



recnnical	UPTIMUM PLUS
Documentation	OF I INIONI FLOS

A28-20-8585 System-No

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Manufacturer and Service

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2017/10/13	Adaptions
2019/03/15	Update Media diagram
2019/05/20	new supplier documentation
2020/02/03	MC adaptions
2020/06/15	MC adaptions
2020/08/19	Release 1.2.3

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System	UPTIMUM PLUS		
Serial no.	A28-20-8585	A28-20-8585	
Match Code	ÜPEI1		
Process	CVD		
Configuration DAS			
Version:	Inlets: Heating for inlet line	►6, DN40 es: ►5 x 80°C, 1x prepared	
	N2 heater:	▶ installed	
	HNPS: Power supply:	► 6 x 100sml 3 x 400V / 50 Hz, ► N, ► PE	
		0 x 100 v / 00 112, v 11, v 1 2	
Burner / Reactor	Burner inlets:	▶2 x ▶22mm	
	Fuel gas:	▶Propane	
	Oxidant:	►CDA ►additional CDA	
Scrubbing line	Scrubbing with:	▶ water	
	Heat exchanger:	▶98 kW	
	Demistor filling:	► Installed	
Control unit	Monitoring options:	►Ethernet	
	Interface options: ►		
Particularities	Signal tower:	▶Installed	
	Seismic protection	▶Installed	
	Drip pan	▶Installed	
	SEMI S2:	▶yes	



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General

The documentation consists of

- Operating manual
- Documents of suppliers

Scope of application The documentation applies to all persons working on the system. Before working on the system, the documentation must be read completely and observed exactly.

The documentation must be kept near the system and must always be available to the staff.

The documentation is a part of the system and must be completely available and updated during the entire period of use.

Content

The content of this documentation is no part of a former or an existing agreement, confirmation or relationship and it is not intended to change this.

All obligations of the manufacturer result from the respective purchase contract which also contains the complete and exclusively valid warranty regulation. This contractual warranty regulation is neither extended nor limited by the information of this documentation

Purpose

The documentation shall make it easier to become acquantained with the system and to use it according to its intended use.

The documentation contains important advice in order to operate the system in a safe, proper and economical manner. Observing it helps to prevent risks, to reduce maintenance costs and downtimes and to increase the reliability as well as the service life.

Design

References to chapters, images and tables are in brackets within the text (e.g. chap. 2.1).

Designations on the system, control and display elements of the touch panel (menu commands, buttons, names of windows and input fields) are **in bold** within the text.

Structure of safety notes (chap. 3.1.1).



ADVICE

Application tips and useful advice for proper work are marked with an icon.

Updates

Updated pages have a new edition. Updated pages must be replaced by the operator and marked as invalid.

After having updated the documentation, all users must be efficiently informed about the changes.

2 Product description

2.1 Ir

Important advice

Requirements

The following points apply for a safe, failure-free and proper operation of the system:

- The system must be in an excellent and reliable condition.
- Connect the system according to the valid assembly and installation documents.
- Comply with the technical data.
- Comply with the permitted ambient conditions.
- Do not start the system before it is integrated into the safety installations of the entire system.
- All safety installations and covers of the entire system must always be assembled and operational when the system is in operation.
- Ensure the timely execution of maintenance works.
- Only have the control and maintenance effected by persons trained for this purpose and authorised by the operator of the system.
- Only use original spare parts or spare parts recommended and admitted by the manufacturer.

NOTICE



Due to chemical load the expected lifetime of the plastics PP, PPs, PVC and PVC-C is approx. 8 years. The manufacturer recommends replacing all internal plastic components made of PP, PPs, PVC and PVC-C within the lifetime. Damaged plastic components may lead to major damage within the system and represent a safety risk.

WARNING



Unintended use of the system can cause severe damages to the system.

An incorrect use can cause life-threatening injuries, death and severe property damage.

Only the described use is deemed to be intended. Any other use is not considered intended use and is not permitted.

Intended use

The function of the system is to render harmful or polluted waste gases of an upstream system harmless by burning and subsequent scrubbing, so that they can be fed to an exhaust air installation provided by the customer.

Unintended use

Unintended use can result in risks. For example, unintended uses can be:

- Exceedance of the permitted loads.
- Control and maintenance of the system by persons who are not trained and authorised for this purpose.
- Use of fuel gas and oxidant different to the ones described in the media profile and the purchase contract.
- Introduction of non-ignitable gas mixtures through the waste gas pipes.
- Introduction of volume flows larger than specified.

2.2 Technical data

The detailed configuration of the system is described in the following documents in the annex:

- Connections and layout plan
- Media diagram
- Values of media to be connected (Facility requirements)
- Layout schematic
- Circuit wiring diagram

Safety regulations 3

3.1 **Visualisation**

3.1.1 Safety notes

DANGER Marks a directly imminent risk. If it is not avoided, death or serious injuries can result. **WARNING** Marks a possibly dangerous situation. If it is not avoided, death or serious injuries can result. **CAUTION** Marks a possibly dangerous situation. If it is not avoided, injuries can re-**NOTICE** Marks situations which can cause property damages.

3.1.2 Icons and pictograms



General warning



Warning of explosive substances



Warning of inflammable substances



Warning of substances supporting combustion



Warning of dangerous voltage



Warning of crushing hazards



Warning of hot surfaces



Warning of suspended load



General mandatory sign



Wear respiratory protection



Wear protective glasses



Wear protective shoes



Wear protective gloves



Wear protective clothing



Locking



Observe the operating manual

3.2

Product reliability

Safety regulations

The system complies with the current requirements of the following European directives:

- Directive 2006/42/EC (Safety of systems)
- Directive 2014/30/EU (Electromagnetic compatibility)

The system complies with the basic requirements on safety and health protection.

The following safety rules have been observed during the development and the manufacture of the system:

- BGV A1 (workplace guidelines for health and safety in the workplace, general regulations)
- BGV A3 (electrical systems and equipment)

Other applicable rules

The system is developed, designed and manufactured according to German and European technical rules.

The system may only be operated in accordance with the laws, regulations and safety rules valid at the place of application. This includes, among others, the health, work and fire protection regulations.

3.3 Safety installations

Familiarise yourself with all safety installations of the system. The safety installations serve the protection against risks.

Markings and designations

The attached markings and designations describe danger zones, safety installations and important advice. The markings and designations must always be clearly visible and readable. If necessary, replace markings and designations.

Protective installations Do not modify or remove any protective installation of the system. The protective installations serve the protection against risks.

Protective covers

Do not remove any protective cover of the system. The protective covers serve the protection against risks.

Personal protection

The following safety installations protect against personal damages:

- EMERGENCY STOP installation
- Protective circuit
- Gas sensor
- Cabinet exhaust
- Leakage sensors
- Safety temperature switch
- Cabinet, housing, cladding
- Flame arrester
- Flame sensor
- Pressure sensor tank

Safety installation	Risk	Effect
EMERGENCY STOP	 Risks in case of general exceedances and/or lower deviations of limiting values Risks in case of averages and accidents 	 The effect is exclusively limited to this system All moving parts of the system are stopped All operating functions are blocked After the contactor K0 of the main voltage supply, the system is de-energised Pneumatically controlled components are no longer actuated and take their initial position EMERGENCY STOP button remains locked until the manual reset
Protective circuit	 Risk in case of restart after mains failure Risk during working under voltage Risk due to an operation by unauthorised persons 	Protection against restart: The system does not switch on automatically after mains failure and return of the mains voltage Without current, the contactor K0 installed between the main switch and the consumers is always deactivated After current failure, the contactor K0 must be activated with the button ON in order to reactivate the system Mains isolator (main switch) The deactivated mains isolator deenergises the system The voltage feed until the mains isolator remains energised The deactivated mains isolator can be locked with a padlock (safety for maintenance works) Fault current circuit breaker The system switches off in case of contact with a fault current > 30 mA Key switch Prevents the access to the system by unauthorised persons
Gas sensor	Explosion due to leaking fuel gas / waste gas	 Monitoring of the air composition inside the cabinet In case of fuel gas concentration of > 25% of the lower explosion limit, the system is switched off Alarm message is triggered System changes to the bypass mode System activates the emergency stop
Flame arrester	Damaging or explosion of the fuel gas line	Prevents the breakthrough of the flame in opposition to the flow direction of the fuel gas

Safety installation	Risk	Effect
Cabinet exhaust	 Contamination of the environment with leaking gases Danger for persons by contaminated air Forming of an explosive atmosphere inside of the cabinet 	 Exhaust of the housing by vacuum inside of the cabinet Air change inside of the cabinet Monitoring with flow sensor Alarm message is triggered, if the flow rate falls below the minimum Monitoring of the door position with sensors Alarm message is triggered if the cabinet doors are opened for more than 120 s
Pressure sensor tank	 Leaving of gases due to excessive pressure inside the scrubbing liquid tank (exhaust too low) damaging of the tank or the scrubbing columns due to too low pressure in the scrubbing liquid tank (exhaust too high) 	Sensor measures over- and under pressure Sensor triggers warning and/or alarm messages if limiting values are exceeded or below the set point
Leakage sensors	Leakage of possibly toxic or harmful fluids	Alarm message is triggered System changes to the bypass mode Water supply is disconnected Pump switches off system switches to "FAIL-URE/BYPASS"
Safety temperature switch	Thermal overload due to an excessive heat-up	 Alarm message is triggered System changes to the bypass mode, if the temperature limit is exceeded
Flame sensor with automatic firing device	Explosion due to the entering of unlit combustion gas into the reactor and downstream modules	Automatic firing device closes the com- bustion gas valve if no flame signal ex- ists
Cabinet, housing, barrier	 Life-threatening voltage Surface temperature at the accessible points is too high Crushing/ shearing of fingers/ hand when adjusting valves 	 Protection of persons against accessible danger zones by mechanical modules (protective cover, housing) Nitrogen heater safely covered for tools with a cover plate Danger zones of the valves are covered by the outer housing of the system and pipelines and therefore they are inaccessible

Tab.3-1 Safety installations personal security



System security

The following safety installations protect against damages to the system:

- Temperature monitoring
- Pressure sensor tank
- Signal coupling vacuum pump
- Programmable logic controller (PLC)
- Level sensors
- Flame sensor
- Flow Monitoring
- Seismic protection

Safety installation	Risk	Effect
Temperature monitoring	 Thermal overload due to a failure of the cooler General thermal overload of the scrubbing liquid 	Sensors trigger warning and/or alarm messages if the limiting values are ex- ceeded (temperature of the scrubbing liq- uid too high)
Pressure sensor tank	 Leaving of gases due to excessive pressure inside the scrubbing liquid tank (exhaust too low) damaging of the tank or the scrubbing columns due to too low pressure in the scrubbing liquid tank (exhaust too high) 	Sensor measures over- and under pressure Sensor triggers warning and/or alarm messages if limiting values are exceeded or below the set point
Signal coupling vacuum pump	Light-back Backflow of the fuel gas	Switch off of the respective input signal in case of a failure of an upstream pump Switching of the bypass valve of the defective channel to the bypass mode
Programmable logic controller (PLC)	Dangers due to incorrect operations	Unauthorised operational condition caused by incorrect operations is limited through software locking devices in the PLC program
Level sensors	Overflow protection Interruption of the circulation flow	Overfull filling level (high level): Water supply stops Drain opens if, within 5 s, the filling level does not fall below the highest level permitted, an alarm message is triggered normal filling level (normal level): Filling stops Low filling level (low level) Pumping off process stops run dry protection circulation pump stops
Flame sensor with automatic firing device	Explosion due to the entering of unlit fuel gas into the reac- tor and downstream modules	Automatic firing device closes the fuel gas valve if no flame signal exists

Safety installation	Risk	Effect
Flow monitoring	Thermal overload	Alarm message in case of 20 % difference set value of the fuel gas Alarm message of falling below
		Error condition means bypass mode
Seismic protection	Damage of the system due to unintentional movement dur- ing seismic activity	System is fixed to the ground with additional anchor equipment

Tab.3-2 Safety installations system protection

Seismic protection drawing

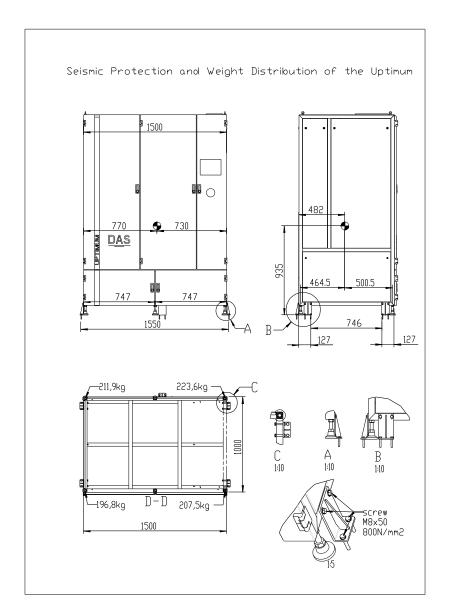


fig.3-1:Seismic Protection

3.4 Responsibility of the operator

The operator must ensure the following protective measures:

- Managing of the keys for lockable cabinet doors. (The access to the control module must only be possible for electrically skilled persons!)
- Regularly check the functionality of the safety installations.
- Ensure the completeness and the readability of the markings and labelling on the system (chap. 3.3, p. 6).
- Arrange the responsibilities for the different activities on the system (chap. 0, p. 11).
- Create and announce operating instructions for the operation and maintenance staff.

The operator must comply with all applicable statutory regulations and in particular with the working and environment protection regulations.

Furthermore the operator of the UPTIMUM is recommended to:

- make personal protective equipment available
- Store the electrical circuit diagrams in the compartment reserved for them on the inside of the door for the control insert module.

Faults and damages

Faults and damages affecting the safe operation must be reported to the operator and removed immediately. The system must be decommissioned until the fault has been removed.

Retrofitting

The retrofitting of the system can require modifications of the safety installations and new calculations of the specific load values. Contact the manufacturer for retrofitting.



ADVICE

The safety can be affected negatively if the system is modified on own authority.

3.5 Qualifications and authorisations

By describing every activity in this operating manual, the staff assignment and the responsibility are defined. In doing so, the following groups of persons are differentiated:

- · Operating staff
 - A person qualified and authorised by the operator for the control. He/she knows and understands the functional sequences of the system and their interaction with the environment.
- User
 - Person or institution with the capability to commission and/or to utilise a product in order to execute a required function, including a range of activities from cleaning to decommissioning at the end of the life cycle of the product.
- Operator
 - Legal person who uses the system and its related electrical equipment.
- External persons
 - All persons who are no part of the mentioned groups of persons. It is forbidden for external persons to stay in the work space of the system.
- Responsible electrically skilled person
 - Person who, as electrically skilled person, assumes the specialist and supervisory responsibility and who has been assigned with it by the operator.
- Electrically skilled person
 - Person who, due to his/her professional (electro technical) qualification, has knowledge and experience, including the valid norms and provisions, in order to

be able to evaluate the works assigned to him/her and to be able to recognise possible dangers.

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- Electro technically instructed person
 - Person who is instructed and, if necessary, trained by an electrically skilled person with its tasks assigned to him/her and the possible dangers in case of an improper behaviour as well as with respect to the necessary protective installation, personal protective equipment and protective measures.
- Skilled person
 - Person who, due to his/her relevant qualification and experience, is competent to recognise risks and to prevent possible dangers which could be caused by the operation or the maintenance of a product.
- Maintenance staff
 - Person who is verifiably qualified for the maintenance works and who is authorised by the operator. He/she knows and understands the functional sequences of the system and their interaction with the environment.
- Competent person
 - Person who is verifiably qualified for management tasks and who is authorised by the operator. He/she knows and understands the functional sequences of the system and their interaction with the environment. He/she has interdisciplinary supervision of all activities.

