Beghelli “SanificaAria 30”

...

Characteristics of an air sanitization system based on the use of UV-C technology

...

Laboratory test results

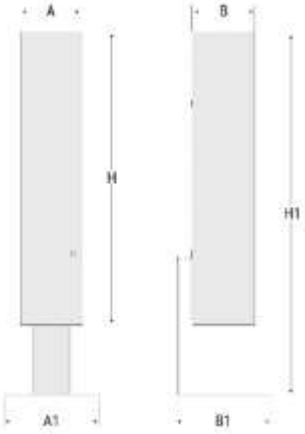
November, 12th , 2020

BEGHELLI SPA
Ing. Fabio Pedrazzi

SUMMARY

DESCRIPTION

The new Beghelli sanitation system called SanificaAria 30, consists of a axial fan suction system for air treatment by means of a lamp (cartridge) with ultraviolet rays in C band (UV-C). Characteristics and effectiveness of the treatment of the air through ultraviolet rays are known in the literature, as well highlighted in bibliography attached.
The air present in the room is sucked in and introduced into a room where it is activates the UV-C source where the sanitization process is carried out, at the end of which air is expelled and returned to the environment.
The main technical characteristics are reported below



Dimensioni mm						Portata di sanificazione
A	B	H	A1	B1	H1	
100	100	475	152	152	584	30 m^3/h

TECHNICAL CARCACTERISTICS SanificaAria 30
Power Supply: 230Vac ±10%, 50÷60Hz;ù
Consumption: 24W
UV-C Lamp: TC 2G11 18W
Wave length UV-C: 254nm
Scope of sanitation: until 30m^3/h
Radiant flow UV-C: 5,5W
Lamp UV-C Ozone Free
Lamp Life: 12 month (according to use)
Noise Level: 40dB(A) at 1 meter
Weight: 3,5kg
Product classification: The product can be classified as an air purifier according to the standard IEC 60335-2-65:2002 “Household and similar electrical appliance – *Safety – Part 2-65: Particular requirements for air cleaning appliances (paragraph 32.102)*

ASSESSMENT OF ANTIVIRAL ACTIVITIES

The anti-viral efficacy tests of the ***SanificaAria 30*** Beghelli system were performed at the Laboratory of Microbiology and Virology of UNIMORE - University of Modena and Reggio Emilia.

The activity involved the use of 2 types of viruses: Adenovirus and OC43 Coronavirus HCov-OC43 (the latter very similar to HCoV-SARS-2 responsible for CoViD-19).

The virus used in this study is the human coronavirus HCov-OC43 which has an extremely high homology of structure with the virus responsible for CoViD-19, HCoV-SARS-2, from both a phylogenetic and molecular point of view.
Since germicidal treatments act with non-specific mechanisms, morphologically similar viruses respond in a similar manner to inactivation. Therefore, HCoV-OC43 has been used in several viral persistence / inactivation studies as a model substitute for the highly pathogenic coronaviruses SARS-1, SARS-2 and MERS.
In addition, AdenoVirus-5 (AdV) was also used, a virus with much greater resistance than that of HCoV-OC43, so much so that it is required for certification tests of virucidal systems according to the UNI EN standard.
The results of the tests showed that the virucidal action of ***SanificaAria 30*** is as follows:

CORONAVIRUS HCoV-OC43:
percentage deactivation **99.7%** deactivation rate (2.5 log reduction)

ADENOVIRUS AdV-5:
percentage deactivation **94.4%** (log reduction 1.25)

(See Attachment. 1: TPM / UNIMORE Report- Confidential)

EVALUATION OF MICROORGANISMS REDUCTION

The product was subjected to tests to verify the germicidal activity of the device against microorganisms that differ from each other in terms of resistance to UV-C light.

The analyzes were carried out at the Tecnal srl laboratory accredited according to the UNI CEI EN ISO / IEC 17025: 2005 standards, in collaboration with Gelt International srl, between 12/06/2020 and 13/07/2020.

