

Nr. 263 - ex din 11.07.2025

Către: Centrul pentru Achiziții Publice Centralizate în Sănătate

În atenția: Grupului de lucru în cadrul LP M Tender ID nr. ocds-b3wdp1-MD-1748267071111 / 21424521

Stimați membri ai Grupului de lucru,

Prin prezenta S.C. IMUNOTEHNOMED S.R.L. urmare a recepționării scrisorii de clarificare nr. Rg02-3113 din 08.07.2025 pe marginea procedurii de achiziție nr. ocds-b3wdp1-MD-1748267071111 / 21424521 - *Achiziționarea dispozitivelor medicale conform necesităților instituțiilor medico-sanitare publice (listă suplimentară nr. 15)* în parte ce ține de parametri tehnici care nu s-au regăsit pentru lotul nr. 1 Sistem radiografic digital (cu bucky vertical), vă informăm următoarele:

1. Generator de raze X, High speed starter - Obligatoriu

Generatorul de raze X model: GXR – 82 din configurația dispozitivului propus, dispune de parametrul high speed starter. Pentru confirmare, va rugam sa consultați pagina nr. 126 a manualului de operare atașat la ofertă fisier "*Pagini din manual de operare 103_163 GXR_SD.signed*" pe care îl atașăm la acest răspuns.

Producătorul marchează acest prin parametrul „Rotor Supply - Dual Speed „

Rotor Supply	Low Speed (Option: LSS Brake, Dual Speed for 3Φ)	Low Speed (Option: LSS Brake, Dual Speed)	Dual Speed
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Unde „ Dual Speed” include „ low speed” si „ high speed”.

2. Tubul de raze X Anod rotativ, Rata de răcire KHU/min. ≥ 120

3. Tubul de raze X Anod rotativ, Viteza de start a anodei rpm min. 9000 rpm

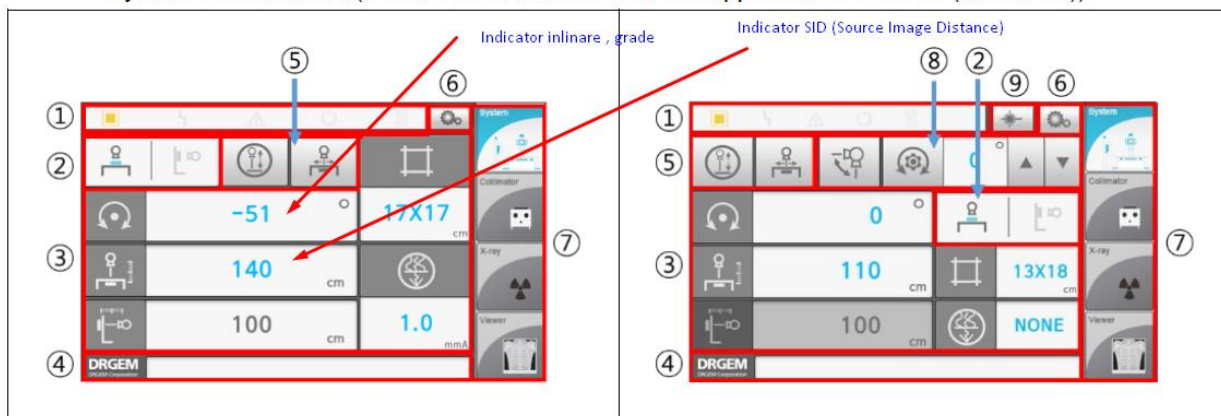
În vederea confirmării acestor parametri, vă rugăm să consultați pagina nr. 3 a fișierului *RTM101-HS-0.6_1.2_DSS_63kW_100kW_400kHU.semnat* care conține descrierea tehnica completa a tubului cu raze X model: RTM101HS

Dissipazione termica massima Maximum heat dissipation Dissipation thermique maximale	1500 W	<u>120 000 HU/min</u>	
Velocità di rotazione dell'anodo Anode speed Vitesse de l'anode	50 / 60 Hz 2450 / 2850 min ⁻¹	150 / 180 Hz 8500 / <u>10000 min⁻¹</u>	

4. Colimator, afisare, SID → Afisare SID pe ecranul montat pe tubul X-ray
5. Colimator, afisare, inclinare → Afisare inclinare pe ecranul montat pe tubul X-ray

Parametrul **SID** (Source Image Distance) precum si parametrul **încalinare** , sunt afișați pe ecranul de 7 inch **Touch Screen LCD**, montat pe tubul X-Ray. Drept dovadă, va rugăm să consultați pagina nr. 330 a manualului de operare pe care o atașăm la acest răspuns.

- System Control Menu (7 inch Touch Screen LCD, Not applicable to TS-FC2 (Motorized))



Extras din manualul de operare, pagina 330

6. Colimator, afișare, tip Filtru → Afisare tip filtru pe ecranul montat pe tubul X-ray

Parametrul tip filtru colimator este afișat pe ecranul de 7 inch **Touch Screen LCD**, montat pe tubul X-Ray. Filtre disponibile: 1 mm Al; 0,1 mm Cu; 0,2 mm Cu; None. Pentru confirmare, va rugam sa consultați pagina nr. 335 a manualului de operare pe care o atașam la acest răspuns.

- Auto Filter Selection & Indicator Menu (7 inch Touch Screen LCD, Not applicable to TS-FC2 (Motorized))



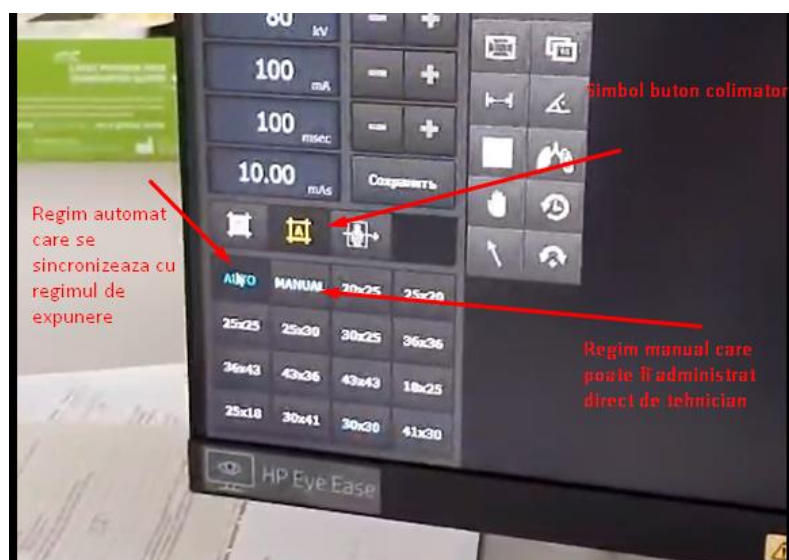
Extras din manualul de operare, pagina 335

7. Colimator, Sincronizare cu regimul de expunere Obligatoriu
8. Consola de achiziție integrată (PC Tehnician radiolog), Administrează, Colimator

Conform specificației tehnice oferite, în configurația propusă este inclus colimator model: R 302MLP/A motorizat. Descrierea tehnică completa a colimatorului este ilustrată în fișierul *MT_R_302_000_0_MLP000-A_0000_D_E.semnat*, pe care îl atașăm la acest răspuns.

Drept dovadă că acest tip de colimator dispune de sincronizare cu regimul de expunere, dar și dovada că (PC Tehnician radiolog) administrează colimatorul, vă rugăm să consultați linkul de mai jos unde este încărcat un material video care demonstrează acest lucru.

<https://drive.google.com/file/d/1xEhAOdYA42eo3kb-5B9UIRNbe2AIPHrB/view?usp=sharing>



Extras din material video care demonstrează sincronizarea colimatorului dar și administrarea acestuia de către (PC Tehnician radiolog)

9. Consola de achiziție integrată (PC Tehnician radiolog), Software de achiziție a imaginii, Presetări personalizate

Descrierea softului care Consola de achiziție integrată (PC Tehnician radiolog) o găsim în manualul de operare paginile 121-125. În parte ce ține de parametrul **Presetări personalizate**, vă rugăm să consultați pagina nr. 121 unde este indicată disponibilitatea funcției de preset.

- Grid line suppression function
- Reject analysis function
- 9 Preset function
- Cobb's angle function
- Tube & Line Enhancement function

Extras din manualul de operare, pagina 121

Dar și pagina nr. 123 unde la fel este menționat despre disponibilitatea presetărilor de utilizator.

- ROI Shape : Support the shape of rectangle, circle and polygon
- MARK : Support the creation of up to 30 of MARKER by user (User preset support)
- Arrow Marker

Extras din manualul de operare, pagina 121

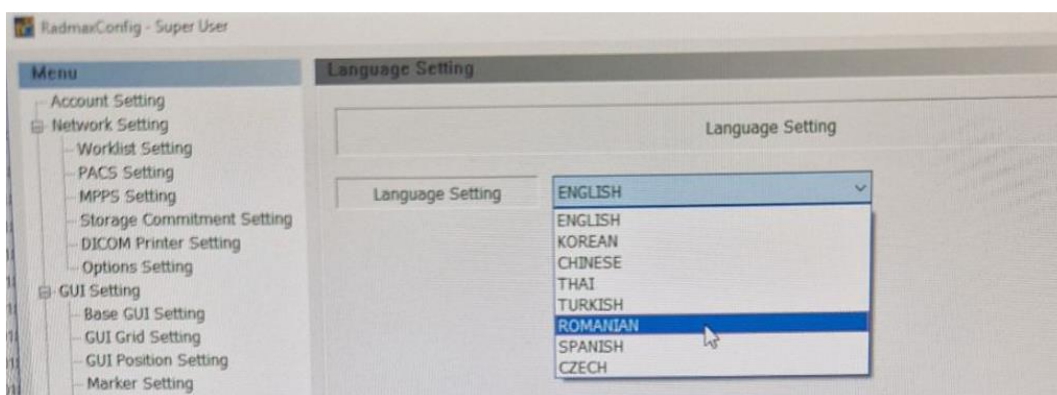
Suplimentar, vă rugăm să vizualizați pagina nr. 513 din manual de operare pe care o atașăm la acest răspuns, unde sunt indicați parametrii care pot fi modificați și create presetări noi personalizate de către utilizator.

①	X-ray Setting	Sets the kV, mA, ms, AEC, Field, Density, Screen, Filter and AEC BUT value among the shooting conditions of the selected APR. Double click the value in the above list and it will be listed as the preset item. Select the item to set the value.	
		Apply all detectors	Applies the APR information to all registered Detectors.
		COPY	Copy the X-ray data of activated APR information.
		PASTE	Paste the X-ray data of checked APR information.
		REFRESH	Refresh the X-ray data of activated APR information.
		SAVE	Save the X-ray data of activated APR information by editing values.

Extras din manualul de operare, pagina 513

10. Consola de achiziție integrată (PC Tehnician radiolog), Software de achiziție a imaginii, Interfața software rus/rom/eng

Interfața software rom/rus/eng se poate vedea în poza de mai jos care reprezintă un print-screen al meniului cu setările disponibile pentru modificarea limbii.



În parte ce ține de stația de **Stație de arhivare și procesare a imaginii**, menționăm că în cadrul configurației a fost oferit server model: # DELL Optiplex 7010 Tower i5-13500 8Gb SSD 512GB + 2.5" HDD 2.0TB Western Digital WD20SPZX +2x DDR4 8GB RAM memory, pe care va fi instalat PACS software **GEMPCAS** produs de DRGEM. Descrierea completa a acestui software este oferită în fișierul *RMD2406-001_GEMPACS Operation Manual_Rev.2.signed*, atașat la ofertă.

