



TECHNICAL REPORT DC2-2000-OZONE DISINFECTION CHAMBER

The project for the disinfection of even fibrous materials through treatment with O₃ ozone, an allotropic form of oxygen, was born from the study on the effectiveness of this gas as a natural oxidant, present in the environment.

Its peculiar characteristics allow its use also on food, since, being a very unstable molecule, it is absolutely not a residual element and therefore, on the treated material, no residues can be found. The feasibility study of the project led us to prepare on a small scale, what in the future could be a large volume disinfection cell.

The device made, in this case, completely in stainless steel, has the characteristics necessary for the good use of ozone, looking at its effectiveness and operator safety.

These characteristics are:

- Structure with sealed chamber with double wall and insulated in the interspace.
- Double insulated door with magnetic seal.
- Preparation of the chamber with special openings for catalyzing the residual gas.
- Installation in a protected structure inside the chamber of UV lamps for the generation of ozone, producing ozone with lamps and not with a voltaic arc, allows to obtain a purer ozone free from sometimes harmful by-products.
- Installation in a protected structure above the chamber of a forced air recirculation system which, through an activated carbon filter, catalyzes the ozone, eliminating it completely before consenting to open the doors.
- Installation of a stirrer to distribute the gas evenly inside the chamber, ozone being heavier than air, tends to stratify downwards, with this equipment, it is redistributed in the total volume of the chamber.
- Installation of an electromechanical key system on the doors to prevent opening of the same until the ozone level inside the chamber is below the allowed limits, ensuring the safety of the treatment.
- Cycle control system controlled by Touc Screen and specific control software which, through a special ozone detection cell, completely controls the cycle, allowing you to set different chamber saturation levels, from 0.5 to 9 ppm, based on the pathogen to be destroyed (see table below), once in operation, the system automatically closes the doors, preventing the user from opening

them until it has been verified that the ozone level in the chamber is less than 0, 2 ppm, once the safety value is reached, the system will send a cycle message successfully completed and by e-mail, it will send the certification of the treatment, with times, doses and duration of ozone exposure. Internal predisposition of sliding shelves for the positioning of the material or the possibility, according to the requests, to equip it for the treatment of specific materials.

-Courtesy light for checking the interior of the room with open doors.

DESCRIPTION OF OPERATING PROCEDURE

A 230V electrical connection is provided to which the treatment chamber is connected with a normal civil socket.

By inserting the power line, the door safety keys open, this system has been set up, because if the power fails during the cycle, the doors would remain locked, then having to restart the cycle in order to open them at the end.

As an experiment, the chamber has been equipped with an adjustable sensor, on which it is possible to set, ozone quantities varying from 0 to 9 PPM, more than sufficient dose for the treatment required.

By acting on the Touch Screen, the required amount of ozone is set, the external display will indicate its effective achievement.

Four pre-set recipes can be used to select four cycles with different durations and saturations based on the material to be treated.

By closing the doors and pressing START, the safety keys will lock them and the ozone production lamps will begin to transform the oxygen present inside the chamber until the sensor detects the preset quantity.

The time required for the cycle will be set on the control panel or one of the four pre-set recipes will be selected.

During the cycle, the sensor will turn the lamps on and off to maintain the required ozone level, with a variable of 0.5 PPM.

After the treatment time, during which the stirring system will continue to stratify the ozone inside the chamber upwards, the production lamps will switch off and the catalytic system will switch on, which destroys the ozone.

During the catalyst cycle, the internal agitator continues to operate, forcibly passing the gas present inside the chamber, in front of the catalyst lamp.

The emission into the environment is less than 0.1 PPM.

The sensor detects the ozone level inside the chamber, the display of the external Touch Screen indicates it, once the catalyzing time is over and the quantity of ozone present in the chamber has been detected, which must be less than 0.2 ppm, the electromechanical safety keys for the doors allowing their opening.

The equipment is ready for another treatment cycle

INDICATIVE TIMES OF THE TREATMENT

Indicative times for the elimination of some pathogens are shown below.