3.6 Product-specific dangers

Normal operation

- Only operate the system if all protective installations are completely functional.
- Before activating the system, ensure that no one can be endangered by the starting system.
- Before activating the system, ensure that all tools and assembly aids are removed.

Electrical energy

The system contains electrically operated modules. Especially the terminal box on the roof and the control module contain energised modules.

- Works on electrically operated modules may only be operated by electrically skilled persons.
- Observe the safety instructions on the system.
- Regularly check the electrical equipment of the system.
- Immediately have loose connections and damaged cables removed.
- Do not open protective covers on electrical equipment.
- De-energise energised equipment before working on it.

Media

The system contains elements or modules with media. The media can be highly pressurised and/or temperated. Spraying media can cause injuries.

- Interventions may only be made by maintenance staff.
- The system must be immediately switched off in case of visible defects.

The media used in the system can be alkaline or acid. These alkaline or acid media cause chemical burns on persons.

- Wear protective gloves and protective glasses when working on the system.
- Do not remove covers.
- Observe the safety instructions on the system and in the operating manual.

Exhaust gas harmful to health

In case of a failure of the suction, exhaust gas can enter the system. This can cause damages to health.

- Always ensure sufficient ventilation at the installation place.
- Wear respiratory protection for cleaning and maintenance works.



Hot surfaces

Hot temperatures can occur on the individual modules of the system, in particular on the reactor as well as on the waste gas lines and the bypass lines.

- Wait until these modules are cooled down before effecting maintenance works.
- Wear heat-repellent protective gloves.

Maintenance and assembly

To some extent, a complete decommissioning for maintenance and assembly works is not possible.

- Please proceed with special care and concentration during these works.
- In order to minimise the dangers, de-energise the system and protect the main switch against unintended restart.
- Attach a warning sign against restart and protect all media against unintended commissioning.
- After maintenance, check the safety installations for functionality.

Noise emission

A continuous high noise emission damages health. The sound level of the system is < 70

Wear ear protectors in case of a high noise emission.

Re-commissioning

Before and during all operations requiring a decommissioning of the system, protect the system against restart after decommissioning.

3.7 **General safety notes**

DANGER



Deactivated safety installations!

Not all safety installations are active in manual operation.

- Only use the manual operation for the testing of components.
- Only dispose of waste gases in automatic mode.
- Activate the automatic mode after maintenance works.

DANGER



Life-threatening voltage!

Improper work on the electric installation can cause death or serious injuries.

- Only electrically skilled persons may carry out works on the electric installation.
- Always de-energise the system first, using the mains disconnection device and protect it against unintended restart using a padlock. In doing so, ensure that the terminals on the main connection box and the mains disconnection device remain energised.

DANGER



Chemical burn caused by alkaline and acidic liquids!

The scrubbing liquid can be alkaline or acidic. Improper work with alkaline or acidic liquids can cause chemical burns.

Wear protective clothes, protective gloves and protective glasses when working with corrosive liquids.





Explosive atmosphere!

In case of malfunctioning combustible gases can flow into the system cabinet. Through admixing with the atmospheric gases an explosive capable gas mixture can result.

- > Check the gas sensors at regular intervals.
- Check the hose attachments at regular intervals.
- > Smoking and utilization of open flames is forbidden within the environmental area of the system.

DANGER



Harmful exhaust gas in the gas lines!

Gases escape during work on the gas lines which, in case of contact, can cause death or serious injuries.

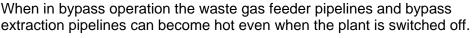
- Wear a protective mask when carrying out disassembly or cleaning work at the gas lines.
- Ensure enough ventilation on the assembly location for the system.

WARNING



Hot surfaces!

High temperatures can occur on the system components especially on the reactor.



- Wait until the components have cooled down before starting any maintenance measures.
- Always wear heat protective gloves.

WARNING



Hot liquids!

In case of malfunctioning it is possible that liquids under high temperatures can escape. Liquids with temperatures of more than 45 °C cause burns.

- Wait until the liquids have cooled down prior to undertaking any maintenance measures.
- Always wear heat protective gloves

3.8 Safety labelling

The following images illustrate the location and meaning of the security label attached to the system.

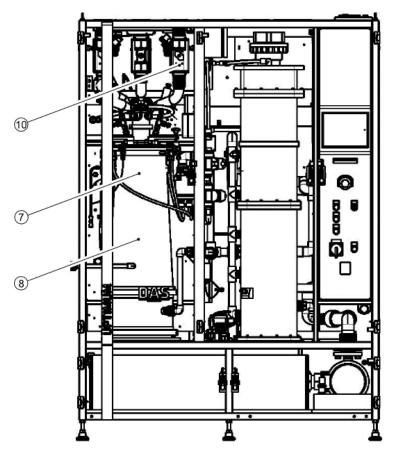


fig.3-2 Security label front side open

Number	Description	Image
7	Hot gases can escape from the reactor! Wear protective gloves and respiratory protection! Ensure the suction (cabinet suction).	Hot gases may escape from reactor! Ensure that you wear gloves, a respiratory apparatus and have an extraction unit available (cabinet exhaust).
8	Hot surface! If the display is red, temperature > 55 °C! Wear protective gloves! Ensure the after cooling has finished!	
10	Do not switch the bypass valve during cleaning! Risk of finger amputation! Close the compressed air supply before cleaning, see operating manual! Use auxiliary materials for cleaning!	WARNING Do not switch 3-way valve during cleaning, contact may cause severing of a finger. Use tools for cleaning – not the fingers! Switch off CDA (read manual).

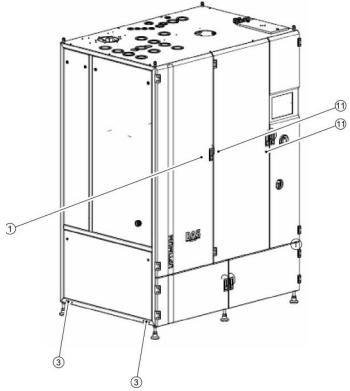


fig.3-3Security label front side closed

Number	Description	Image
3	Additional thread point for earthquake protection and overturning here! Use screws M8 of strength class 8.8, see operating manual!	Additional thread point for earthquake protection and overturning here! Use screw M8 / strength class 8.8 (see manual).
11	Danger of malfunction of cabinet exhaust! Close door and side panels if system is running.	Danger of malfunction of cabinet exhaust! Close door and side panels if system is running.

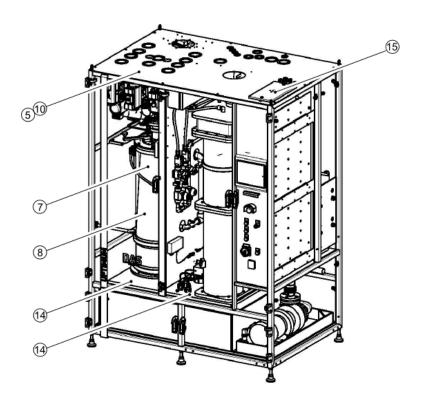


fig.3-4: Security label Front side open

Number	Description	Image
5	Hot surface! Temperature inside of heating is >120 °C (>260 °F)! Before servicing: wear protective gloves and wait till cooling is complete!	WARNING Hot surface! Temperature inside of heating is >120°C (>260°F)! Before servicing: wear protective gloves and wait till cooling is complete (read manual)!
7	Hot gases can escape from the reactor! Wear protective gloves and respiratory protection! Ensure the suction (cabinet exhaust).	Hot gases may escape from reactor! Ensure that you wear gloves, a respiratory apparatus and have an extraction unit available (cabinet exhaust).
8	Hot surface! If the display is red, temperature > 55 °C! Wear protective gloves! Ensure the after cooling has finished!	WARNING Hot surface! If Indicator is red Temperature is > 55°C. Wear protective gloves and ensure cooling procedure is working and complete. Indicator > 55°C > 130°F

Number	Description	Image
10	Do not switch the bypass valve during cleaning! Risk of finger amputation! Close the compressed air supply before cleaning, see operating manual! Use auxiliary materials for cleaning!	Do not switch 3-way valve during cleaning, contact may cause severing of a finger. Use tools for cleaning – not the fingers! Switch off CDA (read manual).
14	Hazardous material! Contact may cause cauterisation, if the couplings of the lye supply are opened. Before servicing close the NaOH/KOH valve and the CDA supply of the system. Protect skin and eyes!	CAUTION Hazardous material Contact may course cauterisation, if the couplings of the lye supply are opened Before servicing, close the NaOH/KOH valve and the CDA supply of the system. Protect skin and eyes! CDA
15	Warning of voltage!	

DAS

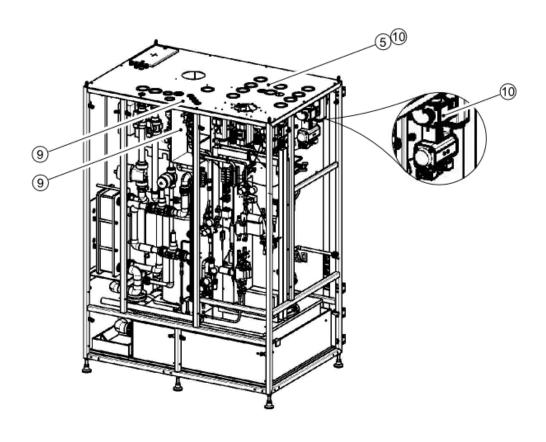


fig.3-5 Security label rear side closed

	9 9	
Number	Description	Image
5	Hot surface! Temperature inside of heating is >120 °C (>260 °F)! Before servicing: wear protective gloves and wait till cooling is complete!	Hot surface! Temperature inside of heating is >120°C (>260°F)! Before servicing: wear protective gloves and wait till cooling is complete (read manual)!
9	Opening line may cause fire! Turn off Fab oxygen & fuel gas valve before servicing.	Opening of line may cause fire! Turn off Fab oxygen & fuel gas valve for Escape system before servicing.
10	Do not switch the bypass valve during cleaning! Risk of finger amputation! Close the compressed air supply before cleaning, see operating manual! Use auxiliary materials for cleaning!	Do not switch 3-way valve during cleaning, contact may cause severing of a finger. Use tools for cleaning – not the fingers! Switch off CDA (read manual).

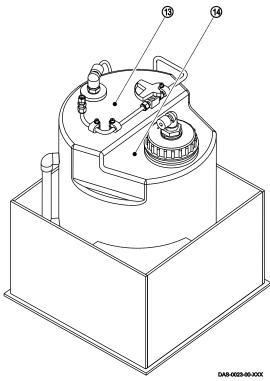


fig.3-6Security label lye tank

Number	Description	Image
13	Warning of corrosive substances!	
14	Hazardous material! Contact may cause cauterisation, if the couplings of the lye supply are opened. Before servicing close the NaOH/KOH valve and the CDA supply of the system. Protect skin and eyes!	CAUTION Hazardous material Contact may course cauterisation, if the couplings of the lye supply are opened Before servicing, close the NaOH/ROH valve and the CDA supply of the system. Protect skin and eyes! CDA

3.9 Emergency information

Fire If possible, switch off all electrical devices and push the **EMERGENCY STOP** button.

Electrical accidents

Do not touch metal parts, push the **EMERGENCY STOP** button and rescue persons located in the danger area using only isolated auxiliary materials.

4

Structure and function

Functional principle

The waste gases to be cleaned are passed via up to six waste gas inlets to the reactor. There they will be combusted using a fuel gas and an oxidant. The control calculates the necessary quantity of fuel gas and oxidant depending on the composition and the quantity of the waste gases. The gaseous and solid combustion products will be absorbed and ligated during the subsequent scrubbing process.

The clean gas which develops during this process will be passed to the exhaust air installation provided by the customer. In case of error or maintenance, the system switches to bypass mode. The waste gas will be thinned with nitrogen and passed to the exhaust air installation provided by the customer.

Structure

The system consists of several modules inside the system cabinet. Each module consists of different elements.

Waste gas supply

- Connections to the waste gas supply and bypass outlets
- Waste gas valves
- Nitrogen purge
- Heating

Reactor

- Combustion chamber with burner
- Fuel gas and oxidant control for burner
- Reactor wall purge (wall, head)

Scrubbing stage

- Scrubbing liquid circulation
- Parallel scrubber (two scrubbing columns)
- Scrubbing liquid tank
- Lye dosage
- Drip pan

Gas outlet

- Exhaust gas line
- Opening for secondary air
- Connection of exhaust air installation

Media

- Media supply
- Current supply, generation of the control voltage
- Control via touch panel



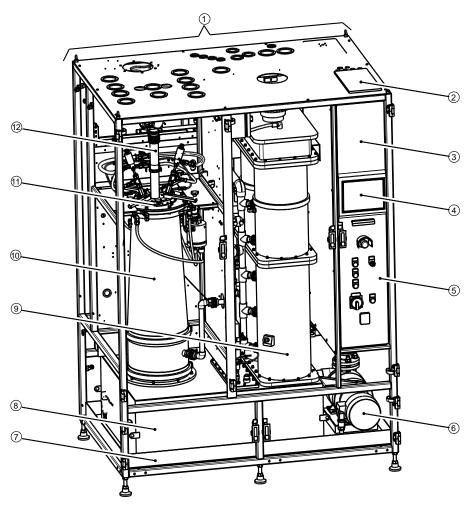


fig.4-1Main components of the front side

- 1 Connectors on the top
- 2 Terminal box on the roof
- 3 control module
- 4 Touch panel
- 5 Control elements
- 6 Circulation pump
- 7 Drip pan
- 8 Scrubbing liquid tank
- 9 Scrubbing column
- 10 Reactor
- 11 Reactor head
- 12 Waste gas supply (bypass valve)

4 Structure and function

4.1 Waste gas supply

Structure and function

The waste gas flows into the system via up to six inlets. The pressure required for this process must be generated by the upstream systems. Via bypass valves, the gases are either passed into the reactor or the bypass line. Pressure sensors measure the inlet pressure of the waste gas. In case of an excessive inlet pressure, the respective channel is switched to bypass mode and an alarm is triggered.

Heating

The heating heats up the waste gas line in order to prevent clogging due to undesired condensation.

Purging with nitrogen At the waste gas inlets, purging with nitrogen has the following functions:

- Purging of the pressure sensor measuring chambers. This protects the pressure sensor membranes form accumulation of deposits and aggressive gases.
- The purging of the bypass pipelines. This retains the pipeline in an inert state and counteracts a return diffusion of oxygen and humidity
- Purging of the waste gas pipelines between the bypass valve and the reactor head.
 This stops and returns diffusion of humidity

4.2 Reactor

Structure and function

The waste gas is fed into the top of the burner and flows downward. The reactor consists of the following elements:

- Reactor head with burner
- Combustion chamber
- Quench (spraying nozzles)

Reactor head

The reactor head is made of corrosion-free material. The individual inlets for waste gas, nitrogen, compressed air, fuel gas and oxidant are located on the reactor head. It is cooled with an extra cooling installation.

Combustion chamber

The combustion chamber is made of corrosion-free material. The internal wall is additionally protected against deposits and corrosions by a water film.

Burner

The burner provides the temperature which is necessary for the waste gas combustion (chap. 4.2.2).

Reactor purging

The reactor is purged with nitrogen and compressed air (chap. 4.2.1).

Sensors

The temperature on the surface of the combustion chamber is checked via temperature switches.