The test is conducted following the requirements, as applicable, of the technical standard ISO 15714: 2019: "Method of evaluating the UV dose to airborne microorganisms transiting in-duct ultraviolet germicidal irradiation devices". The standard describes test methods for analytical laboratories in order to verify the performance of germicidal devices with UV-C irradiation placed in heating, ventilation and air conditioning ducts.
The test microorganisms described in paragraph 6 of the same are used for the test, i.e. what is reported in table 1.

TEST MICROORGANISM	GROUP	DOSE D90* (J/m²)
Serratia marcescens ATCC 13880	Gram negative bacteria	< 25
Bacillus subtilis ATCC 6633	Gram positive bacteria	25 ÷ 120
Cladosporium sphaerospermum ATCC 11289	Fungus	> 120

* UV-C effective dose necessary for the inactivation of the 90% of the microorganisms.

The results obtained confirm that the Beghelli ***SanificaAria 30*** device has an effective UV-C dose between 25 and 120 J / m^2, inactivating up to 90% of Gram positive microorganisms and up to 99% of Gram negative test. The test fungus, Cladosporium sphaerospermum, is inactivated by no more than 33% as it would in fact require higher UV doses.

In Annex C, the ISO 15714: 2019 standard reports multiple scientific literature data relating to UV-C doses (D90) required to break down 90% of different microorganisms, bacteria, viruses, fungi and others. On the basis of the data obtained from laboratory tests that show a proven ability of the ***SanificaAria 30*** system to express a D90 dose of about 120 J / m^2, it is possible to deduce a list of microorganisms, which on the basis of literature data, can be killed by the same system, including Coronaviruses.

(See Attachment. 2: TECNAL Report - Cover page)

SAFETY OF UV-C RADIATION EMISSIONS - OZONE

The device was subjected to the analysis of the emission of spurious UV-C radiation in order to verify its safety in daily use.

The product has been verified at IMQ laboratories and meets the requirements of the IEC 60335-2-65 + A1 + A2, Subclause 32.102, in relation to the safety of the emission of UV-C radiation.

(See Attachment. 3: IMQ Test Report - Cover page)

The device was subjected to an analysis of the ozone emission in order to verify any emissions, despite the use of lamps with intrinsic safety characteristics (declarable "ozone free" with an emission lower than 0.01g / KWh).

The tests carried out according to IEC 60335-2-65:2002+A1:2008+A2:2015 § 32.101 + UNI EN 14625:2012 show full compliance (8,6 µg/m^3 – limit: 100).

(See Attachment. 4: Gelt International Test Report - Cover page)

METHOD OF APPLICATION AND USE

With regard to the interpretation of the flow rate performance data (expressed in m3 / hour) and the methods of use and installation in the environment of ***SanificaAria 30***, the following is specified.
Given the high ability to kill microorganisms (over 99%), the product is able to completely sanitize a certain volume of air (for example 30 m3) in 1 hour and the action is repeated at each further cycle of 1 hour.
Obviously, at the end of the first hour of operation it is unthinkable that the viral load present in the air has returned to the pre-ignition values and therefore, for each 1 hour operating cycle, there is a reduction of residual microorganisms compared to the action carried out in the previous hour (figure 1):

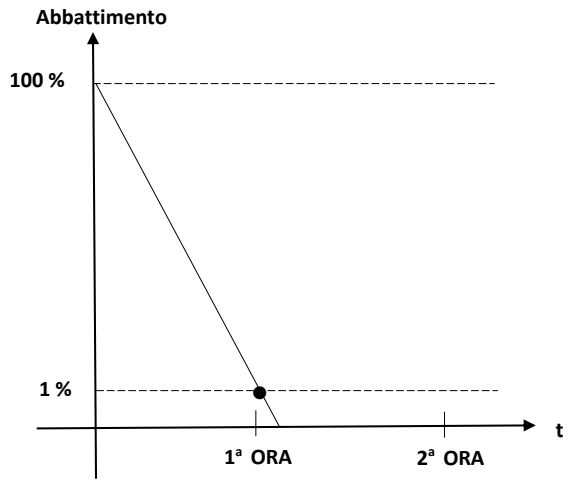


Figura 1

In practical use, the continuous recirculation of air within the environment multiplies its effectiveness over time as the turbulent motions of the air (convective hot / cold motions - opening / closing doors and windows - movement of people) favor the action of the product on the entire volume of air present in the room itself.

