North Carolina Department of Environment and Natural Resources

Pat McCrory
Governor

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Secretary

February 11, 2015

Steve Pellegrene
Executive Vice President Sales
Clean Waste Systems, LLC
3535 Plymouth Blvd, Suite 112
Plymouth, MN 55447

Re: Ozone Medical Waste Technology, OMW-1000

Dear Steve Pellegrene:

This is in response to your letter requesting approval of the Ozone Medical Waste Technology, the OMW-1000 for the treatment of regulated medical waste, as requested in your letter dated January 30, 2015. Regulated medical waste as defined in 15A NCAC 13B .1201 includes pathological waste, microbiological waste and bulk blood and body fluids in excess of 20ml.

The Division of Waste Management is authorized to approve alternative methods of treatment of regulated medical waste according to 15A NCAC 13B .1203(b).

This approval supersedes a previous approval for this product issued May 8, 2013. According to documents and data submitted to the Division by Clean Waste Systems, LLC, the OWM-1000 employs shredding to reduce the waste volume by 90%, rendering the waste unrecognizable, and the use of ozone at 1200 ppm to achieve homogeneous treatment of regulated medical waste.

In documents and test reports submitted to the Division by Clean Waste Systems, LLC, the OMW-1000 technology demonstrated effective treatment of microbial test agents.

This product is approved for the treatment of pathological waste and microbiological waste provided the unit is installed, operated and maintained in a manner consistent with the manufacturer's requirements and recommendations as described in the owner's manual OZAT CFS-1/3 2G provided by Clean Waste Systems. Monitoring under conditions of full loading for effectiveness of treatment shall be performed no less than once per month or as often as is necessary to ensure effective treatment, through the use of biological indicators as described on page 2 in the document "Efficacy Test Procedure" provided by Clean Waste Systems. Bulk blood and body fluids are prohibited from the unit as per the manufacturer's recommendations,

Sharps, dressings, bandages, gowns, gloves and similar items are not defined as regulated medical waste in North Carolina and do not require treatment before final disposal.

This approval is valid until such time as it has been determined that this treatment technology for these waste types no longer meets the requirements of the rules for the regulation and treatment of medical waste.

Should you have any questions regarding this matter you may contact me at (919) 707-8245 or Bill Patrakis at (919) 707- 8290.

Sincerely,

Ellen Lorscheider

Ellen Lorscheider
Solid Waste Section Chief

Cc:
Linda Culpepper, Director, Division of Waste Management
Bill Patrakis, Environmental Scientist

Operating Manual

OZAT CFS-1/3 2G

Survey of revision:

Rev.	Date	Prepared	Reviewed	Approved	Changes
0	18.05.2006	Gi	Mz	PAB	
A	07.06.2006	Mz	Gi	PAB	Add new ozone concentration
B	29.01.2008	Mz	Gi	PAB	Correction Diagnose Mode
C	19.03.2009	SCH	Gi	PAB	Softwareupdate V2.0 / New logo
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E					
F					
G					
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Introduction

Purpose

This operating manual (in the following also called OM) contains all substantial specifications, for safe operation and maintenance of the OZAT® ozone generator during all cycles.

Life cycles

The following life cycles are considered:

- Transportation, Storage
- Installation / Mounting, Commissioning
- Operation
- Trouble shooting / Repair
- Deactivation, Dismantling / Disposal

This operating manual contains important safety notes. It has to be read by the operators carefully before start-up.

Safekeeping of the operating manual

The operating manual of the ozone generator should:

- be kept in direct proximity to the plant.
- be passed on to the owner of the plant.
- be kept until the disposal of the plant.

The access to the operating manual by the operator must be ensured at all time.

Construction

This operating manual contains in the appendix additional information to maintenance, trouble shooting and repair, as e.g.:

- P&I-Diagram
- Circuit diagram
- Operational diagram and curves

The operator information of the ozone generator is part of the equipment manuals of the complete ozone plant.

Representation Conventions

Following is a description of symbols and pictograms, which you can find in this operating manual:

WARNING:

For a directly threatening danger or a possibly dangerous situation, which can lead to heavy bodily injuries or to death.

CAUTION:

For a possibly dangerous situation, which could lead to light bodily injuries, or with which the product or something in its surroundings could be damaged.

NOTICE:

Application notes and other useful information for facilitating the work.

General Regulations

Before commissioning in principle all conditions for a reliable operation of the ozone generator must be fulfilled. In this connection see chapter 2 „Safety Regulations".

The mounting, commissioning and maintenance of the ozone generator may be done only by authorized and appropriately instructed personnel.

No changes shall be made on the ozone generator without written consent of Degrémont Technologies. Random changes may lower the safety of the equipment. Degrémont Technologies is not responsible for faults, which are due to changes without consent.

Table of contents

1 Product Description

The OZAT® *CFS* ozone generators are complete, fully factory tested units that can be easily integrated into all types of systems, old or new, with the minimum amount of installation time and space requirement. The unit incorporates most of the elements necessary to generate ozone. Refer to chapter (1.3) to check that your system complies with the recommended installation requirements for safe and reliable operation of the unit.

The OZAT-CFS units are equipped with one or more specific Advanced Technology non glass dielectric modules which are shock resistant dielectrics providing high endurance and optimized properties for the generation of ozone in the range of 6 to 12 wt% ozone concentration. Higher ozone concentrations may be achievable under specific conditions of operation but are not recommended to be used for continuous operation since unstable ozone production output may occur.

The enclosure of the unit is divided into 2 compartments:

OZAT® AT dielectric and CFS generator module

• Mechanical Compartment

Containing the permanently sealed ozone generator module(s) for CFS 1, 3 and 7 and a vertical vessel containing the dielectric segments for the CFS 14, the associated manifolds in the case of multiple ozone generator modules, all necessary pipes, fittings, valves, connections, and relevant instrumentation for the safe operation of the unit.

• Electrical Compartment

The electrical equipment is contained in a second compartment in the cubicle that completely separates and protects these components. The supply includes the power components and all electrical control equipment necessary for the safe and correct functioning of the generator unit.

• Operator Interface

The units have been designed with the operator in mind and they can be operated from a user friendly operator interface located on the front of the panel.

Refer to this manual for a detailed description of each component of the product.

1.1 Principle of operation

Ozone is generated by converting part of the oxygen gas molecules **O_2** within a gap formed between two electrodes (See fig 1). When applying an alternating high voltage to the high voltage electrode, micro-discharges will take place in the discharge gap which will dissociate the oxygen molecules. Some of the freed oxygen atoms **O** will recombine with the remaining oxygen molecules **O_2** to form ozone **O_3**. This principle is usually called “Silent Electrical Discharge”.

$O + O_2 = O_3$

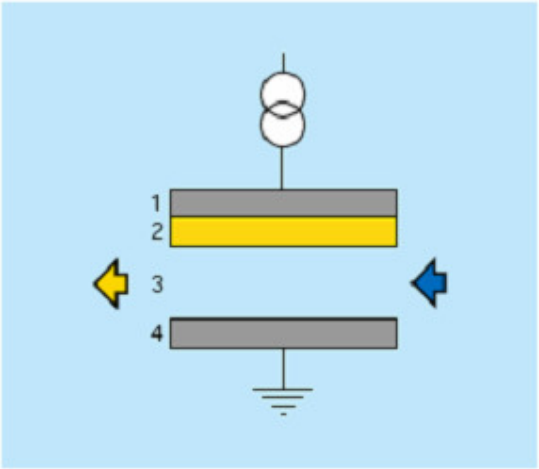


Fig. 1: Ozone generation
1 : High voltage electrode
2 : Dielectric
3 : Discharge gap
4 : Earth electrode

The ozone concentration of the gas at the outlet of the generator is expressed by the ratio of the ozone mass produced divided by the total outlet gas mass (% by weight) or the mass of ozone produced per volume of outlet gas (g/Nm^3).

Only part of the energy applied to the electrodes is used to produce ozone. The ozone generation modules are cooled with water to efficiently remove all the heat generated by the process. Ozone generation is very sensible to the cooling water temperature and the gas quality. The lower the temperature, the higher the ozone efficiency will be.

The operator is responsible for the process and all pertinent safety measures**.**

WARNING:

Contact and especially breathing in of ozone containing gas can be lethal for humans and animals. Gas containing ozone may not be released uncontrolled, neither in buildings, nor to the atmosphere.

CAUTION:

Pay attention to the relevant caution and safety precautions, if the process is fed with oxygen (see chapter 2 „Safety Regulations").

1.2 Intended application

1.2.1 Application area

The OZAT® ozone generator is designed to generate air or oxygen ozone gas mixture suitable for use in all types of processes, for example:

- Drinking water
- Swimming pool water
- Waste water
- Aquaculture
- Disinfection
- Oxidation processes in industry

1.2.2 Location

The ozone generator is constructed for indoor location in dust free, dry environment (ambient conditions according chapter 1.3.6).

1.3 Technical Data

1.3.1 Cabinet dimensions of the OZAT® ozone generator

Type	CFS-1 2G	CFS-3 2G	
Width	720		mm
Depth	370		mm
Height	800		mm
Weight	70	85	kg

1.3.2 Nominal data of the OZAT® ozone generator with oxygen

Type		CFS-1 2G		CFS-3 2G		
Feed gas	Gas	O_2		O_2		
	Nominal ozone concentration	6	10	6	10	wt%
	Nominal feed gas pressure	1.2		1.2		bar g
	Nominal production nominal	75	58	225	175	g O_3/h
	Oxygen from PSA see diagram “APPENDIX“	0.9	0.4	2.65	1.22	Nm^3/h
Cooling media	Water	0.09		0.27		m^3/h
	Nominal cooling temperature	12		12		°C
	Cw temperature rise	5				°C
Grid	Line voltage, single phase	230				V_{AC}
	Line frequency	50				Hz
	Line current	3.2		8.8		A_{AC}
	Fuse 5x20 mm	4		10		A
	Line power factor	0.99				cosφ
	Line power consumption	0.72		2.02		kW
	DC-Power measurement Pe at display	620		1860		W_{DC}

Nominal altitude 1000 m.a.s.l.

1.3.3 Nominal data of the OZAT® ozone generator with air

Type		CFS-1 2G	CFS-3 2G	
Feed gas	Gas	Air	Air	
	Nominal ozone concentration	3	3	wt%
	Nominal feed gas pressure	2.5	2.5	bar g
	Nominal production nominal	40	120	g O_3/h
	Air requirement	1.02	3.1	Nm^3/h
Cooling media	Water	0.09	0.27	m^3/h
	Nominal cooling temperature	12	12	°C
	Cw temperature rise	5		°C
Grid	Line voltage, single phase	230		V_{AC}
	Line frequency	50		Hz
	Line current	3.2	8.8	A_{AC}
	Fuse 5x20 mm (fast blow)	4	10	A
	Line power factor	0.99		cosφ
	Line power consumption	0.72	2.02	kW
	DC-Power measurement Pe at display	620	1860	W_{DC}

Nominal altitude 1000 m.a.s.l.

NOTICE:

The connection to the mains power is made using a plug and socket (P/N/PE). The line fuse must be sufficient to meet the local regulations and our requirements.

1.3.4 Operational data of the OZAT® ozone generator with oxygen

Type		CFS-1 2G	CFS-3 2G	
Feed gas	Gas	O_2	O_2	
	LOX: Oxygen purity Nitrogen addition	 90-99.8 2.3	 90-99.8 2.3	wt%
	PSA: Oxygen purity resulting Nitrogen content resulting Argon content	 90…93 5.1…1.9 4.9…5.1	 90…93 5.1…1.9 4.9…5.1	wt%
	Dew point at 1 bar abs.	≤-65 [1)]		°C
	Oil content	≤0.1		ppm
	Contamination: particle size	≤0.01		µm
	Hydrocarbons	<20		ppm
	Inlet pressure	3…8		bar g
	Operating pressure	1.2 $^{\pm 0.1}$	1.2 $^{\pm 0.1}$	bar g
	Outlet pressure	<0.7	<0.7	bar g
	Temperature	5...40		°C
	Gas flow, adjustable	0.04... 0.96	0.3... 3.52	Nm^3/h
	Maximum mass flow	1.37	5.03	kg/h
	Adjust. range of the ozone production	10...100		%
	Ozone concentration, adjustable	0...14	0...14	wt%
Cooling medium	Cooling medium	Water		
	Chloride content	≤50		mg/l
	Inlet temperature	2...35		°C
	Operational pressure	2...6		bar g
Grid	Line voltage, single phase	230 ±10%		V_{AC}
	Line frequency	48…63		Hz
	DC-Power measurement Pe at display	10...620	20...1860	W_{DC}

1) Dryer than -65°C

1.3.5 Operational data of the OZAT® ozone generator with air

Type		CFS-1 2G	CFS-3 2G	
Feed gas	Gas	Air	Air	
	Dew point at 1 bar abs.	≤-65 [1)]		°C
	Oil content	≤0.1		ppm
	Contamination: particle size	≤0.01		µm
	Hydrocarbons	<20		ppm
	Inlet pressure	3…8		bar g
	Operating pressure	2.5 $^{\pm 0.1}$	2.5 $^{\pm 0.1}$	bar g
	Outlet pressure	<2.0	<2.0	bar g
	Temperature	5...40		°C
	Gas flow, adjustable	0.07.. 1.31	0.5... 5.35	Nm^3/h
	Maximum mass flow	1.69	6.9	kg/h
	Adjust. range of the ozone production	10...100		%
	Ozone concentration, adjustable	0...5	0...5	wt%
Cooling medium	Cooling medium	Water		
	Chloride content	≤50		mg/l
	Inlet temperature	2...35		°C
	Operational pressure	2...6		bar g
Grid	Line voltage, single phase	230 ±10%		V_{AC}
	Line frequency	48…63		Hz
	DC-Power measurement Pe at display	10...620	20...1860	W_{DC}

1) Dryer than -65°C

1.3.6 Environmental conditions:

Type	CFS-1 2G	CFS-3 2G	
Ambient temperature for operation	5...40 (24 h average = 35 °C)		°C
Ambient temperature for transport and storage	-25...+55 (70 °C total max. 24 h)		°C
Altitude [1)]	0 to 3000		m.a.s.l.
Annual average air humidity - for 60 continuous days a year - occasionally	≤65 75 85		% % %
Aggressive environment	absolutely to be avoided		
Protection class for installation	IP 42		
Vibration/Shock	Installation in a vibration-free environment		
Sound pressure level (1 meter)	≤80	≤80	dB(A)
Heat dissipation to the environment	0 to 200	0 to 400	W

1) Note above electrical power reduction: 10% per 1000m

1.3.7 Appendixes to be observed for operation

NOTICE:

For the adjustment of the gas flow and the ozone concentration use the follow appendixes:

Type	CFS-1 2G		CFS-3 2G		
Feed gas	Air	O_2	Air	O_2	
Gas flow diagrams	14	17	14	17	Appendix
Setting curves	15	18	16	19	Appendix

An example for calculation see in chapter 7.3.

1.3.8 Regulation to ensure the product availability

NOTICE:

The OZAT® ozone generator will reach nominal production only after about 400 hours from first commissioning.

CAUTION:

To prevent harm to the OZAT® ozone generator units it is requested to not exceed 80% of electrical loading during the first 100 operating hours.

CAUTION:

Feed gas: Air or Oxygen containing gas (with minimum 0.1%N_2)

The feed gas must have an atmospheric dew point drier than –65°C both during purging and during operation. During commissioning re-commissioning or starting after a long shutdown period special attention must be given to the fact that dryer units and PSA type oxygen generators require conditioning until the specified dew-point is achieved. During this “conditioning period” the gas coming off the feed gas preparation units must not be passed through the ozone generator.

Cooling medium: The cooling water should not contain substances that leads to formation of sludge, deposits, crusts or flow blockages in cooling water lines or cooling water jackets.

1.3.9 Electrical connections of the OZAT® ozone generator

External set-value signal: 4...20 mA (= 0...100%), (potential free)

- Load impedance: 200 Ω
- Max. permissible current: 25 mA

2 external control inputs: potential free contacts (for 24 V_{DC} ±30%, 2 mA)

- Supply ON/OFF
- Gas valves OPEN

4 Signals to master controller: potential free contacts (rating ≤50 $V_{AC/DC}$, 1 A)

- Supply ON/OFF
- Gas valves OPEN
- Control REMOTE
- ALARMBITS 0…2

Wiring to apparatus:

- Control signals, signals to master controller (Appendix 22).

1.3.10 Mechanical connections of the OZAT® ozone generator

Feed gas connection:	Bulkhead fitting Serto SO 41521-10 For hose and pipe lines ∅ 10 x 1
Ozone gas connection:	Bulkhead fitting Serto SO 51521-10 For hose and pipe lines ∅ 10 x 1
Cooling medium in out:	Bulkhead fitting Serto SO 41521-12 For hose and pipe lines ∅ 12 x 1

NOTICE:

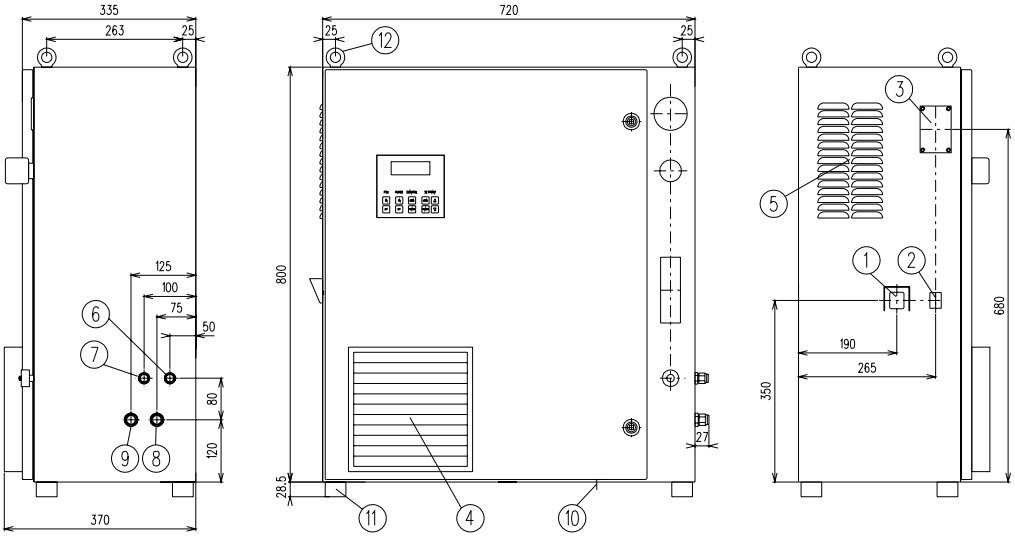
Material recommended for the external connections.

Ozone:	Fluorised plastics (PTFE, PVDF) Stainless steel (e.g. 1.4571, 1.4435)
Oxygen:	Fluorised plastics (PTFE, PVDF) Copper, stainless steel (e.g. 1.4571, 1.4435)
Air:	Fluorised plastics(PTFE, PVDF) Stainless steel (e.g. 1.4571, 1.4435), copper, brass, galvanized steel
Water:	Plastic (PVC, PTFE, PVDF, PE, PA), copper, brass, galvanized steel

CAUTION:

Pressure, vibration or mechanical hits to the mechanical connections have to be avoided.

1.3.11 Dimensional drawing showing connections



Caption:

1	Mains socket
2	Mains switch
3	Gland plate for control-, external operating- and signal-cable
4	Air inlet
5	Air outlet (minimum clearance 300mm)
6	Feed gas inlet
7	Ozone gas outlet
8	Cooling medium inlet
9	Cooling medium outlet
10	Condensate drain
11	Rubber feet
12	Lifting eyes

2 Safety Regulations

2.1 Definitions of Representation

The pictograms used in this operating manual and their meaning are described on page 4.

2.2 Principles

The ozone generator corresponds to the state of the art. It was subjected to a danger analysis. Based on this suitable precautions were taken for safety of humans and domestic animals. Nevertheless **dangers can result** from inappropriate application, lack of maintenance, material ageing etc. These are dangers in connection with:

- Gaseous oxygen (if used as feed gas)
- Ozone
- Electricity
- Mechanical dangers
- Compressed air

Therefore the relevant safety regulations at the installation site have to be strictly observed.