Referitor la clarificările ce țin de **Stație de arhivare și procesare a imaginii**, vă comunicăm următoarele:

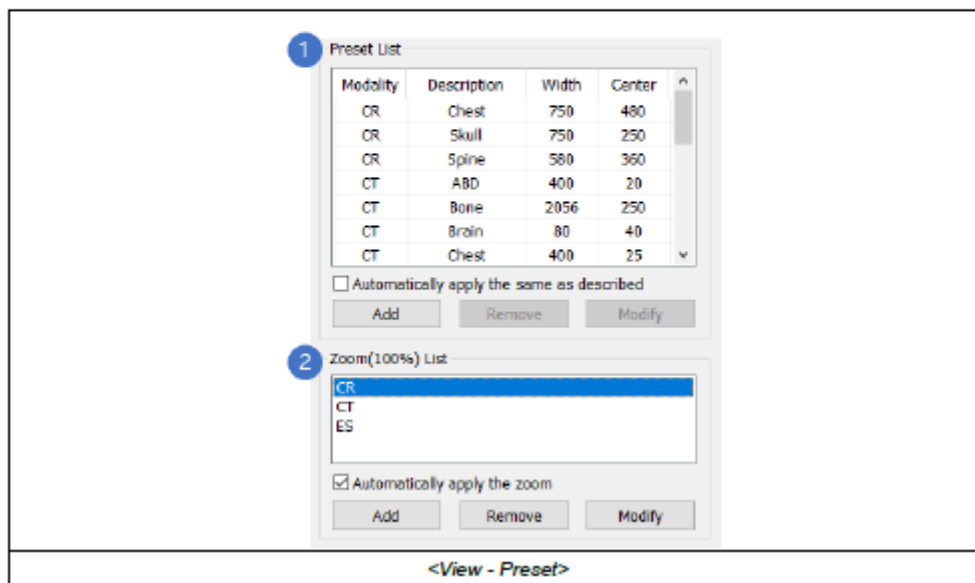
1. Stație de arhivare și procesare a imaginii, Software de achiziție a imaginii, Preseturi personalizate

Drept dovadă că software propus GEMPACS dispune de funția de preseturi personalizate, va rugăm să consultați pagina nr. 100 al fișierului *RMD2406-001_GEMPACS Operation Manual_Rev.2.signed* atașat la ofertă.

- **Preset**

This is the window where you can set the Window Width and Window Center values for images.

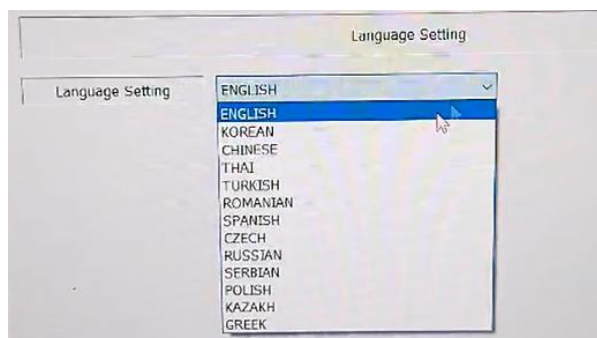
The Preset List allows multiple preset configurations for each Modality. Configured Preset Lists will appear in the Preset combo box in the toolbar on the main screen when opening images or exams, corresponding to the Modality.



Extras din manualul de operare GEMPACS , pagina nr. 100

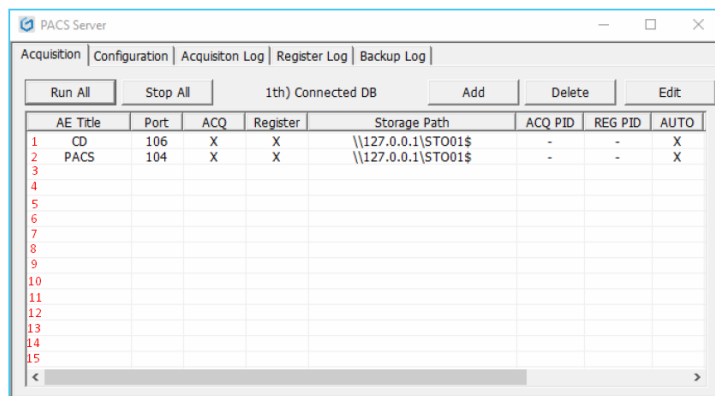
2. Stație de arhivare și procesare a imaginii, Software de achiziție a imaginii, Interfața software rus/rom/eng

Analog ca si în cazul software de pe consola de achiziție integrată (PC Tehnician radiolog). Softul GEMPACS la fel are disponibilitatea următoarelor setări limba pentru interfața de utilizator

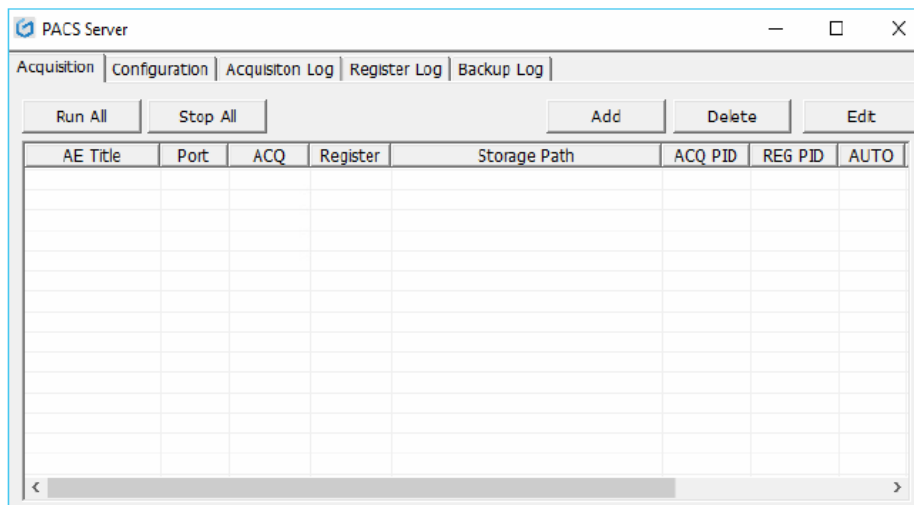


3. Stație de arhivare și procesare a imaginii, Pachet DICOM, transmitere min 10 noduri DICOM

Nu este o limitare în soft pentru numărul de noduri (conexiuni) DICOM, dar pentru a demonstra îndeplinirea cerinței date, va rugam să consultați poza de mai jos care cuprinde interfața de lucru pentru setările de conexiuni DICOM, în acest caz, avem minim 15 conexiuni disponibile.



2. First run screen.



Extras din manualul de service software GEMPACS, pagina nr. 60

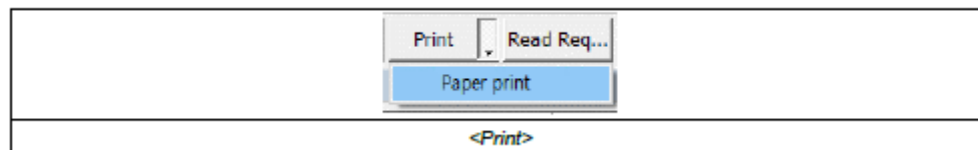
4. Certificat CE, ISO 13845

Vă rugăm să găsiți atașat la acest răspuns fișierul *[EN ISO 13485] Certificate_9767-2017-AQ-KOR-NA-PS Rev.5*, dar si fișierele *EU Declaration of Conformity_GEMPACS* și *DRGEM GEMPACS EAR CERTIFICATE*.

5. Stație de arhivare și procesare a imaginii, Pachet DICOM printare

Disponibilitatea funcției DICOM print, este descrisa la pagina nr. 35 a manualului de operare

6. Print

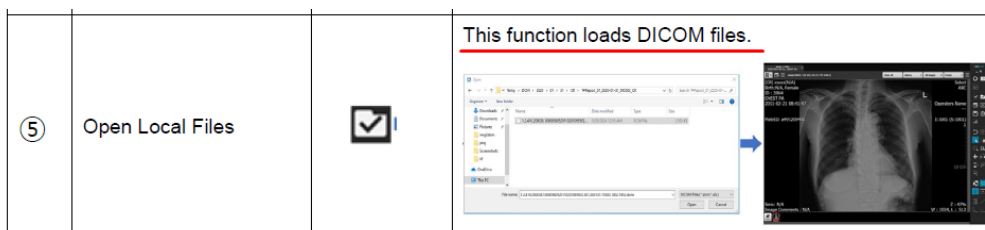


- This function allows printing DICOM images of selected Exams on a regular printer.
- Select one or more Exams from the Exam List and click the Print button or the expanded button to the right of the Print button, then click the Paper Print button.
- Selecting Paper Print displays a screen

Extras din manualul de operare GEMPACS, pagina nr. 35

6. Stație de arhivare și procesare a imaginii, Pachet DICOM import

GEMPCAS software este dedicat pentru a primi, stoca și prelucra imagini în format DICOM de la orice dispozitiv de radiografie, CT sau Rezonanță Magnetică care operează cu formatul DICOM. Suplimentar, softul are și posibilitatea de import fișiere DICOM din sursa locală cum ar fi PC, stick sau CD. Drept dovadă, vă rugăm să consultați pagina nr. 61 din manualul de operare GEMPACS software.



Extras din manualul de operare GEMPACS, pagina nr. 61

Vă mulțumim pentru cooperare și vă stăm la dispoziție pentru alte informații sau ulterioare clarificări.

Cu respect,

Șef Departament Comercial
S.C. Imunotehnomed S.R.L.

Digitally signed by Bolea Petru
Date: 2025.07.11 14:03:37 EEST
Location: Moldova
MOLDOVA EUROPEANĂ



Petru BOLEA

MANAGEMENT SYSTEM CERTIFICATE

Certificate no.:
9767-2017-AQ-KOR-NA-PS

Initial certification date:
07 April 2008

Valid:
20 November 2023 – 07 April 2026

This is to certify that the management system of

DRGEM Corporation

7FI, E-B/D Gwangmyeong Techno-Park, 60 Haan-ro, Gwangmyeong-si, Gyeonggi-do, 14322, Republic of Korea

and the sites as mentioned in the appendix accompanying this certificate

has been found to conform to the Quality Management System standard:

ISO 13485:2016 / EN ISO 13485:2016

This certificate is valid for the following scope:

Design, development, manufacture, servicing, installation, sales and distribution of Diagnostic X-Ray Equipment and sub-components

Digitally signed by Bolea Petru
Date: 2025.07.11 14:12:14 EEST
Reason: MoldSign Signature
Location: Moldova

MOLDOVA EUROPEANĂ



Place and date:
Høvik, 20 November 2023



For the issuing office:
DNV Product Assurance AS
Veritasveien 1, 1363 Høvik, Norway

Cecilie Gudesen Torp

Cecilie Gudesen Torp
Management Representative

Appendix to Certificate

DRGEM Corporation

Locations included in the certification are as follows:

Site Name	Site Address	Site Scope
DRGEM Corporation	7FI, E-B/D Gwangmyeong Techno-Park, 60 Haan-ro, Gwangmyeong-si, Gyeonggi-do, 14322, Republic of Korea	Design, development, servicing, installation, sales and distribution of Diagnostic X-Ray Equipment and sub-components
DRGEM Corporation (Factory 2)	213, Saneopdanji-ro, Eomo-myeon, Gimcheon-si, Gyeongsangbuk-do, 39536, Republic of Korea	Manufacture of Diagnostic X-Ray Equipment and sub-components
DRGEM Corporation (Factory 1)	116-59, Sanho-daero, Gumi-si, Gyeongsangbuk-do, 39377, Republic of Korea	Manufacture of Diagnostic X-Ray Equipment and sub-components

E.A.R. - CERTIFICATE

(Article 11 of the REGULATION (EU) 2017/745 on Medical Devices)

Reference No.: RDP 0694-2024

Date: 05/12/2024

Order No.: EU JC 045-2024

Manufacturer: DRGEM Corporation
Head Office: 7Fl, E-B/D Gwangmyeong
Techno-Park, 60 Haan-ro, Gwangmyeong-si,
Gyeonggi-do, 14322, Republic of Korea

Facilities: DRGEM Corporation
Head Office : 7Fl, E-B/D Gwangmyeong
Techno-Park, 60 Haan-ro, Gwangmyeong-si,
Gyeonggi-do, 14322, Republic of Korea
Factory 1 : 116-59, Sanho-daero, Gumi-si,
Gyeongsangbuk-do, 39377, Republic of
Korea
Factory 2 : 213, Saneopdanji-ro,
Eomo-myeon, Gimcheon-si,
Gyeongsangbuk-do, 39536, Republic of
Korea

Product Categories: Please See Annex A - List of Devices (1 Device, 1 Page)

Models: Please See Annex A - List of Devices (1 Device, 1 Page)

Obelis s.a. declares it will assume the role of European Authorised Representative of the aforementioned manufacturer, provided that the manufacturer complied with the terms and conditions set out in the EAR Services Agreement, which entered into force in accordance with MDR (EU) 2017/745. on **01/03/2024**



Obelis s.a. - O.E.A.R.C.
Registered Address :
Bld Général Wahis 53
1030 Bruxelles
Tél. +32 2 732 59 54 - Fax +32 2 732 60 03

Mr. G. Elkayam CEO
Obelis sa



Obelis European Authorized Representative Center is member of the European Association of Authorized Representatives (E.A.A.R.).
Obelis s.a. is ISO 9001:2015 and ISO 13485:2016 certified.