The figure below clearly illustrates the phenomenon (figure 2):

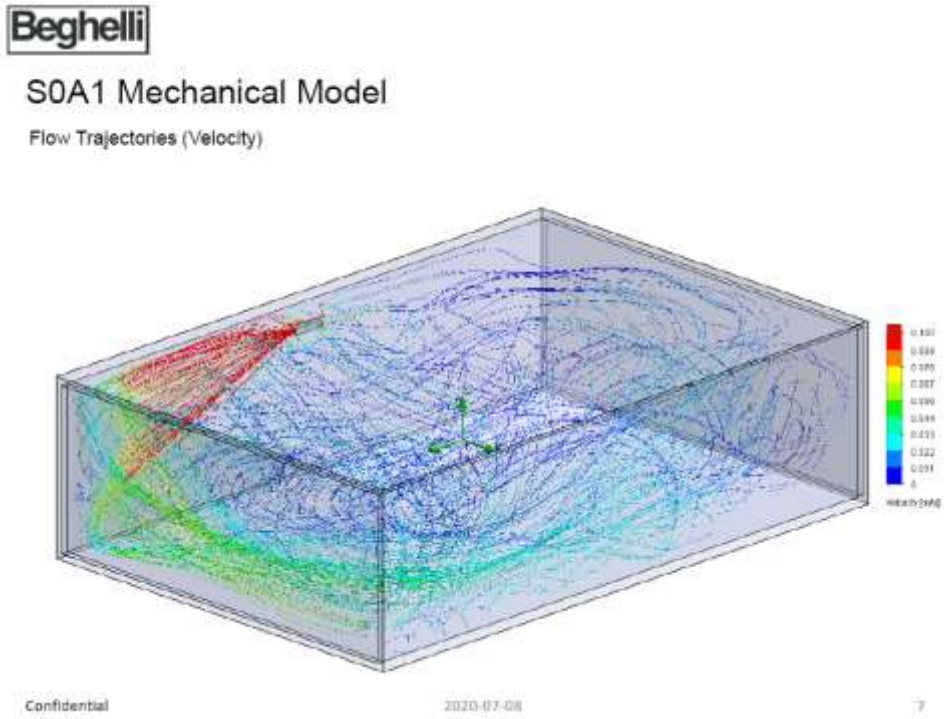


Figura 2

How to use the product

The recommended product use criteria are as follows:

-- Switching on the product in the absence of people, before occupying the room, for a number of hours calculated by dividing the volume of the room by the volume of flow (e.g 50 m3: 25 m3 = pre-ignition time: 2 hours) in order to obtain the initial sanitation of the environment.

-- Recommended installation height: greater than 2 m or near the floor (in order to better exploit the turbulent movements of the air).

-- Continuous switching on of the appliance for the entire time in which the premises are occupied with the presence of people.

-- The combined use of two appliances in the same environment allows you to halve the initial sanitation time.

The instruction booklet shows the correct positioning of the Air Sanitizer 30 to obtain the maximum effectiveness of the air exchange.

(See Attachment. 5: Instruction Booklet)

Beghelli

Annex 1

REPORT FINALE

Valutazione trattamento virucida ad opera del dispositivo SanificAria 30 sull'aria ambientale per mezzo di radiazioni UVc

Report n°: MS2_2020_R42
Edizione: 01
Pagina: 1 di 3

CLIENTE	**BEGHELLI spa** Via Mozzeghine 13/15 - loc. Monteveglio 40053 Valsamoggia, Bologna- P.IVA: 00886341201	
LABORATORIO	X **MaB – Microscopia applicata e biologia cellulare** – ☐ **ToP – Tossicologia e Proteomica** – X **Ms² – Materiali, sensori e sistemi** –	
Analisi svolte da: Mattia Piccini mattia.piccini@tpm.bio	**Firma**	**Data** 28/07/2020
Responsabile di laboratorio: Alberto Ferrari alberto.ferrari@tpm.bio	**Firma**	**Data** 28/07/2020
Approvato da Luigi Rovati, luigi.rovati@unimore.it Scientific Director of materials, sensors and systems laboratory.	**Firma**	**Data** 28/07/2020