Electrical danger

During the operation of the device the components have dangerous parts which are electrically alive, moving or rotating. They can cause extreme health or material damage during inappropriate application or incorrect operation or if the required covers or safety devices are inadmissibly removed.

Mechanical danger

When assembling, exchanging and commissioning components the mounting and commissioning regulations of Degrémont Technologies Ltd or the manufacturing company have to be always obeyed.

Safe handling of the auxiliary equipment must be ensured.

Lifting gear

Suitable lifting gear, which corresponds to the local safety regulations, must be used. Lifting gear of the operator or of third may be used only with their agreement. Loose or swiveling parts of transported components must be attached. When accelerating or delaying the load the permissible limits are to be observed. Standing below lifted loads is forbidden.

Components lifting fixtures can corrode in the course of the time. Therefore, they have to be checked for their load carrying ability before they are used for lifting and transporting components.

Tightness

Before oxygen is fed into the plant after installation, repair work or re-commissioning and ozone is created, a tightness test must successfully be accomplished. Additionally equipment (warning devices, room ventilation, emergency stop circuits) must be ready for use.

Danger from oxygen or ozone

The ozone plant must be depressurized and purged ozone free before dismantling components that have to be replaced. The ozone concentration has to be measured at ozone outlet of the ozone generator. After purging, the measured ozone concentration must be lower than the minimum admissible ozone concentration.

Covers

If protective covers must be removed for work (commissioning, service, repair), it must be ensured that they are reattached properly immediately after finishing the work. If, in the exceptional case the device must be set under voltage despite dismantled protective covers, the endangered area is to be shut off and marked with warning labels.

Fire hazard

Because of acute fire hazard, welding, grinding or open fire are strictly forbidden at components or pipelines, which contain oxygen or ozone gas before these are purged sufficiently with air. Oxygen and ozone relevant regulations must be observed.

Premises

The premises of the ozone plant may not be misused or be used for storage of foreign material. The escape routes must always be free. Because of the danger of damaging pipelines or equipment, no transportation may be carried out, before mechanically protecting the exposed positions.

With bought parts, the manufacturer's regulations must always be strictly followed.

2.3 General Information

2.3.1 Recommended Preventive Measures and –Precautions

The following explanations and notes represent a substantial contribution for the safe handling of the plant. However they can not cover all inappropriate actions and possibilities.

- Paying attention to the regulations of the operator
- Observation of local, national and international regulations
- Observation of the safety notes of this operating manual
- Instruction of the authorized personnel about
  - safety regulations
  - special dangers in handling ozone
  - behavior in cases of defects and accidents
- Areas, where oxygen or ozone is used, are marked with special signs.
  In these areas it is forbidden:
  - to admit unauthorized persons
  - to smoke
  - to work with open fire
  - work with tools, which produce flames or sparks
  - to use oil and grease
  - to leave oily or greasy rags
- On these signs should be mentioned that perception of ozone smell must be notified immediately and it has to be taken care of aeration.
- Effective ventilation systems and well-labeled, short escape routes in areas with ozone installations have to be planned.
- These areas need further an adequate permanent air exchange (also during operation without alarms).
- In order to be able to switch off the plant safely in case of danger, emergency switches (process stop) shall be installed, which shut down the ozone production. They should always be easily accessible.
- It is not allowed to enter rooms that are enriched with oxygen or ozone. In case of doubt, the atmosphere must be checked with an analyser and a "work permit system" has to be applied. When entering these rooms protection equipment has to be worn.
- Oxygen and ozone monitors have to be mounted at suitable position and they have to be kept in working condition all the time
- Sufficient fire-extinguishing equipment must be available and a plan in case of fire outbreak must be prepared
- Outlets where oxygen or ozone exit (e.g. exit gas line, safety valve) have to be placed in such a way that persons don't have access.
- Zones with increased noise pollution have to be marked with warning notices. Persons, who work in these zones, must wear ear protection.

2.3.2 Safety and Monitoring Devices

Safety and monitoring devices increase the security of the plant and must never be dismantled, bypassed or manipulated. These warning devices must be maintained and examined periodically according to the manufacturer's regulations.

Ozone installations must be equipped with ozone warning devices for room monitoring (danger of poisoning). Depending upon the local conditions **several** monitoring systems have to be planned (basically in each room where ozone can leak). Airflows have to be considered ("dead corners“). Sometimes, in very large rooms, several monitoring systems have to be installed.

On oxygen fed plants, oxygen warning devices are recommended, if these are not already prescribed by valid regulations. The warning devices for oxygen and ozone must be periodically maintained, according to manufacturer's specifications or maintained and examined for correct function by the manufacturer. The same applies to the room ventilation.

NOTICE:

A recommendation about a safety concept and room monitoring is written in the separate document HQM 101575 “Safety Concept and Room Monitoring”. The document can be asked for at Degrémont Technologies and is handed out for free.

The room monitoring shall reach at least a safety level of HQM101575.

WARNING:

The room monitoring must trigger a visual and / or acoustic alarm, so that the persons in the concerned area are warned. These persons must immediately move to a safe and ozone-free area. As long as the room ozone monitoring indicates increased ozone concentration, it is **not** permitted to re-enter the room without respiratory protection equipment.

2.4 Organizational, Personnel

It must be guaranteed that before the installation and first commissioning the OI is carefully read and understood by the responsible personnel, in order to ensure the safe application of the ozone generator. The OI contains all substantial specifications for the operation and maintenance of the plant.

The ozone generator may be installed, commissioned and maintained only by authorized technical personnel. The operator must ensure that his authorized operating personnel receive appropriate instructions.

2.5 Product Specific Dangers

2.5.1 Gaseous Oxygen

(Only present, if oxygen is used as feed gas.)

Characteristics:

- Colourless, odourless, tasteless
- Oxygen is heavier than air (nominal density of air 1.293 kg/m3, nominal density of oxygen 1.429 kg/m3). Therefore air enriched with oxygen sinks to the floor and into pits or channels.
- Assists and accelerates oxidation (particularly with concentrations in air of >25% volume / normal concentration of 21% volume.)

The concentration of oxygen, due to leaks in the reactor, in the pipes or opening systems under oxygen pressure, can increase in rooms with insufficient air circulation, even to dangerous levels that cause a substantially increased **fire hazard**.

Many commonly used materials, which do not burn in air, can easily burn in oxygen or oxygen enriched air.

The following factors lead to an increased risk of oxygen fire:

- Presence of combustible substances: Dust, grease, dirty cloths, etc. can easily catch fire by themselves. Clothes, which are stained or soaked with oil or grease, ignite substantially more easily and more quickly.
- Presence of inflammable and explosive gases and vapours. Combustible gases and vapours can react violently with oxygen or oxygen enriched air, if they are ignited. These ignitions and/or explosions can take place also in ambient air:
  - at leaking spots, where oxygen can leak out
  - at pressure safety valves or exhaust outlet stacks, where oxygen can be released
  - when using special substances (e.g. degreasers)
  - when achieving the ignition temperature with:
    - a burning cigarette
    - sparks from a grinding machine
    - an open flame from a welding torch, etc.

Clothing, which is soaked with oxygen, is to be given a good airing.

Oxygen-carrying pipelines have to be marked in accordance with local regulations

WARNING:

Open fire is extremely dangerous
- therefore prohibition of smoking is required
- no welding work
- etc.

WARNING:

Sparking producing equipment (electrical switches, unsuitable tools) is extremely dangerous.

WARNING:

Oil and grease are extremely dangerous
- no oil and grease-smeared clothing
- Oxygen equipment and devices for oxygen operation are to be kept oil and grease free
- use no oil and grease-smeared

Detailed information can be ordered from the oxygen suppliers or be gathered from the publications of specialized committees. E.g.: IGC document, published by “the European Industrial Gases Association, “Brussels (index 10)

2.5.2 Ozone

Characteristics:

- Ozone is poisonous and corrosive
- Ozone accelerates the oxidation
- Ozone is heavier than air and oxygen (enrichment at the floor, in channels, etc.)
- Ozone has a typical smell
- Ozone is unstable

Ozone can already be noticed at a concentration of 0.003..0.02 ppm volume (smell threshold).

NOTICE:

The owner and/or user is responsible for compliance with the regulations regarding the use of ozone. Comprehensive information regarding ozone can be found in the publications of various specialist bodies.

WARNING:

Efficient ozone generators can create ozone concentrations up to 15 %wt and higher. These values are much higher than the lethal limit. Already small leaks can therefore cause dangerous ozone concentrations in the environment of the ozone installation. Therefore, ozone-warning devices must be installed in such zones.

Overview of the effects of ozone with different concentrations:

Ozone concentration in the breathing air in ml/m^3	**Effects**
ca. 0,02	Average smell perception threshold in pure air.
0,1	**Threshold limit value (temporal average value)** Concentration for an 8 hours working day and a weekly work time of 40 hours. (Check because local standards and regulations may deviate!) Irritation of nose and throat mucous membranes is possible.
0.3	Irritation symptoms possible in nose and throat after about 15 minutes exposure time.
ca. 0,5	Dulling of the sense of smell after approximately 5 minutes of impact time.
ca. 1	Violent cough attacks, extreme tiredness
>10	Longer induction period can be lethal
>5000	Death within a few minutes

Source: ZH 1/474

Persons, who are exposed frequently or for a long time to the effect of low ozone concentrations, can become sick with chronic bronchial ailments.

CAUTION:

Ozone generation plants contain ozone gas in equipment and pipes even after switching off the ozone generator. Therefore these have to be purged until no ozone can be measured (sample position at the outlet of the ozone generator).

2.5.3 Electricity

NOTICE:

Before working on the electrical equipment, it must be guaranteed that the concerning parts are without voltage, and unintentional restarting is not possible.
The equipment may **only** be opened if the mains plug is removed. The main plug must **not** be plugged in again as long as the equipment is open.

WARNING:

Operating on devices under voltage is **forbidden.**

In general no work must be executed on control cabinet or components under voltage. If this cannot be avoided, such work may be accomplished only according to the regulations at the installation site of the plant (rules for the prevention of accidents) by trained technical personnel.

Because of electrical dangers, it is not allowed to spray or wash with water or other conducting liquids for cleaning in the ozone plant room

WARNING:

After switching off the device, the service section has to be checked that there is no voltage present.

As the smoothing capacitors can still hold a dangerous charge for up to 3 minutes after switching off, the capacitor covers should only be removed after this time. To be absolutely certain check the line voltage with a suitable measurement instrument

Before starting work the ozone generator G21 ensure that the ozone generator modules have been **individual** discharged (Chapter 9.1.2).

For the measurement of signal voltages a suitable measuring instrument with an internal resistance of at least 10 kΩ/V has to be used.

2.5.4 Mechanical Dangers

The equipment must be secured to prevent it moving and is to be set-up on a **stable bearing area**.

Piping to and from the equipment must be laid so that they **cannot** be damaged. If it is not possible to lay the lines safely, they must be covered. The lines must not transmit any vibrations. It is to be made in such a way that they **cannot** be damaged or turn off mechanically.

2.6 Additional Dangers

Manuals cannot consider each conceivable case of the installation, the operation or the maintenance. Therefore essentially only such notes are contained in the manuals, which are required by qualified personnel concerned with operation of the ozone generator in industrial ranges.

In special cases where the application is not in the industrial range increased safety precautions may be necessary. In these cases additional protective measures must be taken into account during the assembly of the plant.

NOTICE:

Protect the ozone generator against inadmissible stress (temperature, moisture, impact, etc.).

Avoid the contact of electronic components (static discharge!)

Observe the corresponding reference labels.

2.7 Specifications for the Emergency

NOTICE:

The operator has to ensure that the required conditions for rapid first help measures are met in accordance with the local regulations. If necessary also recommendations or guidelines of accident prevention companies have to be considered.

2.7.1 First Aid in case of Exposure to Ozone

In case of exposure to ozone the following first help measures have to be accomplished immediately:

- bring the injured person to the fresh air
- emergency call, thereby indicate ozone as effect of the injury
- give medical oxygen
- absolute rest
- pulse, respiration, consciousness check
- in case of unconsciousness side position
- in case of respiratory arrest breath donation

2.7.2 Respiratory Protection Equipment

The operator has to make available sufficient suitable ozone-resistant respiratory protection equipment (including a portable ozone-warning device and a protective mask). Respiratory protection equipment can be obtained directly from the appropriate manufacturers or their agencies (e.g. company Draeger, Luebeck, Germany).

2.8 Directives, standards and regulations

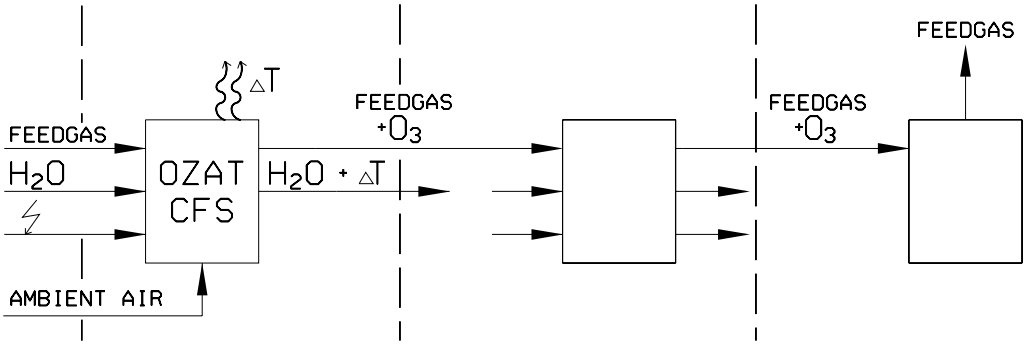
The product was engineered and manufactured according the applicable directives and EN-standards. The effective directives and the most important applied standards are listed on the declaration of CE conformity in appendix 26.

Remarks:

- These lists name the most important standards and regulations, they are not complete
- Further, all local regulations regarding the installation and the assembly of components, especially regulations regarding oxygen and ozone, must be observed.
- When this component is integrated in a plant, all directives, standards and regulations must be observed.
- Degrémont Technologies shall not be held responsible for non-compliance with any such directives, standards and regulations.
- Directives, standards and regulations are not included in the scope of delivery of the ozone generator.

3 Construction and function

3.1 Scope of delivery and interface



OZAT® ozone generator		**Process**	**Vent ozone**
destruction			
Operator	Degrémont Technologies	Operator	Possibly from Degrémont Technologies (**not** dealt with in these operating instructions)

3.1.1 Degrémont Technologies delivery

- OZAT® ozone generator with operating instructions
- Possibly spare parts according to Degrémont Technologies recommendations
- Possible options (e.g. vent ozone destructor)
- On request:
  - Training
  - Servicing

3.1.2 Delivery limitations

The operator will supply:

- Feed gas
- Cooling Water
- Electrical energy
- Control signals
- Emergency Stop

} according to operational data (Chapter 1.3.4)

The equipment will produce:

- Feed gas containing ozone as given in the operational data.
- Supplied quantity of water as given in the operational data (outlet temperature 5 °C above inlet temperature).
- Signals and alarms.

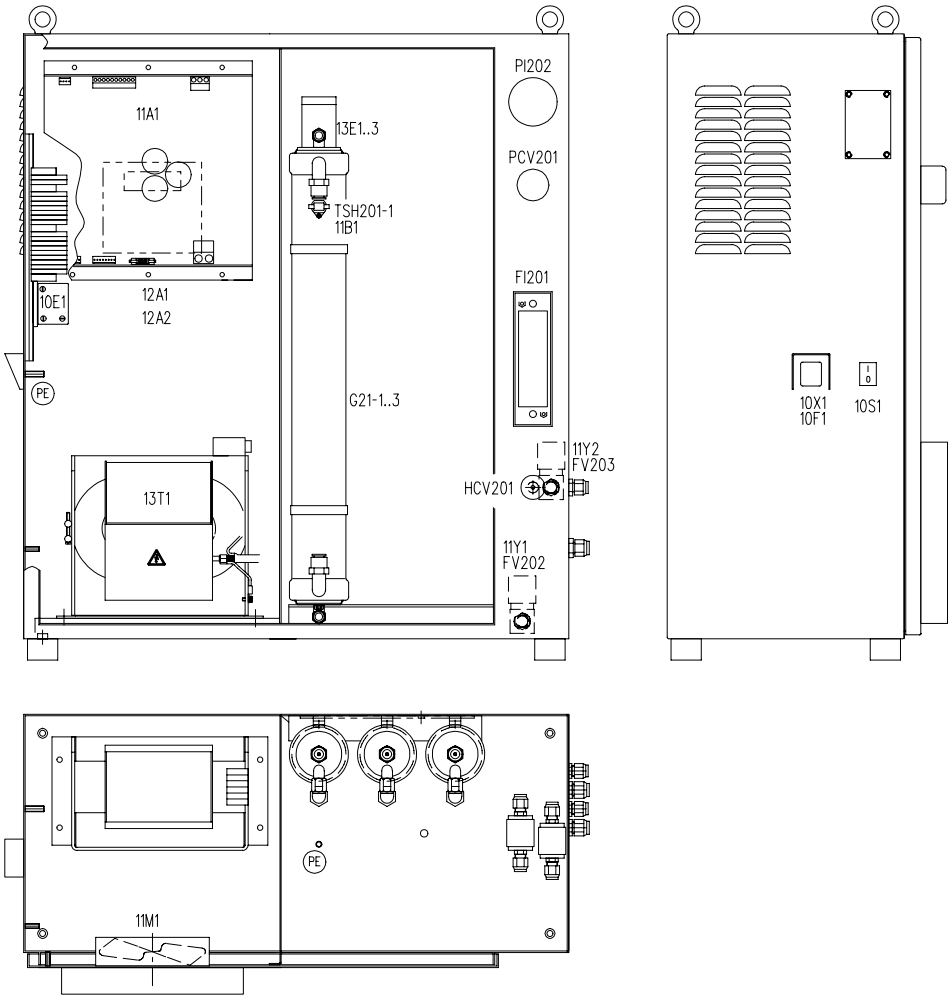
Released to the environment:

- Heat loss through convection.
- Feed gas containing ozone when there is a leak.
- Heat loss through forced ventilation.

The owner and/or user must supply or install:

- Adequate room ventilation.
- Ambient monitoring in all areas in which ozone can escape.

4 Layout of the OZAT® ozone generator



Mechanical captions:

PI202	Gas pressure display
PCV201	Pressure control valve
FI201	Gas flow display
HCV201	Hand operated control valve
TSH201	Temperature monitor
FV202/203	Solenoid valve
G21-1...3	Ozone generator

Electrical captions:

10S1	Mains switch
10F1	Fuse
10E1	Interference suppressor filter
10X1	Mains plug
11A1	Converter electronics
11M1	Equipment fan
11B1	Temperature monitor ozone generator
12A1	Thin layer keyboard
12A2	MMI
13T1	High voltage transformer
13E1…E3	Ozone generator

The equipment is separated into a mechanical/process part (right) and an electrical part (left).

4.1 Mechanical part

The most important mechanical parts are:

Ozone generator G21-1...3:

In the ozone generator, a part of the feed gas is converted into ozone. The ozone generator module has the following connections:

- Cooling media (inlet and outlet)
- Gas (inlet and outlet)
- Electrical connections (high voltage bushing and earth terminal on the module tube)

The ozone generator can contain one or more ozone generator modules.

TSH201-1...2 Temperature monitoring of the ozone generator:

The ozone generator is provided with a temperature monitoring system which will produce a signal to switch off the electrical supply if an excessive rise in temperature (limit 45 °C) as a result of lack of cooling media occurs. The unit can be switched on again when the temperature drops to 30 °C.

Cooling media circuit:

The control devices are to be supplied and installed by the owner and/or user.

Feed gas circuit:

The installed gas line is equipped with the following devices:

Pressure control valve PCV201 (equipment front):

To reduce the input pressure to the optimal operational pressure.

Solenoid valve FV202/FV203 (in the equipment):

For automatic gas flow control. To protect the generators from invading humidity. It has an electrically operated override for purging procedures and maintenance work.

Gas pressure gauge PI202 (equipment front):

For monitoring the operational pressure.

Gas flow meter FI201 (equipment front):

The gas flow is indicated on the flow meter. The effective gas flow can be calculated using the corresponding appendix.