Streptococcus Lactis	0'14"
Streptococcus. Aureus	0'10"
Sarcina Lutea	0'44"
Escherichia coli	1'00"
Staphilococcus	10'00"
Pyogenes Aureus	10'00"
Vibrio Cholerae	20'00"
Salmonella Typi	3'00"
Paramecium	5'30"
Saccharomyces elipsoideus	0'22"
Saccharomices sp.	0'29"
Lievito per pane	0'14"
Morbo del Legionario	19'00"
Microbacterio Paratuberculosis	20'00"
Virus Ebola	20'00"
Mosaico del tabacco	12'15

INACTIVATION OF BACTERIA, VIRUSES, MUSHROOMS, MOLDS AND INSECTS

(Fonti: Edelstein et al.,1982;

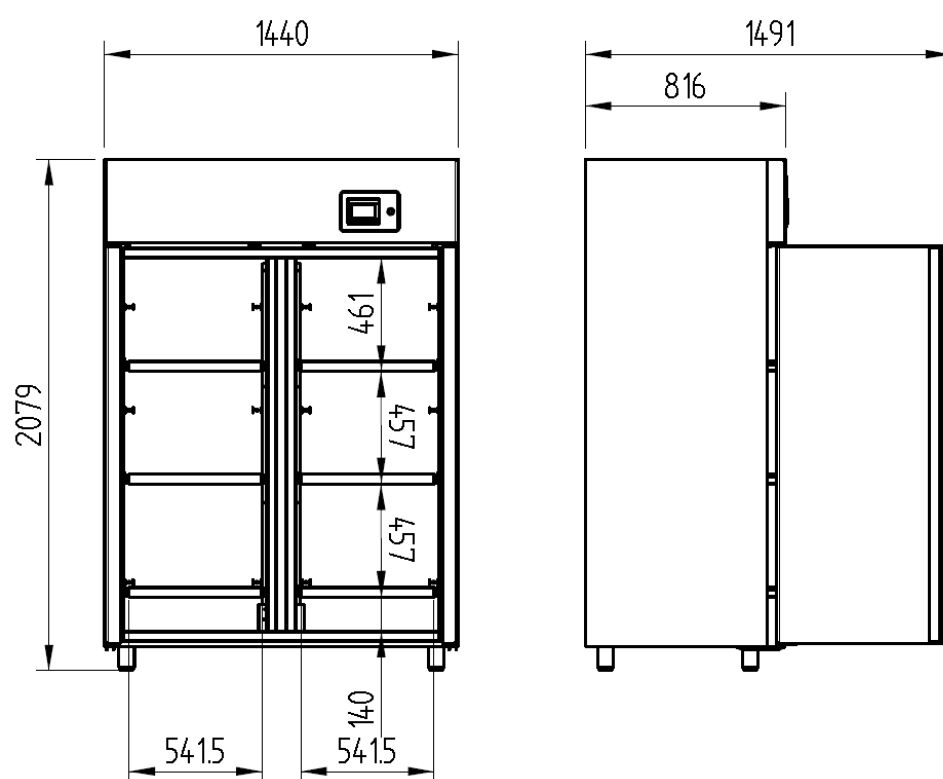
Joret et al.,1982; Farooq and

Akhlaque, 1983; Harakeh and

Butle,1986; Kawamuram et al. 1986)

GERM (E. Coli, Legionella, Mycobacterium, Fecal Streptococcus)	0.23 ppm - 2.2 ppm	< 20 min
VIRUS (Poliovirus type-1, Human Rotavirus, Enteric virus)	0.2 ppm - 4.1 ppm	< 20 min
MOLD (Aspergillus Niger, vari ceppi di Penicillum, Cladosporium)	2 ppm	60 min
(Candida Parapsilosis, Candida Tropicalis)	0.02 ppm - 0.26 ppm	< 1,67 min
INSECTS	1.5 - 2 ppm	30 min

(Acarus Siro, Tyrophagus
Casei, Tyrophagus



Large (mm)	1440	Electrical connection V	220
Depth (mm)	816	Electrical consumption W	350
Depth door open (mm)	1491	Internet connection plug	RJ 45
High (mm)	2079	Touch screen inches	4,3
Ozone lamp generator W	110	Modbus connection TCP	Yes
Ozone destratificator W	24	Auxiliary tension V	24
Catalization fan W	180	Weight kg	150
Activated carbon catalyst cartridge kg.	2	Process certification by mail	Yes
		Safety electric keys	Yes
Ozone concentration PPM	0-4	Internal courtesy light	Yes
External emission PPM	< 0,1	Sound level dBl	50