Ed.	**Report n°**	**Data**	**Descrizione**
01	MS2_2020_R42	28/07/2020	Prima edizione

UNIMORE

Dipartimento Chirurgico, Medico, Odontoiatrico e di Scienze Morfologiche con Interesse Trapiantologico, Oncologico e di Medicina Rigenerativa
Direttore: prof. Ugo Consolo

Fondazione Democenter-Sipe
Via Vivarelli n.2
41125 Modena

Research contract between the University of Modena and Reggio Emilia, Department of Surgical, Medical, Dental and Morphological Sciences with Transplant, Oncological and Regenerative Medicine Interest and the DEMOCENTER-Sipe Foundation of Modena

Evaluation of antiviral activity against AdV and HCoV-OC43 of a germicidal system based on UV radiation on a material (+ control) for a single exposure time and at a single distance)

FINAL REPORT

INTRODUCTION

The virus used in this study is the human Coronavirus HCov-OC43 which has an extremely high homology of structure with the virus responsible for CoViD-19, HCoV-SARS-2, both from a phylogenetic and a molecular point of view. In fact, they both belong to the β-Coronavirus group in an extremely close position in the phylogenetic tree. The homology is such that some antibodies, highly specific against HCoV-OC43 too, also recognize SARS-2. This indicates that proteins, which are the main constituent of the viral particle and determine its resistance, are extremely similar between the two viruses. Since germicidal treatments act with non-specific mechanisms, morphologically similar viruses respond to inactivation in a similar way. Therefore, HCoV-OC43 has been used in several studies on viral persistence / inactivation as a substitute for the highly pathogenic Coronaviruses SARS-1, SARS-2 and MERS. In fact, HCoV-OC43 can be more easily manipulated, not requiring a laboratory with a biosafety level of 3 but 2, as the UNIMORE laboratory is.

1

RISULTATI

Table 1 shows the results obtained with HCoV-OC43 while table 2 shows those with AdV-5. These tables reports: the initial title of the stock used (therefore the quantity of virus put in contact with the slide), that found on the surface of the control slide and the one on the treated slide. Titles are expressed as $TCID_{50}$. The reduction, calculated with respect to the untreated control, is expressed as Log.

Table 1
Results of viral titration of the residual virus on slides experimentally contaminated with HCoV-OC43

Initial Inoculum	**Ctrl slide**	**Treated slide**
$10^{[illegible]}$	$10^{[illegible]}$	Neg
Logarithmic reduction	2,5	

The values shown represent the average of the duplicates of two experiments

Table 2
Results of viral titration of the residual virus on slides experimentally contaminated with AdV-5

Initial Inoculum	**Ctrl slide**	**Treated slide**
$10^{[illegible]}$	$10^{[illegible]}$	$10^{[illegible]}$
Logarithmic reduction	1,25	

The values shown represent the average of the duplicates of two experiments

3

Annex 2

5 CONCLUSIONS

The ISO 15714: 2019 technical standard reports that the different test microorganisms show different resistance to UV-C light (paragraph 6) by requiring UV doses of

- < 25 J/m² for *Serratia marcenscens*,
- between 25 and 120 J/m² for *Bacillus subtilis*,
- > 120 J/m² for *Cladosporium sphaerospermum*

The results of the present study confirm that the SanificaAria 30 device by Beghelli has an effective UV-C dose between 25 and 120 J / m², inactivating up to 90% of the Gram positive microorganisms and up to 99% of the Gram negative test microorganisms. The test fungus, *Cladosporium sphaerospermum*, is inactivated no more than 33% since it would actually require higher UV doses.

The Annex C of the ISO 15714: 2019 reports a long list of scientific literature data relating to the UV-C doses (D90) required to inactivate the 90% of different microorganisms, bacteria, viruses, fungi and others. On the basis of the data obtained from the laboratory tests which show a proven ability of the SanificaAria 30 system to express an effective D90 dose of about 120 J/m², it is possible to point out a list of microorganisms which, theoretically and on the basis of these literature data, can be inactivated by the same system (underlined in green in table 5).