Cooling

Scrubbing liquid is passed into the reactor in such a way that it flows with a spiral form down the inner reactor wall and hence, that it permanently moistens and cools the reactor wall.

An extra installation is cooling the reactor head. This prevents the reactor head from overheating.

Liner

The liner protects the burner against humidity. The water flow is optimised in such a way that a formation of droplets inside the reactor room is prevented.

Function

The reactor has the following functions:

- Combustion
- Quenching/scrubbing

Combustion

The waste gases flow into the reactor and react with the oxidant in the flame of the burner. This effects the breaking of chemical compounds. Solid reaction products are washed out by the scrubbing liquid. Other components which do not oxidise during the combustion and/or which remain in gaseous condition will be hydrolysed.

Quenching/scrubbing

The burned waste gases and the cooling water flow collectively through the openings on the quenching plate. The waste gases are thereby chilled down. This prevents a creation of dioxin and furan during the disposal of waste gases containing chlorine.

Furthermore, the quenching plate causes a gas circulation and mixing in the combustion chamber.

Spraying nozzles for scrubbing liquid are located below the quenching plate.

In the quenching section, the scrubbing liquid, in addition to the quenching, has the following functions:

- Absorption of the acid gases generated during the combustion (e.g. HCl, HF, HBr, SO₂ etc.).
- Neutralisation of the generated acids by providing the respective salts.
- Cooling of the system, this means transport of the heat quantity which is generated by the burner.
- · Scrubbing out of solid components

4.2.1 Reactor purging

Purging with nitrogen At the reactor, purging with nitrogen has the following functions:

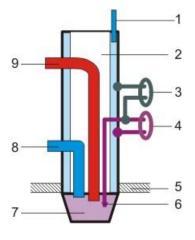
- Purging of the reactor after a failed ignition in order to ensure the specified conditions.
- The purging of the reactor head when burning prevents the clogging of waste gas inlets.
- Permanent purging of the reactor head in order keep the reactor head dry and inert(this function also remains active in case of an emergency stop or a failure of the voltage supply).
- Separation of the wet area and the dry area (located between reactor head and combustion chamber)

Purging with compressed air

At the reactor, purging with compressed air has the following functions:

- The purging of the oxidant line and the burner prevents humidity inside of burner.
- Cooling the burner.
- Creating an excess of air in the combustion chamber.

4.2.2 Burner



- 1 CDA feed line purging (only for Version with oxidant: CDA)
- 2 Burner pipe (double walled)
- 3 Connection for the flame monitor
- 4 Connection for the ignition transformer
- 5 Wall of reactor head
- 6 Electrode
- 7 Mixing chamber
- 8 Oxidant feed line
- 9 Fuel gas feed line

Structure

Fuel gas and oxidant reach the mixing chamber through separate connections, where an ignitable gas mixture will be generated. An electrode at the outlet of the burner is provided for the generation of an ignition spark during the firing and as a sensor for the flame

monitor during burning. The electrode is controlled and monitored by an automatic firing device. The automatic firing device operates independent from the control device.

Firing

During the ignition an ignition transformer supplies a high voltage of 7.5 kV for the generation of an ignition spark.

Monitoring

The burner is monitored using a flame monitor. It measures the ionisation current of the burner inside the mixing chamber.

Sequence of the firing

- 1. The control sends the signal for firing.
- 2. The oxidant valve opens.
- 3. The ignition gas valve opens. The required ignition gas quantity is regulated by the PLC.
- 4. An ignitable gas mixture is formed inside the mixing chamber of the burner.
- 5. Due to the high voltage inside the burner, sparks are generated between the electrode and the wall of the burner.
- 6. The gas mixture inside the burner is fired.
- 7. The gas mixture inside the burner is ionised and electrically conductive.
- 8. The automatic firing device stops the firing process after approx. 3 seconds. If it detects a current via the electrode, it reports to the control device that the firing was successful.
- 9. The fuel gas valve opens.
- 10. The ignition gas valve closes.
- 11. Now, the electrode operates as a flame monitor.

Failed ignition

If the flame monitor detects no ionisation current after a specified time, the firing process is stopped and the control device is notified that the firing was not successful. At the same time, the fuel gas valve and the oxidant valve are being closed. A second firing is carried out. After the second failed ignition, the system switches into error status.

4.3 Scrubbing stage

Structure

The scrubbing stage consists of the following components:

- Scrubbing liquid tank
- Scrubbing columns
- Scrubbing liquid circulation with pump and cooling device
- Lye dosage
- Drip pan with leakage detection

Function

The scrubbing of the combusted waste gas is continued in the scrubbing stage. Water-soluble components are dissolved in the scrubbing liquid. Components insoluble in water are suspended in the scrubbing liquid.

Scrubbing liquid

The scrubbing liquid has the following functions:

- Quenching of the combusted hot gases.
- Absorption of the acid gases generated during the combustion (HCl, HF, HBr, SO₂ etc.).
- Neutralisation of the generated acids by providing the respective salts.
- Cooling of the system, this means transport of the heat quantity which is generated by the combustion and the waste gases.
- Scrubbing out of solid components

Lye

If etch gases are combusted, the combustion generate acids. In order to neutralise them, thinned lye is used as a scrubbing liquid. The used lye is substituted with the lye supply.

Leakage detection

The tank and the circulation pump are each fitted into separate safety tanks. They are both monitored by a leakage sensor. If scrubbing liquid escapes through a leak into the

25

4 Structure and function 26

> tank an alarm will be triggered. The system will switch into failure/bypass operational mode.

4.3.1 Scrubbing liquid tank

In the scrubbing liquid tank, the scrubbing liquid is collected after passing through the reactor and the scrubbing section.

Structure

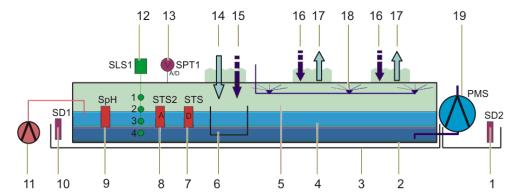


fig.4-2:Scrubbing liquid tank

1	Leakage sensor	11	Lye dosage
2	Scrubbing liquid tank	12	Level sensor
3	Drip pan	13	Pressure sensor
4	Scrubbing liquid	14	Waste gas flow from reactor
5	Waste gases	15	Scrubbing liquid from reactor
6	Sieve cup	16	Scrubbing liquid from the scrubbing columns
7	Temperature switch	17	Waste gas flow into the scrubbing columns
8	Temperature sensor	18	spray nozzles for the roof purging
9	ph sensor	19	Circulation pump
10	Leakage sensor		

Level sensors

The level sensors indicate the filling level inside the scrubbing liquid tank and control the replacement of the scrubbing liquid. In doing so, it is distinguished between the following conditions:

- Overfull filling level
- Normal filling level
- Low filling level
- Run dry protection

If the values exceed or fall below the set limits, warning and alarm messages are triggered. If the level falls below the run dry protection the circulation pup is switched off.

Temperature sensors

Temperature sensors are monitoring the temperature of the scrubbing liquid. Excess temperatures result in warnings. If a maximum temperature is exceeded, an alarm is triggered and the system switches into error condition.

Pressure sensor tank

The pressure sensor is monitoring the pressure inside the scrubbing liquid tank and the scrubbing columns. If the values exceed or fall below the set limits, warning and alarm messages are triggered.

pH sensor

The pH value of the scrubbing liquid is determined using the pH sensor. If the pH value falls below the set value, lye is added or the replacement of the scrubbing liquid is initiat-

ed.

Leakage sensors The scrubbing liquid tank is positioned in a safety tank. The safety tank is monitored by a

leakage sensor which triggers an alarm and switches the system to bypass mode in case

of a contact with the scrubbing liquid.

Sieve cup

The sieve cup separates the reactor area from the circulating pump suction. It holds back

solid components from the reactor.

Drip pan The scrubbing liquid tank and the circulation pump stands in a safety tank. Escaping

scrubbing liquid is detected by a leakage sensor.

4.3.2 Scrubbing column

Structure The combusted waste gas flows through the scrubbing stage by the counter flow principle.

Two scrubbing columns form a parallel scrubber. Filling elements, multiple spray nozzles and a demister are located inside the scrubbing columns. Scrubbing liquid is sprayed into the gas flow with the spray nozzles. During the scrubbing process, particles are suspended in the scrubbing liquid and acid components are neutralised by an alkaline scrubbing liquid. The filling elements enlarge the reaction surface. The scrubbed waste gases contain water droplets which are generated by the atomisation of the scrubbing liquid.

Demister In the demister, the droplets on the surface of the filling elements are separated again.

The separated liquid goes back into the scrubbing liquid tank.

Demister rinsing In order to remove depositions, the demister is rinsed permanently with fresh water. For

this purpose, a water outlet is installed above the demister which is controlled via a

pneumatic valve.

4.3.3 Scrubbing liquid circulation

In the scrubbing liquid circulation, the scrubbing liquid is pumped out of the tank and is divided in multiple partial flows.

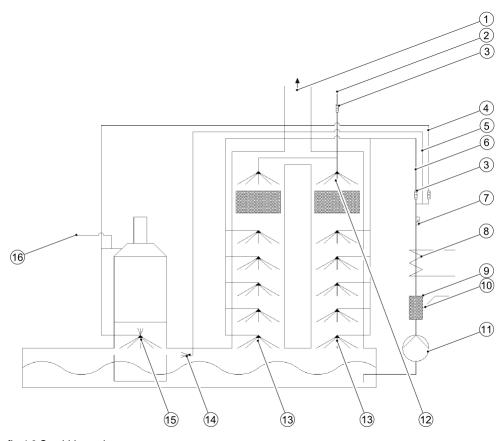


fig.4-3 Scrubbing unit

1	Exhaust gas outlet	9	Y-Filter
2	Fresh water supply	10	Drain (waste water)
3	Flow meter	11	Circulation pump
4	Reactor flow	12	Spray nozzles demister rinsing
5	Agitation flow	13	Spray nozzles Scrubbing columns
6	Scrubbing flow	14	Agitation spray nozzle
7	Temperature sensor	15	Spray nozzles reactor
8	Cooler	16	Lye supply

Pump

The corrosion-free pump sucks scrubbing liquid from the bottom of the tank and pumps it into the lines. The flow is limited by the cross-sections of the lines and the spray nozzles.

Cooler and filter

At first, the scrubbing liquid passes a filter and the cooler. Subsequently, the scrubbing liquid passes an analogous temperature sensor in order to check the cooling function. The measured value is analysed in the control device. After that, the scrubbing liquid is divided into partial flows:

Partial flows

Reactor flow: The scrubbing liquid has two tasks. It forms a water film on the internal reactor wall and is used for the cooling of the reactor wall. Second in scrubs the combusted waste gas via spraying nozzles at the reactor outlet for the first time. Subsequently, it flows back into the tank.

Scrubbing flow: The scrubbing liquid is sprayed into the scrubbing columns through spray nozzles and is used for the scrubbing of the combusted waste gas. Subsequently, it flows back into the tank.

Agitation flow: The scrubbing liquid is sprayed for agitating the scrubbing liquid in the tank.

Waste water

Waste water is drained via the Y-filter.

4.4 Gas outlet

Exhaust gas line

The exhaust gas line passes the cleaned waste gas to the exhaust air installation provided by the operator. In order to further reduce the concentration of pollutant - and especially the concentration of dust - an electrostatic dust separator can be installed as an additional cleaning system.

Secondary air

The waste gas has a relative air humidity of 100%. In order to prevent a condensation inside the exhaust air line, dry ambient air is admixed through secondary air holes.

Monitoring

The functionality of the suction is monitored by a pressure sensor inside the reactor. Insufficient under pressure leads to an alarm message and the system switches into bypass mode.

4.5 Media supply

4.5.1 Cooling

During operation the temperature of the scrubbing liquid increases. Excessive heat is discharged via a heat exchanger. The cooling water flow is switched via a pneumatic valve.

4.5.2 Fuel gas and oxidant

After feeding in, the fuel gas passes a stop valve. A mass flow controller ensures an exact dosage of the fuel gas. Depending on the firing or burning system, the ignition or fuel gas subsequently flows into the burner via a fuel gas valve.

A flame arrester inside the fuel gas line prevents the breaching of the flame contrary to the flowing direction of the fuel gas.

After feeding-in, the oxidant passes a stop valve. A mass flow controller ensures an exact dosage.

4.5.3 Compressed air

Dry compressed air (CDA – Compressed Dry Air) is required for the following purposes:

- · Adjustment of the pneumatic valves
- Purging of the reactor and the burner (optional)
- Oxidant for the combustion reaction (optional)

Preparation

The pressure of the compressed air for the valve terminals is manually adjusted and digitally monitored by a pressure regulator. If the pressure is too low, the control unit generates a warning message.

4.5.4 Nitrogen

Nitrogen is required for the following purposes:

- Purging of the pressure sensors and the bypass lines
- · Purging of the reactor line
- Purging of the reactor after a failed ignition
- Separation of wet and dry section in the combustion chamber

Preparation

The nitrogen pressure is manually adjusted and digitally monitored by a pressure regulator. If the pressure is too low, the control unit generates a warning message.

4.5.5

Lye (option)

Lye supply

The lye is required for the neutralising effect of the scrubbing liquid. The lye supply can be realised as follows:

- Lye tank with dosing pump
- Central lye supply with flow meter

Lye quantity

The lye quantity is defined by the waste products generated during the cleaning process. It must be adopted to the respective conditions and adjusted in the control device.

Lye tank

The lye tank is filled with lye. It is equipped with a level sensor whose output signal is analysed by the control device. A dosing pump dispenses a preset quantity of lye to the water during metering. The lye tank can be filled manually or via central filling. If the filling level falls below the minimum during manual filling, a request for refilling of the lye tank is displayed on the touch panel.

Central lye supply

In case of a central lye supply, the lye is filled into a lye tank or directly into the system via a lye valve and a flow meter. A missing or insufficient lye flow when the lye valve is opened leads to a warning message.

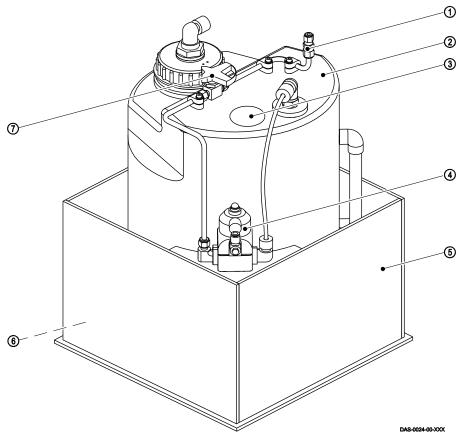


fig.4-4 Lye tank

- 1 Central filling
- 2 Lye barrel
- 3 Manual filling
- 4 Pneumatic valve
- 5 Safety tank
- 6 Leakage sensor
- 7 Stop valve

4.6 Support fan (option)

A continuously operating supporting ventilator can be additionally installed into the exhaust gas line, for a high-performance system exhaust.

4.7 Voltage supply and control device

Control device

The system is controlled via a programmable logic controller (PLC). The functional sequence for the system is stored in the PLC as a program. Switching signals are analysed, logically connected and sent to the actuators via signals.

NOTICE



Modifications on the control device

Incorrect modifications on the control device lead to substantial damages to the system.

Modifications on the control device, including modifications on the programming, must only be effected by the manufacturer of the system and with its approval.

Control unit

The control unit contains the following components for the voltage supply and the control of the system:

- Control and display elements
- Mains adapter for the control voltage
- Automatic circuit breakers for monitoring
- PLC

DANGER



Electrical voltage! When opening the doors to the control module, the system will not be de-energised automatically.

