTRO E 6 – 72 M** series

Size	Steam capacity kg/h	Method of heating
One size	8 – 97	Electrical 6 – 72 kW

Steam generators **ELEKTRO E 100** series

Size	Steam capacity kg/h	Method of heating
One size	135 / 160	Electrical 100 / 120 kW



CONTAINER Steam System
Completely equipped and ready to operate



CVE
Supply unit as complete ready-to-operate
boiler housing installation
In addition: Water softening equipment, measuring equipment



CERTECON
Exhaust gas heat exchangers for Junior series
In addition: Exhaust gas heat exchangers ECO SPI
for Universal series



DESALINATION HEAT EXCHANGER
Heat recycling from the desalination
condensate to heat feed water
Reduction of the amount of cooling water at steam systems with
mixing heat exchangers when waste water cooling is required



Universal 500 – 2000 TC at a glance

Efficiency

- + Extremely high degree of efficiency (with exhaust gas heat exchanger up to 98%) achieved through the 3-fold air insulation with simultaneous preheating of combustion air at very low emission losses
- + Short heat-up time. Full steam output is reached after a maximum of 5 minutes
- + Immediate output adjustment to the respective steam requirements which saves energy and thus costs through electronic combustion management and pilot flame system (gas burner)
- + With gas burner equipment modulating output control between 50 and 100% steam output (at oil operation via two output stages 50 and 100%)
- + Low-maintenance, continuous speed-controlled feed water pump
- + Low-emission burner developed specially to latest European standards for all sizes

User friendliness

- + Notably simplified operation through self-explanatory touch screen menu navigation
- + Graphically supported start and shutdown instructions
- + "Thermotimat" automatic system for fully automatic operation*
- + Remote control and control via Ethernet and mobile communications*
- + Optionally: "CVE" supply unit as complete boiler housing installation of boiler feed pump, steam dryer, water conditioning and waste-water mixing heat exchanger

Operation and installation

- + Secure installation without foundation at low space requirements

- + Can be installed in work areas, no boiler housing required
- + No permit required for installation and use in Germany up to Category III
- + Standard equipping for operation without constant supervision

Safety and quality

- + Function and malfunction indications can be linked to central control system / building services control system provided by customer
- + Can be remotely programmed and read out or controlled via Ethernet, CAN bus, PROFIBUS or GSM/UMTS modem*
- + Customer service standby 24 hours a day, 365 days a year
- + Spare parts supply guaranteed for 20 years
- + Function and error messages as well as service instructions through clear text display in many languages

Advantages of our technology

- + Robust all-steel design with double-shell air cooling without insulation materials
- + Air intake from above, trapped heat in boiler house extracted, floor dust remains
- + Noise and vibration damping, elastic aggregate fastening
- + Flue-gas recycling (NO_x reduction)*
- + Vertical tension-free central mounting of the heating system with low-point clarifying filtration
- + Recognized exemplary service
- + Can optionally be equipped with burners for EL heating oil, natural gas, liquid gas or combined (natural gas/EL heating oil) tested and approved by the TÜV-Rheinland-Berlin/ Brandenburg in accordance with the latest EU regulations for burners

The new generation of a proven series

The steam generators CERTUSS Universal 500 - 2000 TC are characterized by the immediate modulating output adjustment and the simplified operation.

Complete and safe

The new Universal 500 - 2000 TC series encompasses completely equipped, ready-to-operate, electronically controlled steam generators with all safety devices for burner technology, pressure and temperature. An electronic combustion management with self-monitoring of the latest generation can be programmed for all types of fuel. The Universal 500 - 2000 TC steam generators are started via non-seated flow controllers. Steam and waste gas temperatures are controlled through self-monitoring electronic thermostats with approval.

Manual, remote-controlled or automatic

The new series disposes of a self-explanatory control and operation function via a graphical user interface on a 7" touch screen. All the operating and fault messages as well as service instruction are displayed visually in all the desired languages. Controlling is carried out either manually or graphics-supported start and shutdown instructions or with optional "Thermotimat" automatic system in the system for fully automatic operation without operating personnel. Controlling via a central control system / building services control system is also just as possible as the display and transfer of operating and fault messages via Ethernet, CAN bus or PROFIBUS, as well as remote programming via a GSM modem.

Universal 500 – 2000 TC in detail



Automatic desliming and start dewatering

The Universal 500 - 2000 TC steam generators can be equipped additionally with an automatic desliming and start dewatering in connection with the "Thermotimat" automatic system.