Hand operated control valve HCV201 (equipment front):

For regulating the gas flow.

4.2 Electrical part

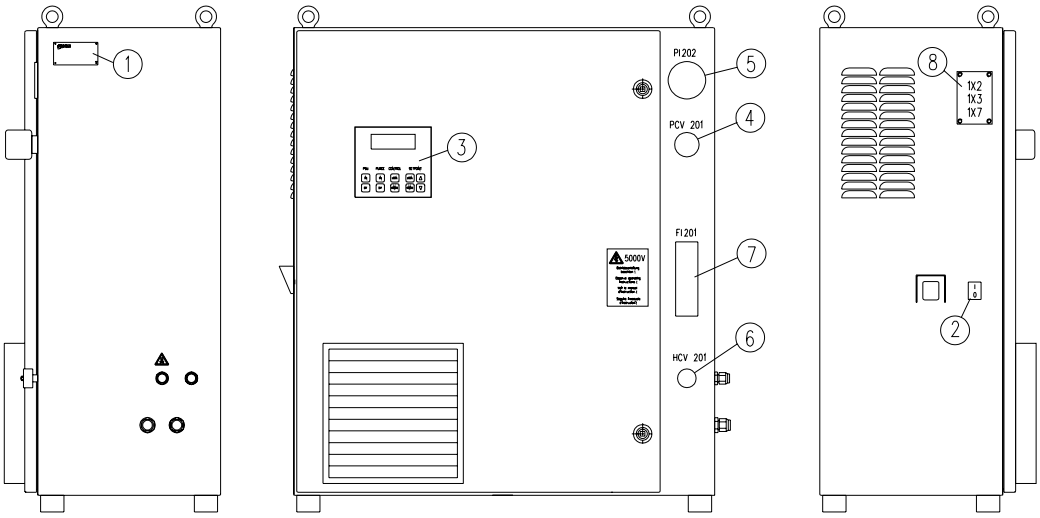
The electrical part is separated from the mechanical / process part by a partition, so that the electrical components are effectively protected from any possible leakages of cooling media. The layout of the individual components with captions can be seen in chapter 4.

The converter electronics are used to supply the ozone generator G21 with medium frequency H.V. The high voltage transformer 13T1 steps-up the output voltage from the converter electronics to the voltage required by the ozone generator module.

The most important components are:

- Mains socket 10X1.
- Converter electronics 11A1 to regulate the DC power Pe and control the IGBTs.
- Control electronics 12A2 for the surveillance of the converter electronics.
- High voltage transformer 13T1 to step-up the output voltage from the converter to that required by the ozone generator module.

5 Operational and display elements and operational modes



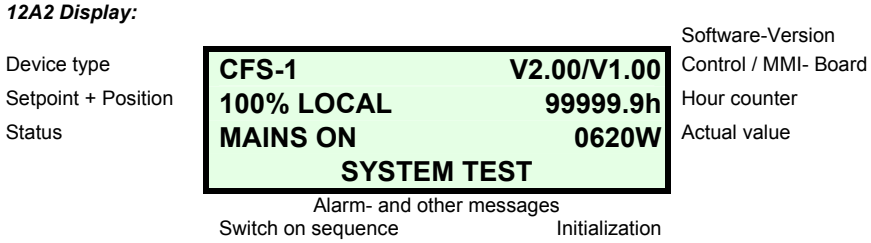
Caption:

1		Rating plate with CE marking
2	10S1	Mains switch
3	12A2	Display: DC-Power Pe, Mode, Service hour counter, Failures
4	PCV201	Pressure control valve
5	PI202	Gas pressure gauge
6	HCV201	Hand operated control valve
7	FI201	Gas flow meter
8		Gland plate for control-, external operating- and signal-cable

5.1 Software versions and initialization

At switch-on proceeding (MAINS ON) of device, will initiate the control and the internal connections will be built. After that a system check starts and the current position of the operating elements will be displayed. When the system check is finished, the software versions of control electronics resp. the converter electronics, the existing device type, the running hours and the current control position and status will be indicated.

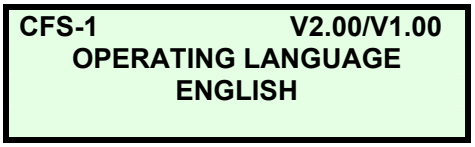
12A2 Display:



5.2 Selection of the displayed language

Five languages may be selected for the display (English, German, French, Italian, Spanish). The mains switch must be in the “MAINS OFF” position. Press the “SET POINT ▼” button continually and, at same time, switch on the mains. The selected language will be displayed for a short period. By continually pressing the “SET POINT ▲” switch either English, German, French, Italian or Spanish can be selected. When the “SET POINT UP” is not pressed within a period of 5 seconds, the displayed language will be selected and the control will go back to the service mode.

12A2 Display:



selected language

5.3 Selection of the control location

There are four possibilities:

	Control command Equipment ON/OFF		Performance Pre-set value		Gas flow setting
Selector switch	LOCAL	REMOTE	LOCAL	REMOTE	LOCAL [1)]
Combination 1	X		X		X
Combination 2		X		X	X
Combination 3	X			X	X
Combination 4		X	X		X

[1)] Only “LOCAL”

12A2 Display:

Setpoint + Position
Status

```
CFS-1              V2.00/V1.00
100% LOCAL          99999.9h
PSU OFF LOCAL             0W
```

Hour counter
Actual value

Setpoint + Position
Status

```
CFS-1              V2.00/V1.00
100% REMOTE         99999.9h
PSU OFF REMOTE            0W
```

Hour counter
Actual value

Setpoint + Position
Status

```
CFS-1              V2.00/V1.00
100% REMOTE         99999.9h
PSU OFF LOCAL             0W
```

Hour counter
Actual value t

Setpoint + Position
Status

```
CFS-1              V2.00/V1.00
100% LOCAL          99999.9h
PSU OFF REMOTE            0W
```

Hour counter
Actual value

NOTICE:

After the main is switched on or after a failure of the power line, the selected control location is maintained.

5.4 Ozone production

The ozone production is dependent on the gas flow and the electrical power. In addition the temperature of the cooling media has a certain effect. The combined effect of the individual values can be seen in the corresponding production diagram (Appendix 15/16/18/19).

The electrical power is set with the set value buttons “UP ▲ / DOWN ▼“.

Setpoint	Indication	Remote signal	Power W
Lower limit	0 %	4 mA	Basic power (no O_3 production)
Upper limit	100 %	20 mA	Nominal power (maximum O_3 production)

Gas flow setting (hand control valve HCV201):

The scale value for the desired gas flow is to be ascertained from the gas flow diagram in the corresponding appendix. The gas flow is altered with the valve until the corresponding scale value is reached on the gas flow meter FI201.

12A2 Display:

Setpoint + Position
Status

CFS-1	V2.00/V1.00
0% LOCAL	99999.9h
PSU ON LOCAL	0W

Hour counter
Actual value

Setpoint + Position
Status

CFS-1	V2.00/V1.00
100% LOCAL	99999.9h
PSU ON LOCAL	0620W

Hour counter
Actual value

Setpoint + Position
Status

CFS-1	V2.00/V1.00
0% REMOTE	99999.9h
PSU ON LOCAL	0W

Hour counter
Actual value

Setpoint + Position
Status

CFS-1	V2.00/V1.00
100% REMOTE	99999.9h
PSU ON LOCAL	0620W

Hour counter
Actual value

5.5 Functional sequence

Precondition: Main is switched on.

5.5.1 Switch-on procedure local & remote

The switch-on sequence is as follows:

– On command “PSU ON” locally over the MMI, or by closing the remote contact “PSU ON REMOTE”.

12A2 Display:

Setpoint + Position	CFS-1 V2.00/V1.00	Hour counter
Status	0% LOCAL 10.1h	Actual value
	PSU ON LOCAL 0W	

Setpoint + Position	CFS-1 V2.00/V1.00	Hour counter
Status	0% LOCAL 10.1h	Actual value
	PSU ON REMOTE 0W	

– “PSU ON LOCAL / REMOTE” will be displayed.
– Solenoid valves FV202/FV203 will be opened.
– Service hour counter begins to count .
– Inverter released.
– Power will increase to the LOCAL or REMOTE pre-selected value. Electrical real power will increase within approx. 4 minutes from the basic power to the maximum admissible load.

12A2 Display:

Setpoint + Position	CFS-1 V2.00/V1.00	Hour counter
Status	100% LOCAL 10.1h	Actual value
	PSU ON LOCAL 0620W	

NOTICE:

From the control location remote, the PSU will be switched on only if the signal sequence **contact open → contact close** is given to control input “PSU ON REMOTE”. The switch on of the PSU is edge sensitive triggered.

NOTICE:

It is possible to change the control location from local to remote while the ozone generator is running without an interruption of the ozone production. For this, close the contact “PSU ON REMOTE” before you change the control location from local to remote.
If the control location is changed from remote to local, the generator is switched off. Thereafter the Generator can be switched on locally, over the MMI, by the control command “PSU ON”. If the generator is not switched on, the system will be purged for 90 sec.

5.5.2 Switch-off procedure local & remote

The switch-off procedure is as follows:

– OFF command “PSU OFF” locally over the MMI, or by opening the remote contact ” PSU ON REMOTE”.

12A2 Display:

Setpoint + Position Status

CFS-1	V2.00/V1.00
0% LOCAL	10.1h
PSU OFF LOCAL	0W

Hour counter Actual value

Setpoint + Position Status

CFS-1	V2.00/V1.00
0% LOCAL	10.1h
PSU OFF REMOTE	0W

Hour counter Actual value

– “PSU OFF LOCAL / REMOTE” will be displayed.
– Inverter will switch off.
– Service hour counter will stop.
– Electrical real power set-value is blocked.
– About 90 seconds later, the solenoid valves FV202/FV203 closes and the ventilator will stop. During the delay time, the equipment will be purged with feed gas, and the residual ozone fed to the process. During those 90 seconds „PURGE“ will be displayed on the MMI.

12A2 Display:

Setpoint + Position Status

CFS-1	V2.00/V1.00
0% LOCAL	10.1h
PSU OFF LOCAL	0W
PURGE	90s

Hour counter Actual value

CAUTION:

Even after the OZAT® ozone generator has been switched off, ozone generator and installations still contains ozone. Therefore, before opening equipment or piping, flush the equipment thoroughly until no ozone can be detected.

5.6 Purging the system local & remote

The solenoid valves (FV202/FV203) can be opened either with the button “PURGE ON” on the MMI, or by closing the contact “PURGE ON REMOTE” from remote. The purging time is indicated. Purging the system to dry out is described in chapter 6.2.4.

12A2 Display:

Setpoint + Position
Status

CFS-1	**V2.00/V1.00**
0% LOCAL	**10.1h**
PSU OFF LOCAL	**0W**
PURGE	**99.9h**

Hour counter
Actual value
Purging time

Setpoint + Position
Status

CFS-1	**V2.00/V1.00**
0% LOCAL	**10.1h**
PSU OFF REMOTE	**0W**
PURGE	**99.9h**

Hour counter
Actual value
Purging time

5.7 Production Stop circuit

In a production stop (switching off the mains switch or interrupting the power supply), the energy supply from the mains will be interrupted and at same time the gas flow stops. Contrary to a normal operational switch-off procedure, there is **no** purging of the equipment with a production stop.

CAUTION:

After a production stop there will still be ozone inside the components (e.g. ozone generator module, piping and, possibly, in the equipment).

5.8 Switch-off following a fault (error) local

Function of the fault monitoring:

Fault	Release of the monitoring	Switch-off delay following occurrence of a fault	Remarks
Ozone generator module temperature too high	Mains is ON	approx. 1 second	On alarm status the unit will purge for 90 sec.
Heat sink temperature too high	Mains is ON	approx. 1 second	On alarm status the unit will purge for 90 sec.
Inverter short circuit	PSU ON	approx. 1 second	On alarm status the unit will purge for 90 sec.
Ozone generator short circuit	PSU ON & power factor too small	approx. 20 second	On alarm status the unit will purge for 90 sec.
Remote set-value too low	Mains ON and set point is on REMOTE Signal < 3mA	approx. 5 second	On alarm status the unit will purge for 90 sec.
Impedance	PSU ON	approx. 5 second	On alarm status the unit will purge for 90 sec.
DC-Voltage too low / high	Mains ON	approx. 1 second	On alarm Gasflow stops; no purging
Mains voltage too low / high	Mains ON	approx. 10 second	On alarm Gasflow stops; no purging

12A2 Display:

Setpoint + Position
Status

```
CFS-1              V2.00/V1.00
100% LOCAL            10.1h
ERROR                    0W
OZONEGENERATOR TEMP
```

Hour counter
Actual value

Setpoint + Position
Status

```
CFS-1              V2.00/V1.00
100% LOCAL            10.1h
ERROR                    0W
HEAT SINK TEMP
```

Hour counter
Actual value

Setpoint + Position
Status

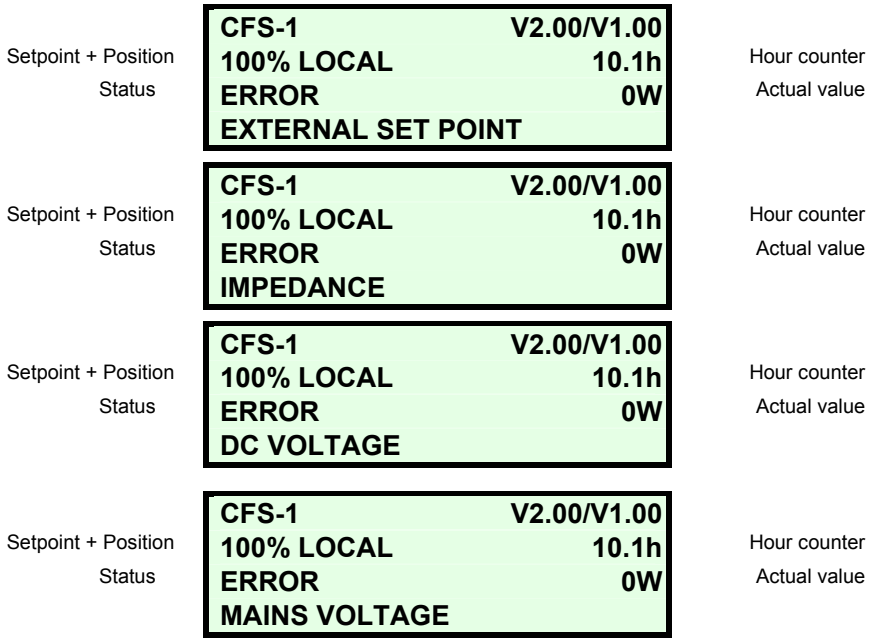
```
CFS-1              V2.00/V1.00
100% LOCAL            10.1h
ERROR                    0W
SHORT CIRCUIT
```

Hour counter
Actual value

Setpoint + Position
Status

```
CFS-1              V2.00/V1.00
100% LOCAL            10.1h
ERROR                    0W
SHORT CIRC. OZONEGEN.
```

Hour counter
Actual value



5.8.1 Fault indication (error) remote

Three relay outputs for the external remote fault indication are available. The following 3 bit fault pattern will be created.

Error	Fault bit 2	Fault bit 1	Fault bit 0
No error	0	0	0
Ozone generator temp. too high	0	0	1
Heat sink temp. too high	0	1	0
Inverter short circuit	0	1	1
Ozone generator short circuit	1	0	0
External set point too low	1	0	1
Impedance	1	1	0
DC-Voltage too high / low Mains voltage too high / low	1	1	1

5.9 Acknowledging an error

An alarm remains set until the fault is corrected and the alarm signals that must be acknowledged are acknowledged.
By operating the “PSU OFF” switch, or by opening the “PSU ON REMOTE” contact from remote, the alarm signals are acknowledged.

NOTICE:

The fault indication from remote of the DC-Voltage and Mains voltage fault will be set until the fault remain, the fault indication from remote will be reset without an acknowledge. To restart the PSU from control location remote, the signal sequence **contact open → contact close** must be given to the control input “PSU ON REMOTE”.

6 Commissioning

6.1 Setting-up and installation

6.1.1 Setting-up

The equipment is to be set-up on a stable table, on the floor or on a wall.

CAUTION:

It is of most importance that **no** water enters the ozone generator module - either in the form of water vapour in the feed gas (see feed gas specification in chapter 1.3.4), or in the form of water being back-fed from the operator's process.

To prevent water or humidity being back-fed from the process the operator must install a solenoid valve **and** a non-return valve between the ozone generator and the ozone contacting system. The solenoid valve is to be controlled to suit operating parameters and may **not** be closed during the purging time of the device.

FAILURE TO OBSERVE THESE INSTRUCTIONS COULD RESULT IN IRREVERSIBLE DAMAGE TO THE OZONE GENERATOR UNIT

6.1.2 Ambient conditions

The installation location must comply with the data given in Chapter 1.3.6:

- Ambient temperature
- Altitude
- Humidity
- Protection class
- Vibration

In addition, it should be ensured that the dissipated heat does not lead to any unacceptable temperature rise in the generator room and that the installation corresponds to the safety regulations for areas in which ozone can be present (Chapter 2).

6.1.3 Installation of the equipment and the piping

CAUTION:

During the **whole installation period**, the equipment is to be protected against dirt, dust and foreign bodies (metal chips, screws, etc.) or humidity.

All gas lines must be kept free from dust, oil and grease. When installing the unit the correct materials (oxygen and ozone resistant) must be used for the lines, devices, seals, etc..

6.1.4 Serto installation instructions

All external line connections for cooling media, feed gas and ozone should be made according to the Serto installation instructions in Appendix 21.

When mounting the external connections, pay attention to the **marking** on the equipment (feed gas, ozone or cooling media input and output).

6.1.5 Protection of lines

Where there is the danger that the lines can be damaged or ripped away, they must be **protected**.

6.1.6 Electrical installation

The electrical connections must comply with local regulations. If the equipment is fitted with an instrument socket, a corresponding mains cable with a suitable plug must be used.

6.2 Commissioning

Preparation:

- The commissioning personnel authorized by the owner and/or user, must read and understand the operating instructions.
- The commissioning personnel must be familiar with the safety measures and regulations, be equipped with the necessary breathing apparatus and must **know** the escape routes.

6.2.1 Checking the installation

Before the electrical feed, the feed gas and the cooling media can be connected, the following must be checked:

- Is the equipment secured against moving?
- Is the line feed protected?
- Are the lines for:
  - Feed gas (oxygen or air)
  - Ozone
  - Cooling medial

  connected to the correct unions on the equipment?

6.2.2 Further checks

The following additional points must be checked before commissioning:

- Is there adequate ventilation for normal operation and in the case of a malfunction?
- Is the feed gas and the cooling media (quantity, quality and pressure) in accordance with the technical data in Chapter 1.3.4“ Product description”?
- Have all connections been correctly made?
- Is the owner’s and/or user’s process, in which the ozone will be used, ready for the ozone and is the vent ozone destruction operational?
- Are the relevant safety elements tested and active?

6.2.3 Tightness check

If above conditions have been fulfilled, a tightness check should be carried out. This is done as follows:

- Set the installation, including feed and return lines, under operational pressure and treat all connections on the gas side with leakage spray. Any connections where bubbles form, must be re-made.

As a leakage spray, “SNOOP LIQUID LEAK DETECTOR” from “NUPRO COMPANY” for example, can be used.

NOTICE:

The tightness test must be repeated until no further leaks are found.

6.2.4 Purging the system to dry it out

Before commissioning the ozone generator, ensure that there is no moisture in the gas lines. To dry out the system, the gas flow circuit must be purged for at least 12 hours with feed gas (in accordance with the operational data). When doing this, the following sequence should be followed:

Check the dew point of the feed gas: -65°C or dryer.