The contact with hazardous contact voltages on all installed devices, cables and contact points leads to death or to serious injuries.

- Keep the doors closed during the operation of the system.
- The keys for opening the doors of the control module must only be accessible to electrically skilled persons.

Terminal box

A terminal box on the system's roof allows the connection of the network supply. It contains inputs for 24-volt signals and outputs (potential-free contacts). The input and output signals are used for the process coupling and/or the reporting of certain system conditions on a monitoring system. In the terminal box, the required control cables are connected to the respective terminals.

Process coupling

The signals of the process coupling are used for the control of the system with the upstream and downstream systems.



Control and display elements, modes of operation 5

The following control and display elements are located on the control module:

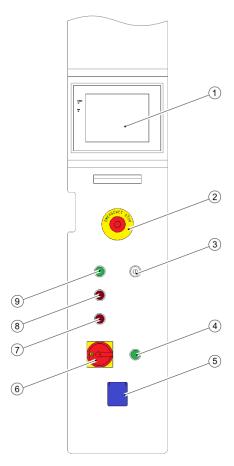


fig.5-1"Control and display elements on the control module

- 1 Touch Panel
- 2 **EMERGENCY STOP**
- 3 Key switch AUTO - SERVICE
- 4 Button **ON**
- 5 Power socket
- 6 Mains disconnection device
- 7 Illuminated button **QUIT**
- 8 Illuminated button **STOP**
- 9 Illuminated button **START**

EMERGENCY STOP

The pushing of this button activates the emergency stop and switches the machine into a safe state.

START

The pushing of this illuminated button starts the functions burning and scrubbing in service mode. In automatic mode, this button has no function.

STOP

The pushing of this illuminated button stops running processes in service mode. Pushing once stops the burning process, pushing twice stops the cooling and scrubbing processes. In automatic mode, this button has no function.

QUIT

The pushing of this illuminated button acknowledges faults.



ON

The pushing of this connects the voltage to the system (protection against restart).

Mains disconnection device

Turning this switch disconnects the system from the mains supply.

Key switch

Turning this switch allows a shifting between service mode (manual operation) and automatic mode.

Signal tower

Colour fields on the signal tower indicate different operating conditions of the system.

Red: Alarm Yellow: Warning

Green: System in operation, no error message

5.1 **Touch Panel**

The Touch Panel serves the visualisation and the control of the system. All information is entered by directly touching the active elements on the screen surface. A memory card slot for data recording is located at the rear side of the device.

NOTICE



Sensitive surface of the Touch Panel.

Do not use sharp or hard objects (e.g. ball pens, screw drivers) on the display.

5.2 Operating modes and operating conditions

Operating modes

The system operates mostly automatically. The position of the key switch defines the operating mode.

Automatic mode

In automatic mode it is possible to monitor the components and to edit the parameters. The control device executes all settings according to the requirements and monitors the system. No operational actions are required.

NOTICE



In automatic mode, modified parameters affect the entire process.

Incorrect parameters cause damages to the system.

- Parameters must only be modified by specialist staff.
- Always set the parameters as specified by DAS.

Service mode

The service mode is activated with a key. Just as in automatic mode, all important data and parameters can be entered and edited by the user. Maintenance works can be carried out in service mode. Furthermore, it is possible so switch to manual operation in service mode, which is used for the testing of the system. Subsequently, individual components of the system (e.g. valves, pumps) can be selected individually. The safety installations remain active. In doing so, the manual operation is a particularisation of the service mode.

In service mode, maintenance work can be performed. The system does not have to be switched off but disposes of the waste gas via the bypass line. Only for maintenance work on the bypass valves, it is necessary to turn off the system completely.

Operating conditions

Depending on the signals of the upstream / superordinate system, the system can be switched to different operating conditions which are displayed on the screen.

Operating messages

Current operating messages are displayed in the status line of the touch panel. The last 1024 system conditions are recorded in the image "HISTORY OPERATING MESSAGES". The messages are displayed in clear text together with the date and time.



Operating message on the display screen	Diagnosis
CHANGE SCRUB. LIQUID MODE FILL FW	Fresh water is refilled during the scrubbing liquid replacement.
CHANGE SCRUB. LIQUID MODE FILL LYE	New lye is added during the scrubbing liquid replacement.
CHANGE SCRUB. LIQUID MODE PUMP DRY	The emptying of the scrubbing liquid tank is active.
EVACUATION VPI16 ACTIVE	Process chamber is emptied. The waste gas valve is closed.
PUMP PMS1 MODE WASHING	Scrubbing liquid circulation is active.
RESTART MODE BURNING	The reactor starts up until reaching the normal burning power.
RESTART MODE IGNITION	A second firing process starts.
OPERATION MODE LOW FLAME	The system burns with a small flame waiting for gas request.
OPERATION MODE SERVICE	The system is in service mode.
SYSTEM MODE BURN ON	The system is running.
SYSTEM OFF	The system is switched off.
SYSTEM OFF - FAILURE	The system has switched off because of an error.
SYSTEM MODE STANDBY	The system is ready for disposal. No failure is pending. Cooling and scrubbing is active.
VPI16 POSITION REACTOR	The bypass valve of the respective channel is in reactor position.

Tab.5-1 Operating messages

6 Commissioning

6.1 Introduction

The system may only be commissioned by competent or specialist persons.

The initial commissioning of the system will be carried out by the manufacturer DAS EE GmbH. The system will be delivered to the customer after a functional test. This section describes the recommissioning of the system after transport, scheduled downtime and maintenance.



ADVICE

Before starting the system, ensure that the requirements of the EC Machinery Directive 2006/42/EC have been met.

Undefined operating conditions may occur during the commissioning process. Therefore, always carry out the commissioning of the system with special care and in compliance with the safety instructions.

NOTICE



Incorrect integration of the system into the overall system.

An incorrect integration significantly damages the system and/or the upstream/downstream systems.

- Strictly observe this operating manual and the documentation in the annex.
- > The operator is responsible for the overall safety concept.

DANGER



Energised elements!

Touching energised elements results in death or serious injuries.

- > Only operate the system when the control module is closed and the cladding is properly sealed.
- Protective installations such as the safety switch must work properly.

6.2 Transport and packaging

The system will be prepared for transport according to the dispatch type.

- The system is completely or partly secured on pallets.
- Depending on the dispatch type, the system is packed in protective foil or protective foil with transport box
- Projecting parts are secured.

The system may only be transported by competent or specialist persons.

DANGER



Elements can fall down.

Falling elements cause death or serious injuries.

- Do not stay or work under suspended loads.
- Only use slinging means which have been certified and which are suitable for the transport weights.
- Only use the provided attachment points.

Transport of the packaged system

Transport the packed system using a forklift or lifting carriage.

Transport of the unpackaged system

Transport the unpacked system using a forklift or lifting carriage. In doing so, use load hooks! If the transport lock of the slide-in door has been removed, close and lock the slide-in door.

6.3

Setup and assembly



ADVICE

Before assembly, take all necessary safety measures, close off the assembly area and instruct and train the staff.

Persons not involved in transport and assembly works must leave the danger area.

Unpacking

Unpacking of the system:

- Compare the content of delivery to the packing list.
- 2. Check the tilt and shock indicators at the boxes and the system.
 - Report defective or triggered indicators to the forwarding company and DAS Environmental Expert GmbH.
- 3. In case of triggered indicators and other visible damages, photographically record the unpacking process.
- 4. Remove cover and walls of the transport box.
- 5. Remove the side panel on the right side.
- 6. Loosen the earth cables.
- 7. Remove the transport lock (screw at the control module).
- 8. Attach the earth cable and reassemble the side panel.
- 9. Assemble the lifting eyes.
- 10. Loosen the screws between the lower system frame and the pallet.
- 11. Lift the system from the pallet and transport it to the installation place.
 - Observe the transportation requirements
- 12. Drip pan at the planned installation place
 - Please note: A subsequent placement of the drip pan by lifting the system is not possible!

Setup and assembly

Setup and assembly of the system:

- Assemble the system at its intended place.
- 2. Adjust the height of the pedestals (see "connection and layout plan").
- 3. Horizontally align the system.
- 4. Anchor the system to the floor using the earthquake protection system.
- 5. Install the lye tank next to the system.
- 6. Dispose of the packaging material according to the regulations of the country in which the system is used.
 - ✓ The system has now been assembled and is ready for the installation of the media.

Installation of the media

Requirements:

- Observe the facility requirements
- Connect the waste gas and bypass lines together with the bellows. Do not set up permanent connections!
- Use the lines according to the system pressure and the media to be carried and clean them before mounting.

Installing the media:

- Install the media according to the "connections and layout plan".
 - Observe the facility requirements.
 - ✓ The system is now supplied with all media.

Recommendations for exhaust air installation

The requirements for the connection of exhaust air can be found in the facility requirements.

- Before integrating the cabinet and reactor suction, install one throttle valve each. Assemble throttle valves next to the system.
- When integrating the cabinet and reactor suction into the same central exhaust air installation, observe the minimum distance of 1 m between the throttle valve and the integration.
- Integrate the bypass line, the cabinet suction and the reactor suction horizontally in order to prevent dirt particles and condensate from falling into the vertical ventilation line
- In case of heavily clogging processes, individually integrate the bypass line, the cabinet and reactor suction into the exhaust air installation.
- In case of integration into the same exhaust air installation, do not integrate the bypass line directly next to the reactor suction. Observe the minimum distance of 0.5 m.
- Install a flange for inspection and cleaning in the bypass line.
- Integrate the bypass line into the exhaust air installation in such a way that combustible and corrosive gases can escape in case of an error. Use a bypass line made of coated stainless steel.
- Do not use spiral pipes for the entire exhaust air installation. They do not comply with the required tightness.
- For measurements of the reactor suction, an additional measuring connection can be installed above the connecting flange of the system. Please note:
 - Specifications for the minimum distances of flaps and bends
 - Measuring connection must be located in the laminar range of the suction of a reactor

Electric supply

Requirements:

- Only electrically skilled persons may carry out these works.
- Carry out the installation according to the "layout schematic" and the "wiring diagram".
- Observe the documentation of the upstream and downstream system.

Connect the system to the electric supply:

- Run the cables from the electric supply to the terminal clamps in the terminal box on the roof.
- 2. Connect earth conductors, neutral conductors and three phases.
- Lay the cables, attach the strain relief.
- 4. Protect the energy lines and the control lines against damage and destruction.
- 5. If necessary, insert and/or activate fuses.
 - ✓ Now, the system is connected to the electric supply.

Finishing works

After successful assembly, please check the following:

- Proper assembly
- Damages to the corrosion protection





Incorrect or incomplete assembly of the system

An incorrect or incomplete assembly of the system results in serious injuries and/or damages to the system.

- Do not commission the system before the complete connection of all pipelines, proper assembly of the reactor and correct locking of the doors.
- If no faults have been detected, a competent person authorises the commissioning of the machine.
- After installation, carry out a commissioning and check the safety installations.

6.4 Initial commissioning

The initial commissioning at the customer's site must always be carried out by the manufacturer's service staff.

Requirements

The initial commissioning at the customer's site can be carried out if the following requirements have been met:

- The assembly and the installation of the system were finished without faults.
- The proper assembly and installation of the system was checked.
- Elements containing media were deaerated and checked for tightness.
- · All safety installations are functional.
- The responsible staff has authorised the commissioning and has ordered it with the manufacturer.

6.5 Recommissioning

6.5.1 Preparations for recommissioning

Procedure

For each recommissioning, proceed as follows:

- · Carry out a general visual check
- · Check the safety installations

Visual check with opened system

Ensure the following points:

- All necessary media are connected and comply with the facility requirements.
- The stop valves are open.

Check the system for abnormalities, damages and fixations. Especially:

- Waste gas conduction
- Reactor
- Tank
- Scrubbing unit
- Fuel gas conduction
- Oxidant conduction
- Nitrogen conduction
- Compressed air conduction
- Scrubbing liquid conduction
- Lye supply

Checking of the safety installations

Ensure the following points:

- Mains adapter has been earthed properly.
- System has been assembled properly and completely.
- All mechanical safety installations have been assembled properly.
- The **EMERGENCY STOP** button is unlocked.
- Drip pan is empty.
- All prescribed checks are effected after longer downtimes, interventions and repairs work within the electrical part of the system.
 - Insulation check
 - Checking of protective earth conductor (mains adapter and system safely earthed)
 - Functional check (especially the functional test of the emergency stop installation and the safety circuits)

The system may now be switched on.

6.5.2 Commissioning after EMERGENCY STOP

Requirements:

- Determine and remove the cause for the emergency stop.
- Take suitable measures in order to prevent further stops.
- Make sure that nobody is endangered when starting the system.
- 1. Unlock the **EMERGENCY STOP** button.
- 2. Push the **ON** button.
- 3. In order to remove and to acknowledge possible faults, push the **QUIT** button.
 - ✓ The system is now operating again.

Depending on the position of the key switch, the system is in automatic or in service mode.

6.5.3 Commissioning after a power failure

Protection against restart

If there was a failure of the power supply, the system does not start automatically when the voltage returns. It is necessary to reactivate the system manually. For the record of the system function, see chap. 7.5, p. 47.

- 1. Push the **ON** button.
 - The control unit starts up, the start display is displayed on the screen.
- 2. Remove and acknowledge possible faults push the **QUIT** button.
 - ✓ The system is now operating again.

Depending on the position of the key switch, the system is in automatic or in service mode.

6.5.4 Commissioning after decommissioning

- 1. Activate the mains separator.
- 2. Push the ON button.
 - The control unit starts up, the start display is displayed on the screen.
- 3. In order to remove and to acknowledge possible faults, push the **QUIT** button.
 - The system is now operating again.

Depending on the position of the key switch, the system is in automatic or in service mode.

6.5.5 Activating manual operation in service mode

- 1. Switch the key switch AUTO SERVICE to SERVICE.
- 2. Press the button **MENU** on the screen. Enter the password.
 - > The screen switches to the main menu.
- 3. Press the button **MANUAL OPERATION** on the screen.
 - ✓ The system is ready for manual operation.

7 Operation

7.1 Introduction

The system may only be operated by competent or specialist persons.

Visualisation

The visualisation on the touch panel provides the interface between the system and the user, informs about the system condition and allows manual operating activities. Continuously monitored system parameters are constantly updated on the screen, can be called up by the user or they draw the user's attention to required operating activated by releasing corresponding warnings. The following image types are displayed:

- Main menu: branching into other images
- System images: schematic display of the system and components
- Information images: display of parameters
- Special images: special functions (e.g. language switching)

Menu structure

The following overview shows the menu structure of the visualisation.

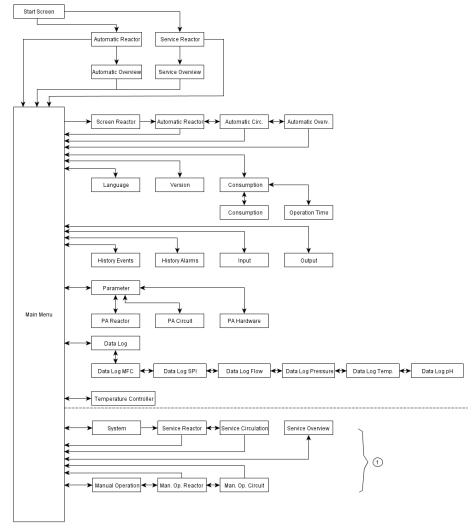


fig.7-1: Menu structure visualisation

Only visible if the key switch is in service position

Structure of system images

The system images have a uniform schematic structure. Two status lines display current fault and operating messages. The **ALARM RESET** button has the same function as the illuminated **QUIT** button on the control module (acknowledgement of faults).