Annex 3

IMQ

B.U. PRODUCT CONFORMITY ASSESSMENT - LIGHTING SECTOR

TEST REPORT

No. AI20-0056718-01

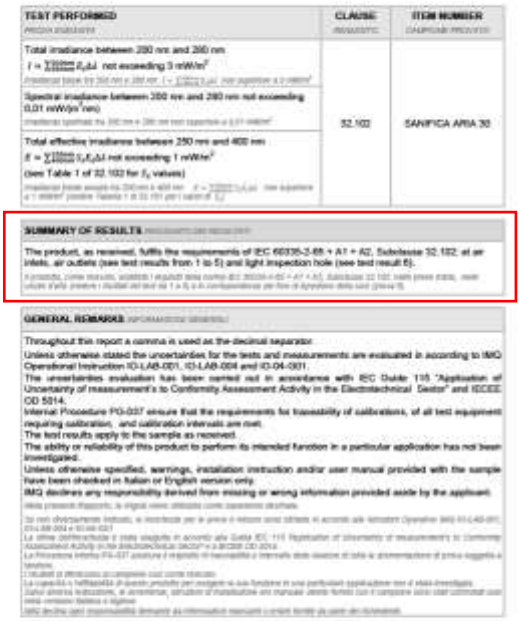
Household and similar electrical appliances - Safety - Part 2: Particular requirements for air-cleaning appliances performed in accordance with
IEC 60335-2-65:2002+AMD1:2008+AMD2:2015 (subclause 32.102)

PRODUCT	Air-cleaning device
MODEL(s) TESTED	SANIFICA ARIA 30
TRADE MARK(s)	BEGHELLI
APPLICANT	Beghelli S.p.A. - Via Mezzaghina, 1315 - 40050 Valsamoggia – Località Monteveglio (Bologna) Italy

Tested by	Paola Guarnotta (Laboratory Technician)	
Approved by	Giacomo Barale (Laboratory Manager)	

Revision Sheet

Release No.	Date of issue	Revision Description
Rev. 0	2020..21st October	First edition



TEST PERFORMED	CLAUSE	ITEM NUMBER
Total irradiance between 200 nm and 280 nm $I = \sum_{200nm}^{280nm} E_\lambda \Delta\lambda$ not exceeding 3 mW/m²	32.102	SANIFICA ARIA 30
Spectral irradiance between 200 nm and 280 nm not exceeding 0,01 mW/(m²·nm)		
Total effective irradiance between 250 nm and 400 nm $E = \sum_{250nm}^{400nm} S_\lambda E_\lambda \Delta\lambda$ not exceeding 1 mW/m² (see Table 1 of 32.102 for S_λ values)		

SUMMARY OF RESULTS

The product, as received, fulfils the requirements of IEC 60335-2-65 + A1 + A2, Subclause 32.102, at air inlets, air outlets (see test results from 1 to 5) and light inspection hole (see test result 6).

GENERAL REMARKS

Throughout this report a comma is used as the decimal separator.
Unless otherwise stated the uncertainties for the tests and measurements are evaluated in according to IMQ Operational Instruction IO-LAB-001, IO-LAB-004 and IO-04-001.
The uncertainties evaluation has been carried out in accordance with IEC Guide 115 "Application of Uncertainty of measurement's to Conformity Assessment Activity in the Electrotechnical Sector" and IECEE OD 5014.
Internal Procedure PO-037 ensure that the requirements for traceability of calibrations, of all test equipment requiring calibration, and calibration intervals are met.
The test results apply to the sample as received.
The ability or reliability of this product to perform its intended function in a particular application has not been investigated.
Unless otherwise specified, warnings, installation instruction and/or user manual provided with the sample have been checked in Italian or English version only.
IMQ declines any responsibility derived from missing or wrong information provided aside by the applicant.