*This certificate is not a confirmation of product notification nor an approval to place products on the market.

ANNEX to MDR/IVDR Certificates

Manufacturer: DRGEM Corporation

Country: Republic of Korea

#	Name of device	Intended use	Class and Rule under MDR	EMDN Code	GMDN Code	Basic UDI-DI	Mandated (Y/N)	Mandate starting date	Mandated Vigilance (Y/N)
1	GEMPA CS	The "GEMPACS" is intended for use in obtaining, storing, communicating, displaying and diagnosis assisting in of human anatomic images for medical diagnosis.	Class I, Rule 11	Z110 603	41670	88000111RP SGEM6000P 2	Y	19/11/2024	Y

Obelis s.a.

Date: 05/12/2024

Stamp

History log				
Version number	Version Date	Order Form number	Reference Number	Action
V1	05/12/2024	EU JC 045-2024	XX XXXX	First issuance



EU Declaration of Conformity

Manufacturer	DRGEM Corporation 7FI E-B/D Gwangmyeong Techno-Park 60, Haan-ro, Gwangmyeong-si, Gyeonggi-do, Republic of Korea, 14322 SRN(Single Registration Number): KR-MF-000017990
Authorized Representative	Obelis s.a. Bd. Général Wahis 53 B-1030 Brussels, Belgium Phone: 32.2.732.59.54 Fax: 32.2.732.60.03 E-mail: mail@obelis.net SRN: BE-AR-000000106
Conformity assessment	Annex IX, excl. Chapter II in Regulation (EU) 2017/745
Certificate No	-
Product	Basic UDI-DI: 88000111RPSGEM6000P2 Product Name: Radiological PACS Software Model: GEMPACS
Risk Classification	Class I by Rule 11 according to Annex VIII of Regulation (EU) 2017/745
Intended Purpose	The GEMPACS is intended for use in obtaining, storing, communicating, displaying and diagnosis assisting in of human anatomic images for medical diagnosis.

The declaration is issued under the sole responsibility of the **DRGEM Corporation**.

We here declare that the above mentioned products comply with REGULATION (EU) 2017/745 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 5 April 2017.

Place and date: Gwangmyeong, Republic of Korea, December 05, 2024

Name and Function: Jung-Byung Park / President
On behalf of DRGEM Corporation

Signature:





Ralco s.r.l.



R302MLP/A

**COLLIMATORE RADIOLOGICO MOTORIZZATO
CON LUCE E CONTROLLO POTENZIOMETRI**

**MOTORISED X-RAY COLLIMATOR
WITH LIGHT AND POTENTIOMETER CONTROLLED POSITIONING**

**MANUALE ISTRUZIONI / INSTRUCTIONS MANUAL
MTR302MLP/A**

Data Emissione:
Date of Issue:
24.01.2006

Livello di Revisione:
Revision Level:
12.06.2008

Emesso da:
Issued by:



.livello revisione/*revision level*:

<i>The English version of this manual is a translation of the Italian text, which prevails in case of doubts.</i>			
Rev. N	Data/Date	N	Descrizione/Description
A	26.01.2007	MRM/048/06	<i>Replace front panel group</i>
			Sostituzione del gruppo pannello anteriore
B	31.01.2007	MRM/024/07 MRM/025/07	Migliorata sostituzione specchio, pannello anteriore e posteriore
			<i>Improvment mirror substitution, front and rear covers</i>
C	29.03.2007	ACD/004/07 ACD/006/07	<i>Preventive action: Rear cover,</i> <i>Preventive action: Retractable tape measure.</i>
			Azione preventiva: coperchio posteriore Azione preventiva: metro retraibile
D	12.06.2008	MRE/15/08	FM 338 timer board updating
			Aggiornamento della scheda timer FM 338

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AND STORAGE

M - TROUBLESHOOTING

N - SUBSTITUTION, DISASSEMBLY, TRANSPORT AND STORAGE

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A - AVVISI / FRONT MATTER

LE RADIAZIONI EMESSE SONO DANNOSE PER L'OPERATORE E PER COLORO CHE SI TROVANO NELLA VICINANZE A MENO CHE NON SIANO OSSERVATE CORRETTAMENTE LE PROCEDURE PROTETTIVE. TUTTI COLORO CHE SONO AUTORIZZATI A INTERVENIRE SULL'APPARECCHIATURA RADIOLOGICA DEVONO CONOSCERE BENE LE PROCEDURE RIGUARDANTI LA PROTEZIONE CONTRO LE RADIAZIONI.	X-RAYS ARE DANGEROUS TO BOTH OPERATOR AND OTHERS IN THE VICINITY UNLESS ESTABLISHED SAFE EXPOSURE PROCEDURES ARE STRICTLY OBSERVED. THOSE AUTHORISED TO OPERATE OR SERVICE THE RADIOLOGICAL EQUIPMENT MUST BE THOROUGHLY FAMILIAR WITH THE PROCEDURES REGARDING RADIATION PROTECTION..
IL DISPOSITIVO SODDISFA I REQUISITI ESSENZIALI DESCRITTI NELL'ALLEGATO 1 DELLA DIRETTIVA 93/42/CEE ED È CLASSIFICATO SECONDO L'ALLEGATO IX IN CLASSE IIB. IL COLLIMATORE È CONFORME ALLE NORME: IEC 601-1, IEC 601-1-2, IEC 601-1-3.	THE COLLIMATOR DESCRIBED HEREIN CONFORMS TO THE REQUISITES DESCRIBED IN ATTACHMENT 1 AND IS CLASSIFIED CLASS IIB ACCORDING TO ATTACHMENT IV OF CEE 93/42/CEE DIRECTIVE. THE COLLIMATOR CONFORMS TO STANDARDS IEC 60601-1, IEC 60601-1-2, IEC 60601-1-3.
IL COLLIMATORE DEVE ESSERE INSTALLATO SU UN SISTEMA RADIOLOGICO GENERALE CONFORME ALLA DIRETTIVA CEE 93/42 LA CORRETTA INSTALLAZIONE, UTILIZZO E MANUTENZIONE DEL COLLIMATORE DOVREBBERO ESCLUDERE PROBLEMI DI FUNZIONAMENTO DEL COLLIMATORE STESSO E DEGLI APPARECCHI CIRCONSTANTI IN QUANTO LA RALCO HA SUPERATO LE PROVE EMC.	THE COLLIMATOR IS TO BE INSTALLED ON A GENERAL PURPOSE RADIOLOGY UNIT CONFORMING TO DIRECTIVE CEE 93/42. PROPER INSTALLATION, OPERATION AND MAINTENANCE OF THE COLLIMATOR SHOULD EXCLUDE OPERATION PROBLEMS OF THE COLLIMATOR AND OF THE SURROUNDING EQUIPMENT SINCE RALCO HAS SUCCESSFULLY PASSED EMC TESTING.
IL MANUALE ISTRUZIONI FORNISCE I RIFERIMENTI SU STANDARD E OPTIONALS. VERIFICARE LA VERSIONE ACQUISTATA SULL'ETICHETTA POSTA SULL'APPARECCHIO O NELLA DOCUMENTAZIONE AGGIUNTIVA..	THE INSTRUCTIONS MANUAL SUPPLIES INDICATIONS ON STANDARD OPTIONAL MATERIAL. SPECIFIC DATA REGARDING THE VERSION PURCHASED IS PROVIDED BY THE LABEL OR BY ANNEXED DOCUMENTATION.

CHIUNQUE SI TROVI AD UTILIZZARE QUESTO MANUALE DEVE LEGGERLO ATTENTAMENTE E PRESTARE ATTENZIONE AGLI AVVISI ED AI CONSIGLI IN ESSO CONTENUTI ANCHE NEL CASO IN CUI LA PERSONA INCARICATA DEL MONTAGGIO FOSSE ESPERTA DI COLLIMATORI RADIOLOGICI.	THE USER OF THIS MANUAL IS DIRECTED TO READ AND CAREFULLY REVIEW THE INSTRUCTIONS AND CAUTIONS CONTAINED HEREIN EVEN IF THE PERSON IS PERFECTLY CONVERSANT WITH THE INSTALLATION OF X-RAY COLLIMATOR.
VERIFICARE SUBITO DOPO L'INSTALLAZIONE LA SICUREZZA DEL SISTEMA GENERALE. QUANDO SI RENDE NECESSARIO SMONTARE LE COPERTURE FARE ATTENZIONE A RIMONTARLE CORRETTAMENTE – VEDI CAPITOLO - MANUTENZIONE.	TEST THE GENERAL SYSTEM SAFETY IMMEDIATELY AFTER ITS INSTALLATION. WHENEVER THE COVERS REQUIRE TO BE REMOVED CARE MUST BE TAKEN TO REMOUNT THEM CORRECTLY - SEE CHAPTER ON MAINTENANCE
L'INSTALLAZIONE E LE RIPARAZIONI DEL COLLIMATORE DEVONO ESSERE EFFETTUATE DA PERSONE AUTORIZZATE DALLA CASA COSTRUTTRICE DELL'APPARECCHIATURA RADIOLOGICA OPPURE DA PERSONA AUTORIZZATA DALLA RALCO STESSA. IL PERSONALE DEVE ESSERE A CONOSCENZA DELLE NORMATIVE SULLA SICUREZZA.	COLLIMATOR INSTALLATION AND SERVICING IS TO BE PERFORMED BY PERSONNEL AUTHORISED BY THE MANUFACTURE OF THE X-RAY EQUIPMENT OR BY RALCO SRL. PERSONNEL MUST BE FAMILIAR WITH THE SAFETY STANDARDS COVERING ELECTROMEDICAL EQUIPMENT
QUESTO DOCUMENTO E' STATO REDATTO E DISTRIBUITO DALLA RALCO SRL. PRODUTTRICE DEL COLLIMATORE IN OGGETTO. PER ULTERIORI INFORMAZIONI RIVOLGERSI A: RALCO SRL - VIA DEI TIGLI 13/G - 20046 BIASSONO (MI) - ITALIA FAX: ++39-039-2497.799 - EMAIL: RALCO@RALCO.IT	THIS DOCUMENT IS A TRANSLATION FROM THE ORIGINAL ITALIAN, PREPARED AND DISTRIBUTED BY RALCO SRL MANUFACTURER OF THE X-RAY COLLIMATOR DESCRIBED. ADDRESS ENQUIRIES TO: RALCO SRL -VIA DEI TIGLI 13/G -20046 BIAS- SONO (MI) - ITALIA FAX: ++39-039-2497.799 - EMAIL: RALCO@RALCO.IT

B - DESCRIPTION

Square-field, x-ray collimator suitable for installation on stationary x-ray equipment.

The x-ray field is defined by 6 pairs of shutters, four of which are lead-lined. The six pairs of shutter move perpendicularly within the x-ray field. Two pair of bronze shutters are located near the focus, two are located near the entrance window and two are located near the exit window of the x-ray beam from the collimator. The latter shutters serve to accurately define the x-ray field edges.

Shutter movements are motorised: shutter positioning is potentiometer controlled and adjusted remotely or by two knobs on the collimator front panel.

CHARACTERISTICS:

- External adjustment of mirror angulation.
- High luminosity provided by a quartz iodide lamp.
- Timer limiting projection lamp exposure time to 30 seconds thus extending lamp life and preventing overheating.
- Radiation shielding: 150 kVp - 4mA
- Minimum inherent filtration 2 mm aluminium equivalent. (1mm on request)
- Continuous film coverage from Min: 00 x 00 cm to Max: 48 x 48 cm at 100 cm FFD (SID).