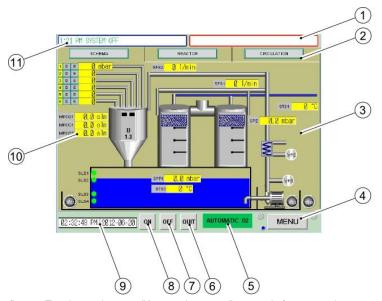


fig.7-2: Touch panel screen "Automatic reactor", example for system image

- 1 Status line fault messages
- 2 Tab for image selection
- 3 Display of the system components
- 4 Button return to main menu
- 5 Display of operating mode
- 6 Button for the acknowledgement of faults
- 7 Button for stopping the system
- 8 Button for starting the system
- 9 Display of current time and date
- 10 Display of system values
- 11 Status line operation messages

7.2 Automatic mode

Requirements

The system is operational if the following requirements have been met:

- The commissioning of the system was finished without faults.
- The system is completely incorporated into the operating sequence and the control of the entire system.
- The key switch **AUTO-SERVICE** is switched to **AUTO**.



ADVICE

The operator is responsible for ensuring the compliance with the technical data.

Operating actions

In automatic mode, the system runs independently. No operating actions are possible. The system status can be observed and controlled. The parameters can be checked and edited.

Replacement of the scrubbing liquid In automatic mode, the scrubbing liquid is replaced automatically. A part of the scrubbing liquid is automatically drained.

As soon as one of the requirements is met, the control device starts the replacement of the scrubbing liquid:

· normal filling level is reached

Procedure

- The drain valve opens.
- 2. The drain valve close s as soon as the low filling level at the level sensor is reached.
- 3. The valve of the lye supply opens.
- 4. Fresh water is permanently added via the demister rinsing.

Lye dosage

In automatic mode, the lye is added automatically if the pH is outside of preset values (see chap. 7.4, p. 44).

Procedure

- The lye dosing pump starts.
- The lye dosing pump stops as soon as the preset ph value is reached.

7.3 Manual operation

Requirements

The system is operational if the following requirements have been met:

The key switch AUTO-SERVICE is switched to Service.

Operating actions

In manual operation, it is possible to directly select individual components. For example, it is possible to test the bypass valves and the pumps. For this purpose, press the respective components on the images.

Activating manual operation:

- 1. Press the button **MENU** on the screen. Enter the password.
- 2. Press the button MANUAL OPERATION on the screen.
 - An overview image is displayed. System components can be selected individually by pressing on the individual system components on the screen.
 - ✓ The system is in manual mode.

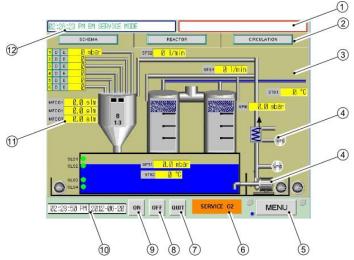


fig.7-3Touch panel screen "Manual operation circuit"

- 2 Tab for image selection

1

3 Display of the system components

Status line fault messages

- 4 Button for operating system components
- 5 Button return to main menu
- 6 Display of operating mode
- 7 Button for the acknowledgement of faults
- 8 Button for stopping the system
- 9 Button for starting the system
- 10 Display of current time and date
- 11 Display of system values
- 12 Status line operation messages

7.4 **Parameter**

NOTICE



In automatic mode, modified parameters affect the entire process.

Incorrect parameters cause damages to the system.

- Parameters must only be modified by specialist staff.
- Always set the parameters as specified in the parameter list.

Editing parameters:

- Press the button **MENU** on the screen.
- 2. Press the button **MENU PARAMETERS** on the screen.
- 3. Press the required button on the screen.
- Edit the parameters.
 - Now, the parameters are edited.

Screen PA HARDWARE

Data plate MFC

Designation	Description	Unit
MFC BG final value	maximum value of the measuring range of the MFC for fuel gas	slm
MFC BG final value	maximum value of the measuring range of the MFC for fuel gas	slm
MFC CDA final value	maximum value of the measuring range of the MFC for oxidant	slm
SFS1 C/W final value	maximum value of the measuring range of the flow meter for the scrubbing flow	l/min
SFS2 React. final value	maximum value of the measuring range of the flow meter for the reactor flow	l/min
SFW1 FW/final value	fresh water value at the flow meter (SFW1) for DEPO	l/min
SFW2 FW/final value	fresh water value at the flow meter (SFW2) for ETCH	l/min

Data plate flow meter

N2 flow

Function BURNING with fixed values

DP-clock/time per

Limits temperature

pass

tank

Time empty tank	check time for emptying the scrubbing liquid tank till low level	min
N2-Flow VSN4	value of nitrogen for purging the waste gas line from bypass valve to reactor	l/min
BG/CDA fixed value DEPO/ETCH	values for burning gas and oxidant in modes DEPO/ETCH	slm

S

Designation	Description	Unit
Time tank filling	check time for filling the scrubbing liquid tank	
pH value start lye dosage	pH value when dosage of lye is started to get into the optimum range for the pH value	
pH value stop lye dosage	pH value when dosage of lye is stopped	
ETCH-time per pass	Clock of dosing pump for signal ETCH	sec
DISABLE	Button for disabling this function	
Warning value Tank STS2	Warning value for the temperature of scrubbing liquid in the tank, exceeding this value triggers a failure message	
Warning value Flow STS1	Warning value for the temperature of scrubbing liquid after the heat exchanger, exceeding this value triggers a failure message	°C
Alarm value Tank STS2	Alarm value for the temperature of scrubbing liquid in the tank, exceeding this value triggers a failure message and stops the system	
Set point SPT1 – Start enable	Pressure value in scrubbing liquid tank which will be required for starting the system	
Alarm value SPT1 plus	value SPT1 High alarm value for the pressure in scrubbing liquid tank, exceeding this value triggers a failure message and stops the system	
Alarm set point SPT1 minus	Low alarm value for the pressure in scrubbing liquid tank, falling below this value triggers a failure message and stops the system	
Warning value SPT1 minus	Warning value for the pressure in scrubbing liquid tank, falling below this value triggers a failure message	mbaı
Warning value flow SFS1	Warning value for the flow in the scrub- bing flow, falling below this value trig- gers a failure message	l/min

Parameter pressure tank

Limits flow washing line

Designation	Description	Unit
Alarm value flow SFS1	Warning value for the flow in the scrub- bing flow, falling below this value trig- gers a failure message	l/min
Warning value flow SFW1	Warning value for fresh water flow in mode DEPO, falling below this value triggers a failure message	l/min
Warning value flow SFW2	Warning value for fresh water flow in mode ETCH, falling below this value triggers a failure message	l/min
check time flow SFW	allowed time when no flow of fresh water is detected	min

Screen PA REACTOR

	Designation	Description	Unit
Time after burning	VPI16 burn after time	Time for opening the bypass valves into position reactor for after burn	sec.
Time after cooling	Time after cooling	Time with active scrubbing liquid circulation to cool down the reactor in mode BURN OFF	sec
Common parameter	Delay time new ignition	Waiting time for a new ignition attempt after acknowledging an alarm	sec
	Constancy of N2-flow VSN4	Value of nitrogen flow	sec
	HNPS after run time		
Limits pressure inlet WGV	Warning value SPI	Warning value for the minimum pressure in the waste gas inlet, triggers a failure message	mbar
	Alarm value SPI	Alarm value for the minimum pressure in the waste gas inlet, triggers a failure message and stops the system	mbar
Limits flow reactor	Warning value SFS2	Warning value for the reactor flow of scrubbing liquid, falling below a failure message is triggered	mbar
	Alarm value SFS2	Alarm value for the reactor flow of scrubbing liquid in, falling below a failure message is triggered and mode BURN ON is switched off	mbar
CDA Flow perma- nently I/min			l/min
Setup burner gas flow	Service value CDA, BG1	Value for fuel gas, oxidant and additional oxidant in mode SERVICE	l/min
	Ignition flow CDA, BG1	Value for fuel gas, oxidant and additional oxidant for ignition	I/min
	LOW FLAME CDA, BG1	Value for fuel gas, oxidant and additional oxidant in mode LOW FLAME	



Screen **HEATING**

Designation	Description	Unit
E1E6 set point	setting value for the temperature in the waste gas line	°C
E1E6 Current value	Display of current temperature in the waste gas line	°C
E1.1E6.1 set point	setting value for the temperature in the bypass line	°C
E1.1E6.1 Current value	Display of current temperature in the bypass line	°C
E1E6 ON/OFF	Button for switching on and off the heating	
Heat HN ON set point	switching on temperature value for the nitrogen heater	°C
Heat HN ON current value	Display of current nitrogen temperature	°C
Heat HN OFF set point	switching off temperature value for the nitro-gen heater	°C

7.5 Records and media consumption

Data Log

Via the button **DATA LOG** in the main menu, it is possible to call up images which display time curves of actual system values. Displayed are:

- MFC: Values for fuel gas, oxidant and additional oxidant
- SPI: Pressure inside the waste gas line
- · SFS: Partial flows of the scrubbing liquid circuit
- SPT: Pressure inside the scrubbing liquid tank
- STS: Temperature of scrubbing liquid in the tank and after the heat exchanger
- SpH: pH-value in the tank

Ordinate

The ordinate (y-axis) is set to the maximum and minimum possible values of the selected measured variable.

Abscissa

The abscissa (x-axis) is determined via the time designations. It is displayed in a timeframe which is limited by the start and end time.

Buttons

The images **DATA LOG** are provided with the following buttons:

- Start: for the starting of the trend log
- Stop: for the stopping of the trend log
- Import: for the import of data which have already been recorded
- Export: for the export of recorded data

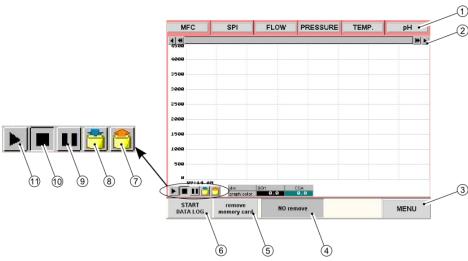


fig.7-4 Touch Panel Screen "DATA LOG""

- 1 Tab for image selection
- 2 Buttons for the scrolling of the display detail and shifting of the measuring point
- 3 Button return to main menu
- 4 Display of status for removing memory card
- 5 Button for removing memory card
- 6 Button for Start and End of recording
- 7 Button for the export of recorded data
- 8 Button for the import of recorded data
- 9 Button for pausing the trend log
- 10 Button for the stopping of the trend log
- 11 Button for the starting of the trend log

Operating data

Via the button **OPERATING DATA** in the main menu, it is possible to call up images in which the consumption data and operating hours of the individual media and components can be read and reset.

The following consumption counters are implemented in the control device:

Display	Description
BG Consumption of fuel gas in m³	
Fresh water	Consumption of fresh water in m ³
Lye	Consumption of lye in litres

Tab.7-1 Consumption counter

The operating hours are recorded for the following system conditions:

Display	Description
Power ON	Overall time of the system with working control unit
Mode STBY	Overall time of the system in Standby mode
Burning ON	Overall time for the activated burner
Service	Overall time in service mode



Display	Description
Warning active	Overall time with an active WARNING message
ALARM active	Overall time with an active ALARM message

Tab.7-2 Operating hours

Reset

Reset operating data:

- 1. In order to reset the operating data: press the **RESET operation time** button.
- 2. In order to reset the consumption counter: press the **RESET consumption** button
- Answer the security question with YES.
 - The buttons **NO** and **BACK** cancel the reset process.

7.6 Heating

Via the button **HEATING** in the main menu, the overview images for the heating are opened. At this point it is possible to individually activate and deactivate the respective heating, to adjust set values and to compare actual temperature values with the set values.

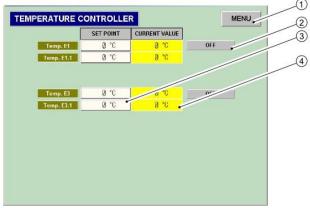


fig.7-5 Touch Panel Screen "HEATING"

- 1 Button return to main menu
- 2 Buttons for the activation and deactivation of the respective heating
- 3 Buttons for the adjustment of the respective set values
- 4 Display of the current values

TEMP. Ex identifies the heating for the waste gas inlet line whereas **TEMP. Ex.1** identifies the heating for the line to the burner.

7.7 Failure Checklist

Observe the following points if faults occur during operation, commissioning or other situations:

- A competent person must determine the cause and decide on further measures.
- Decommission the system and protect it against restart.
- Works on the electric system may only be effected by electrically skilled persons.

Faults at the system can be removed according to the information in the fault message table.



ADVICE

If the cause of the fault cannot be determined exactly or if it is not listed in the fault message table, the manufacturer must be contacted.

DANGER



In case of a fault, an explosive gas mixture could be generated by escaping fuel gas and ambient air.

Explosions cause death and serious injuries.

- Regularly check the gas sensors.
- Regularly check the fixations of the hoses.
- In the area surrounding the machine, smoking and open flames are forbidden.

Fault messages

Occuring fault messages are displayed on the touch panel. A table with active fault messages can be called up by actuating the fault message field.

Alarms

An alarm message is triggered if there is a dangerous situation at the system. As a consequence, the system switches to backup or bypass mode. The system will not automatically switch to the previous condition, even after the removal of the alarm-triggering situation. For this purpose, the alarm must always be acknowledged after the removal of the cause.

Warnings

If a condition occurs on the system which presents values beyond the normal range without presenting a direct danger, a warning message is triggered. The warning message is reset automatically when the causes are removed.

Removing faults

Fault messages disappear after the fault has been removed and acknowledged. Faults can be acknowledged in the following two ways:

- Push the QUIT button on the control panel.
- Press the button ALARM RESET on the screen.

Alarm history

The last 1024 fault messages are displayed in the image "ALARM HISTORY". The messages are displayed in clear text with the date and time as well as the status.