Test Report No. AI20-0056718-01 Date: 2020..21st October Page 6 of 10

Annex 4

GELT INTERNATIONAL
scientific consulting

GELT INTERNATIONAL S.R.L.
Via Andrea Costa 228
40134 BO Italia
CF/P. IVA 03650351200
Cap. Sociale € 10.000,00 i.v.
Registro Imprese di Bologna
REA 535891

Rapporto di Prova n° **20COA01109** del **11/11/2020**

Spett.
Beghelli spa
Via Mozzeghine 13/15 – loc. Monteveglio
40053 Valsamoggia (BO)

Campione: **Lampada UV-C TAC – UVC 18 W**
Modello: **UV C H 18W 2G11 (Montato su dispositivo Sanifica 30 codice 26700 e 26704)**

Data di accettazione: **29/10/2020**
Data inizio analisi: **29/10/2020** Data fine analisi: **30/10/2020**

Campionamento a cura di: **Lambertini Fabio - Gelt International srl**
Luogo di campionamento: **Locale di prova allestito come da norma tecnica IEC 60335-2-65:2002+A1:2008+A2:2015 § 32.101 presso lo stabilimento Beghelli spa – Via Mozzeghine 13/15 – loc. Monteveglio - 40053 Valsamoggia (BO)**

Data e ora campionamento: da **29/10/2020 10.05**
a **30/10/2020 10.20**

Metodo di campionamento: **IEC 60335-2-65:2002+A1:2008+A2:2015 § 32.101**

Parametro Metodo	U.M.	Risultato	Valori Limite
Ozono (O_3) nelle 24 ore *IEC 60335-2-65:2002+A1:2008+A2:2015 § 32.101 + UNI EN 14625:2012*	ppb	4,3	50
Ozono (O_3) nelle 24 ore da calcolo	µg/m³	8,6	100

La concentrazione di Ozono in µg/m³ è riferita alla temperatura di 20°C e 1 atm.

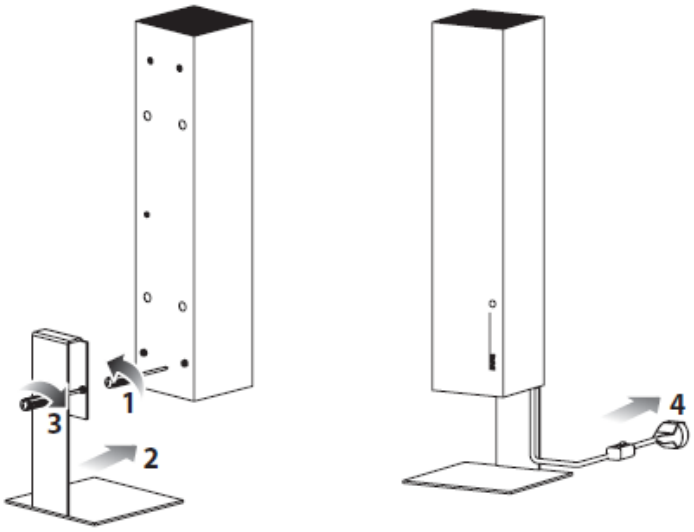
I valori limite sono indicati nella norma tecnica di riferimento IEC 60335-2-65:2002+A1:2008+A2:2015 § 32.101 Household and similar electrical appliances - Safety - Part 2-65: Particular requirements for air-cleaning appliances

Giudizio: Rispetto al parametro Ozono, il campione risulta CONFORME alla normativa di riferimento.

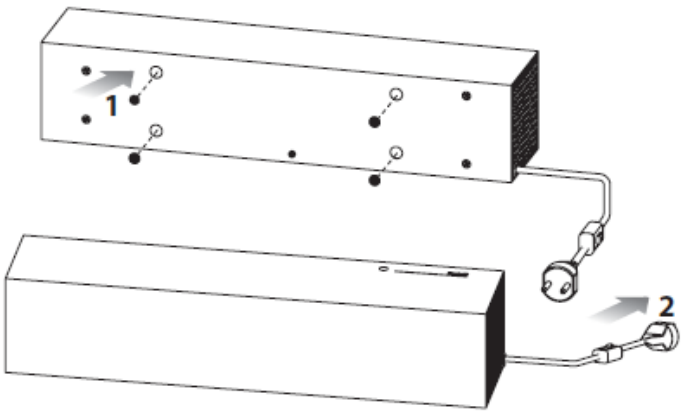
Il Responsabile del Laboratorio
Dott.ssa Chiara Piana