1. Operate “PURGE ON” switch local, or close the contact “PURGE REMOTE” until the respective display appears.
2. Slowly open the stop valve in the feed gas line. Keep to the maximum permissible pressure given in the operational data!
3. **Variation of the pressure:**
   Adjust the pressure control valve PCV201 on 2.5 bar gage (control with the gas pressure gauge PI202) and at the same time adjust the feed gas flow with the hand regulating valve HCV201 on 20% scale-value (control with the gas flow display FI201). Hold in this condition for 30 minutes.
4. Adjust the pressure control valve PCV201 on 0.5 bar gage and at the same time adjust the feed gas flow with the hand regulating valve HCV201on 20% scale-value. Hold in this condition for 30 minutes.
5. Adjust the pressure control valve PCV201 again on 2.5 bar gage and at the same time adjust the feed gas flow with the hand regulating valve HCV201 on 20% scale-value. Hold in this condition for 30 minutes.
   The variation of the pressure has to be repeated four times.
6. Adjust the pressure control valve PCV201 on 0.5 bar gage and at the same time adjust the feed gas flow with the hand regulating valve HCV201on 20% scale-value.
   Hold in this condition for at least 12 hours.
   While purging make sure the gas flow never drop under 20%.
7. Close the stop devices in the feed line and the hand operated regulating valve.
8. Operate locally “PURGE OFF” switch, or open the contact “PURGE REMOTE”.

The equipment is ready for commissioning.

CAUTION:

During commissioning, ozone will be produced. It must be ensured that the ozone produced can be routed to the process and that any residual ozone will be destroyed.

CAUTION:

If a smell of ozone is detected, the mains switch PRODUCTION STOP must be immediately switched off and the area evacuated in accordance with the safety measures.

6.2.5 Commissioning LOCAL

1. Set the cooling media flow according to the operational data.
2. Open the stop valve in the feed gas line (owner and/or user).
3. Switch on the mains (power to the equipment).
4. Display will indicate the software version and the system check.
5. Switch the “CONTROL” to “LOCAL”.
6. Switch “SET POINT” to “LOCAL”.
7. Set the “SET POINT” to 0%.
8. Operate “PSU ON” switch, “PSU ON LOCAL” will be displayed.
9. Rating display will show minimum load.
10. Increase the gas flow with the hand operated control valve HCV201 and the pressure with the pressure regulating valve PCV201 to maximum permissible value see curves “APPENDIX“.
11. Increase the load with the „SET POINT ▲“ button slowly, in 5% increments, with at least 15 seconds pauses between the increments, up to the maximum (max. 80% during first 100 operating hours) permissible load.
12. Rating display will indicate maximum load.
13. Rating set value and gas flow to be set to minimum.
14. Switch off the unit with the switch “PSU OFF”. The display must indicate minimum load and “PSU OFF LOCAL” will appear.

6.2.6 Commissioning REMOTE

1. Set the cooling media flow according to the operational data.
2. Open the stop valve in the feed gas line (owner and/or user).
3. Switch on the mains (power to the equipment).
4. Display will indicate the software version and the system check.
5. Switch the “CONTROL” to “REMOTE”.
6. Switch “SET POINT” to “REMOTE”.
7. Set the “SET POINT REMOTE” to 4mA.
8. Close the remote contact “PSU ON/OFF”, “PSU ON REMOTE” will be displayed.
9. Rating display will show minimum load.
10. Increase the gas flow with the hand operated control valve HCV201 and the pressure with the pressure regulating valve PCV201 to maximum permissible value see curves “APPENDIX“.
11. Increase the load with the „SET POINT“ signal (4-20mA) from remote slowly with at least 15 seconds pauses between the increments, up to the maximum (max. 17mA during first 100 operating hours) permissible load.
12. Rating display will indicate maximum load.
13. Rating set value and gas flow to be set to minimum.
14. Switch off the unit by opening the contact “PSU ON/OFF from remote”. The display must indicate minimum load and “PSU OFF REMOTE” will appear.

NOTICE:

If the commissioning cannot be carried out, check in Chapter 9.3 for possible causes and, if necessary, contact the Degrémont Technologies service personnel.

7 Operation

The equipment may only be operated by persons authorized by the owner and/or user. It is up to the owner and/or user how many persons he authorizes to operate the installation, and whether he will instruct further persons with partial functions.

The owner and/or user must ensure that the persons authorized by him have familiarized themselves with the safety measures and regulations, and that they also comply with them, in addition to having read and **understood** the operating instructions.

7.1 Preconditions for the operation and setting of the equipment

The preconditions for service are:

- The process (installation) is ready for taking up ozone.
- The installed vent ozone destructor must be ready.
- The O2/O3-Roommonitoring must be working.
- Power supply switched on.
- Mains switch on, “MAINS ON” lamp illuminated.
- Cooling media is flowing.
- Gas feed open.

The equipment can now, locally or remote, be switched on, to the pre-set values for gas flow and electrical set point. The necessary settings are found as follows; for the setting of the equipment the “gas flow diagram” and the setting curves can be used.

CAUTION:

An installed vent ozone destructor must be positioned in such a way, that there is no danger for persons or domestic animals due to released oxygen. The oxygen release must be positioned outdoors and that it is not accessible for persons. To exclude a danger due to a not ready for use vent ozone destructor, at the release of the destructor an O3-monitoring has to be installed. In case of an O3-Alarm the ozone production has to be stopped

7.2 Operation of the equipment

7.2.1 Operation of the equipment from local

7.2.1.1 Switch-on from local

- The conditions listed in chapter 7.1, has to be fulfilled.
- ON-Command “PSU ON” given locally over the MMI.
  - The solenoid valves (FV202/FV203) will be opened.
  - The Inverter is released and the service hour counter begins to count.
- Preselect the power set point.
  - The power will increases to the set point value, within approx. 4 minutes from the basic power to the maximum admissible load.

7.2.1.2 Switch-off from local

- OFF-Command „PSU-OFF“ is given locally over the MMI.
  - After the OFF-Command, the generator will be purged for 90 sec. After purging the solenoid vales (FV202/FV203) will be closed.

7.2.2 Operation of the equipment from remote

7.2.2.1 Switch-on from remote

- The conditions listed in chapter 7.1, has to be fulfilled.
- ON-Command given by closing the contact “PSU ON REMOTE” from remote.
  - The solenoid valves (FV202/FV203) will be opened.
  - The Inverter is released and the service hour counter begins to count.

NOTICE:

To avoid accidentally starting of the PSU, the switch on of the PSU is edge sensitive triggered. The PSU will start only, if the signal sequence **contact open → contact closed** is given at the control input “PSU ON REMOTE”.

- Increase the load with the “SET POINT” control signal (4-20 mA) from remote slowly, with at least 15 seconds pauses between the increments, up to chosen set point.

CAUTION:

In case of operation from remote, it must be guaranteed that the equipment is started from an external control only if the conditions listed in chapter 7.1 are fulfilled. Especially in case of an automatic restart of the equipment, for e.g. in case of a mains failure, this has to be guaranteed.

7.2.2.2 Stop of the equipment from remote

- OFF-Command from remote given by opening the contact „PSU ON REMOTE“.
    - After the OFF-Command the generator will be purged for 90 sec. After purging the solenoid vales (FV202/FV203) will be closed.

7.3 Setting the ozone production and concentration:

Example for a CFS-1 2G air feed:

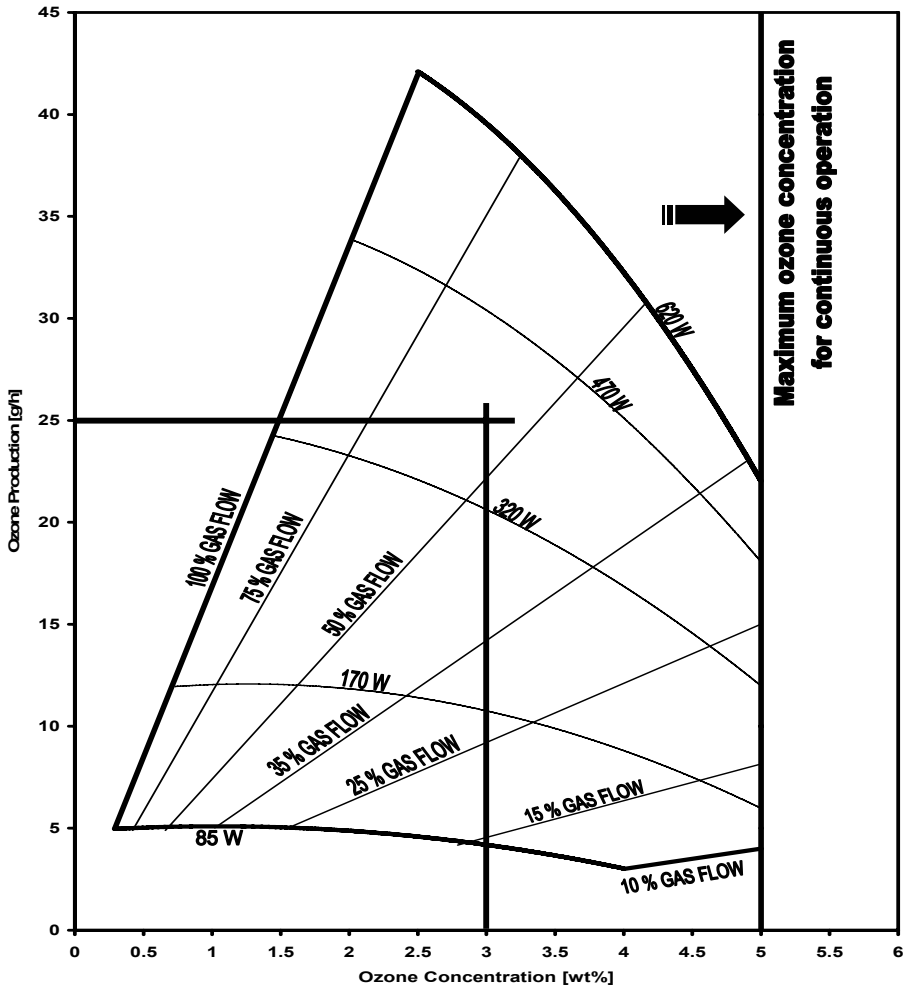
Select your required ozone production and ozone concentration.

M_{O3} = 25 g/h ozone production.

c = 3 wt % ozone concentration.

Use the setting curves for the CFS-1 2G for air (Appendix:15).

Apply your required ozone production and ozone concentration on the curve.



Adjust the power set point on the unit according the curve, approx. 380 W on the display.

Adjust the gas flow on the unit according the curve, approx. 56%.
To convert the gas flow from % to m^3_{STP}/h use the “gas flow diagrams” in Appendix 14/17

The result will slightly vary with the cooling water temperature and with the operating gas pressure in the ozone generation modules, those parameters having a direct impact on the ozone production. The ozone production decreases with a higher cooling water temperature.

7.4 Production stop

In cases of danger, such as.:

- Ozone leakage
- Electrical accident
- Etc.

The mains switch of the equipment must be switched off, which also functions as an production stop switch. In this way, the electrical energy supply and the feed gas flow will be **immediately** interrupted.

7.5 Alarm signals

If an alarm signal is given, the equipment will switch off. After the fault has been cleared, the alarm signal can be acknowledged by operating the “PSU OFF” switch local or by opening the contact “PSU ON/OFF” from remote and the equipment can be switched on again. If a fault repeatedly appears, the service personnel should be informed.

7.6 Required minimum gas flow

CAUTION:

The actual feed gas flow should never be set to lower than 10% of the gas flow meter’s scale value in order to avoid any inaccuracies due to low flow conditions.

7.7 Switching off for long periods

If the equipment is not to be used for a long period, operate “PSU OFF” local switch, or open the contact “PSU ON/OFF” from remote and “PSU OFF LOCAL/REMOTE” will be displayed. The solenoid valves will be closed. This will save gas and will avoid water and moisture entering the equipment and the ozone generator from the client`s process side. The water of the cooling water side should be drained / blown out.

When the unit is re-commissioned, Chapter (6.2) must be followed.

CAUTION:

The ozone generator is sensitive to moisture. For this reason the feed gas must always comply with the specification and the ingress of moisture from the process side must be prevented.

7.8 Changing from air to oxygen feed gas

NOTICE:

If the ozone generator was initially operated with air as the feed gas, and it is changed to oxygen, the performance data will be lower than expected in the setting curves. Therefore Degrémont Technologies recommends to replace the used ozone generator modules with new ones.

7.9 Changing from oxygen to air feed gas

NOTICE:

If the feed gas is changed from oxygen to air, the performance data should be as given in the setting curves (but only if there was no possibility for water vapor to enter the ozone generator module).

8 Maintenance

Maintenance work may only be carried out by personnel who have been trained and authorised for this work by the owner and/or user. The owner and/or user must ensure that the maintenance personnel are familiar with the safety measures and regulations, and that they also comply with them, in addition to having read and understood the operating instructions.

Maintenance work should be conducted minimum once a year.

8.1 Periodical tightness check

It is recommended that periodical tightness checks on the complete installation are carried out.
To do this, the complete system is pressurized, the inlet and outlet valves are then closed and afterwards the feed pressure to the inlet valve is reduced to zero.
The starting pressure (i.e., after about 10 minutes) and the end pressure (after hours) should be recorded. At the same time the temperature must be measured.

If the condition

$$p_{1abs.} \cdot (t_2 + 273) = p_{2abs.} \cdot (t_1 + 273)$$

is established, the system is tight.

If the system is not tight, the procedure described in Chapter 6.2.3 “Tightness check” must be repeated.

NOTICE:

$p_{1abs.}$ and $p_{2abs.}$ are absolute pressures in bar, i.e., the ambient pressure must be added to the indicated gas on the pressure gauge (effective pressure) PI202.

8.2 Periodical check of the ambient ozone monitoring devices

The ozone monitoring devices installed by the owner and/or user must be periodically checked. For the time interval between checks and the procedure for the test, consult the supplier’s operating instructions.

8.3 Periodical check of the breathing apparatus

Breathing apparatus must be regularly checked in accordance with the supplier’s instructions.

8.4 Terminal check

Once a year all electrical connection screws should be tightened. To do this the supply most be switched off and the mains plug removed. The covers should only be removed after waiting 3 minutes as the smoothing capacitors on the converter electronic (11A1) require time to discharge.
Before beginning work, the ozone generator modules G21 are to be discharged (Chapter 9.1.2) and the converter electronics (11A1) to be checked with a suitable measuring instrument (...750 V_{DC}).
After completing the work, close the equipment door.

WARNING:

If the time of 3 minutes between switching off the mains switch 10S1 and open the equipment door is not observed, there is a **danger of electrocution**.

WARNING:

External signal voltages are to be switched off!

8.5 Cleaning of the air in-/ outlet

Depending on the environment where the equipment is installed, the air in-/ outlet must be cleaned at regular intervals.

9 Overhauling

Overhaul work must only be carried out by authorised and trained personnel. The owner and/or user must ensure that his maintenance personnel are familiar with the safety measures and regulations, and that they also comply with these, in addition to having read and understood the operating instructions.

WARNING:

If work has to be carried out on the ozone generator, or on the high voltage transformer, the high-voltage terminals have to be earthed in accordance with local regulations. If work has to be carried out on the ozone generator, or on the gas lines, it must first be ensured that the parts are free from ozone (ozone concentration at the ozone generator outlet lower than the MAK-value) and pressure-free.

9.1 Replacement of defective fittings, lines or ozone generator modules

WARNING:

Before repair or service work, the complete system must first be purged (ozone concentration at the ozone generator outlet lower than the MAK-value). (Chapter 9.1.1). The gas pressure is then to be reduced to atmospheric pressure, the cooling media and the mains switch are to be turned off and pull out the mains plug. The ozone generator modules G21 must be **separately** discharged directly at the high voltage bushing (Chapter 9.1.2).

Only original replacement parts from Degrémont Technologies must be used.

If in doubt contact Degrémont Technologies.

After installing a new fitting, ensure that the connections are properly made and carry out a tightness check (Chapter 8.1).

In case of replacement of ozone generator module(s), proceed according to chapter 6.2.5 for re-commissioning.

9.1.1 Purging the systems before overhaul work

Every time overhaul (repair) or service work has to be carried out on the pipeline guides or the fittings, the residual ozone in the system must be purged with feed gas. To purge the system proceed as follows:

1. Switch “PURGE ON”.
2. Set a medium gas flow with the hand control valve HCV201 (observe the gas flow display FI201).
3. Purge for at least 15 minutes.
4. Close the shut-off device in the feed gas line.
5. When the system pressure has dropped, close the hand operated control valve HCV201. Check on the gas pressure gauge PI202.
6. Switch “PURGE OFF”.
7. Open unit.
8. The OZAT® ozone generator is now ready for any repair or service work that may be necessary. After completing the work, the system tightness must always be checked (Chapter 6.2.3) and be dried out by purging (Chapter 6.2.4).
9. Close unit.
10. Put the equipment into operation (Chapter 6.2.5).

WARNING:

When the system is opened, a concentration of oxygen can accumulate in the clothing, with an associated increased fire risk. The corresponding safety measures should therefore be taken (Chapter 2).

9.1.2 Discharging the ozone generator module:

WARNING:

Discharging may only take place when mains switch (10S1) is switched off. The discharging device is first connected to earth terminal and only then may the discharge rod be introduced into the opening on the upper side of the connector cover to discharge the ozone generator module (Appendix 22).

The discharging device must only be held by the handle. It is essential to ensure that there is a metal-to-metal contact with H.V bushing on the ozone module.

9.2 Setting the operational pressure

NOTICE:

Changes in the system pressure have a direct effect upon the ozone production. If the operational pressure has changed, this must be reset with the pressure control PVC201, to the values given in chapter 1.3.2.

The operational pressure is set using the pressure control valve PCV201, on the front of the unit. Proceed as follows:

1. Set the required gas flow using the hand operated control valve HCV201 (observe the gas flow meter FI201).
2. Set the gas pressure using the pressure control valve PCV201. For reasons of safety, a pressure limiter is built in. The set operational pressure can be read from the gas pressure gauge PI202.
3. Put the equipment into operation (Chapter 6.2.5).

9.3 Correcting faults

WARNING:

The following described actions may only be performed with the mains plug pulled out (separated from electrical supply).

9.3.1 Temperature monitor TSH201

A temperature alarm TSH201-1 (11B1) on the ozone generator can have the following causes:

- Cooling media flow interrupted or turned off.
- Cooling media inlet temperature too high >35 °C.
- Ambient temperature >40 °C.
- Air bubbles in the ozone generator; cooling media operational pressure and/or cooling media flow too low.
- Temperature monitor defect.
- Cooling media flow too low (set-value: as in “Operational data” in Chapter 1.3.2).

After the error has been localised and corrected, the equipment can be put into operation.

9.3.2 Inverter short circuit

An inverter short circuit alarm could have following reasons.

- Short circuit on the converter electronics (11A1).
- Short circuit on the primary side of the high voltage transformer.

In both cases the defective part has to be replaced.

9.3.3 Ozone generator short circuit

An ozone generator short circuit can be repaired as followed.

- Replace the defective generators G21-1…G21-3..
  After replacing, the system must be purged according chapter 6.2.4
- Check the operating parameter, adjust the operating pressure if necessary.
- Check if there is excessive moisture in the generator modules. If the single module capacity is higher than 2.1uf, purge the system according chapter 6.2.4.

9.3.4 Heat sink temperature high

If the bimetal switch on the heat sink trips, following points should be checked.

- Fan defect.
- Ambient temperature too high (max. 40°C).
- Bimetal switch defect.

9.3.5 External set point low

The detection of an external set value lower than 4mA can be caused by the following:

- External signal <3,0A.
- Broken wire in the external set value wiring.

9.3.6 Impedance

The detection of Impedance can be caused by the following:

- Pressure at the ozone generator and/or gas flow out of the “Setting curves”.

9.3.7 DC Voltage low/high

The 400 Volt intermediate circuit voltage is monitored by the unit. As soon as the intermediate circuit voltage fluctuates more than ±10% for longer than 1 seconds ore a fault on the converter electronics occurs the unit will switch off.

If the voltage align within the prescribed tolerance, the unit can be taken into service.

9.3.8 Mains Voltage low/high

The mains voltage is monitored by the unit. As soon as the mains voltage fluctuates more than ±10% for longer than 10 seconds, the unit will switch off.

If the voltage align within the prescribed tolerance, the unit can be taken into service.

10 Putting out of Operation, Storage

10.1 Introduction

10.1.1 Safety Regulations

CAUTION:

Putting out of operation represent an extraordinary operating condition, where additional dangers can occur that do not exist in normal operation. In chapter 2 "Safety Regulations" indicated dangers and the local safety regulations must be therefore particularly observed.