The square-field X-ray beam Limiting Device is designed for installation on rotating or fixed anode X-ray tubes (**EN 60601-1-3 par 29.202.3**); motorised controls provide for the adjustment of the X-ray field dimension to the size of the image receptor or to that of the anatomical area of interest. Adjustment to the area under investigation is controlled remotely or by two knobs on the collimator front panel.

The direct visualisation of the x-ray field is given by a light beam which correspond to the x-ray beam, within a tolerance of two percent of the selected FFD (SID) value. The light-field centre is provided by the intersection of two perpendicular silk-screened lines into the Lexan window and projected on the light field by the light beam.

To activate the light field, press the area marked with the light symbol on the front of the device. The light will switch on for 30 seconds and an electronic timer will switch the lamp **OFF** automatically.

Average illumination is not less than 160 LUX; edge contrast ratio is minimum > 4:1.

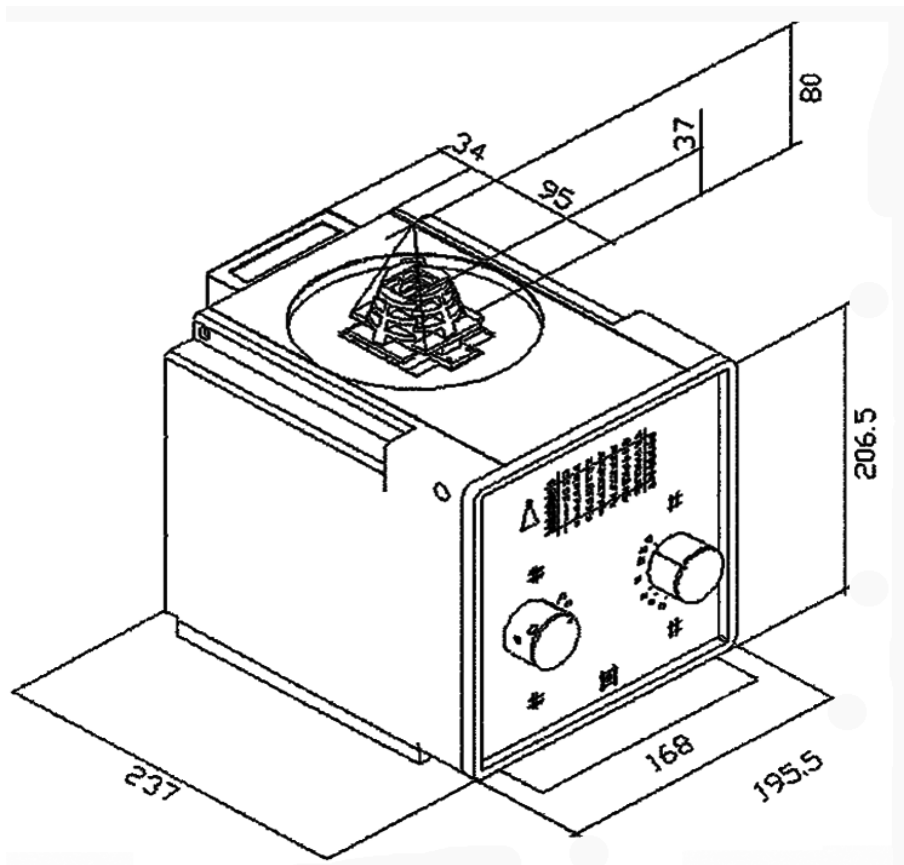
Field size at the different Focus Film Distance (FFD - SID) settings is shown on the front panel.

Figura 1I - R302/MLP/A



images\collimatori\302-A.jpg

Figura 2 - Dim. R302/MLP/A



images\collimatori\302\302_A.jpg

figure_descriz.fm

C - SPECIFICHE / SPECIFICATIONS

Filtrazione inerente in equivalente di alluminio : Fascio radiogeno = 75 kV EN 60601-1-3 par. 29.201.6 / 29.201.7	Min. Al 2 mm
Inherent filtration Al. equivalent : X-ray beam = 75 kV EN 60601-1-3 par. 29.201.6 / 29.201.7	
Limitazione Radiazione Extra-focale : Distanza focale prevista, D.F.F. 1 m EN 60601-1-3 par.29.202.3	< 150 mm
Limitation of Extra focal radiation: Set focus distance, FFD (SID) 1 m EN 60601-1-3 par.29.202.3	
Campo radiogeno quadro selezionabile: 1 m D.F.F - ($\pm 1\%$ FFD - SID) EN 60601-1-3 par. 29.202.4	Min: 00 x 00 cm Max: 48 x 48 cm
Square X-ray field selection : 1 m FFD (SID) - ($\pm 1\%$ FFD - SID) EN 60601-1-3 par. 29.202.4	
Campo radiogeno tondo selezionabile: 1 m D.F.F - ($\pm 1\%$ FFD - SID) EN 60601-1-3 par. 29.202.4	n.a.
Round X-ray field selection : 1 m FFD (SID) - ($\pm 1\%$ FFD - SID) EN 60601-1-3 par. 29.202.4	
Indicatore luminoso di campo - luminosità: Luminosità a 1m dal fuoco, campo impostato 35 x 35 cm , Lampada alimentata a 24V, conduttori da 1.5mm EN 60601-1-3 par. 29.202.7	> 160 lx
Light field indicator - luminosity: luminosity at 1 m from the focus, set field size 35x35 cm, 24V lamp supply, 1.5mm leads EN 60601-1-3 par. 29.202.7	
Indicatore luminoso di campo- contrasto: Contrasto ai bordi impostando 35x 35 cm a 1m dal fuoco EN 60601-1-3 par. 29.202.7	> 4:1
Light field indicator - contrast: edge contrast setting 35x35 cm at 1 m FFD (SID) EN 60601-1-3 par. 29.202.7	
Precisione dell'indicatore luminoso di campo: Corrispondenza con il campo radiogeno EN 60601-1-3 par. 29.202.9	< 1 % FFD - SID>
Light field indicator precision: Light field/x-ray field correspondence EN 60601-1-3 par. 29.202.9	

specifiche.fm

Precisione dell'indicazione di campo RX: Impostazione indice su scala graduata EN 60601-1-3 par. 29.202.8	< 2 % FFD - SID
X-ray field indication precision: Settings on an index scale EN 60601-1-3 par. 29.202.8	
Distanza fuoco ricettore : (optional) Precisione indicazione con metro retraibile EN 60601-1-3 par. 29.203.2	< 2 % FFD - SID
FDD (SID): (optional) Precision of measurement with retractable tape EN 60601-1-3 par. 29.203.2	
Radiazione di fuga: Misurata a 100 cm dal fuoco con fascio radiogeno = 150 kVp kVp / 4 mA - EN 60601-1-3 par. 29.204.3	< 40 mRh
Leakage radiation : Measured at 100 cm with x-ray beam = 150 kVp / 4 mA - EN 60601-1-3 par. 29.204.3	
Alimentazione lampada:	24 V DC/AC - 50/60 Hz -6.5 A
Power supply, lamp :	
Alimentazione motori:	24V DC - 250 mA
Power supply for motors:	
Alimentazione led	n.a.
Power supply for led	
Fusibile:	8 Amp delayed certified ritardato certificato
Fuse:	
Lampada / Lamp	OSRAM HLX 64638 - 100 W 24V
LED	n.a.
Filtrazione Aggiuntiva:	n.a.
Filtration, Additional	
Potenzimetri:	1 turn/giro - 1 Kohm 3 turns/giri - 1 Kohm
Campo quadro Campo tondo	
Potentiometers:	1 turn/giro - 1 Kohm 3 turns/giri - 1 Kohm
Square field Round field	

Portata massima delle guide porta-accessori	Carico statico:70N (circa 7.1 Kg) Carico dinamico:15Nm (circa 3.06 Kg)
Maximum load for accessory guides	Static load: 70N (about 7.1 Kg) Dynamic load:15Nm (approx. 3.06 Kg)
Utilizzo del collimatore:	Sistemi fissi di radiografia e tomografia.
Collimator operation:	Fixed equipment for radiography and tomography
Dotazione Standard:	- Manuale Istruzioni - Guida porta accessori
Items included with the collimator	- Instructions Manual - Accessories Rail
Peso/ Weight	10 kg

Validation of specification data:

- Validation of minimum filtration of the radiation unit (x-ray tube, collimator and possible filters) must be performed on a completely installed system by whoever is responsible for the installation.
- Validation of light field luminosity and contrast is performed in-factory. See Chapter **COMPLIANCE VERIFICATION**.
- Validation of system x-ray leakage is to be performed following the installation of the system components under the responsibility of the person performing the installation.
- The correct installation of the system, electronic calibration and wiring layout of the same are the responsibility of the engineer responsible for the installation of the system.
- Protection of the cable is to be provided by the installation engineer.

Ralco is prepared to provide any information required regarding the validation methods described above.

Classification**WARNING**

GUIDES FOR ACCESSORIES PRIOR TO INSERTING ACCESSORIES IN THE GUIDES CHECK ON THE PERFECT FIT OF THE SUPPORT WITH THE MOUNTING SLOT ON THE COLLIMATOR (TOLERANCE MAX. $\pm 0,5$ MM). A FAULTY FIT COULD BE DANGEROUS AND IT COULD CAUSE THE FALL OF ACCESSORIES

EN 60601-1 par. 5

- Protection against electric hazards: "Class I" equipment
- Protection against direct and indirect contacts: Type B equipment with applied parts.
- Protection against water see page: "Common equipment"
- Safety of operation in the presence of inflammable anaesthetics with air or oxygen or nitrous oxide: Equipment not suited to application in the presence of inflammable anaesthetic mixtures containing air or oxygen or nitrous oxide.
- Operation conditions: Equipment for continuous operation at intermittent loads - See Chapter OPERATION INSTRUCTIONS.
- Should label data on the collimator not correspond to the specifications herein, inform Ralco of the non conformity.
- Verifications of the specifications are to be performed according to the indicated equipment standards.

Operation environment:

- Ambient temperature = from 10°C to 40°C
- Relative Humidity = from 30% to 75%
- Atm. Press. = from 700 to 1060 hPa.

verifica_spec.fm

per collimatori dotati di metro	for collimators with tape measure
AVVISO	WARNING
<i>Uso del metro retraibile in collimatori dotati di questa funzione:</i> Il metro adottato è un metro standard montato su apparecchiatura radiologica. In questa applicazione il metro parte con la misurazione con un valore che corrisponde alla distanza fuoco/ bordo inferiore del collimatore; la massima estensione radiologica è di 2m max anche se, per ragioni meccaniche, il metro raggiunge 3 m max. A fine lettura meccanica massima viene riportata la scritta STOP. <u>Estendere e/o forzare il nastro del metro oltre a questa misura causa i seguenti inconvenienti:</u> • rottura del nastro oppure • distorsione del nastro oppure • l'impossibilità di fare rientrare il nastro nell'alloggiamento perché è stata forzata la tenuta della molla sul nastro creando una distorsione. NOTA: NON ESTENDERE IL NASTRO OLTRE IL NECESSARIO E IN OGNI CASO NON OLTRE LA SCRITTA STOP	<i>Use of the retractable tape measure in collimators with this feature:</i> The type of tape measure adopted is a standard tape mounted on a radiological unit. In this application the tape starts with values that correspond to the focus/collimator lower edge distance; maximum radiological measurement with the tape is 2 m max even though, for purely mechanical reasons, maximum tape extension is 3 m max. The indication of STOP is evident immediately after the maximum mechanical value. <u>Forcing and/or extending the tape beyond this point with cause the following inconveniences:</u> • Breakage of the tape or, • Distortion of the tape or, • Impossibility of retracting the tape into its lodging because the grip of the spring has been forced and hook-up is consequently distorted. NOTE: DO NOT EXTEND THE TAPE BEYOND THE INDICATION OF STOP

EN 60601-1-3 para. 29.205 - Focus-Skin Distance

Paragraphs 29.205.1 - 29.205.3 of the above standard deal with preventing the use of inappropriate focus/skin distances in order that the dose equivalent to the patient be kept as low as reasonably achievable.