Installation conditions

In accordance with the European Pressure Equipment Directive 2014/68/EU the CERTUSS steam generators are classified as Category III or IV depending on the operating pressure. They have been tested in accordance with the EC type examination. No permit is required for installation and use in Germany up to Category III Initial and repetitive tests can be carried out by the CERTUSS customer service as qualified persons on the Universal 500 - 600 series up to an operating pressure of 20 bar.

Size	Capacities			Levels	Pressures		Consumption			Dimensions (~ mm)						Weight (~ kg)	Connections								Categorization	Regulations
	Steam-capacity kg/h	Heating capacity kW	Nominal load kW		Max. operating pressure MPa (bar)	Max. permissible overpressure MPa (bar)	Heating oil (EL) kg/h	Natural gas m³/h	Liquid-gas m³/h	Height A	Width B	Depth C	Boiler Ø D	Flue gas pipe Ø E	Flue gas (center) F		Electrical connection load kVA	Oil connection DN	Natural gas DN	Liquid gas DN	Feed water DN	Steam connection DN	Safety valve DN	Start-up line DN	EPEG category	Germany BetrSichV Tests § 15 – 16
4	500 600	328 393	364 436	2	0.8-1.4-1.8-2.2-2.9 (8-14-18-22-29)	1.0-1.6-2.0-2.5-3.2 (10-16-20-25-32)	30.6 36.8	36.4 43.6	14.1 16.9	1980	930	1600	700	250	1460	950	6.32	⅜"	50	25	1 ¼"	32	40	¾"	III	up to 20 bar CERTUSS ¹⁾ over 20-32 bar AIA ²⁾
5	700 850	459 557	510 619	2	0.8-1.4-2.2-2.9 (8-14-22-29)	1.0-1.6-2.5-3.2 (10-16-25-32)	42.9 52.1	50.9 61.8	19.7 24.0	2290	1160	1870	870	300	1750	1100	7.34	⅜"	65	40	1 ¼"	40	40	1"	up to 25 bar III over 25-32 bar IV	AIA ²⁾
6	1000 1300	656 853	728 947	2	0.8-1.4-2.2-2.9 (8-14-22-29)	1.0-1.6-2.5-3.2 (10-16-25-32)	61.3 79.8	72.7 94.6	28.2 36.7	2535	1260	2125	1000	350	1940	1500	13.02	⅜"	65	40	1 ¼"	50	40	1 ½"	up to 16 bar III over 16-32 bar IV	AIA ²⁾
7	1500 1800 2000	984 1180 1320	1093 1311 1457	2	0.8-1.4-2.2-2.9 (8-14-22-29)	1.0-1.6-2.5-3.2 (10-16-25-32)	92.0 110.4 123.0	109.1 130.9 145.7	42.3 50.8 56.5	2675	1380	2310	1100	500	2025	2300	15.85	½"	80	50	1 ¼"	65	50	1 ½"	up to 10 bar III over 10-32 bar IV	AIA ²⁾

Reference values: Natural gas 10 kW/Nm³ - 8600 kcal/Nm³, liquid gas 25,8 kW/Nm³ - 22200 kcal/Nm³. Dimensions and weights have been rounded up or down. MPa and bar are overpressure values. Performance values referenced to 100 °C feed-water temperature and 1 MPa (10 bar) steam overpressure. CERTUSS burner with flue-gas recycling (NO_x reduction)*.

¹⁾ Through CERTUSS customer service as "qualified persons"

²⁾ Through "approved inspection agency", e.g. TÜV

* Supplementary equipment

We reserve the right to make technical modifications.

Appendix B Agarose Manufacturing Waste Stream Schematic

[The following text is a dense, continuous block of text, likely a scan of a document page. It contains numerous words and phrases, many of which are repeated or appear to be part of a list or index. The text is mostly illegible due to the quality of the scan and the density of the characters. It appears to be a list of names or terms, possibly related to a historical or scientific study. The text is organized into several paragraphs, with some lines starting with capital letters, suggesting the beginning of new entries or sections. The overall structure is that of a formal document or report.]

[The following text is a dense, continuous block of text, likely a scan of a document page. It is mostly illegible due to extreme blurring and low contrast. The text appears to be a single paragraph or a series of closely related sentences, but the specific words and structure cannot be discerned.]