10.1.2 Executing Personnel

For a professional and safe putting out of operation, qualified personnel is required, who is trained or supervised by the plant responsible person and who knows all danger areas of an ozone plant. The necessary material has to be prepared too.

10.2 Putting out of Operation

Before the definitive shutdown of the equipment, all lines must be thoroughly purged so that all ozone remaining in the equipment and in the feed lines is either fed to the process or to the vent ozone destructor. (Ozone concentration at the ozone generator outlet lower than the MAK-value)

If the equipment is to be re-installed at another location, it must be purged with dry gas (dew point -65°C or lower).

After purging, the pressure should be lowered to atmospheric pressure, the gas connection lines sealed with **airtight** sealing caps and the cooling media drained.

10.3 Dismantling the equipment and the connecting pipelines

Dismantling the connecting pipelines:

WARNING:

If oxygen has be used as feed gas when the lines are dismantled, oxygen can escape. There is therefore an increased risk of fire and increased oxygen concentration, particularly in the clothing. It is therefore very important to observe the regulations for the handling of gaseous oxygen (Chapter 2).

Dismantling the electrical connections:

WARNING:

Before disconnecting electrical connections, the power feed to the unit must be switched off and the cable then disconnected. For equipment with plug connections, the connector plug must be pulled out external power supplies for any external signaling must be switched off. Any possible external electrical signals must also be switched off.

Dismantling the equipment:

NOTICE:

The equipment is to be placed on a palette, using suitable lifting equipment, and secured. Before the units fixing elements are removed, the equipment must be secured (from tipping) by using the lifting gear.

10.4 Storage Conditions

CAUTION:

During the storage the equipment components must be protected against mechanical damage and overturning as well as against moisture, dust, dirt and direct solar radiation. (See also chapter 1.3.6)

11 Packing and Transport

11.1 Introduction

11.1.1 Safety Regulations

CAUTION:

Packing and transport represent an extraordinary operating condition where additional dangers can occur that do not exist in normal operation. In chapter 2 "Safety Regulations" indicated dangers and the local safety regulations must be therefore particularly observed.

11.1.2 Executing Personnel

For a professional and safe packing, qualified personnel is required, who is provided with the necessary information and experience and who knows possible dangers. The necessary material has to be prepared too.

For transport only qualified personnel and suitable means of transport may be used.

11.2 Packing

The unit should be packed safe and appropriate and/or welded into plastic provided with silica-gel as humidity protection.

For transport the units must be protected against mechanical damage, vibrations, tilting, from moisture, direct solar radiation, dirt and dust.

It has to be guaranteed that the permissible maximum load of the lifting attachment is not exceeded.

11.3 Transport

For a safe transport the safety notes and packing note have to be observed.

CAUTION:

Packing and transport represent an extraordinary operating condition where additional dangers can occur that do not exist in normal operation. For transportation the unit must be packed safe and appropriate. Loading or unloading of the unit may only be done by instructed personal. Suitable lifting and transportation gear must be used.

After unloading the equipment shall be placed at its final location. Intermediate storage shall be avoided.

12 Disposal

12.1 Introduction

12.1.1 Safety Regulations

CAUTION:

The disposal represents an extraordinary operating condition where additional dangers can occur that do not exist in normal operation. In chapter 2 "Safety Regulations" indicated dangers and the local safety regulations must be therefore particularly observed

12.1.2 Executing Personnel

For a professional and safe disposal qualified personnel is required that knows the dangers, which can occur with a disposal.

12.2 Disposal

In the whole plant materials can be present, which must be disposed according to local regulations. Therefore a competent disposal company should be contacted.

12.2.1 Remaining

The other materials have to be sorted to disposal-conform structural components. Disposal-conform structural components are parts, which are separated into equivalent materials, so that these can be disposed correctly.

Then the structural components have to be disposed according to local regulations.

13 Part list

13.1 Electrical material =PSU21+S01...

Type			CFS-1 2G	CFS-3 2G
Pcs.	Article	Tag-No.	Art-No.	Art-No.
1	Interference suppressor filter	-10E1	TE13401	TE13400
1	Main switch	-10S1	TE10509	TE10509
1	Socket	-10X1	TE25031	TE25031
1	Fuse slow blob	-10F1	TP25253	TP25252
1	MMI RD600	-12A2	TE23295	TE23295
	Thin layer keypad	-12A1	TE23243	TE23243
1	Control electronics RD603	-11A1	TE24822	
1	Control electronics RD604	-11A1		TE24823
1	HV transformer	-13T1	TE24830	TE24831
1	Air plug on filer	-11M1	TE24948	TE24948
1	Air filter		TE25578	TE25578
1	Air fan	-11M1	TE10347	TE10347

13.2 Mechanical material =PSU21+G21...

Type			CFS-1 2G	CFS-3 2G
Pcs.	Article	Tag-No.	Art-No.	Art-No.
1...3	Ozone generator module	-G21	TV14055	TV14055
1	Temperature monitor	-TSH201	TV12388	TV12388
2	Solenoid valve	-FV202/203	TV24900	TV24900
1	Control valve	-HCV201	TV25030	TV13106
1	Gas pressure display	-PI202	TV13953	TV13953
1	Pressure regulating valve	-PCV201	TV13085	TV13085
1	Gas flow display	-FI202	TV14084	TV14083

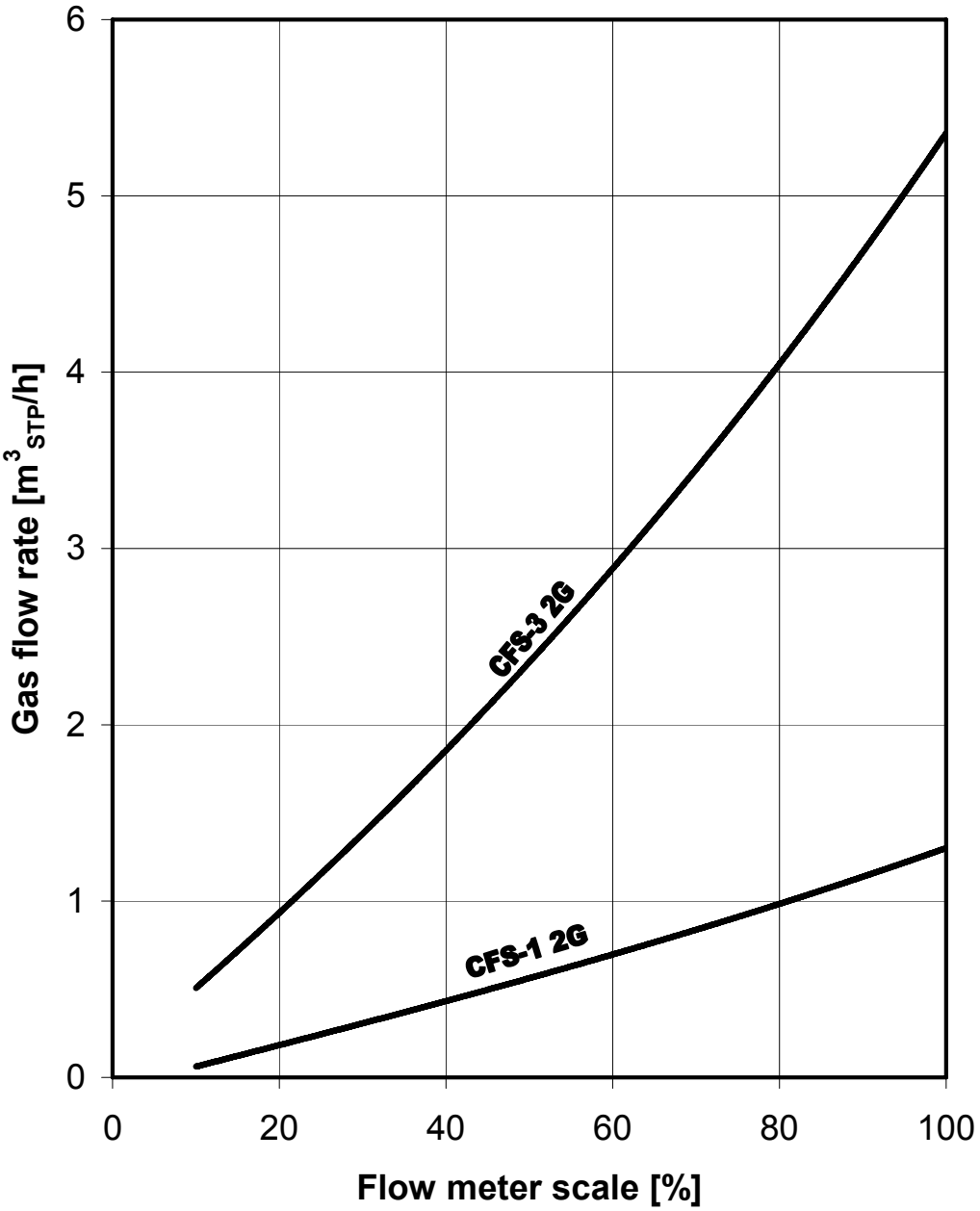
13.3 Other materials =PSU21...

Type			CFS-1 2G	CFS-3 2G
Pcs.	Article	Tag-No.	Art-No.	Art-No.
1	Hose 10x1 PTFE		TV12308	TV12308
1	Hose 12x2 PU		TV12305	TV12305
1	Set: support sleeve		TV13456	TV13456
1	Set: clamping rings		TV13457	TV13457
1	Teflon tape SO841-9		TP10851	TP10851
1	Grease for O_2 and O_3		TV15704	TV15704

14 Appendix “Gas flow diagram CFS-1...3A / Air”

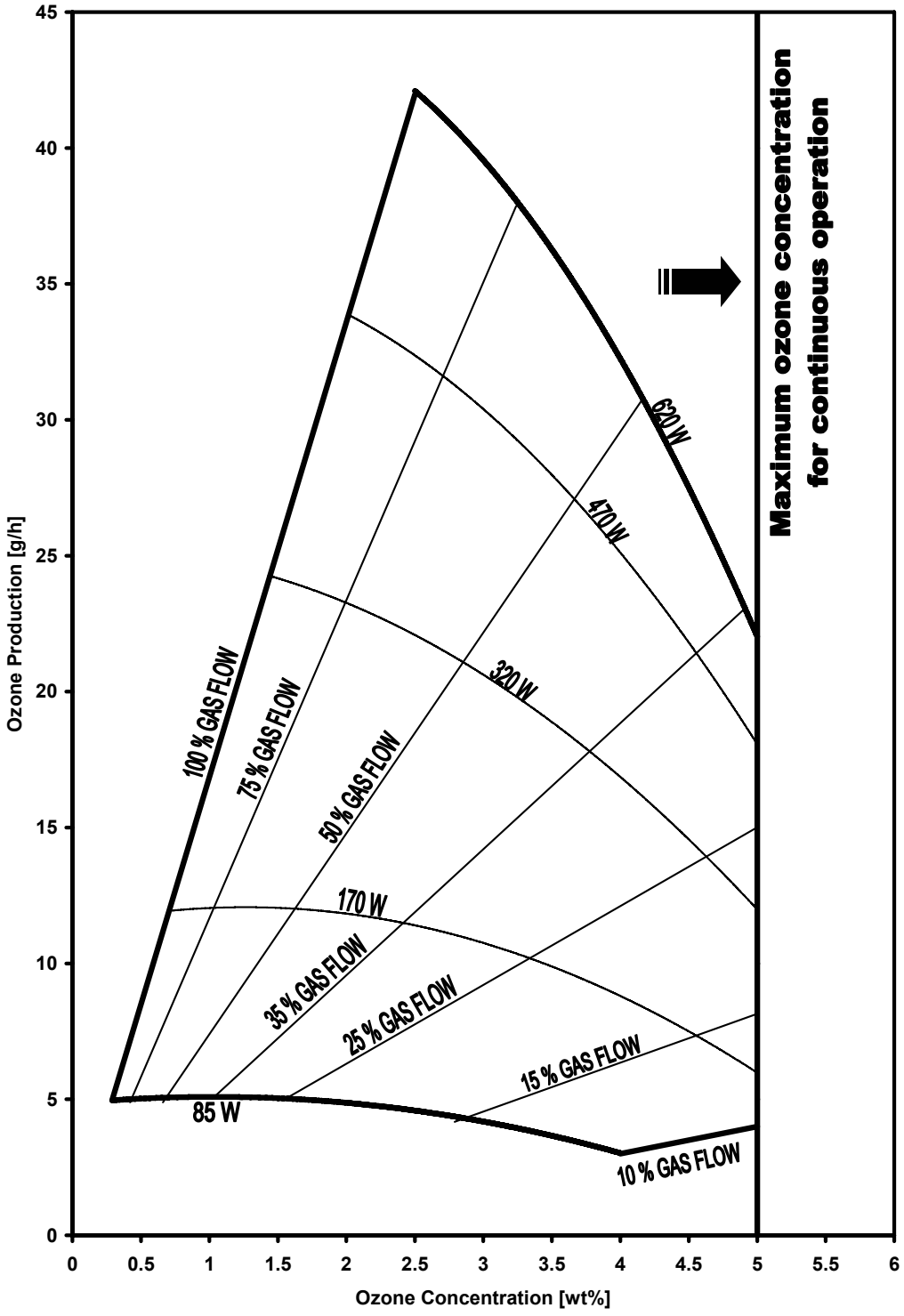
Gas flow rates through flowmeters

**Feed gas: Air with atmosperic Dewpoint Temp. of at least -60 to 100°C,
20 °C inlet Temp. and mean gas pressure of 3.50 bar (absolute)**



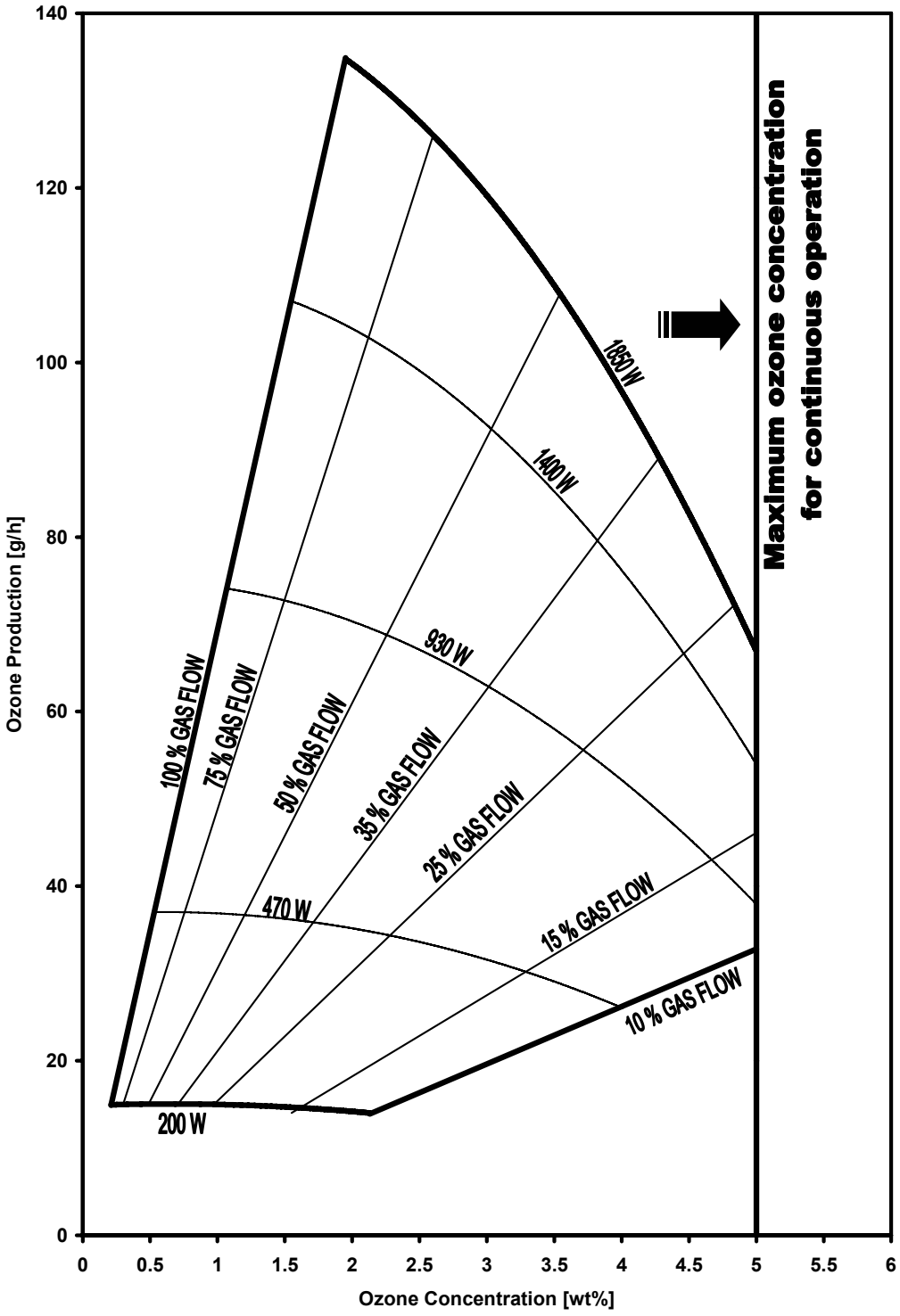
15 Appendix “Setting curves CFS-1A / Air”

Feed gas: Air at 20 °C and 3.5 bar (absolute) mean pressure and a inlet / outlet cooling water temperature of 12 / 17 °C



16 Appendix “Setting curves CFS-3A / Air”

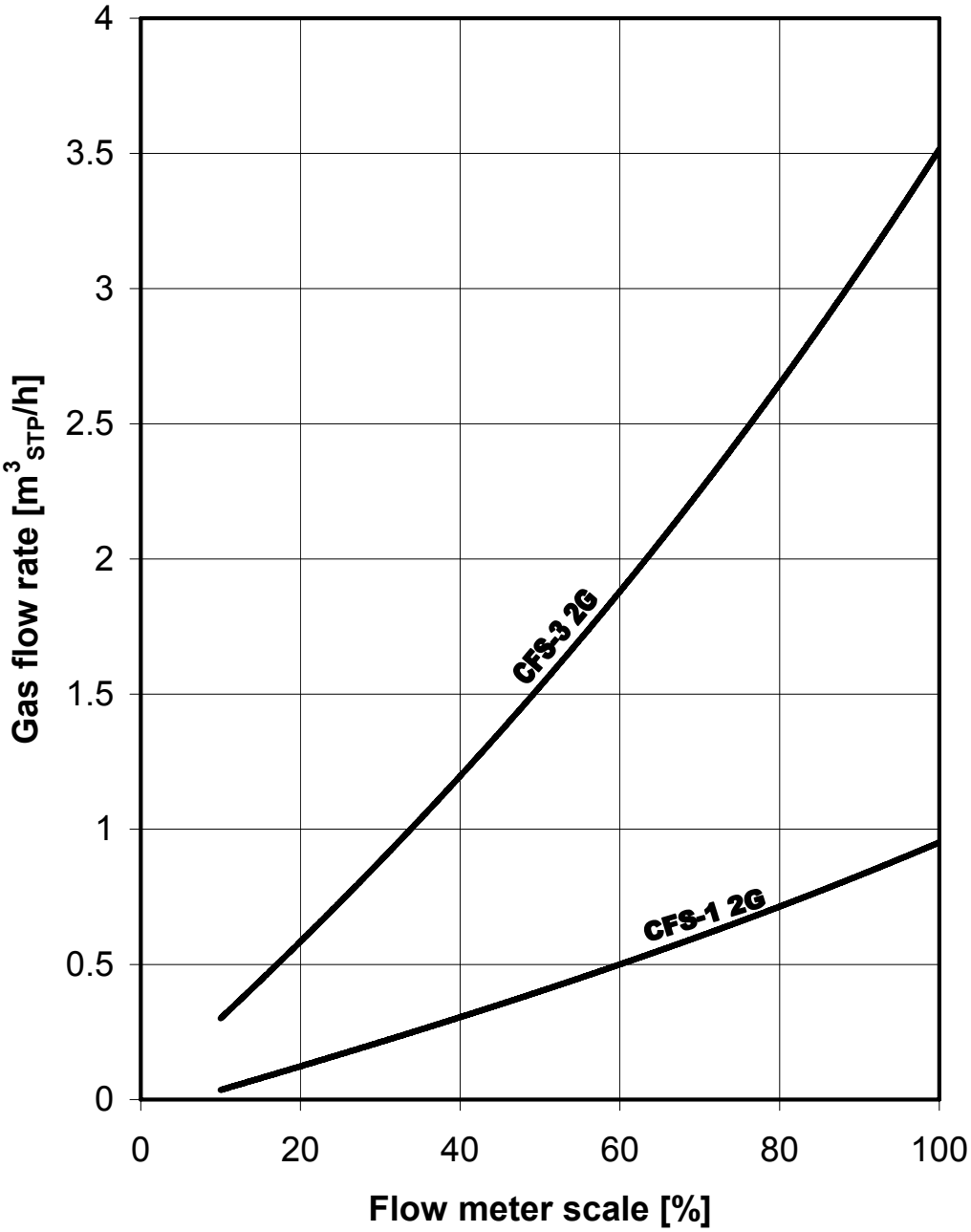
Feed gas: Air at 20 °C and 3.5 bar (absolute) mean pressure and a inlet / outlet cooling water temperature of 12 / 17 °C