29.205.1 - Radiation Equipment for fluoroscopy

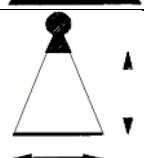
X-ray devices for fluoroscopy must feature characteristics that, during fluoroscopy, will prevent focus-skin distances less than:

- 20 cm if the x-ray device is specifically for fluoroscopy
- 30 cm for other applications

Conformity is measured and checked visually. The x-ray system must comply with the norm; this means that the operator is responsible for the verification. A focus/skin spacer device is an option made available by Ralco.

D - SIMBOLI/SYMBOLS

Simboli/ Symbols	Descrizione	Description	no.	Rif.CEI
	Corrente Alternata	Alternating Current	01-14	417-IEC 503
	Corrente Continua	Direct current	01-18	417-IEC 5031
	Corrente continue e Alternata	Both Direct and alternating current	01-19	417-IEC 5033
	Terra di protezione	Protective earth	01-20	417-IEC 5019
	Più; polarità positiva	Plus; positive polarity	01-27	417-IEC 5019
	Meno; polarità negativa	Minus; negative polarity	01-28	417-IEC 5006
	Entrata	Input	01-36	417-IEC 5006
	Uscita	Output	01-37	417-IEC 5034
	Controllo a distanza	Remote Control	01-38	
	Controllo manuale	Manual control	01-45	ISO 7000-096
	Controllo automatico	Automatic control (closed loop)	01-46	ISO 7000-0017
	Diaframma a iride aperto	Iris Diaphragm: open	01-69	ISO 7000-0017
	Diaframma a iride: chiuso	Iris Disaphragm: closed	01-70	417-IEC 5324
	Attenzione, consultare i documenti di accompagnamento	Attention: Consult accompanying documents	03-02	IEC 601-1
	Filtro di radiazione oppure filtrazione	Radiation filter or filtration	04-51	417-IEC 5381
	Indicatore luminoso del campo di radiazione	Light indicator of radiation field	04-51	417-IEC 5381
	Dispositivo di limitazione fascio: aperto	Beam limiting device: open	04-55	417-IEC 5385
	Dispositivo di limitazione fascio: chiuso	Beam limiting device: closed	04-56	417-IEC 5386

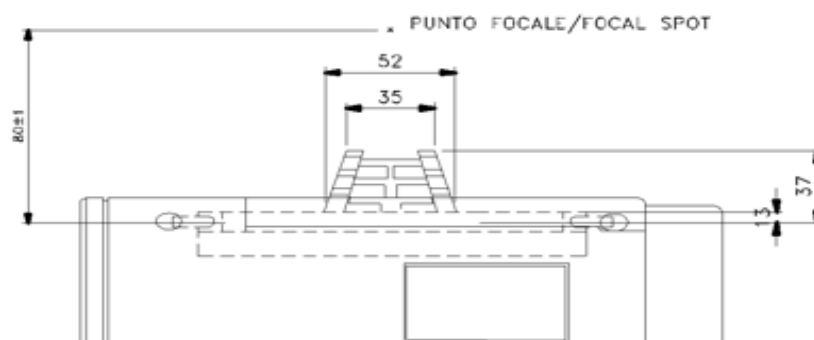
Simboli/ Symbols	Descrizione	Description	no.	Rif.CEI
	Dispositivo di limitazione fascio:chiuso con apertura separata della lamelle.	Beam limiting device: closed with separate opening of the shutters.	04-57	417-IEC 5387
	Dispositivo di limitazione fascio con chiusura separata della lamelle.	Beam limiting device with with separate closing of the shutters	04-58	417-IEC 5388
	Apparecchio tipo B	Type B device	02-02	601-I-IEC
	Attenzione radiazione Laser	Caution: Laser Radiation		60825-1
	Dispositivo sensibile all'energia elettrostatica.	Electrostatic sensitive device.		
	Dispositivo impostazione dimensione cassetta	Cassette size sensing device.		
	Dispositivo che richiede un corretto smaltimento.	Device requiring proper disposal.	attch.4	2002/95/CE

E - COMPATIBILITÀ CON LE CUFFIE RADIOGENE / COMPATIBILITY WITH X-RAY TUBES

N.B. I dati forniti qui di seguito sono in formato bilingue ciò per evitare discrepanze tra le versioni.

N.B. The following indications are edited in both languages to avoid providing contradictory information in the two versions

- | | |
|---|---|
| <p>a) La compatibilità tra il collimatore ed il tubo radiogeno è determinata dalla possibilità meccanica di montarli - vedi la Fig. 1 che segue.</p> <p>b) Accertarsi, consultando il manuale tecnico della cuffia radiogena, che la filtrazione interna minima sia conforme (1mm) ed abbia una perdita massima di radiazione di 30 mr/hr misurati ad un 1m dalla sorgente. (150 kVp, 4 mA.)</p> <p>c) I valori della sorgente (cuffia radiogena-collimatore) non devono essere inferiori a 3mm di Alluminio per la filtrazione e non oltrepassare 100 mR/Hr per la perdita di radiazioni. (EN 60601-1-3 par. 29.201.7/29.201.6 e 21 CFR sub-chapter J, part 1020.30 (m) (1).</p> <p>d) La flangia di montaggio del collimatore al tubo radiogeno deve essere fornita con il collimatore o con il tubo. Se la flangia usata è di altra provenienza la sorgente deve essere verificata per la radiazione di fuga.</p> <p>e) La distanza dal fuoco del tubo radiogeno al piano di montaggio della flangia (piastra superiore del collimatore) deve essere di 80 mm (3.14"), tolleranza +/- 1 mm (0.04").</p> | <p><i>a) Collimator/x-ray tube compotibility is determined by the mechanical possibility of mounting them - See the following Fig.1.</i></p> <p><i>b) Collimator R605DASM has no inherent filtration. Check that the tube housing literature indicates congruent minimum inherent filtration (1mm) and, that maximum radiation leakage is 30 mr/hour measured at one meter from the source when operating at its leakage technique factors (150 kVp at 4 mA).</i></p> <p><i>c) Source values (tube housing-collimator) must not be less than 3mm Al for filtration and must never exceed 100 mR/hr for radiation leakage. (EN 60601-1-3 par. 29.201.7/29.201.6 e 21 CFR sub-chapter J, part 1020.30 (m) (1).</i></p> <p><i>d) The collimator mounting flange must be provided with the collimator or with the tube. If a flange other than the one supplied is used, the source must be verified with regards to radiation leakage.</i></p> <p><i>e) The distance between the tube x-ray focus and the flange mounting plane (collimator upper plate) must be 80 mm (3.14"), tolerance +/- 1mm (0.04").</i></p> |
|---|---|



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F - INSTALLATION

MOUNTING THE COLLIMATOR TO THE X-RAY TUBE

WARNING:

CAREFULLY FOLLOW THE MOUNTING INSTRUCTIONS AND MAKE SURE THAT THE COLLIMATOR IS CORRECTLY ASSEMBLED. INCORRECT MOUNTING COULD BE DANGEROUS: IT COULD CAUSE THE COLLIMATOR TO FALL OR TO OPERATE INACCURATELY

- a) Determine the distance from the focal spot to the tube port face from the X-ray tube housing literature
- b) Subtract the resulting distance from 80 mm. (3.15") and determine how many 1.5 mm (0.06") spacers combined with the thickness of the mounting flange will make up the difference (20mm for the fixed flange; 18mm for the rotating flange; 21.5 mm for collimator R806D). Allowable tolerance is 1 mm. (0.04").
- c) Make sure that the flange is perfectly interchangeable with a Ralco flange - see **Figure 1 - Collimator/X-ray tube Adapter Mounting Flange** in this Chapter.
- d) Select four bolts of suitable thread (M6) and of such a length that they protrude through the flange and spacers far enough to engage at least 5 threads into the tube port face. Securely bolt the flange to the tube port face..

WARNING

TO SAFEGUARD THE OPERATOR AND PATIENT AGAINST THE HAZARD OF A FALLING COLLIMATOR, THE FOLLOWING INDICATIONS MUST BE RESPECTED.

- e) Unscrew the four mounting and centering adjustment Allen screws until the four tongues are withdrawn from the collimator top opening.
See **Figure 2 - Collimator/X-ray tube Adapter Mounting Flange** in this Chapter..

NOTE:

WHEN UNSCREWING THE ALLEN SCREWS WHICH CONTROL THE TABS, DO NOT USE FORCE EXCEEDING 0,55 NM.

UNSCREW WITH CARE SO AS NOT TO DAMAGE THE FIXING TABS.

- f) If feasible manually adjust the collimator shutters to their widest setting.
- g) Carefully couple the collimator with the tube to ascertain that the primary shutters have clearance to move in the port opening and in the mounting flange. See **Figure 1 Chapter COMPATIBILITY COLLIMATOR/X-RAY TUBE.**

Note: Collimators without extra-focal shutters do not require to perform preceding controls f and g.

- h) Place the collimator on the flange. Tighten the four mounting screws equally until the collimator is held firmly on the tube housing.

See **Figure 2** in this Chapter.

The collimator control tabs conform to **EN 60601-1- par 28.4**. Ralco recommends an appropriate force which ensures safe locking of the tabs min. 0.75 Nm (± 5 cNm)

WARNING:

MAKE SURE TO TIGHTEN THE M6 ALLEN SCREWS SECURING THE CONTROL TABS.

APPROPRIATE TIGHTENING OF THE 4 ALLEN SCREWS ENSURES SECURE MOUNTING OF THE COLLIMATOR. TIGHTENING FORCE USED MUST BE GREATER THAN 0.50 NM.

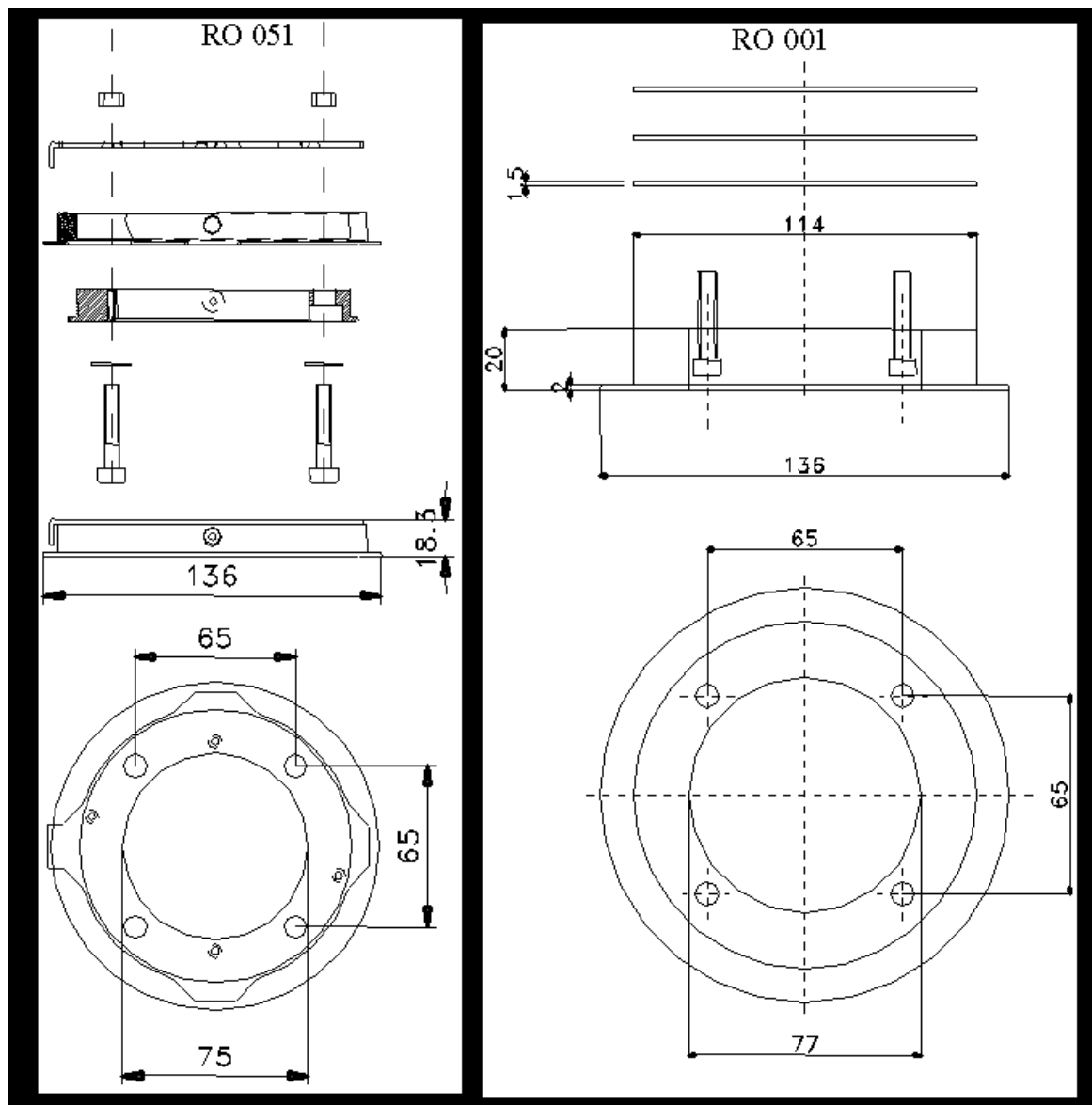
NOTE: IF THE COLLIMATOR IS TO BE MOUNTED ON A ROTATING FLANGE, USE A TIGHTENING FORCE BETWEEN MIN. 0,50 NM AND MAX. 0.75 NM.