Annex 5
Assembly instructions

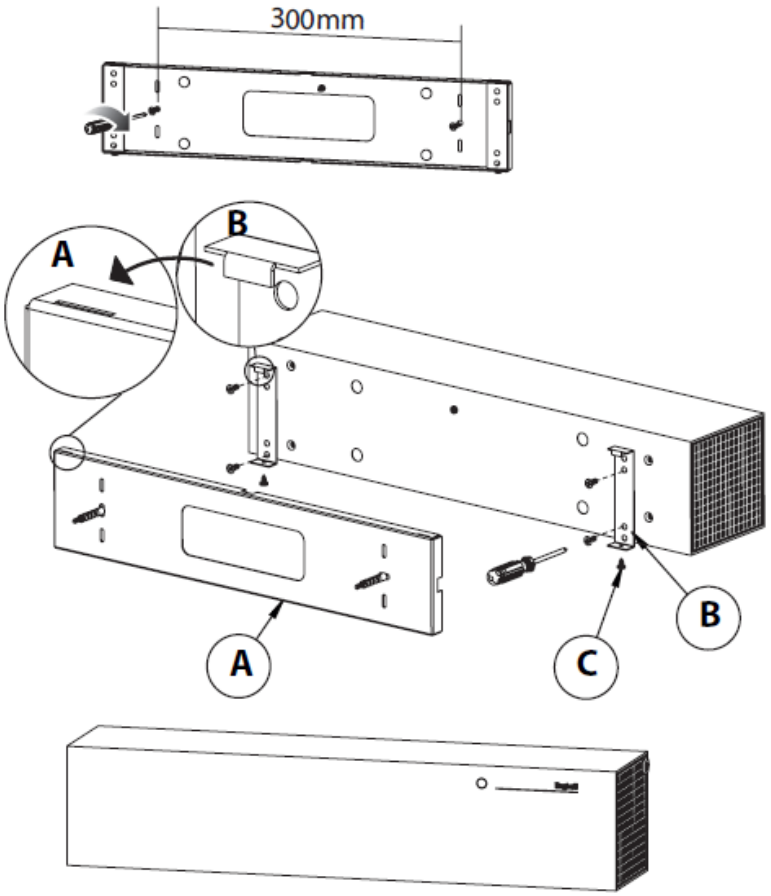
FLOOR-STAND INSTALLATION



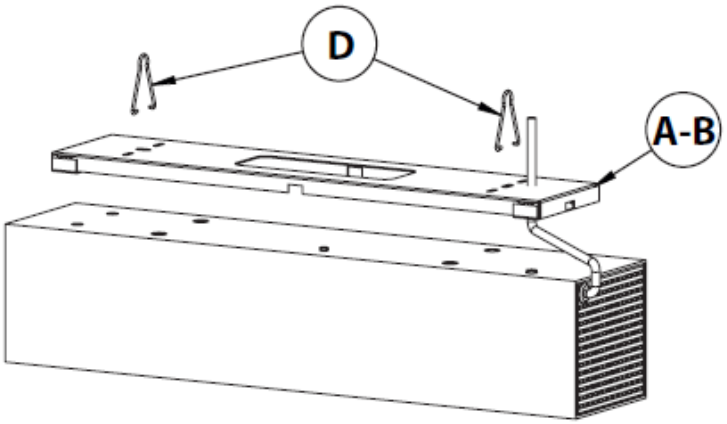
MOUNTED ON A SUPPORT

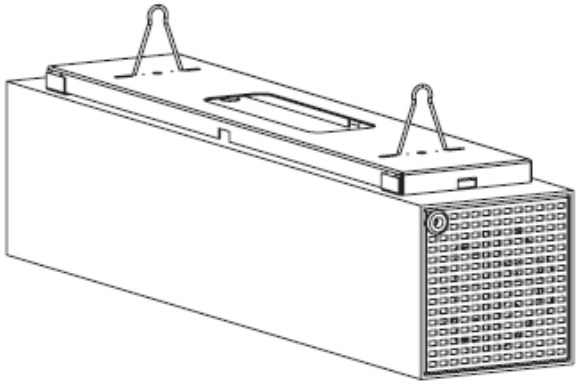


WALL AND CEILING MOUNTING



SUSPENDED MOUNTING





Annex 6
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