Message no.	Error message on display screen	Diagnosis	Possible causes	Instructions for removal
001	ALARM GASSENSOR	Alarm by gas sensor	 Leakage in the gas supply Device error of sensor and evaluation device 	 Check the gas supply using leakage detector spray or appropriate measuring devices and remove the leakage Check and/or replace the sensor and evaluation device
002	ALARM SENSOR EX- HAUST	Incorrect cabinet exhaust	Incorrect exhaust power (provided by the customer) Sensor clogged Sensor error Sensor defective	 Check the exhaust at customer's site Clean the sensor Check and adjust the setting Check and replace the fixation Check sensor, replace
			Ochsor derective	it if necessary
003	ALARM SENSOR STR1 TEMPERATURE REACTOR	Temperature inside the reactor is too high	Flow of the reactor purge is too lowWire break on sensor	Check the flow, clean the filter if necessaryCheck wiring
004	ALARM SENSOR STR2 TEMPERATURE REACTOR	Temperature inside the reactor is too high	Flow of the reactor purge is too low Wire break on sensor	 Check the flow, clean the filter if necessary Check wiring
005	ALARM LEAK SEN- SOR SD1	Leakage sensor SD 1 detects liquid in safety tank	 Liquid in safety tank leakage in the system Signal wiring defective Sensor defective 	 Check system for leaks remove the cause check wiring Check sensor, replace it if necessary



Message no.	Error message on display screen	Diagnosis	Possible causes	Instructions for removal
006	ALARM LEAK SEN- SOR SD2	Leakage sensor SD 1 detects liquid in safety tank	 Liquid in safety tank leakage in the system Signal wiring defective Sensor defective 	 Check system for leaks remove the cause check wiring Check sensor, replace it if necessary
007	ALARM SLS1 TANK BRIMFUL	Level in the tank is overfull	Water valves do not closeWaste water flows back into the system	Check valves, replace if necessary
009	ALARM LEVEL SLS4 DRY CONTROL	Level in the tank is too low	Waste water valve does not closewater filling	Check valves and selection control
010	ALARM TIME - TANK NOT FILLED TO SLS2	Control time for the filling of water has expired without reaching the level sensor SLS2	 Water pressure too low Pneumatic valve defective Manual valve not opened Pressure controller set incorrectly, filter inside the pressure controller is soiled or defective Floating switch blocked/defective 	 Check water pressure Check valves and activation Set and clean the pressure controller, replace it if necessary Check the floating switch, clean or replace it if necessary
011	ALARM TIME - TANK NOT EMPTY - SLS3	Control time for the function "Emptying tank" has expired without reaching the level sensor S3	 Waste water valve does not open Manual valve closed Pump line provided by the customer is soiled Floating switch blocked/defective 	 Check valves and activation Check the line, clean it if necessary Check the floating switch, clean or replace it if necessary



Message no.	Error message on display screen	Diagnosis	Possible causes	Instructions for removal
012	ALARM STS2 TEM- PERATURE > ALARM VALUE	Temperature of the cooling/scrubbing liquid in the tank higher than set limit value	 Cooling water flow too low Heat exchanger clogged Set values are incorrect Mechanical or electrical defect of cooling water valve 	 Check cooling water flow Clean heat exchanger, change if necessary Check set values at the touch panel, adjust if necessary Check cooling water valve, change if nec-
013	ALARM STS2 FAULT SENSOR		signal wiring defectiveTemperature sensor is defective	Check connections and wiring Check sensor, change if necessary
014	ALARM STS INACTIV DIGIT. SENSOR TANK	Sensor STS reports an excessive temperature	Local overheating due to heat accumulationFaulty coolingSensor defective	 Check the cooling Check sensor, replace it if necessary
015	ALARM SFA FLOW CDA VSA52 INAC- TIVE	Flow of additional compressed air for burner is too low	Stop valve closedPressure too lowSensor defective	 Open the stop valve Check the compressed air line Check the sensor, replace it if necessary
016	ALARM PMS1 FAI- LURE	Motor circuit breaker in immersion pump PMS has been activated	 Mechanical causes (e.g. pump soiled and/or defective) Motor circuit breaker set incorrectly 	 Check and clean the pump, replace it if necessary Check scrubbing liquid lines for blockages Check the switch



Message no.	Error message on display screen	Diagnosis	Possible causes	Instructions for removal
017 020 023 026 029 081	ALARM VPI16 POS. REACTOR NOT REACHED	Valve has not reached "REAC-TOR" position	 Position indicator defective Valve blocked Pressure (control air) too low signal wiring defective 	 Check position indicator Repair the valve Set the pressure of the control air Check signal wiring
018 021 024 027 030 082	ALARM VPI16 NOT IN POS. BYPASS	Valve has not reached "BYPASS" position	 Position indicator defective Valve blocked Pressure (control air) too low Signal wiring defective 	 Check position indicator Repair the valve Set the pressure of the control air Check signal wiring
019 022 025 028 031 083	ALARM VPI16 CONNECTING FAIL- URE	Contact of bypass and reactor closed	Position indicator defectiveSignal wiring defective	 Check position indicator, replace it if necessary, Check signal wiring
033 035 037 039 041 043	ALARM SPI16 > ALARM VALUE	Pressure in waste gas line chan- nel 1 and backup line higher than the set alarm value	 Waste gas duct clogged N2-purge at sensor too high 	 Clean the waste gas duct Check the purge flow



Message no.	Error message on dis- play screen	Diagnosis	Possible causes	Instructions for removal
034 036 038 040 042 044	ALARM SPI16 FAULT SENSOR	No signal from sensor	Sensor defectivesignal wiring defective	 Check sensor, replace it if necessary Check signal wiring
045 046 047 048 084 085	ALARM VACUUM PUMP INLET16 PI 16 NOT READY	Vacuum pump connected to valve VPI not ready	 Vacuum pump off (service works, error) No 24-V-signal on inlet PI F7 defective 	Check status of the vacuum pump Check the mains adaptor, replace it if necessary Check fuse F7, replace it if necessary
049	ALARM FLOW SFS1 < ALARM VALUE	Flow at the flow meter of scrub- bing section is too low	Filter is blockedFlow meter cloggedNozzles clogged	Check filter, flow meter and nozzles for depositions, clean if necessary
050	ALARM SFS1 FAULT SENSOR	No signal from sensor	Sensor defectivesignal wiring defective	Check sensor, replace it if necessary Check signal wiring
051	ALARM FLOW SFS2 < ALARM VALUE	Flow at the flow meter of scrub- bing section is too low	Filter is blockedFlow meter cloggedNozzles clogged	Check filter, flow meter and nozzles for depositions, clean if necessary
052	ALARM SFS2 FAULT SENSOR	No signal from sensor	Sensor defectivesignal wiring defective	 Check sensor, replace it if necessary Check signal wiring
054	ALARM FLOW SFS1 / SFS2 NOT OFF	Flow detected in flow meter alt- hough the flow is switched off	Pump does not switch offFlow meter defective	Check pump and selectionCheck flow meter
059	ALARM SPT1 FAULT SENSOR	No signal from sensor	Sensor defectivesignal wiring defective	Check sensor, replace it if necessaryCheck signal wiring



Message no.	Error message on display screen	Diagnosis	Possible causes	Instructions for removal
060	ALARM SPT1 UN- DERPRESSURE TANK TOO HIGH	Exhaust in the reactor too high; actual value < parameter SPT max	 Process exhaust too strong Sensor defective 	 Set the exhaust air at the throttle valve Check the exhaust air line Check sensor replace
				it if necessary
061	ALARM SPT1 UN- DERPRESSURE TANK TOO LOW	Exhaust in the reactor too low; actual value > parameter SPT alarm value	Process exhaust too low	 Set the exhaust air at the throttle valve Check the exhaust air line
	(ANALOUGE)		Demister clogged	Clean demister
			Sensor defective	Check sensor, replace it if necessary
			Zero point in no order	Readjust alarm value
062	ALARM SPT2 FLAP OPENED	No signal from sensor	Safety valve open	Check safety valve and clean if necessary
	Of ERED		sensor defective	Check sensor and exchange if necessary
			signal wiring defective	Check signal wiring
063	ALARM SPT INAC- TIVE - DIGIT. SEN-	Under pressure too low	Process exhaust too low	Set the exhaust air at the throttle valve
	SOR		Demister clogged	Clean demister
	SOR		Sensor defective / set incor- rectly	Check sensor, replace it if necessary
			Exhaust gas line clogged	Check the exhaust gas line
064	ALARM START VAL-	Under pressure too low during start	Process exhaust too low	Set the exhaust air at the throttle valve
	UE SPT1 NOT OK	- Start	Demister clogged	Clean demister, scrubbing section, quenching unit
			Sensor defective / set incor- rectly	Check sensor, replace it if necessary
			Exhaust gas line clogged	Check the exhaust gas line



Message no.	Error message on display screen	Diagnosis	Possible causes	Instructions for removal
065	ALARM STARTING FLOW 03 NOT REACHED	Additional oxygen flow during start not sufficient	Additional Oxygen not stable	 Check oxygen pressure Check the valve Check the inlet filter MFC, clean if necessary
066	ALARM MFC 03 - FAULT SENSOR	No signal from sensor	Sensor defectivesignal wiring defective	Check sensor, replace it if necessaryCheck signal wiring
067	ALARM MFC 03 - FLOW-03 > SET+20%	Deviation from set value too large	MFC clogged or defective	Clean MFC, replace it if necessary
068	ALARM MFC 03 - FLOW-03 < SET -20%	Deviation from set value too large	Supply pressure too lowMFC clogged or defective	 Check pressure Check valves/inlet filters Clean MFC, replace it if necessary
069	ALARM MODULE FA_CDA ERR1	Automatic ignition device triggers an error signal	Faulty media supplyElectrode defectiveFaulty ignition regime	 Check media supply Check electrode Check ignition regime with regard to the hardware interlock (see wiring diagram)
070	ALARM MODULE FA_02 FAILURE	Automatic ignition device triggers an error signal	Faulty media supplyElectrode defectiveFaulty ignition regime	 Check media supply Check electrode Check ignition regime with regard to the hardware interlock (see wiring diagram)
071	ALARM MFC-BG1 FLOW > SET+20%	Deviation from set value too large	MFC clogged or defective	Clean MFC, replace it if necessary



Message no.	Error message on display screen	Diagnosis	Possible causes	Instructions for removal
072	ALARM MFC-BG1 FLOW <	Deviation from set value too large	Supply pressure too low	Check pressureCheck valves/inlet filters
	SET-20%		MFC clogged or defective	Clean MFC, replace it if necessary
073	ALARM MFC-01 FLOW > SET+20%	Deviation from set value too large	MFC clogged or defective	Clean MFC, replace it if necessary
074	ALARM MFC-01 FLOW <	Deviation from set value too large	Supply pressure too low	Check pressureCheck valves/inlet filters
	SET-20%		MFC clogged or defective	Clean MFC, replace it if necessary
075	ALARM IGNITION NOT SUCCESSFUL	No flame detected after ignition attempt	 Faulty fuel gas / oxidant supply or MFC Set ignition values not reached 	Check media supply and MFC
			Electrode shifted, clogged or defective	Check the electrode if necessary re-adjust, clean or exchange
076	ALARM MFC BG1 FAULT SENSOR	No signal from sensor	Sensor defective	Check sensor, replace it if necessary
078	ALARM MFC 01	No signal from sensor	signal wiring defectiveSensor defective	Check signal wiring Check sensor, replace it if passessor.
	FAULT SENSOR		signal wiring defective	it if necessaryCheck signal wiring
079	ALARM MODULE FA_CDA ERR2	Automatic ignition device triggers an error signal	Faulty media supplyElectrode defectiveFaulty ignition regime	 Check media supply Check electrode Check ignition regime with regard to the hardware interlock (see wiring diagram)
080	ALARM CONNEC- TION NS8 - PLC	Defective connection between Touch Panel and PLC	Plug connections between PLC and TP defective	Check plugs and ca- ble feeds



Message no.	Error message on dis- play screen	Diagnosis	Possible causes	Instructions for removal
086	ALARM MFC-CDA FLOW > SET+20%	Deviation from set value too large	MFC clogged or defective	Clean MFC, replace it if necessary
087	ALARM MFC-CDA FLOW < SET-20%	Deviation from set value too large	Supply pressure too lowMFC clogged or defective	 Check pressure Check valves/inlet filters Clean MFC, replace it if necessary
088	ALARM MFC CDA FAULT SENSOR	No signal from sensor	Sensor defectivesignal wiring defective	 Check sensor, replace it if necessary Check signal wiring
089	ALARM SFA2 FAULT SENSOR	No signal from sensor	Sensor defectivesignal wiring defective	Check sensor, replace it if necessaryCheck signal wiring
090	ALARM FLOW SFA2 TOO LOW	Flow of additional compressed air for reactor too low	Stop valve closedPressure too lowSensor defective	Check compressed air supplycheck sensor, change if necessary
091	ALARM MFC G1 SET VALUE > MAX. VAL- UE MFC	Calculated set value higher than the max. value MFC	Input in the gas calculation incorrect	Check/modify the gas calculation
092	ALARM MFC 01 SET VALUE > MAX. VA- LUE MFC	Calculated set value higher than the max. value MFC	Input in the gas calculation incorrect	Check/modify the gas calculation
093	ALARM MFC 03 SET VALUE > MAX. VA- LUE MFC	Calculated set value is higher than the max. value MFC	Input in the gas calculation incorrect	Check/modify the gas calculation
094	ALARM MFC CDA SET VALUE > MAX. VALUE MFC	Calculated set value is higher than the max. value MFC	Input in the gas calculation incorrect	Check/modify the gas calculation



Message no.	Error message on dis- play screen	Diagnosis	Possible causes	Instructions for removal
097	ALARM SFL FAULT SENSOR	No signal from sensor	Sensor defectivesignal wiring defective	Check sensor, replace it if necessary Check signal wiring
098	ALARM SFL NO FLOW LYE	Lye flow too low	Lye supply closedLye pressure too lowFlow meter clogged or defective	 Check lye supply Check lye valve Clean the flow meter, replace it if necessary
099	ALARM pH TOO LOW AFTER CHANGE SCRUBBING LIQUID	pH value below starting value for lye dosage	 pH probe defective Dosage pump defective Dosage pump has drawn air Pressure retention valve blocked 	 Check pH probe and if necessary exchange and calibrate Check dosage pump Deaerate in pipes Clean pressure retention valve
100	ALARM SpH1 FAULT SENSOR	No signal from sensor	Sensor defectivesignal wiring defective	Check sensor, replace it if necessary Check signal wiring

Tab.7-3 Alarm messages



Message no.	Error message on dis- play screen	Diagnosis	Possible causes	Instructions for removal
145	WARN HNP FLOW	Nitrogen flow in bypass waste	Nitrogen supply was cut off	Check pressure con-
146	SFN7176 TOO LOW	gas channel 16 too low (set value / switch point not reached)		trollerCheck nitrogen supply
147		value / switch point not reached)	Valve defective (not opened)	Check valves, change
148			, , ,	if necessary
149			Adjustment of valve incorrect	Check set values
150			Signal wiring defective.	Check connections
161	WARN HEAT E4 C	T	Heater defective	and signal wiringCheck the heater,
162	WARN HEAT E16	Temperature at the valve 16 too low/ too high	Treater defective	replace it if necessary
163	TEMP OUT OF	too low/ too riigii	Heater control defective	Check the heating
164	RANGE			module, replace it if
165				necessary
166			Waste gas temperature too low	Check the installation provided by the cus-
			IOW	tomer
167	WARN HEAT	Temperature at waste gas line	Heater defective	Check the heater,
168	E1.16.1 TEMP OUT	channel 16 too low/ too high		replace it if necessary
169	OF RANGE		Heater control defective	Check the heating
170				module, replace it if necessary
171			Waste gas temperature too	Check the installation
172			low	provided by the cus-
				tomer
173	WARN SPI16 >	Pressure in waste gas line chan-	Waste gas line clogged	Clean the waste gas line
174	WARN VALUE	nel 16 and backup line higher than the set alarm value	N2-purge at sensor too high	Check the purge flow
175		than the Set didiffi value	Sensor defective	Check sensor, replace
176				it if necessary
219				
220				



Message no.	Error message on dis- play screen	Diagnosis	Possible causes	Instructions for removal
177	WARN SPA PRES- SURE TOO LOW	Pressure of the compressed air at inlet too low	 Supply pressure too low Pressure controller set incorrectly Pressure controller defective Sensor defective 	 Check the supply pressure at customer's site Check and set the pressure controller, replace it if necessary Check sensor, replace it if necessary
178	WARN CABINET REACTOR OPENED	Door to reactor room opened	 Door is open for longer than 2 min Door sensor set incorrectly Sensor defective 	 Close the door Check assembly of the sensor Check sensor, replace it if necessary
179	WARN BATTERY PLC TOO LOW	Battery voltage of the PLC too low	 No connection between battery and battery base Battery voltage is too low 	Check connection and terminals Replace battery: acknowledgement of the error on the PLC (red flashing lamp ERR/ALM) only by switching off/on of the system and subsequent error acknowledgement!
180	WARN BATTERY NS8 TOO LOW	Battery voltage of the touch panel too low	 No connection between battery and battery base Battery voltage is too low 	Check connection and terminalsReplace battery
182	WARN IGNITION FAULTY	No flame detected after ignition attempt	 Faulty burner gas supply or MFC Set ignition values not reached 	Check media supply and MFC