- i) Check to see that the distance from the collimator housing to the mounting flange is equal in all directions and that the collimator face is parallel to the axis of the table.
- j) Loosen the screws and adjust if required.

Figura 1 - Flangia di Montaggio tubo-collimatore/ Tube-Collimator Mounting flange

RO 051 rotante/rotating

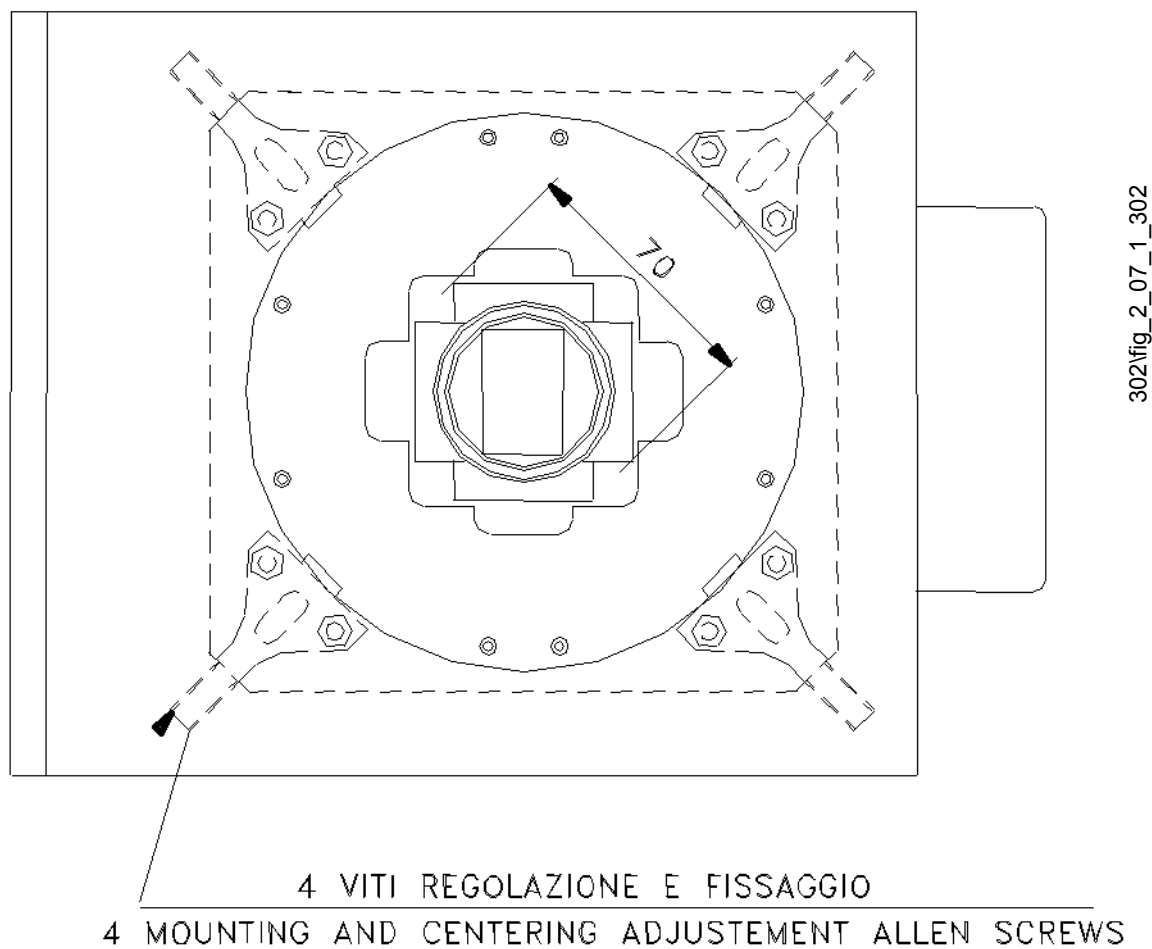
RO 001 fissa/fixed



collimatori\flange001_051

flangia_montag_coll-tubo.fm

Fig. 2



G - ELECTRICAL POWER CONNECTION

WARNING

COLLIMATOR SUPPLY IS NOT PROTECTED BY A FUSE.

CHECK THAT THE COLLIMATOR IS PROTECTED BY AN EXTERNAL FUSE PRIOR TO CONNECTION.

FUSE REQUIREMENTS:

- 4A DELAYED FOR COLLIMATORS WITH 100W- 24V LAMP
- 8A DELAYED FOR COLLIMATORS WITH 100W - 12V LAMP
- 8A DELAYED FOR COLLIMATORS WITH 150W- 24V LAMP
- MOTOR FUSE: 315 MA FOR MOTORISED COLLIMATORS,
- 2A DELAYED FOR COLLIMATORS WITH WHITE LED.

CABLES AND TERMINALS USED FOR THE INTERNAL CONNECTION OF THE COLLIMATOR MUST BE SUITABLE FOR OPERATION AT TEMPERATURES OF 70° C AND COLLIMATOR CURRENT ABSORPTION

Power supply connection:

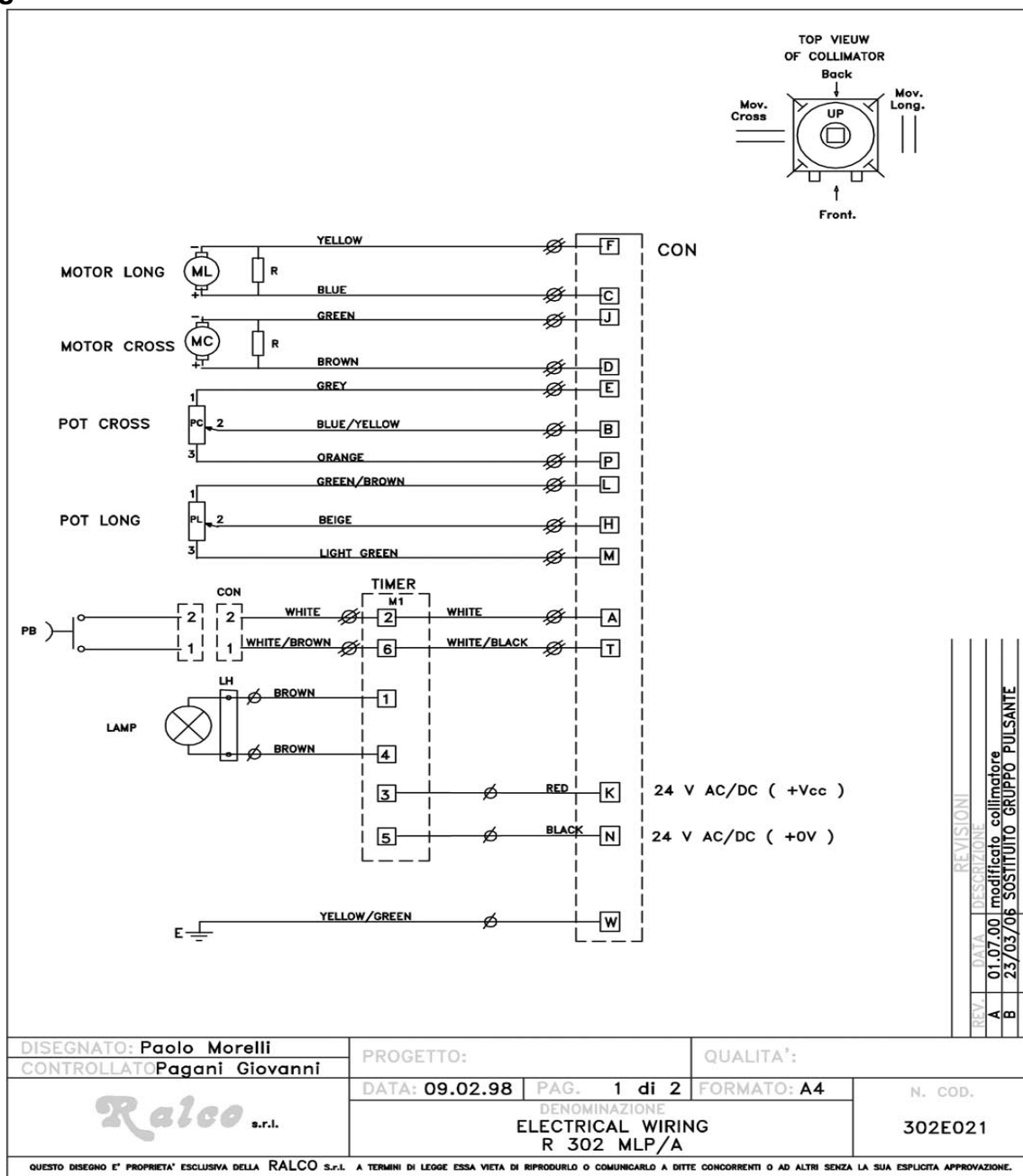
- Depending on the model of collimator, unscrew the screws on the rear cover or panel; remove the cover or panel
- On collimators with this feature, remove the free cable stop.
- Connect the the supply cables.
- On collimators with this feature, re-mount the cable stop and tighten the screws to immobilise the cable.
- Remount the rear cover or panel, depending on the collimator model

WARNING

INCORRECT POWER SUPPLY COULD DAMAGE THE ELECTRONIC TIMER AND/OR THE LAMP.

SUPPLY TO THE QUARTZ IODIDE LAMP AND TIMER MAY BE EITHER IN ALTERNATE CURRENT OR DIRECT CURRENT - IN THE LATTER CASE MAKE CERTAIN THE POLARITY IS RESPECTED

Fig. 1



CON	MICROPIN MALE	2	MP11398
R	AMP CONNECTOR MALE 2 WAYS	1	MP11397
P.B.	PUSH BUTTON	1	MP11716
TIMER	ELECTRIC TIMER BOARD FM338 24V	1	GE00034
E	PROTECTION HEART	1	MP11772
CON	CONNECTOR AMP 201359/1 (PIN GUIDA MASCHIO IN A)	1	GE00504
Ø	Ø1 mmq ELECTRIC WIRING	1	GE00177
Ø	Ø0.35 mmq ELECTRIC WIRING	1	GE00177
L	ALOGEN LAMP 24V 100W	1	MP11737
LH	LAMP HOLDER 905/1	1	MP11720
PC-PL	POTENTIOMETER SERVO 1 Kohm	2	MP11810
ML-MC	MOTOR C/C 2224 24V 79.4:1	2	MP11894

POSIZ.	DENOMINAZIONE	N° PEZZI	N° DISEGNO
DISEGNATO: Paolo Morelli	PROGETTO:	QUALITA':	
CONTROLLATO: Pagani Giovanni	DATA: 09.02.98	PAG. 2 di 2	FORMATO: A4
	DENOMINAZIONE	N. COD.	
	ELECTRICAL WIRING	302E021	
	R 302 MLP/A		

H - COLLIMATOR CALIBRATION

WARNING:

THE FOLLOWING PROCEDURES REQUIRE THAT X-RADIATION BE PRODUCED. TAKE ADEQUATE PRECAUTIONS TO SEE THAT NO PART OF THE HUMAN BODY IS EXPOSED TO X-RADIATION, DIRECT OR INDIRECT.