17 Appendix “Gas flow diagram CFS-1...3A / O2”

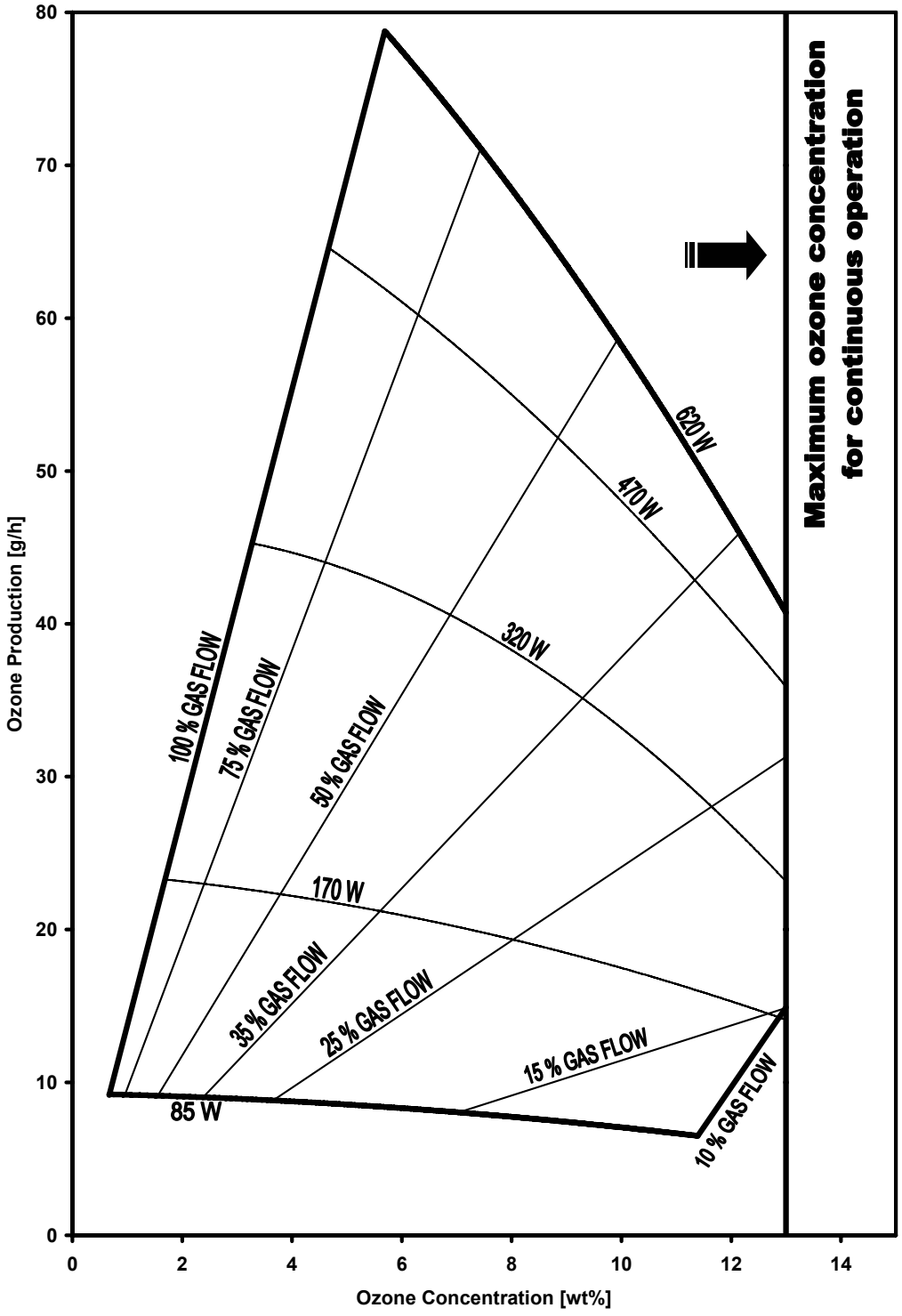
Gas flow rates through flowmeters

Feed gas: 92.4 wt% Oxygen, 2.6 wt% Nitrogen and 5 wt% Argon
20 °C inlet Temp. and mean gas pressure of 2.20 bar (absolute)



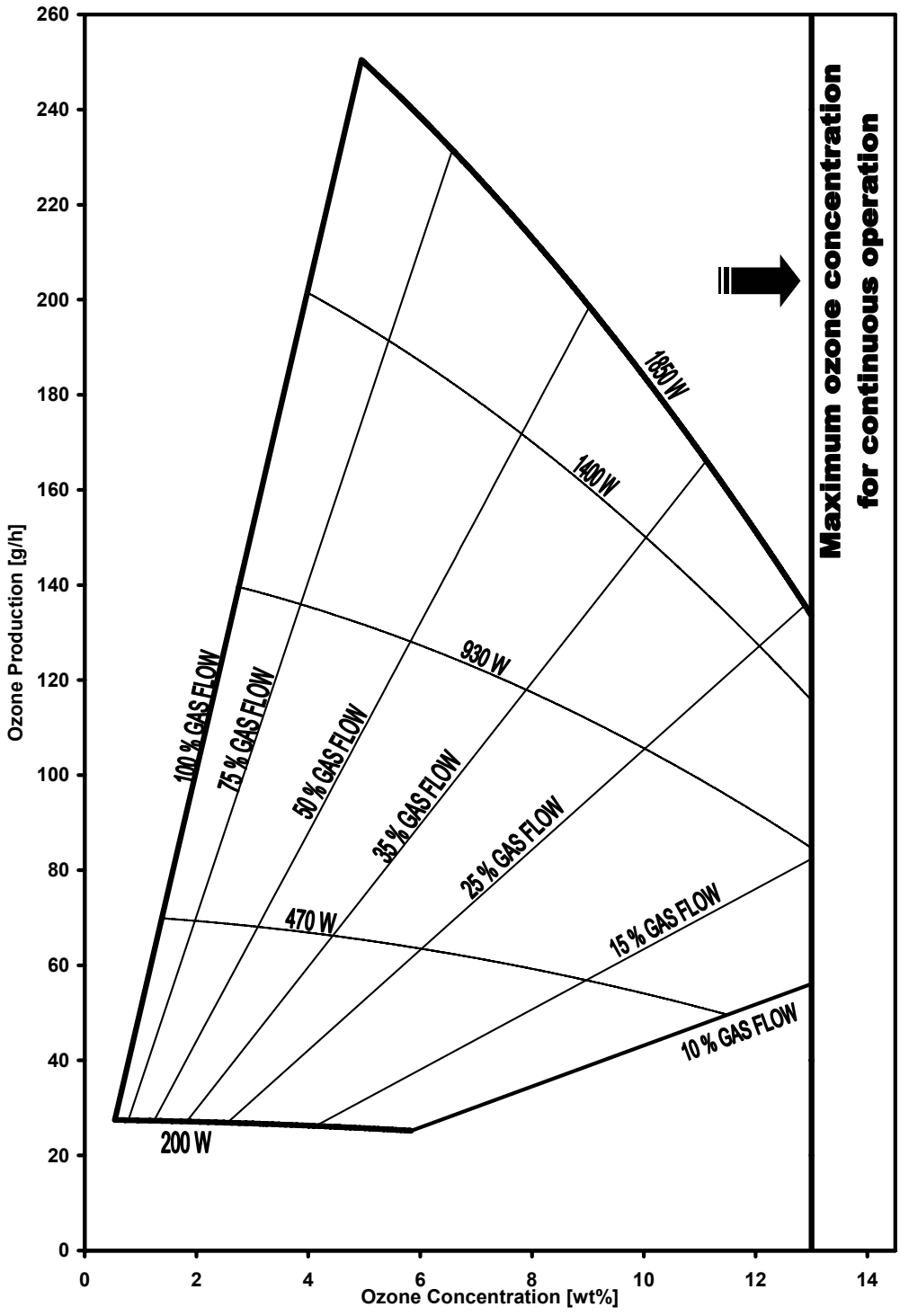
18 Appendix “Setting curves CFS-1A / O2”

Feed gas: 92.4 wt% Oxygen, 2.6 wt% Nitrogen and 5 wt% Argon
20 °C inlet Temp. and mean gas pressure of 2.20 bar (absolute)

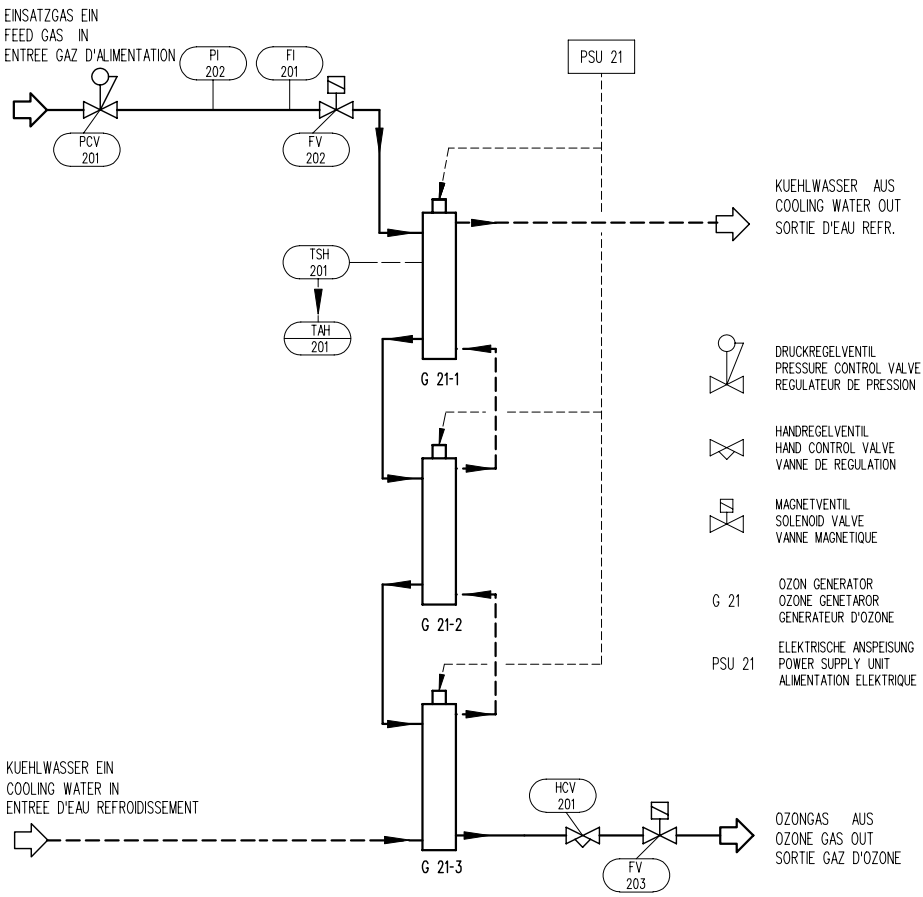


19 Appendix “Setting curves CFS-3A / O2”

Feed gas: 92.4 wt% Oxygen, 2.6 wt% Nitrogen and 5 wt% Argon
20 °C inlet Temp. and mean gas pressure of 2.20 bar (absolute)



20 Appendix“P&I diagram”



Caption:

PCV201	Pressure control valve
FV202/FV203	Solenoid valve
PI202	Gas pressure display
FI201	Gas flow display
G21-1...3	Ozone generator
TSH201	Temperature monitor switch
TAH201	Temperature alarm, high
HCV201	Hand operated control valve
PSU21	Electrical power supply

21 Appendix “Serto installation instructions”

General:

– PIPING:
Piping with a clean smooth surface is to be used, with external diameters within ± 0,1 mm.

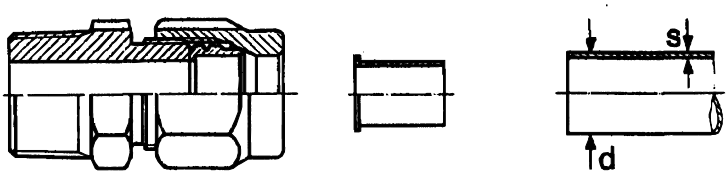
– CLAMPING RING:
It has no effect on the quality of the connection if the clamping ring can be turned on the tube or the tube in the connection nut after assembly.

– INSTALLATION SUPPORTS FOR PRE-ASSEMBLY:
SO 56000, stainless steel treated for Inox and brass M-programme SO 6000, CrNi-Steel hardened for steel.

21.1 Metal fittings

EXTENT OF DELIVERY:

– SERTO cable fittings are delivered ready for assembly:
Base part / connection nut / clamping ring



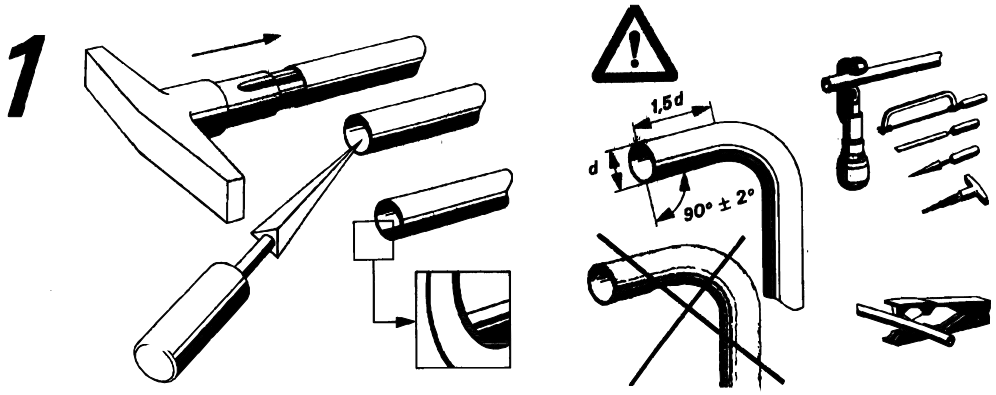
Support sleeve

d = external tube diameter
S = wall thickness

1) PREPARATION:

– Cut the pipe at right angles and remove burrs.
The pipe end must be straight for a length of about 1.5 d, and have an **undamaged** surface. The fitting for the oxygen and ozone/oxygen circulation must be free from oil and grease.

– In order to prevent steel unions from seizing when tightening them up, the threads **and** the faces of the sealing collars **are to be** carefully lubricated with special grease suitable for oxygen service (e.g.: Oxigenoex S4 marketed by Klüber & Co). Special care is to be given to the sealing collar in order to ensure that the complete sealing surface is covered by a thin film of grease.

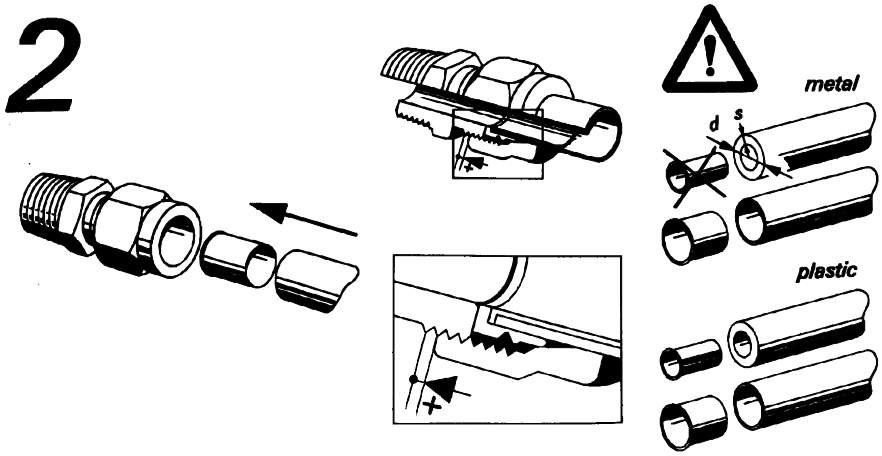


2) REINFORCE AND INSERT PIPE:

– The supporting sleeve is foreseen for thin-walled and/or soft piping, as well as for plastic pipes.

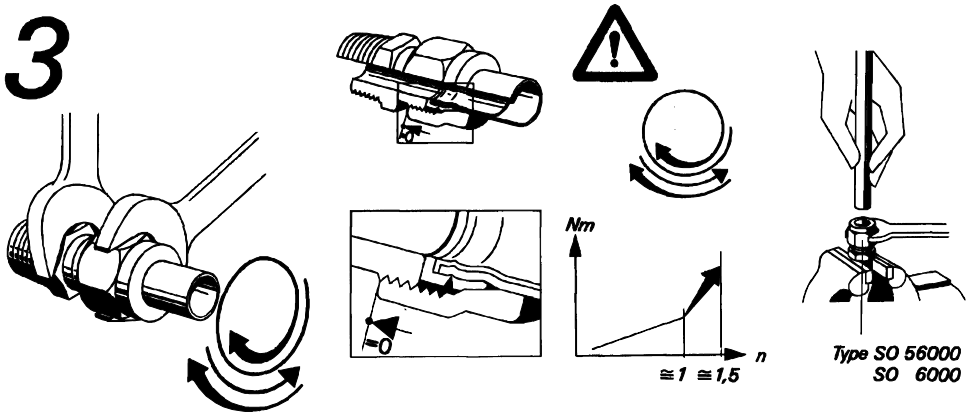
Copper pipes:	from 10mm with thickness < 1,0mm
	from 12mm with thickness < 1,5mm
Inox pipes:	from 6mm with thickness < 0,5mm
	from 10mm with thickness < 0,8mm
	from 12mm with thickness < 1,0mm

– Ensure alignment of the pipe and the fitting
– Insert up to the stop



3) DEFORMATION, RELEASING TENSION, CHECKING:

– Screw on the union nut by hand until finger tight and tighten down the union nut 1 ½ rotation using an open ended spanner.
– Slightly release the nut once again to take the radial stress.
– screw on the union nut until finger tight again and tighten down the union nut with ¼ rotation for the final fit.

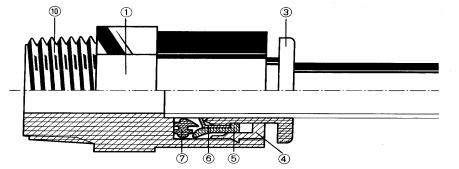


4) Repeated fitting of the union

When refitting the same tube union, screw the union nut back on until finger tight and tighten down the union nut with an open ended spanner ¼ rotation for the final fit.