Message no.	Error message on dis- play screen	Diagnosis	Possible causes	Instructions for removal
183	WARN MFC 03 DIFF. SET VALUE / ACTUAL VALUE TOO LARGE	Calculated set value higher than the max. value MFC	 Input in the gas calculation incorrect MFC clogged or defective 	 Check/modify the gas calculation Check and clean MFC, change if necessary
184	WARN MFC G1 DIFF. SET VALUE / ACTUAL VALUE TOO LARGE	Calculated set value higher than the max. value MFC	 Input in the gas calculation incorrect MFC clogged or defective 	 Check/modify the gas calculation Check and clean MFC, change if necessary
185	WARN MFC 01 DIFF. SET VALUE / ACTUAL VALUE TOO LARGE	Calculated set value higher than the max. value MFC	 Input in the gas calculation incorrect MFC clogged or defective 	 Check/modify the gas calculation Check and clean MFC, change if necessary
186	WARN MFC CDA DIFF. SET VALUE / ACTUAL VALUE TOO LARGE	Calculated set value higher than the max. value MFC	 Input in the gas calculation incorrect MFC clogged or defective 	 Check/modify the gas calculation Check and clean MFC, change if necessary
187	WARN SPE PRES- SURE DIFFERENCE TOO LARGE	Pressure difference between the scrubbing columns too high	Demister clogged	Clean demister
190	WARN N2-HEATING DEFECTIVE STHN	Digital signal reports defective heater	Fuse defectiveNitrogen heater defectiveNo nitrogen flow	 Check the fuse Replace the heater if necessary Check nitrogen flow
191	WARN STF7 FUSE DEFECTIVE	Fuse F7 defective	Fuse F7 defectiveShort circuit in 24V control voltage	Replace the fuse Check the cable connections for possible short circuits



Message no.	Error message on dis- play screen	Diagnosis	Possible causes	Instructions for removal
192	WARN SPN PRES- SURE N2 TOO LOW	Nitrogen supply too low	Nitrogen pressure too low	Check the nitrogen supply at customer's site
			 Pressure reducer misaligned or defective 	Check the pressure reducer, replace it if necessary
			Pressure switch misaligned or defective	Check the pressure switch, replace it if necessary
193	WARN SPT1 UNDER-	Under pressure inside the tank exceeds the starting value	Process exhaust too high	Check the exhaust, clean it if necessary
	PRESSURE TANK TOO HIGH	exceeds the starting value	Sensor defective	Check the sensor, change it if necessary
194	WARN SPE FAULT SENSOR	No signal from sensor	Sensor defective	Check sensor, replace it if necessary
	JENSON		signal wiring defective	Check signal wiring
197	WARN SFW12	No signal from sensor	Sensor defective	Check sensor, replace it if necessary
199	FAULT SENSOR		signal wiring defective	Check signal wiring
198 200	WARN FLOW SFW12 TOO LOW	The flow rate of fresh water falling below the warning value during operation	Supply pressure too low	Check the supply pressure at customer's site
		operation	Pressure controller is set incorrectly	Check and set the pressure controller, replace it if necessary
			Flow meter clogged or defective	Clean the flow meter, replace it if necessary
			Pneumatic valve defective	Check pneumatic valve replace it if necessary
			 Manual valve not completely opened 	Open manual valve
201	WARN SFS2 FLOW	The flow rate of the scrubbing	Filter clogged	Check filter
	REACTOR < WARN	liquid for reactor falling below the	Flow meter clogged	Check flow meter
	VALUE	warning value during operation	Nozzles clogged	Check nozzles Check nump
			Pump defective	Check pump



Message no.	Error message on dis- play screen	Diagnosis	Possible causes	Instructions for removal
202	WARN START VALUE SFS2 NOT OK	The flow of the scrubbing liquid for reactor falling below the alarm value during start	Filter cloggedFlow meter cloggedNozzles cloggedPump defective	Check filterCheck flow meterCheck nozzlesCheck pump
203	WARN START VALUE SFS1 NOT OK	The flow of the scrubbing liquid for scrubbing stage falling below the alarm value during start	Filter cloggedFlow meter cloggedNozzles cloggedPump defective	Check filterCheck flow meterCheck nozzlesCheck pump
204	WARN SFS1 FLOW < WARN VALUE	The flow rate of the scrubbing liquid for scrubbing stage falling below the warning value during operation	Filter cloggedFlow meter cloggedNozzles cloggedPump defective	Check filterCheck flow meterCheck nozzlesCheck pump
209	WARN TEMP. HN OUT OF RANGE	Temperature nitrogen heater too low/ too high	Nitrogen flow too highHeater defectiveHeater fuse defective	 Check nitrogen flow Check the switching relay Check heater fuse
210	WARN HN FAULT SENSOR	No signal from sensor	Sensor defectivesignal wiring defective	 Check sensor, replace it if necessary Check signal wiring
211	WARN STS2 TEM- PERATURE > WARN VALUE	Warning value of the scrubbing liquid tank temperature exceeded	Faulty cooling functionCooling water valve does not	Check the cooling water flow Check the cooling water temperature / clean the heat exchanger if necessary Check valve and acti-
212	WARN STS2 FAULT SENSOR	No signal from sensor	openSensor defectivesignal wiring defective	 vation Check sensor, replace it if necessary Check signal wiring



Message no.	Error message on display screen	Diagnosis	Possible causes	Instructions for removal
214	WARN STS1 TEM- PERATURE > WARN VALUE	Warning value of the flow temperature is exceeded	 Faulty cooling function Cooling water valve does not open 	Check the cooling water flow Check the cooling water temperature / clean the heat exchanger if necessary Check valve and activation
215	WARN STS1 FAULT SENSOR	No signal from sensor	Sensor defectivesignal wiring defective	Check sensor, replace it if necessary Check signal wiring
217	WARN HNI FAULT SENSOR	No signal from sensor	Sensor defectivesignal wiring defective	Check sensor, replace it if necessary Check signal wiring
223	WARN LYE TANK EMPTY	The level in the lye tank falls below the level SLL3	 Central filling: Function "Lye filling" not correctly executed (external problem) Lye valve not opened Manual filling – no lye refilled Floating switch hangs 	 Check lye supply Check the valve Repeat function "Lye filling" Manually refill the lye Check the floating switch
224	W LYE TANK LEAK- AGE	Lye detected in the safety tank	 Lye tank leaky Overfilling due to a defective sensor system Lye valve not closed 	Check the tank for leakages Check the sensor system Check valve and activation
225 226 227 228 229 230	WARN Pt100 E16 FAULT SENSOR	No signal from sensor	Sensor defectivesignal wiring defective	 Check sensor, replace it if necessary Check signal wiring

Message no.	Error message on dis- play screen	Diagnosis	Possible causes	Instructions for removal	
231 232 233 234 235 236	WARN Pt100 E1.16.1 FAULT SENSOR	No signal from sensor	Sensor defectivesignal wiring defective	 Check sensor, replace it if necessary Check signal wiring 	
239	WARN SPT1 UNDER- PRESSURE TOO LOW	Under pressure inside the reactor falls below the starting value	Process exhaust too lowDemister clogged	Check the exhaust, clean it if necessary Check the demister, clean if necessary	
239	WARN SPT1 PRES- SURE > PA SPT1 START	Under pressure too low	 Process exhaust too low Demister clogged Sensor defective / set incorrectly 	 Set the exhaust air at the throttle valve Check the exhaust gas line Clean demister Check sensor, replace it if necessary 	
240	WARN FILL CON- TAINER TO LEVEL SLS2	Control time for the filling of water has expired without reaching the level sensor SLS2	 Water pressure too low Pneumatic valve defective Manual valve not opened Pressure controller is set incorrectly, filter inside the pressure controller clogged or defective Floating switch blocked/defective 	 Check water pressure Check valves and activation Set and clean the pressure controller, replace it if necessary Check the floating switch, clean or replace it if necessary 	

Tab.7-4 Warning messages

<u>DAS</u>

8 Maintenance

8.1 General information on maintenance

General

In order to maintain the function and the operational reliability, it is necessary to regularly carry out the activities of the maintenance plan. Changes in comparison to the normal operation show that the function and the operational reliability are affected. These include:

- Higher temperatures
- Higher power consumption
- Abnormal noises
- Leakages
- Material cracks and breaches
- Deformations

The system may only be maintained by competent or specialist persons.

DANGER



Life-threatening voltage!

Improper work on the electric installation can cause death or serious injuries.

- Only electrically skilled persons may carry out works on the electric installation.
- Always de-energise the system first, using the mains disconnection device and protect it against unintended restart using a padlock. In doing so, ensure that the terminals on the main connection box and the mains disconnection device remain energised.

DANGER



Harmful exhaust air in the gas lines!

Gases escape during work on the gas lines which, in case of contact, can cause death or serious injuries.

Wear a protective mask when carrying out disassembly or cleaning work at the gas lines.

DANGER



Toxic gases!

By inhalation of dust and contact with eyes, poisoning and health problems are the result.

Wear protective mask in combination with appropriate filter.

DANGER



Explosive atmospheres caused by increased hydrogen concentration in the air.

Premature opening of the pipeline may lead to the formation of an explosive atmosphere.

- Before starting work, purge with sufficient nitrogen.
- > Before starting work, stop the supply of hydrogen.
- In no case shut off the cabinet exhaust.
- Before restarting check the system for leaks.







Contaminated elements!

Work on contaminated elements cause damages to health.

- Inform about possible contaminations before starting to work.
- Observe applicable regulations and protective measures when working with contaminated elements.
- Decontaminate contaminated elements properly before disposal.
- When dispatching contaminated elements, declare and transport them according to the national and regional provisions.

DANGER



Chemical burn caused by alkaline and acidic liquids!

The scrubbing liquid can be alkaline or acidic. Improper work with alkaline or acidic liquids can cause chemical burns.

Wear protective clothes, protective gloves and protective glasses when working with corrosive liquids.

DANGER



Deactivated safety installations!

Not all safety installations are active in manual operation.

- Only use the manual operation for the testing of components.
- Only dispose of waste gases in automatic mode.
- Activate the automatic mode after maintenance works.

Preparation

Observe the following points before starting maintenance work:

- Notify the person responsible for the upstream and/or downstream system.
- Familiarise yourself with the works to be carried out on the system.
- Provide the required materials.
- Inform arriving persons about the active maintenance works using a sign.
- Close off the danger area around the system.
- Disconnect all media relevant to the system according to the STOP+SAVE-process.
- Check the applicability of system and documentation:
 - Type plate on the system
 - Serial number in the documentation
- Switch the system into service mode (key switch on position **SERVICE**).

Environmental hazard

Operating materials can be dangerous for the environment. They must not enter the ground. Spilled or escaped operating materials must be absorbed immediately and disposed of according to the valid regulations and specifications of the manufacturer.

Component groups by external suppliers

The maintenance works and frequencies at component groups by external suppliers have been taken over into the maintenance plan of the system. The description of the activities is also included in the documentation by the external suppliers.

After the maintenance

It is essential to ensure the following:

- The entire maintenance equipment and all maintenance aids (e.g. tools, cleaning materials, adjusting devices) must be removed from the system.
- All protective installations are fully functional again.
- The system is switched to automatic mode and the key is removed from the key switch.

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8.2

Maintenance plan



ADVICE

The system does not have lubrication points which are subject to maintenance at regular intervals.

The time intervals of the activities to be effected are recommendations. The maintenance intervals must be adapted to the prevailing operating conditions.

Design of the	Maintenance/Inspection	Running controls	Cleaning	Check deadlines: (Months)			
Designation				1	3	6	12
Electric control	<u>'</u>	•					
Control module insert		Х	Х				Х
others	General checks (for example sensory)	Х					Х
General	General visual inspectionSecure earthing	Х					Х
(general)			•	•		•	-
Circulating pump	 Damage, attachments, wear and tear → Manufacturer's instructions 		X				X
Y-Filter	Clean, if necessary exchange	Х			Х		
Quenching plate	Check the opening for depositing and geometry of the opening, if necessary clean or replace					Х	
Waste gas lines	Clean, if pressure increase on SPI	Х	Х				
Reactor head	Clean, if pressure increase on SPI	Х	Х				
	Control sealing rings	Х					X
Lye supply (option)	Check the pH-probe	Х			Х		
Pressure sensors	Generally maintenance free, check if measured values divergences	Х					Х
Gas sensor (burner gas)*	Only check by authorised personnel	Х					Х
Measured value transmitter	Damage, attachmentsCheck if measured values divergences	Х					Х
Circuit	Check sieve cup, empty if necessary						X
Touch panel	Clean touch panel	Х	Х				
Connection elements	Visual inspection, if necessary tighten	Х		Х			
others	General checking of the plant, check cleanliness	Х	Х				

Tab.8-1 Maintenance plan

^{*}Sensors may only be checked and calibrated by trained and authorised specialist staff.

8.3 Maintenance works



ADVICE

When screwing together the connectors, the stability of the connections must be ensured! The connections must not be over tightened!

- 1. Ask for approval from the tool operator.
- 2. Note the operating hours of the system.
- 3. Wear the following protective equipment: protective glasses, protective gloves, protective suit, protective shoes

8.3.1 Switching the system off

- 1. Open the door to the control module insert
- 2. Switch the key switches of both reactors to **Service**.
- 3. Push both **OFF** buttons and wait 1 minute. The corrosive gas valve is switched to bypass.
- 4. Push both **ON** buttons. In doing so, the after burning is activated. Wait 1 minute.
- 5. Push both **OFF** buttons. The green button flashes.
- 6. Wait for the after-cooling time to finish until the **STOP** button illuminates.
- 7. Main switch must be switched off.

8.3.2 Cleaning waste gas pipelines

This is how to clean or exchange the waste gas pipeline on the reactor head.

- 1. Switch off the plant, open the cabinet.
- 2. Disassemble the heating jackets (option).
- 3. Loosen the wing bolts on the 3-way valve.
- 4. Remove the clamp.
- 5. Loosen the wing bolts on the waste gas feed.
- 6. Hold the exhaust gas pipe tightly, remove the clamp (take care of the sealing ring).

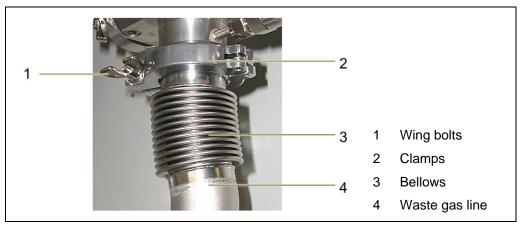


fig. 8-1 Attaching the waste gas pipe onto the 3-way valve

- 7. Check the pipe insides for deposits and clean
- 8. Check the bellows for damage, if necessary replace the waste gas pipe
- 9. If necessary replace the "O-rings"
- 10. Re-attach the waste pipe in the reverse order to disassembly

8.3.3 Cleaning

8.3.4 Exchanging pump

This is how the pump is disassembled:

- 1. Empty tank.
- 2. Switch plant off (see .chap. 8.3.1, p. 71)
- 3. Disable the shut-off valve from the water inlet or waste water outlet.
- 4. Separate the pressure connection and suction connection.
- 5. Pull off pump plug.
- 6. Loosen the attachment screws.
- 7. Exchange pump.
- 8. If necessary replace the "O-rings"

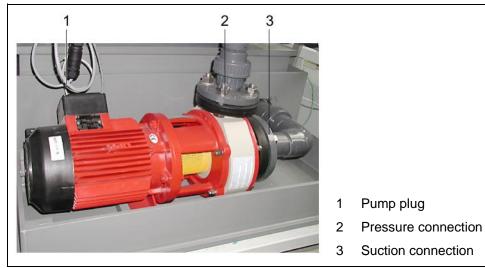


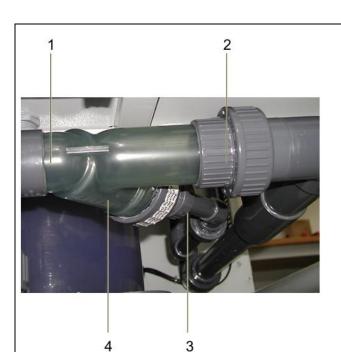
fig. 8-2 Exchange pump

The pump is assembled as follows:

• Assembly is carried out in the reverse order to the disassembly.