CENTERING, X-RAY BEAM

Place a 35x43 cm. (14x17") cassette on the table top or other flat, horizontal surface

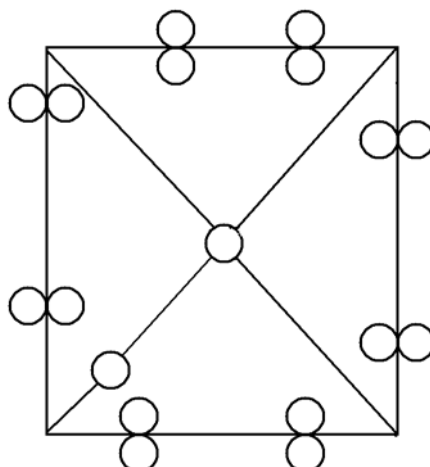
Position the x-ray tube/collimator assembly with the focal spot at 1 meter (40") above and with the x-ray beam perpendicular to the cassette surface. Do not use equipment scales for reference, but measure the distance from focal spot to cassette surface.

NOTE: IF ONE METER FFD (SID) CANNOT BE OBTAINED, USE THE OBTAINABLE FFD (SID) THAT IS CLOSEST TO ONE METER AND CALCULATE THE MEASUREMENT TOLERANCES AS THE APPROPRIATE PERCENTAGES OF THE DISTANCE

If the x-ray beam cannot be oriented vertically, then make provision by using clamps, masking tape, etc. as required to place the test objects and image receptor at the specified FFD (SID) and perpendicular relative to the x-ray beam as described in the following procedures:

- Use the collimator light to centre the cassette in the field.
- Mark the location of the cassette with masking tape or other means so that it may be removed and replaced in the same position.
- Place white paper on top of the cassette to provide maximum contrast for the light field.
- Set the collimator to provide a field size of 30x30 cm. (14x14") at one meter (40").
- Activate the light field and use it to position 18 coins as shown in the diagram.
- Position each pair of coins touching one another so that the inner coin is lighted as much as possible and the outer coin is lighted as little as possible.

- The contact points will define the edges of the light field.
- The extra two coins are to be set:
- one in a corner to allow film angulation and,
- the second coin at the intersection of the diagonals in order to define film centre.
- Set the technique factors at the x-ray generator to produce a density of about 50 kVp, 5 mAs.
- Make an exposure. Remove the cassette and process the film.
- Use the test film to check the alignment described below.



COLLIMATOR TO FOCAL SPOT ALIGNMENT (PRIMARY SHUTTER CUT-OFF).

Inspect the four images of the four collimator shutters which form the edges of the x-ray field. A definitely indistinct edge indicates that the primary shutter, close to the focal spot, is the one forming the line, rather than the outermost shutter.

To correct the condition, use the four mounting/centering adjustment screws to shift the collimator in the direction of the indistinct line.

Repeat the test film exposure after making the adjustment.

NOTE: THE HEEL EFFECT WILL CAUSE THE FIELD TOWARD THE CATHODE TO BE SLIGHTLY LESS SHARP THAN ON THE OTHER THREE SIDES . THIS IS NORMAL AND CANNOT BE CORRECTED BY ADJUSTMENT. IN ADDITION, AN X-RAY TUBE OF 12 ° OR LESS TARGET ANGLE WILL PRODUCE AN ASYMMETRICALLY SHAPED FIELD WHEN A LARGE FIELD SIZE IS USED AT SHORT FFD (SID), BECAUSE OF ANODE CUT-OFF EFFECT. THIS IS NORMAL AND MAY NOT BE CORRECTED BY ADJUSTMENT.

LIGHT FIELD TO X-RAY FIELD ALIGNMENT.

EN 60601-1-3 par 29.202.9

Misalignment of the light field to the x-ray field in either the X (cross table) or Y (long table) direction must not exceed 2% of the FFD. In this case, it would be less than 20 mm (0.80"). If the test film shows that the light field (shown by the shadows of the markers) matches the x-ray field (shown by the shadow of the collimator shutters) to within the diameter of one marker and, if the diameter is less than 20 mm (1.80"), then alignment complies with the regulations.

Greater precision than this is possible. The recommended maximum deviation is one fourth. It is recommended that you adjust for the greatest degree of congruency possible.

If misalignment is detected in both X and Y directions, check that the spacing from the focal spot to the collimator mounting surface is 80 mm. ± 1 mm. (3.15" $\pm$.039"). If the spacing requires adjustment, repeat the test film exposure after the adjustment.

If the collimator mount spacing is correct, but adjustment is still necessary, do not move the collimator relative to the x-ray tube, but proceed as follows:

- Place the test film on the face of the cassette over the white paper.
- Place the cassette in the position originally marked.
- Check the correct position of the film by the shadows cast by the markers.
- Using the images of the collimator shutters as the reference for the shape and size of the x-ray field, adjust the light field to match.
- If adjustment is necessary, adjust the travel of the light-field in the transversal, vertical and longitudinal displacements.

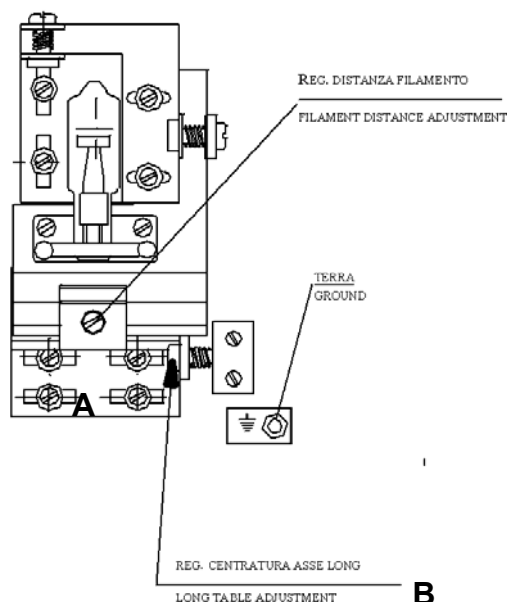
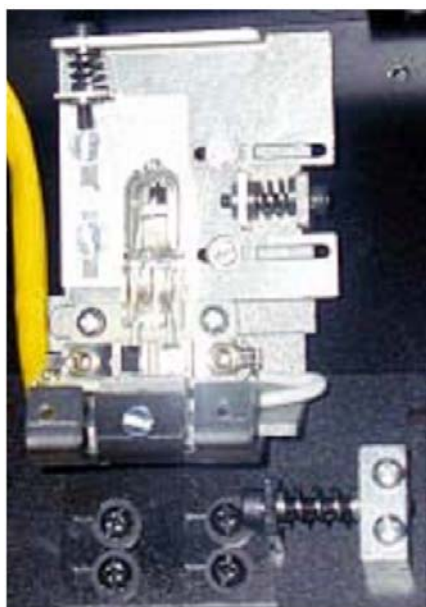
Transversal alignment:

WARNING:

DO NOT TOUCH THE DISSIPATOR WITH YOUR FINGERS IT COULD BE HOT AND CAUSE SEVERE BURNS.

- Remove the cover (See COVER REMOVAL)
- Remove the lamp protection (dissipator) by unscrewing the fixing screws and access the lamp holder.
- If the light field need to be shifted laterally, loosen (not remove) the 4 fixing screws **A**.
- To adjust for a lateral shift, use screws **B**.
- When calibration is terminated, lock the 4 screws **A**

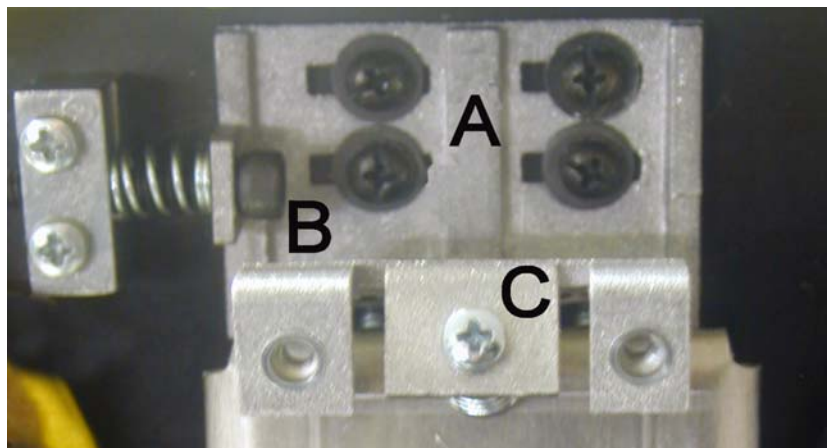
collimator\portlampada_302.jpg



collimator\portlamp_man.gif

Vertical Alignment

- If the light field is smaller than the x-ray field, lower the lamp by adjusting screw C
- If the light field is bigger than the x-ray field, raise the lamp by adjusting screw C



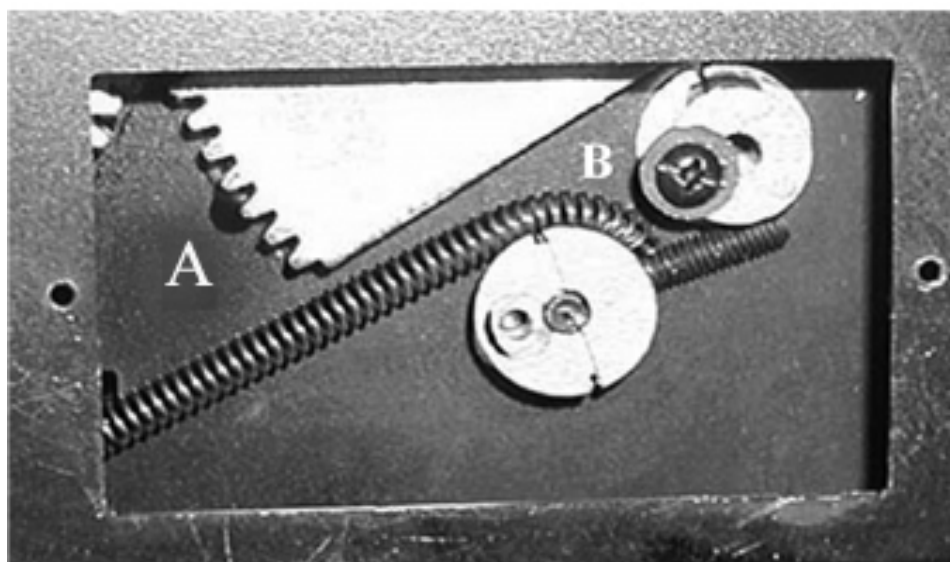
collimatori\302DACS\supporto_lampada_pg

Longitudinal adjustment

If the light field needs to be moved in the cross table direction, adjustment of the mirror is to be performed as follows:

- Remove the small plate on the right side of the collimator cover.
- Loosen the screws fixing the mirror stop and cam to allow cam rotation and mirror positioning.

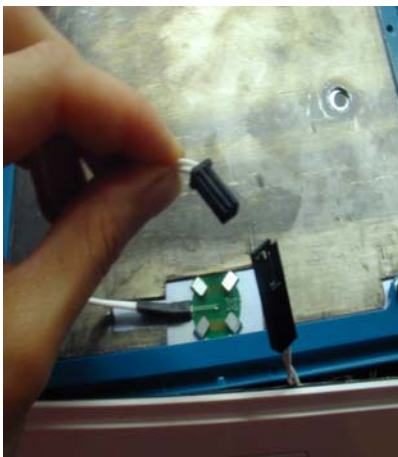
Tighten the cam and mirror screws after adjustment has been completed and remount the small plate.