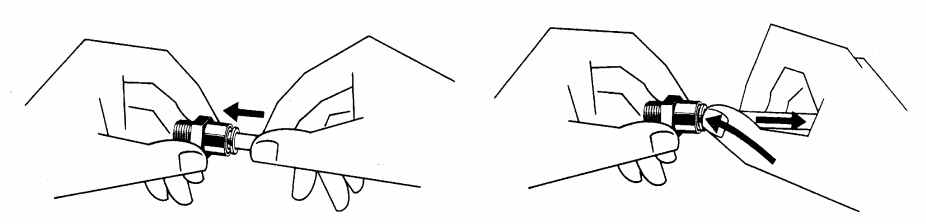
21.2 Chuck fittings FLIP

EXTENT OF DELIVERY:



1) TECHNICAL SPECIFICATION:

1. Body: Polyamid PA6.6
3. Release button: Acetal
4. Retainer: Brass
5. Collet: Acetal
6. Chuck: Stainless steel
7. Seal: NBR
10. Tapered male thread PTFE coated

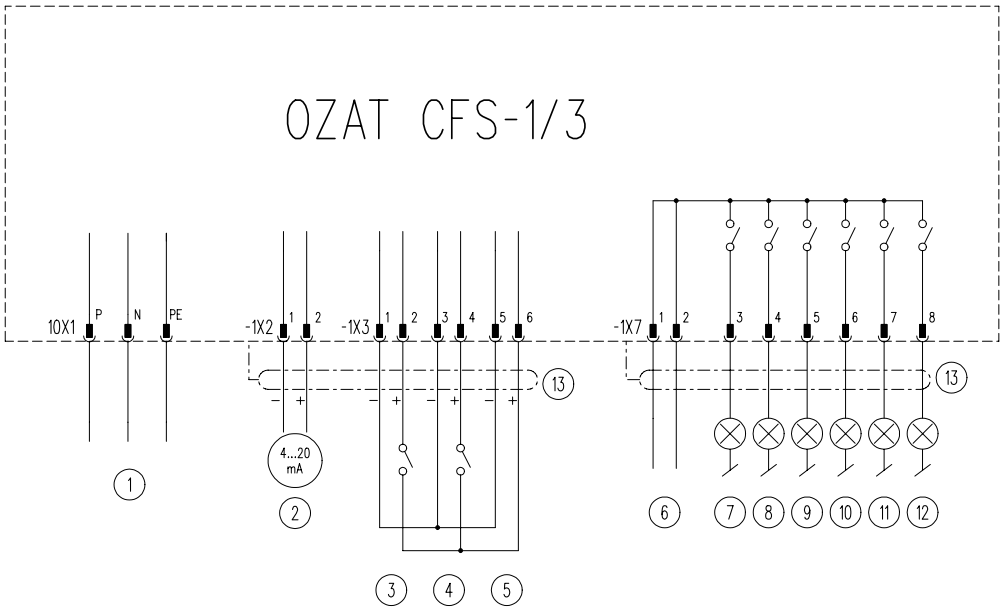


2) INSTALLATION INSTRUCTIONS (Tube installation and dismantling):

1. Cut plastic tube squarely and neatly to length (preferable with tube cuter SO 835). Damage to the end of the tube can result in leaks.
2. Insert the end of tube into the SERTO flip fitting and push it until it reaches the stop. The tube is held in the cartridge by the chuck and closed with the seal.
3. To dismantle the tube press the light-grey release button slightly and withdraw end of tube from the SERTO flip fitting. The chuck is opened by the button and release the end of the tube.

Depending on the Quality of tube used, the end may need to be re-cut after several dismantling.

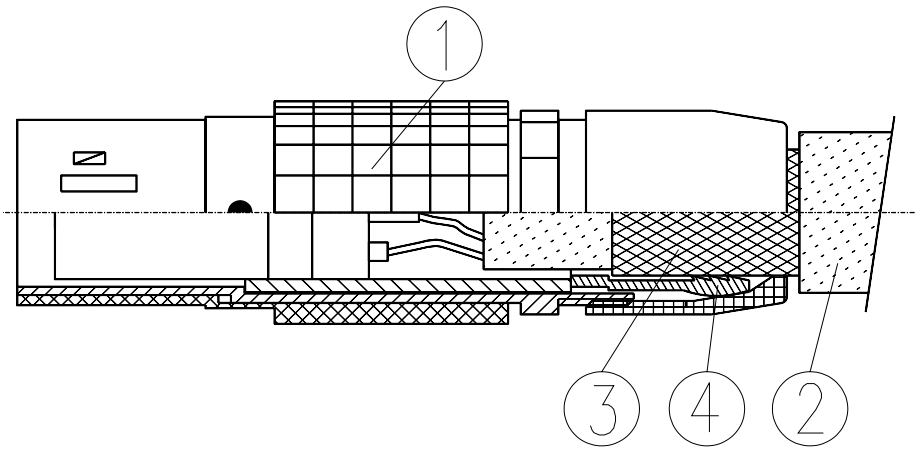
22 Appendix “Electrical connection circuit”



Caption:

1	-10X1	Single phase mains connection with plug and socket	
2	-1X2	External set value 4...20 mA	(= 0...100 %)
3	-1X3	External on command	(contact closed)
4	-1X3	External gas valves open command	(contact closed)
5	-1X3	24 VDC power supply for external commands	**Use for external commands**
6	-1X7	Common potential	
7	-1X7	PSU running	(contact closed)
8	-1X7	Gas valves open	(contact closed)
9	-1X7	Control remote	(contact closed)
10	-1X7	Alarm Bit 0	
11	-1X7	Alarm Bit 1	
12	-1X7	Alarm Bit 2	
13		Screened cable	

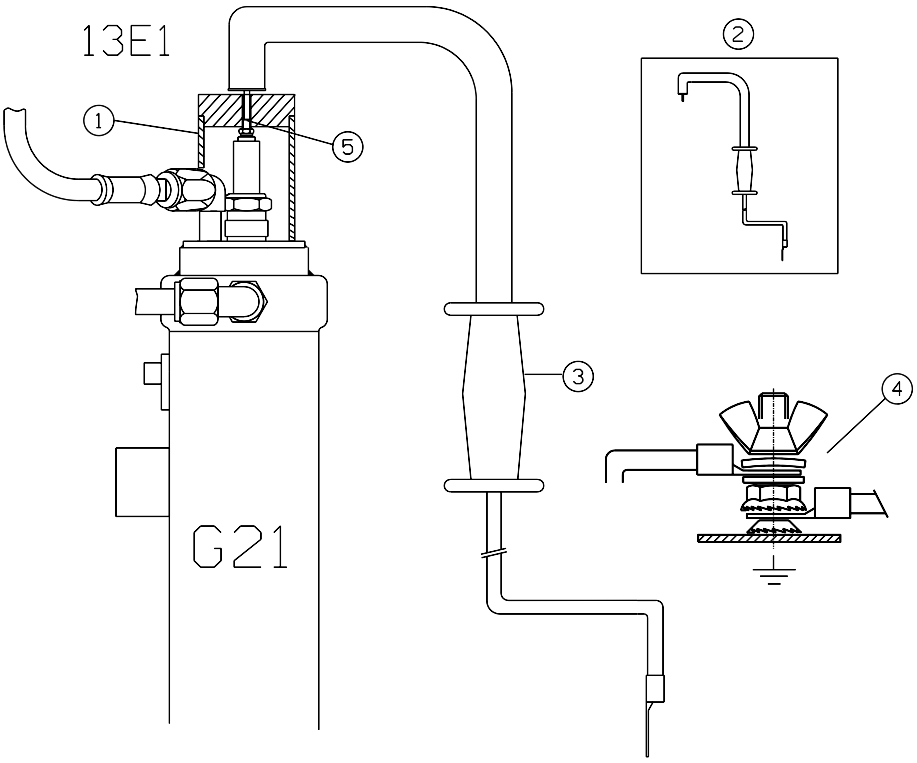
23 Appendix “EMP-Connector”



Caption:

1	EMP-Connector (**E**lektro-**M**agnetical-**P**ulse)
2	Screened cable
3	Screen
4	Electrical contacts
5	Gland plate (blank aluminum)

24 Appendix “Discharging the ozone generator module”



Caption:

G21	Ozone generator module
13E1	Electrical connection
1	Connection cover
2	Discharging device
3	Isolated handle
4	Earth for discharge device
5	Metal-to metal contact

25 Appendix “Standards, regulations and guidelines”

General:

EN 292	Machine guidelines
EN 60204-1	Safety of Machines (European standard)
prEN 1278	Ozone

Oxygen installations:

The regulations valid for the assembly and operation of oxygen installations must be complied with. Only the following regulations are referred to in this document:

SVS 211.1	Guidelines for fixed storage systems for low temperature, liquid, non-inflammable gases by the user.
SVS 531.1	Guidelines for oxygen lines and their fittings for Operating pressures up to 40 bar.
IGC 04/93	Fire hazards in oxygen and concentrated oxygen atmospheres.
VGB 62	Accident prevention regulation No. 28. Oxygen employer’s liability insurance association of the chemical industry (1.4.69 / Germany).

Ozone installations:

The regulations valid for the assembly and operation of ozone installations must be complied with. Only the following regulations are referred to in this document:

SBA-Nr. 143	Swiss sheets for Safety at Work. Accident prevention with protection of health at water treatment.
DIN 19627	Ozone generation installations for water treatment.
ZH 1/474	Guidelines for the use of ozone for water treatment..
DVGW W225	Ozone in water treatment; Terms used, reactions, application possibilities.
FIGAWA Nr. 12 & 13	Ozone technology in water treatment.
- FIGAWA Nr. 6	Information sheet regarding the handling of ozone and ozone generating systems in the water treatment.

The above standards, regulations and guidelines do not from a part of this service manual and should be procured separately by the owner or user. In each and every case local regulations must be adhered to.

26 CE certificate of conformity

EG-KONFORMITÄTSERKLÄRUNG
CE CERTIFICATE OF CONFORMITY
DECLARATION DE CONFORMITES AUX NORMES CE

im Sinne der EG-Richtlinie
in accordance with CE guidelines
selon les directives de la CE

Maschinen 98/37/EG Machines 98/37/EC Machines 98/37/CEE	Niederspannung 73/23/EWG Low voltage 73/23/EWG Basse tension 73/23/CEE	Elektromagnetische Verträglichkeit 89/336/EWG Electromagnetic compatibility 89/336//EWG Compatibilité électromagnétique 89/336/CEE

Die Bauart des Gerätes:
Type of apparatus:
Type de l'appareil:

Fabrikat	:	OZAT® Kompakt-Ozongenerator	Typenbezeichnung	:	CFS-1/3 2G
Article	:	OZAT® compact ozone generator	Type	:	CFS-1/3 2G
Fabrication	:	OZAT® générateur compact d'ozone	Désignation	:	CFS-1/3 2G

Wurde entwickelt, konstruiert und gefertigt in Übereinstimmung mit den o.g. EG-Richtlinien, in alleiniger Verantwortung von:
The above has been developed, designed and manufactured in accordance with refered to EU guidelines by:
A été conçu, construit et fabriqué en accord avec les directives de la CE sous la propre responsabilité de:

Firma	:	Ozonia AG, Schweiz
Company	:	Ozonia Ltd, Switzerland
Raison sociale	:	Ozonia SA, Suisse

Folgende harmonisierte Normen wurden angewandt:
The following harmonised standards were applied:
Les normes harmonisées suivantes on été appliquées:

DIN EN ISO 12100-1,2	Sicherheit von Maschinen; Teil 1 und Teil 2 Safety of machinery; Part 1 and part 2 Sécurité des machines; Partie 1 et partie 2
EN 60335-1	Sicherheit elektrischer Geräte für den Hausgebrauch und ähnliche Zwecke; Teil 1: Allgemeine Anforderungen Safety of household and similar electrical appliances; Part 1: General requirements Sécurité des appareils électrodomestiques et analogues; Partie 1: Prescriptions générales
EN 61000-6-3	Elektromagnetische Verträglichkeit (EMV), Fachgrundnorm Störaussendung; Teil 1: Wohnbereich, Geschäfts- und Gewerbebereich sowie Kleinindustrie Electromagnetic compatibility (EMC), Generic emission standard; Part 1: Residential, commercial and light industry Compatibilité électromagnétique (CEM), Norme générique émission; Partie 1: Résidentiel, commercial, industrie légère
EN 55014	Grenzwerte und Messverfahren für Fünkstörungen von Geräten mit elektromotorischem Antrieb und Elektrowärmegeräten für den Hausgebrauch und ähnliche Zwecke, Elektrowerkzeugen und ähnlichen Elektrogeräten Limits and methods of measurement of radio disturbance characteristics of electrical motoroperated and thermal appliances for household and similar purposes, electric tools and similar electrical apparatus Limites et méthodes de mesure des perturbations radioélectriques produits par les appareils électrodomestiques ou analogues comportant des moteurs ou des dispositifs thermiques, par les outils électriques et par les appareils électriques analogues
EN 61000-3-2	Elektromagnetische Verträglichkeit (EMV); Teil 3: Grenzwerte; Hauptabschnitt 2: Grenzwerte für Oberschwingungsströme (Geräteeingangsstrom ≤ 16A je Leiter) Electromagnetic compatibility (EMC); Part 3: Limits; Section 2: Limits for harmonic current emissions (equipment input current ≤ 16A per phase) Compatibilité électromagnétique (CEM); Partie 3: Limites; Section 2: Limites pour les émissions de courant harmonique (courant appelé par les appareils ≤ 16A par phase)
EN 61000-3-3	Elektromagnetische Verträglichkeit (EMV); Teil 3: Grenzwerte; Hauptabschnitt 3: Grenzwerte für Spannungsschwankungen und Flicker in Niederspannungsnetzen für Geräte mit einem Eingangsstrom ≤ 16A Electromagnetic compatibility (EMC); Part 3: Limits; Section 3: Limitation of voltage fluctuations and flicker in low-voltage supply systems for equipment with rated current ≤ 16A Compatibilité électromagnétique (CEM); Partie 3: Limites; Section 3: Limitation des fluctuations de tension et du flicker dans les réseaux basse tension pour les équipements ayant un courant appelé ≤ 16A
EN 61000-6-2	Elektromagnetische Verträglichkeit (EMV), Fachgrundnorm Störfestigkeit; Teil 2: Industriebereich Electromagnetic compatibility (EMC), Generic immunity standard; Part 2: Industrial enviroment Compatibilité électromagnetique (CEM), Norme générique immunité; Partie 2: Environnement industriel

Eine Technische Dokumentation ist vollständig vorhanden. Die zum Gerät gehörende Betriebsanleitung liegt vor:
Full technical documentation is available. Service manuals for the equipment are available:
Une documentation technique complète est disponible. Le manuel d'opération relatif à l'appareil est obtenable en:

Originalfassung	:	deutsch	In den Sprachen	:	englisch
Original text	:	German	In the translation	:	English
Version originale	:	allemand	Traduction	:	anglais

Ort, Datum	:	Dübendorf, 17. Mai 2006
Place and date	:	Duebendorf, 17th May 2006
Lieu et date	:	Dübendorf, le 17. Mai 2006

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OZONIA Ltd — Head R&D
OZONIA SA — Direction R&D

B. Paolini
Mitglied der Geschäftsleitung
Board Manager
Membre de la direction

27 Electrical diagram

Document : Electrical drawings

Plant : CFS-1/3 2G

Project number : 8033

Customer : OZONIA AG

Date of the last modification :

Rev.						
				Date	21.11.2005	
				Creat.	Gi	
				Review.	Mz	
				Appr.	PAB	

project : CFS-1/3 2G
number : 8033

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ELECTRICAL DRAWING
POWER SUPPLY UNIT

Repacement for :	=PSU21
Derived from :	+S01
HSP107047	Sheet 1
	from 10

Sheet	Description	Date	Editor	Document type
1	ELECTRICAL DRAWING		Gi	
2	CONTENTS		Gi	
6	COLORS OF CABLES		Gi	
7	CLASSIFICATION		Gi	
8	DIMENSION OF CABLES		Gi	
9	BLOCK DIAGRAM		Gi	
10	LINE FEED		Gi	
11	CONVERTER		Gi	
12	CONTROL		Gi	
13	OZONE GENERATOR		Gi	

Rev.					
A	29.12.2004	22114	Date	21.11.2005	
X	X	X	Creat.	Gi	
X	X	X	Review.	Mz	
X	X	X	Appr.	PAB	

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Contents
POWER SUPPLY UNIT

Repacement for : HOR 165 123
Derived from : HOR 123 234
HSP107047

=PSU21
+S01
Sheet 2
from 10

Identification of colours for electrical wires EN 60'204-1 / 14

Protective conductor	yellow-green
Neutral conductor	light blue
Main current circuit with AC and DC voltage	black / orange / copper rail
Control circuit with AC voltage	red
Control circuit with DC voltage	blue
External voltage	white
Floating signals	white
Analogue signals	green

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			Date	21.11.2005	
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			Review.	Mz	
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project : CFS-1/3 2G
number : 8033

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COLORS OF CABLES
POWER SUPPLY UNIT

Repacement for : =PSU21
Derived from : +S01
HSP107047
Sheet 6
from 10

=	A A A	N N N	+	A A	N N	-	N N A	N . N N	.	N N N

A : Letter
N : Number

Installation
Inst. Marking
Inst.-No

Site
Site marking
Site-No

Device
Sheet-No / code
Device-No

Terminal
Terminal-No

Terminal marking

-X0 Power supply <= 50 VAC / <= 75 VDC
-X1 Power supply > 50 VAC / > 75 VDC
-X2 Measuring and regulating signals
-X3 Control signals <= 50 VAC / <= 75 VDC
-X4 Control signals > 50 VAC / > 75 VDC
-X5 Intrinsically safe and explosion-proof circuits
-X6 Measurments in power circuit (I,U,P)
-X7 External signalization
-X8 Interface terminals for transport divisions

Installation

=CFS : CFS
=CLIENT : Client

Installation

+S01 : Control box
+S02 : Dryer skid

Device designation according DIN EN 61'346-2

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CLASSIFICATION
POWER SUPPLY UNIT

Repacement for : =PSU21
Derived from : +S01
HSP107047
Sheet 7
from 10

Cross section of control circuits according default values, unless it is indicated otherwise in the drawings	
Cable colour	Cross-section [mm2]
red	1.5
blue	0.75
white	1.5
green	1.5

Cross section of earth wires according EN 60'204-1 IEC 60'439-1	
Power cable Cross-section [mm2]	Earth wire Cross-section [mm2]
S <= 16	S
16 < S <= 35	16
35 < S <= 400	S / 2
400 < S <= 800	200
800 < S	S / 4

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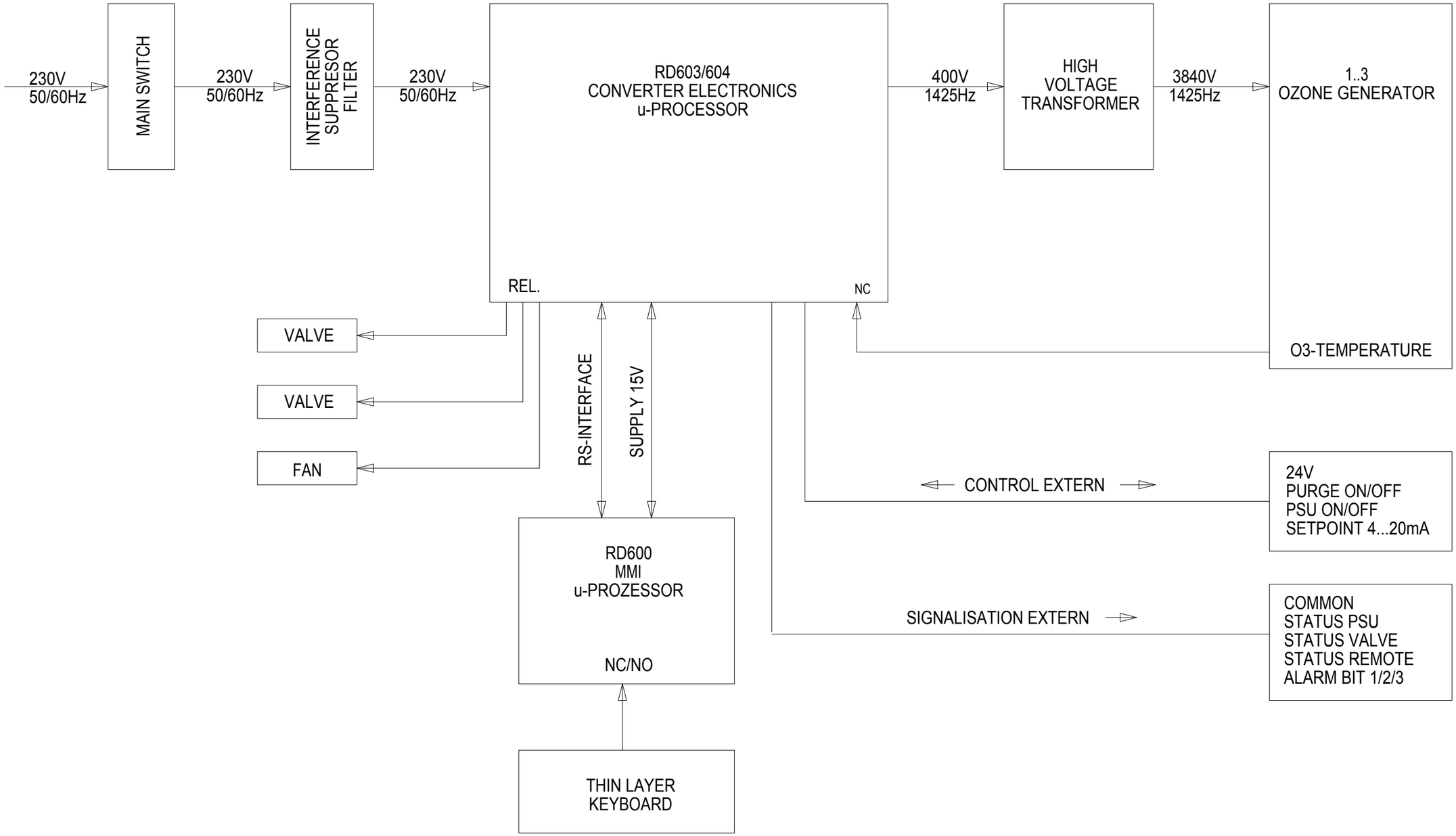
DIMENSION OF CABLES POWER SUPPLY UNIT