8.3.5 Cleaning Y-Filter

The washing liquid Y-Filter is fitted underneath the control module insert.



- 1 Connection to pump
- 2 Connection to circuit
- 3 Waste water connection
- 4 Filter insert

fig. 8-3 Y-filter

This is how the Y-Filter is cleaned

- 1. Switch the plant off (see .chap. 8.3.1, p. 71)
- 2. Open the lower right hand door (underneath the control module insert).
- 3. Remove the waste water pipe from the filter. (see fig. 8-3, p. 73)
- 4. Remove the filter insert and either clean or exchange.
- 5. If necessary replace the "O-rings".
- 6. Refit the waste water pipe to the filter.

8.3.6 Cleaning reactor head

According to the type of waste gas the waste gas opening can become blocked. If the pressure on the sensors SPI increases then cleaning is necessary.



DANGER

Harmful exhaust air in the gas lines!

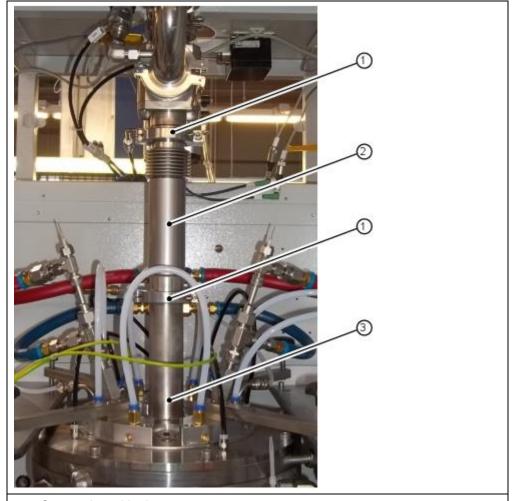
Gases escape during work on the gas lines which, in case of contact, can cause death or serious injuries.

Wear a protective mask when carrying out disassembly or cleaning work at the gas lines.

This is how the reactor head is cleaned.

Quick clean





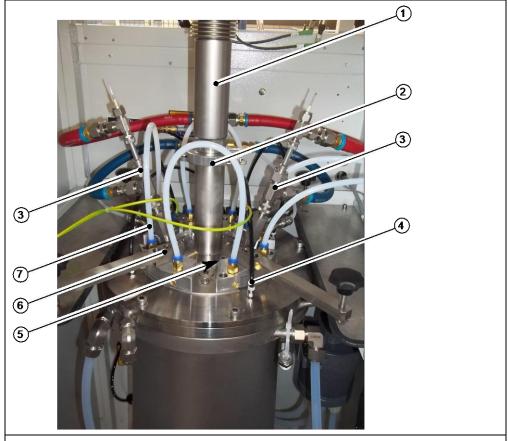
- Connection with clamp
- 2 Waste gas line
- 3 Reactor head

fig. 8-4 Reactor head

- Loosen the wing bolts on the 3-way valve. 1.
- 2. Remove the clamp.
- Loosen the wing bolts on the reactor head.
- Remove the waste gas line.
- 5. Clean the reactor head with an appropriate tool (e.g. bottle brush, trianglular scraper).
- 6. Reassemble the waste gas line.

If this quick clean procedure is not sufficient clean the reactor head as following:





- 1 Waste gas line
- 2 Connection with clamp
- 3 Burner
- 4 Nitrogen feed line
- 5 Screws for fastening the reactor head (see detailed figure)
- 6 Reactor lid plate
- 7 Head cooling

fig. 8-5 Reactor head

- 1. Switch of system (see chap. 8.3.1, p. 71)
- 2. Open cabinet.
- 3. Disassemble the waste gas pipe. (see Chap 8.3.2, page 71)
- 4. Disassemble the feeder pipeline for Nitrogen on the reactor head.
- 5. Disassemble the head cooling line on the reactor head.
- 6. Disassemble the earthing cable.

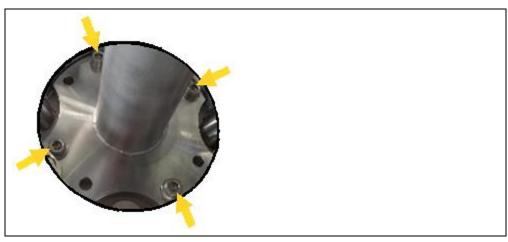


fig. 8-6 Screws reactor head

- Disassemble the reactor head, for this loosen and remove 4 hexagonal socket screws.
 - (all further work to be carried out on a soft underlay, so that damage is not caused to the sealing surfaces)
- 8. Clean the reactor head.
- 9. Clean sealing surface
- 10. Reassemble the reactor head in the reversed sequence to the disassembly.

8.3.7 Calibrating pH sensor

This is how the pH sensor is calibrated:

- 1. Remove the pH sensor from the tank.
- 2. Rinse the electrode with distilled water.
 - Remove deposits from the pH sensor.
 - In case of alkaline deposits rinse the senor with a citric acid (10% solution)
 - After cleaning rise the sensor with distilled water and condition the sensor in its reference electrolyte solution for at least one hour.
 - In case of new installation or replacement better store the senor in water over night.
 - Afterwards rinse the sensor with water.



- 3. Dry the sensor using cleaning tissues.
- 4. Immerse the cleaned and rinsed sensor into a buffer solution of 7 pH. Attend to the right immersion depth; diaphragm has to be completely immersed into the buffer.
- Calibrate the zero point.
- 6. Read the actual pH value in the touch panel screen and adjust the value to 7.
- 7. Rinse the sensor with water and dry it with a clean cleaning tissue.
- 8. Avoid cross contamination between the buffer solutions.
- 9. Immerse the cleaned and rinsed sensor into a buffer solution of 10 pH. Attend to the right immersion depth; diaphragm has to be completely immersed into the buffer.
- 10. Calibrate the slope.
- 11. Adjust the value to 10.
- 12. Rinse the sensor with water and dry it with a clean cleaning tissue.
- 13. Avoid cross contamination between the buffer solutions.
- 14. Immerse the cleaned and rinsed sensor into a buffer solution of 7 pH.
- 15. Read the actual pH value in the touch panel screen.
- 16. The pH value has to be adjustable to 7.00 ± 0.3 . If not, repeat the calibration. If necessary, replace the sensor.
- 17. Rinse the sensor with water and dry it with a clean cleaning tissue.
- 18. Install the sensor in the tank.

8.3.8 Check the touch panel

NOTICE



Sensitive surface of the control and display device.

Do not use sharp or hard objects (e.g. ball pens, screw drivers) on the display...

- Clean the touch panel using a soft, dry cloth.
 If necessary, use a neutral 2%-rinsing solution and subsequently wipe it with a dry cloth.
- 2. Check the touch panel for scratches. If necessary, replace heavily scratched touch panels.

8.4 Repair



ADVICE

The manufacturer has extensive experience in the field of construction, manufacturing and assembly which is required in order to obtain the operational reliability, durability and production accuracy.

Due to this fact, we strongly recommend to have maintenance works for essential system components carried out by the manufacturer's service.

Preparation

Carry out the following points before starting repair works:

- Notify the person responsible for the upstream system.
- Familiarise yourself with the works to be carried out on the system.
- Switch the subsystem to service mode (key switch in position **SERVICE**) or, depending on the work to be carried out, switch the system off and protect it against restart.
- Provide the required spare parts.
- Inform arriving persons about the active maintenance works using a sign.
- Close off the danger area around the system.
- Close and/or lock all media lines relevant to the subsystem.

Contaminated
elements

When dispatching the element to the manufacturer, please declare if the element is free from dangerous contaminations. If an element is contaminated, also indicate the type of hazard. This is required for the compliance with legal regulations and for the protection of employees.

Environmental hazard

Operating materials can be dangerous for the environment. They must not enter the ground. Spilled or escaped operating materials must be absorbed immediately and disposed of according to the valid regulations and specifications of the manufacturer.

Completion

After completing the maintenance works, carry out the commissioning activities.

8.4.1 Spare parts and after sales service

Check the applicability of system and documentation:

- Type plate on the system
- Serial number in the documentation

Order address

The order address for spare parts as well as information on the after sales service is stated at the beginning of the documentation.

Original spare parts

Only original spare parts ensure quality, safety and replaceability. Due to this fact, only use original spare parts or spare parts recommended and permitted by the manufacturer.

Spare parts list

The parts list of this system is enclosed in the annex to this operating manual.

Development

The manufacturer continuously works on the development of its products. Due to this fact, modifications to images and technical data are reserved. As a result, no claims can be asserted from the information and images in the spare and wear parts lists.

8.4.2 Circuit diagrams, media plans

The following diagrams in the annex of this system must be observed for the maintenance of this system:

- Media scheme
- layout schematic
- Circuit wiring diagram



9 Decommissioning, storage

9.1 Introduction

The system must only be decommissioned by competent or specialist persons.

DANGER



Life-threatening voltage!

Improper work on the electric installation cause death or serious injuries.

- Only electrically skilled persons may carry out works on the electric installation.
- Always de-energise the system first, using the mains disconnection device and protect it against unintended restart using a padlock. In doing so, ensure that the terminals on the main connection box and the mains disconnection device remain energised.

DANGER



Harmful exhaust air in the gas lines!

Gases escape during work on the gas lines which, in case of contact, can cause death or serious injuries.

Wear a protective mask when carrying out disassembly or cleaning work at the gas lines.

9.2 Decommissioning

Switch off the system and protect it against unauthorised use in case of the following events:

- In case of a longer downtime of the system
- Prior to maintenance works requiring a complete decommissioning of the system
- Prior to dispatch and transport

Switching off the system:

- 1. Switch the key switch **AUTO SERVICE** to **SERVICE**.
- Press the STOP button for at least 3 seconds.
- 3. Wait for the after burning and after-cooling to finish.
- 4. Switch off the mains disconnection device and protect it against restart using a padlock.
- 5. Switch off the energy according to the STOP + SAVE-process.
 - ✓ Now, the system is switched off.

NOTICE



Follow the switch-off order when deactivating the media!

A wrong order during the deactivation of the media causes damages to the system.

> Always respect the correct switch-off order for media during the decommissioning of the system (LOCKOUT-TAGOUT-procedure).

9.3 Storage conditions

The operator must take all measures for the intermediate storage of the system at the place of application from the delivery until the start of assembly or, in case of a longer downtime of the system, to prevent damages to the system.



In particular, the following points must be observed:

- Protect transport units against weather influences and aggressive and dustcontaining surroundings.
- Comply with the required ambient conditions, see connections and layout plan
- Storage on solid ground or pallets.
- In order to prevent vibration wear, avoid storage next to vibrating systems.
- · Keep all openings of the system closed.

System downtime

Observe the following points in case of a longer downtime of systems already commissioned:

- System was cleaned within the scope of maintenance.
- Media connections are disconnected.

10 Disposal

DANGER



Contaminated elements!

Work on contaminated elements cause damages to health.

- Inform about possible contaminations before starting to work.
- > Observe applicable regulations and protective measures when working with contaminated elements.
- Decontaminate contaminated elements properly before disposal.
- When dispatching contaminated elements, declare and transport them according to the national and regional provisions.

NOTICE



Environmentally hazardous substances

During disassembly or disposal of the system, substances damaging or affecting the environment could escape.

- Prevent damages to the environment by a proper disposal.
- Inform about possible contaminations before starting the disassembly works. Comply with applicable regulations and take protective measures when working with contaminated elements.
- Have the disposal carried out by an authorised expert company.

A proper disposal comprises:

- Supplying reusable materials to recycling.
- Disposing of the waste in an environmentally sound manner.
- Sorting disassembled parts by material groups.
- If required by law, certain parts must be returned to the manufacturer.
- If recycling is possible, pass the parts to the respective collection points.
- Individual, still usable modules can be stored temporarily for further use.
- Notify the manufacturer about the end of the usage time.

End of the usage time

After the usage time has expired, the maintenance staff must disassemble the system in a sorted manner. National regulations and laws must be observed.

Disassembly

Observe the following points during disassembly:

- Put the system out of operation before starting the works.
- Have the system de-energised by an electrically skilled person before starting the works.
- Drain, remove and properly dispose of all operating fluids, e.g. scrubbing liquid, before starting the works.
- If required, attach the elements to an appropriate lifting gear.
- Disassemble the system into individual modules and elements.

Most frequently used materials

The materials most frequently used in the system and therefore to be disposed of are:

- · Painted steel: Cabinet
- PPs: Tank
- PVC-U: Liquid duct
- Stainless steel: Reactor, burner unit, waste gas lines, fuel gas piping, scrubbing line, tray, screw connections
- Brass: Screw connections for O2-piping, compressed air
- Copper: O2-piping

- POM: SMC-plug-in connector
- PU: Hose for compressed air
- PE: Hose for scrubbing liquid
- PTFE: Hose for connections in the reactor room
- PP: Pipe clamps

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11 Registers

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For the abatement system UPTIMUM PLUS – Match Code ÜPEI1

12.1 Electrical drawings

Circuit wiring diagram

12.2 Mechanical drawings

Connections and layout plan

Media diagram

Values of media to be connected

12.3 Spare parts

List of spare parts

9/8/2020



13 Safety – LOTO procedure

<u>Lockout-Tagout</u> procedure-safe disconnection of energy sources



14 Technical Documentation Supplier

MS tag	TYP	Producer
MFCA	MFC8745	Bürkert
MFCG	MFC8741	Bürkert
PMS	BN50-32-125	Jesco
SD1, SD2	<u>LS03</u>	LDT
SD3	<u>LBFS</u>	Baumer
SFA1, SFN7x	<u>PFM711S</u>	SMC
SFA3	PFMC7501	SMC
SFA55.x	PF2A751	SMC
SFE	FCS-K20-AP8X	Turck
SFSx	<u>VVX25</u>	SIKA
SFWx	<u>VVX15</u>	SIKA
SG	<u>CC22</u>	GfG
SLS	<u>ABRPP</u>	KSR
SPAx, SPN	<u>DS4012</u>	Riegler
SPIx	<u>A-10</u>	WIKA
SPT1	DMU4	Kalinsky
STRx, TR	<u>B12E</u>	Microtherm
STS	741.xxx	Jacob
STS1	PT100/B/2	B+B Thermotechnik
STS2	<u>PT100</u>	WIKA
U30	GMA41	GfG



15 Quality Documentation – Test Reports

Test reports of the abatement system UPTIMUM *PLUS* – A28-20-8585:

- DAS <u>Final Test Report</u>
 (Quality Management-Working Instruction and Electrical Safety Test)
- Calibration / test reports gas sensor GfG Gas_Test