Repacement for : =PSU21
Derived from : +S01
HSP107047
Sheet 8
from 10



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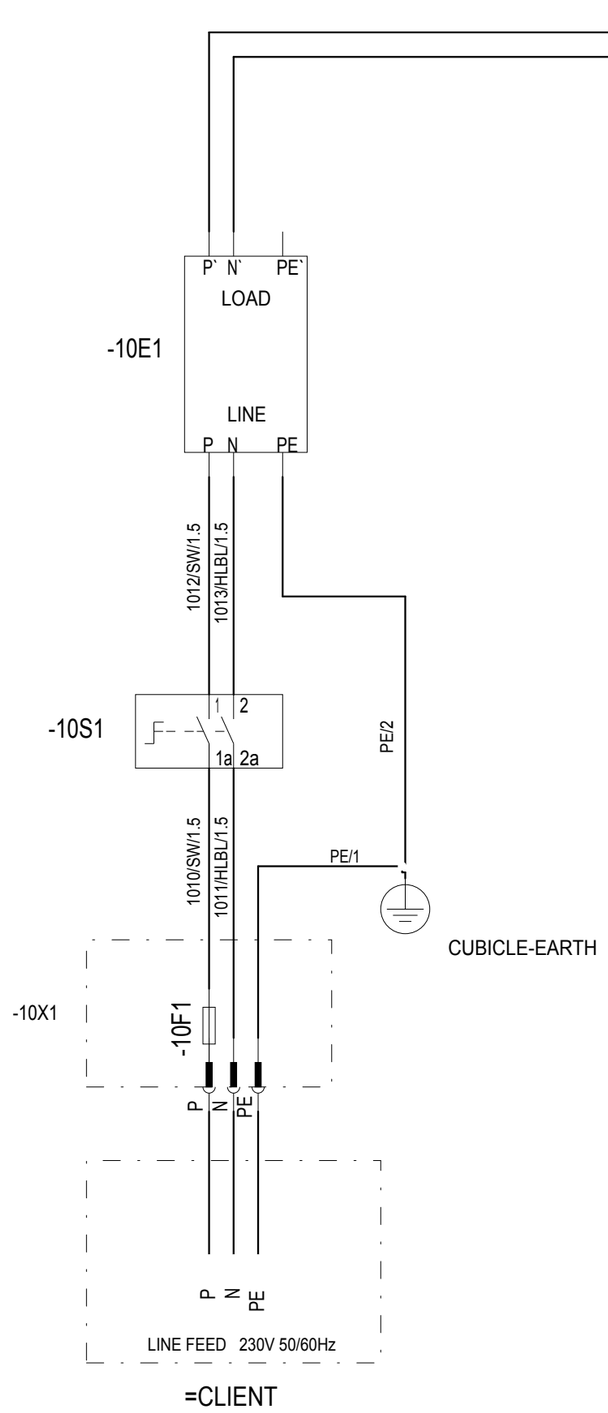
BLOCK DIAGRAM POWER SUPPLY UNIT

Repacement for :
Derived from :
HSP107047

=PSU21
+S01
Sheet 9
from 10



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project : CFS-1/3 2G
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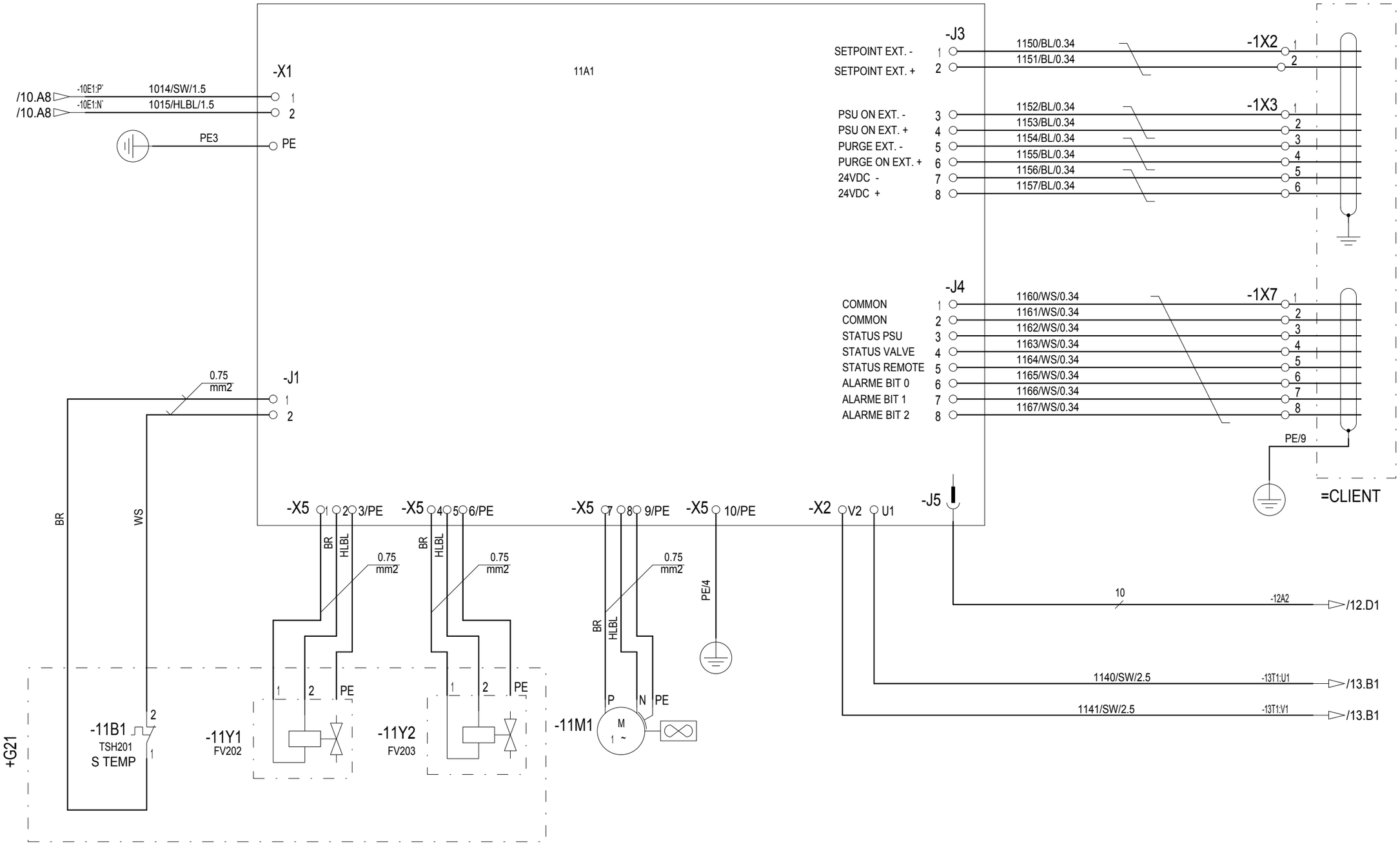
LINE FEED POWER SUPPLY UNIT

Repacement for : =PSU21
Derived from : +S01
HSP107047
Sheet 10
from 10



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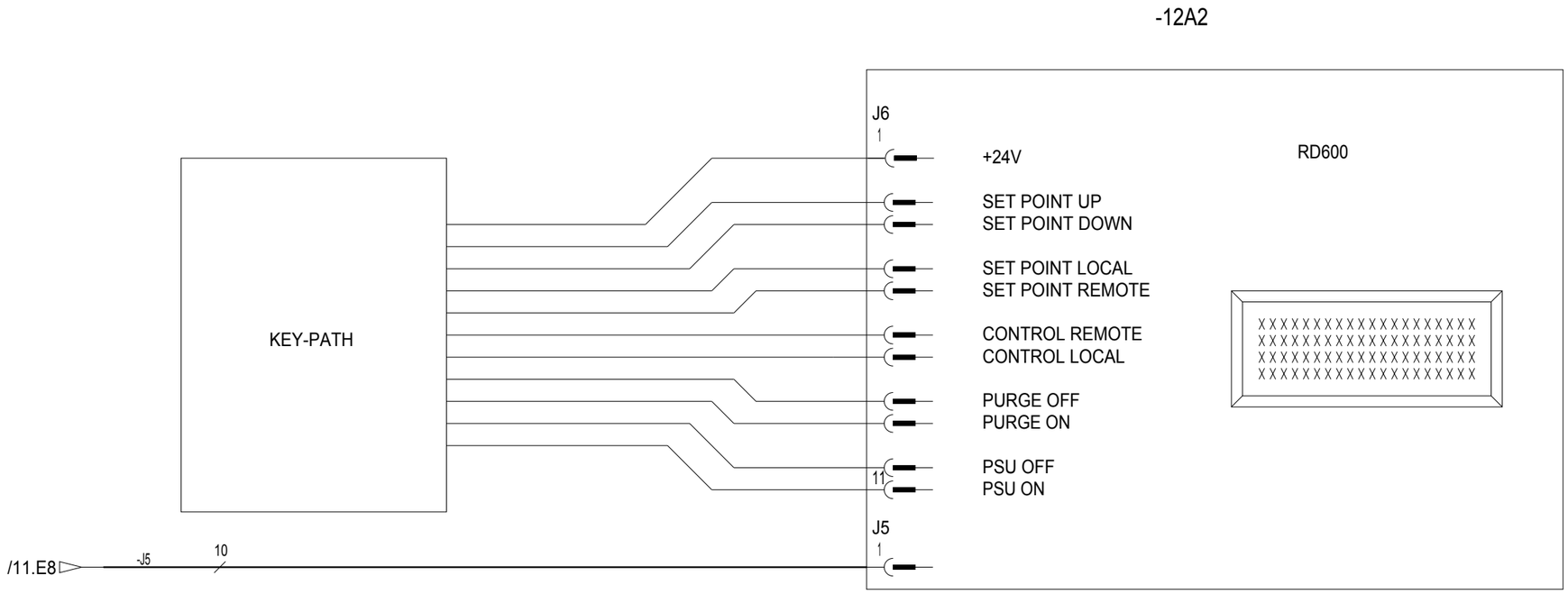
CONVERTER POWER SUPPLY UNIT

HSP107047

Repacement for :	=PSU21
Derived from :	+S01
Sheet	11
from	10



Rev.					
			Date	21.11.2005	
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project : CFS-1/3 2G
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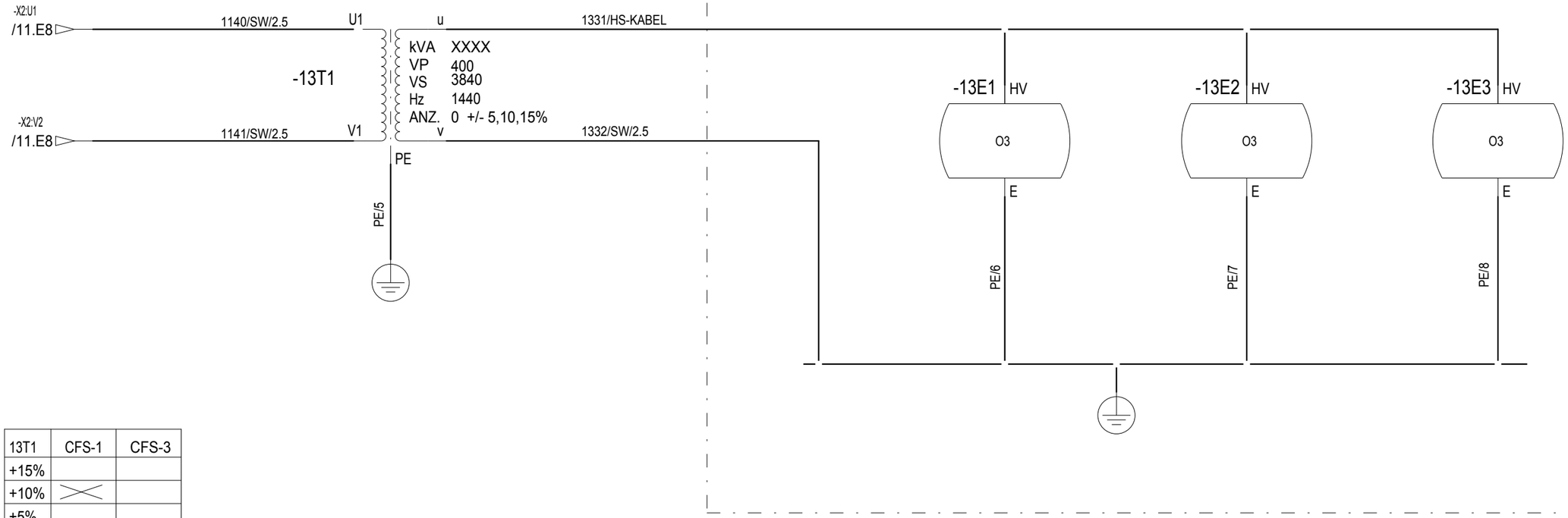
CONTROL
POWER SUPPLY UNIT

Repacement for :	=PSU21
Derived from :	+S01
HSP107047	Sheet 12
	from 10



13T1	CFS-1	CFS-3
+15%		
+10%	X	
+5%		
0%		
-5%		X
-10%		
-15%		

+G21

HV-TRANSFORMER

OZONE GENERATOR

Rev.					
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OZONE GENERATOR
POWER SUPPLY UNIT

Repacement for :	=PSU21
Derived from :	+S01
HSP107047	Sheet 13
	from 10

ONGOING EFFICACY TEST PROCEDURE

The Clean Waste Systems OMW-1000 ozone monitoring system is self calibrating. The on-board Programmable Logic Control (PLC) unit monitors all functions of the OMW-1000 and records and saves the data.

Through the display panel, all functions of the OMW-1000 can be monitored. The process can only be over-ridden or modified by entering a secure access code.

Note: Only persons trained in manual override procedures should attempt to override the automated system.

Monthly Efficacy Testing Protocol (or as required by state or local authorities)

The efficacy testing protocol for the OMW-1000 has been designed to meet the standards established by the governing body that is responsible for the licensing and approval of bio-hazardous waste treatment in your state.

The test frequency may vary depending on the regulations in force in the State where the system is installed. Always refer to applicable regulations in your State to determine the intervals at which on-going efficacy monitoring is to be performed.

The OMW-1000 system you purchased was tested at the factory to ensure that it confirms with manufacturer's specifications for efficacy in treating bio-hazardous waste.

For ongoing efficacy monitoring after installation Clean Waste Systems recommends the use of SGM Biotech's test strips comprising Bacillus Atrophaeus spores.

These strips are approved for testing of efficacy of ozone treatment by their manufacturer. These biological indicators can be ordered from Clean Waste Systems.

Clean Waste Systems, LLC
3535 Plymouth Blvd., Suite 112
Plymouth, MN 55447
Phone: 1.877.478.5195

Test Procedure

Test biological indicators (BI's) are traceable to a B Atrophaeus recognized culture collection and certified for population, D-value, Z-value and performance.

Required equipment available for efficacy testing:

- Bacillus Atrophaeus 6 Log spore strip in the Tyvek/Tyvek envelope (for sterilization)
    - On site incubator
    - Broth
    - Vials

  Note: Bacillus Atrophaeus 4 Log spore strip in Tyvek/Tyvek envelopes is also available for States only requiring disinfection

- EZTest Bacillus Atrophaeus 6 Log spore vials with broth ampoule included in vial
    - On site incubator

Refer to Mesa Labs SGM procedures for handling, culturing and evaluation of the results.
If the results still indicate that treatment was ineffective, repeat testing following Mesa Labs SGM procedures.

IMPORTANT: If results still indicate that the expected efficacy was not achieved, immediately contact the distributor to arrange for a maintenance call to diagnose and correct the problem. Do not process waste until the system has been determined to be functioning according to manufacturer's specifications.

Monitoring Frequency:

For optimum control of bio-hazardous waste, we recommend that Test biological indicators be used on a monthly basis or at a frequency as directed by local regulatory authorities.

Instructions for Use:

<u>Exposure:</u>

1. Remove an appropriate number of test BI's from the box and identify the BI's by labeling with necessary information.
2. Pull the Test Probe out of the Test Port.
3. Place the BI's in the appropriate locations on the Test Probe.
4. Re-insert the Test Probe into the Test Port.

5. Process the waste loads as usual.
6. After the sterilization cycle is completed, pull the Test Probe out of the Test Port.
7. Remove the indicators and re-cap the Test Port.

Ventilation:

To ensure that no residual ozone within the indicators falsely affects the incubation process, allow the indicators to ventilate for a **minimum of four (4) hours**. This ventilation process allows any residual ozone to naturally decay.

Incubation:

Any microbiological incubator that is adjusted for 35c to 39c will satisfy the incubation conditions for the test. To activate the media for the EZTest, place the indicator in an upright position in a plastic crusher. Gently squeeze the crusher to break the glass ampoule. Place the activated indicator in the incubator rack, and incubate immediately. For non-EZTest spore strips, place the BI in a glass vial with broth then incubate immediately.

Interpretation

1. Examine the indicator at regular intervals for any color change (i.e. 18, 24, 48 hours). The appearance of a yellow color indicates bacterial growth. No color change indicates adequate sterilization.
2. Act on a positive test (a color change of yellow) as soon as the color change is noted. Notify appropriate hospital personnel (i.e. Infection Control);

   Always re-test the sterilizer with several test indicators in the test port. Test indicators can be sub-cultured if identification of positive growth is desired. Recommended sub-culturing procedure techniques are available upon request from SGM Biotech.

3. The recommended incubation time for the EZTest is 48 hours and for non-EZTest test strips, 7 days.
4. Record the results.
5. Dispose of all used test indicators in accordance with your institution's policy.

Use of Controls:

1. As a positive growth control, place an activated, non-sterilized test indicator in the incubator each time you perform a test on a load of bio-hazardous waste.
2. Examine the positive indicator at regular intervals such as 18 and 24 hours. The yellow color is evidence of bacterial growth. Record the results. Remove all positive indicators as the yellow color is noticed and dispose of properly.
3. If the positive control does not grow, do not use the units from this box; Contact SGM Biotech.
4. Reversion may occur from a yellow positive with extended incubation time or on an underexposed unit. The color will be a fuchsia red color and turbid. Reversion will only occur if living spores are present on the spore strip.

Storage:

1. Store Test BI's at room temperature conditions. Do not desiccate.
2. Do not store these indicators near chemicals.
3. Test BI's have a shelf life which is clearly designated on each box.
   Note: Do not use after expiration date printed on package. Dispose of expired test indicators.