Collimatori\302_9_long.jpg

I - SMONTAGGIO COPERTURE / COVER REMOVAL

(1).		
AVVITARE I QUATTRO GRANI PER FACILITARE LA RIMOZIONE DELLA COPERTURA		TIGHTEN THE FOUR ALLEN SCREWS TO ALLOW REMOVAL OF THE COVER.
(2).		
TOGLIERE LE DUE MANOPOLE DAL PANNELLO FRONTALE SVITANDO I 2 GRANI PER MANOPOLA.		REMOVE THE TWO KNOBS BY UNSCREWING THE TWO DOWELS PER KNOB.
(3).		
TOGLIERE LA FACCIATA AD INCASTRO SOLLEVANDOLA CON LE DITA COME MOSTRATO NELLA FOTO		REMOVE THE SNAP-FIT FRONT PANEL BY PRISING IT OFF AS SHOW IN THE PHOTOGRAPH

(4).		
SCOLLEGARE IL CONNETTORE		DISCONNECT THE CONNECTOR
(5).		
NELLE VERSIONI DI COLLIMATORE CON METRO, TOGLIERE IL FERMO ALLARGANDOLO DALLA BANDELLA E SFILANDOLO. QUINDI SFILARE LA BANDELLA E FARLA RIENTRARE ALL'INTERNO DEL COLLIMATORE.		IN COLLIMATORS WITH MEASURING TAPES, REMOVE THE TAPE STOP BY LIFTING IT OFF WITH A SCREW DRIVER. GENTLY EASE THE TAPE INTO ITS CONTAINER WITHIN THE COLLIMATOR
(6).		
GIRARE IL COLLIMATORE DALLA PARTE INFERIORE E SVITARE LE 4 VITI		TURN THE COLLIMATOR OVER AND UNSCREW THE FOUR SCREWS

(7).		
TOGLIERE IL COPERCHIO POSTERIORE SVITANDO LE 3 VITI. ATTENZIONE: QUANDO LA COPERTURA VIENE MONTATA PRESTARE ATTENZIONE CHE IL COPERCHIO POSTERIORE SIA ALLOGGIATO CORRETTAMENTE NELLA COPERTURA BIANCA. L'INADEGUATO ASSEMBLAGGIO POTREBBE DANNEGGIARE LA COPERTURA.		REMOVE THE REAR COVER BY UNSCREWING THE THREE SCREWS. WARNING: WHEN RE-MOUNTING THE COVER THE BACK PANEL MUST BE LODGED PERFECTLY IN THE WHITE COVER. INAPPROPRIATE ASSEMBLY COULD DAMAGE THE COVER.
(8).		
APPOGGIARE IL COLLIMATORE SULLA PARTE POSTERIORE, LEGGERMENTE SOLLEVATO, E SFILARE LA MEZZALUNA.		PLACE THE COLLIMATOR LOWER SIDE DOWN AND SLIGHTLY RAISE. SLIP THE SEMI-CIRCLE OUT.
(9).		
SFILARE LE COPERTURE LENTAMENTE - LO SPORTELLO SI LIBERA DA SOLO.		EASE THE COVER UPWARDS GENTLY. THIS WILL ALSO RELEASE THE SMALL PANEL

J - ADJUSTMENTS

FIELD SIZE INDICATION ADJUSTMENT

EN60601-1-3- par. 29.201.8

Regulations state that collimators must indicate the size of the X-Ray field at the FFD (SID) in use to within 2% of that FFD (SID). In this case, the indication must be correct to within 20 mm. (0.80").

Shutter Dial Adjustment:

- Rotate the two control knobs to completely close both sets of shutters. Use the field light to ascertain that the shutters are in fact closed.
- Rotate the knobs and make the knob index coincide exactly with the scale reading that coincides with size 30x30cm at 1m FFD (SID).
- Measure the x-ray field of the test exposure.
- If the reading is not correct, adjust the indicator through the screws on the sides of the knobs.

Bucky Light Line Adjustment - in collimators featuring a Bucky

Remove the collimator rear cover to gain access to the point of adjustment .

See Chapter COVER REMOVAL

Bucky Position Adjustment - in collimators featuring a Bucky:

- The line is to fall on a perpendicular bisector line constructed against the antidust plastic panel toward the control face of the collimator.
- To adjust the position of the line, shift the light support group as required. Note that the support group and bracket are inside the collimator frame and cannot be seen, but may be controlled by the two securing screws as shown in **Fig.1**.

Crosshair Alignment

- Activate the light-field.
- Turn the control knobs in turn and adjust the light field to a narrow line for each pair of shutters.
- Check that each narrow light line is projected exactly over the silk screened cross on the Lexan panel; i.e. equidistant from the edges.
- If adjustment of the panel is required, remove the cover from the sides and bottom of the collimator to gain access. See **COVER REMOVAL**.
- Loosen the four screws securing the plastic panel to the collimator frame and centre the cross with the light lines.

Friction Brake Adjustment

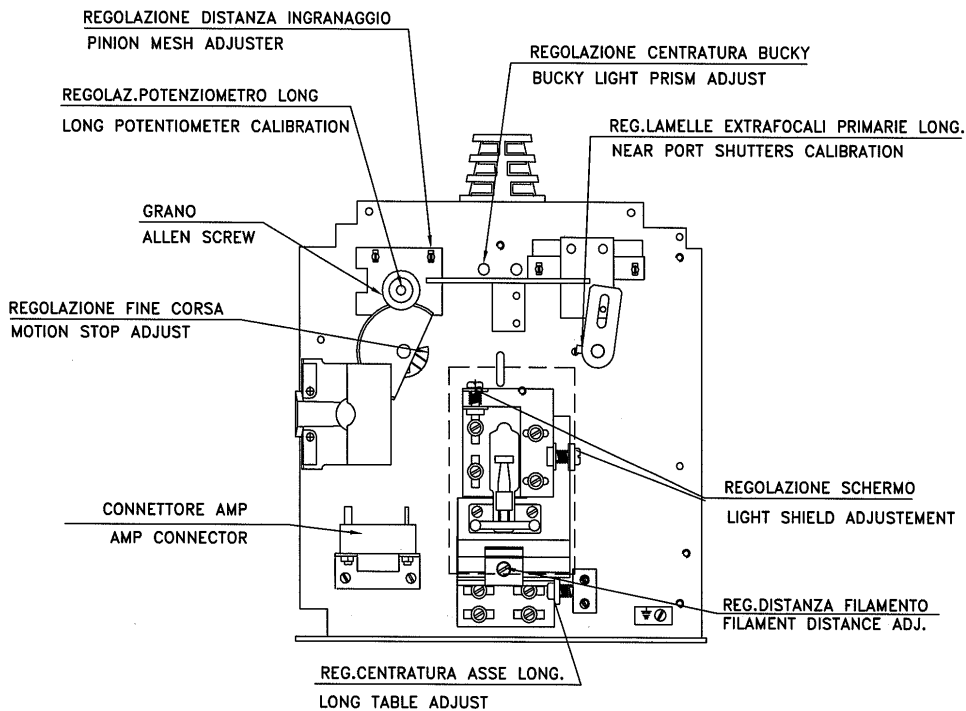
- If the shutters are too loose or too tight, proceed as follows:
- Remove the knobs and front panel to gain access to the adjustment point . See Chapter **COVER REMOVAL**.
- If a shutter control is too loose and does not hold position, tighten the two screws on the gear that frictions the shaft - See **Fig. 2**.

- If a shutter control is too tight, loosen the two screws on the gear that frictions the shaft . See **Fig. 2**
- Before replacing the knobs, close both shutters and calibrate the position of the indicators: these must show correct field size.- See **Field Size Indication Adjustment** in this Chapter.

Mechanical Motion Stop Adjustment

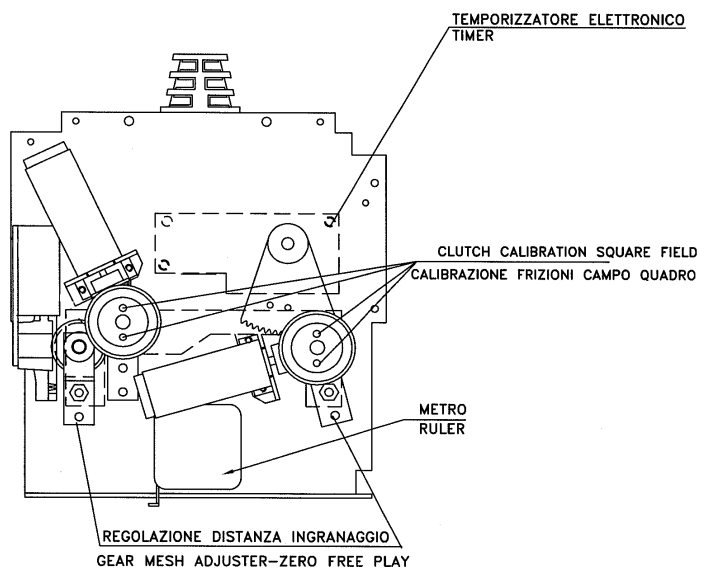
- The purpose of these stops is to prevent stressing the control shafts of the shutters at the two limits of travel This is done by limiting d rotation of the control shafts.
- Adjustment of these stops will not be required unless:
 - * The shutters cannot be completely closed or opened to the largest size.
 - * Torsion is felt at one or both ends of the travel.
 - * The shutters themselves appear to limit the motion rather than the stops.

**Figura 1 - Position
Posizione**



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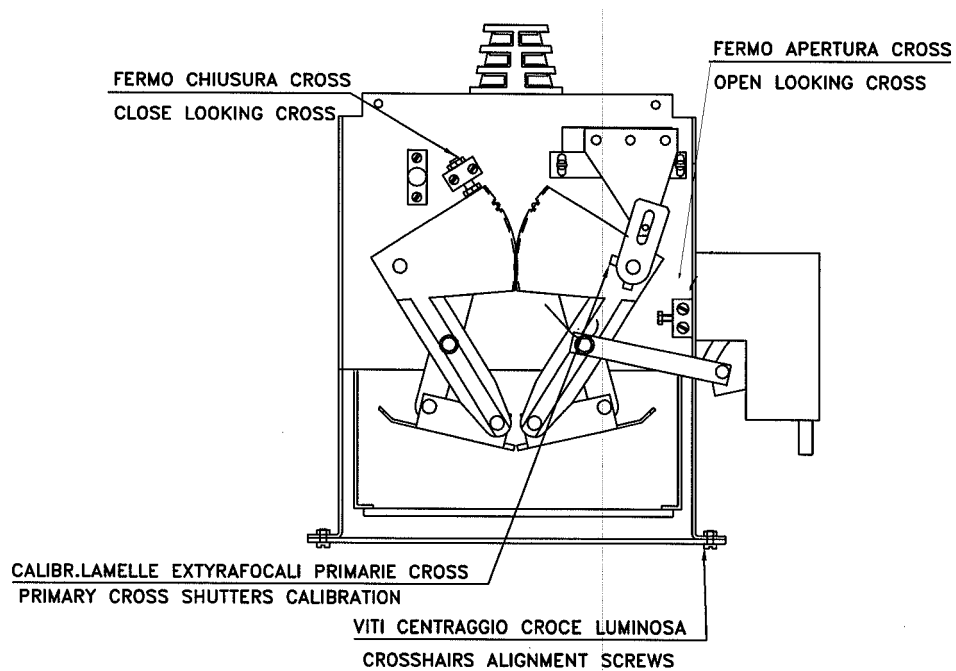
**Figura 2 - Friction Brake
Frizioni**



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Figura 3 - Regolazione dei fermi/



ADJUSTMENT OF THE STOPS:**CLOSED stop - Long Shutters**

- Remove the rear cover - See Chapter - **COVER REMOVAL**
- Loosen the Allen screw on the cam located on the left shaft under the larger potentiometer gear - **See Figure - Close stop Long Shutters** .
- Use the knob to bring the shutters to the closed position. Take care not to use more pressure than necessary to check that the shutters touch.
- Use the field light to check that shutters are closed.
- Rotate the cam stop to a standstill and tighten the screw.
- Open and close the shutters several times to check that they close and open completely and that when they close the cam touches the stop.

Fig. 1. - Close stop - Long shutters

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CLOSED stop - Cross Shutters

- Remove the collimator cover - See Chapter - **COVER REMOVAL**
- Tighten the screw on the upper rear right part of the collimator - See **Figure - Close Stop Cross Shutters**
- Using the light field, close the shutters several times to check that they close completely
- Loosen the screw until it touches the gear and check that when the shutters close, the gear touches the stop.
- Open and close the shutters several times to check that they close and open completely and that when they close the cam touches the stop.
- Tighten the fixing nut on the screw.

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Fig. 2. - Close Stop - Cross shutters.



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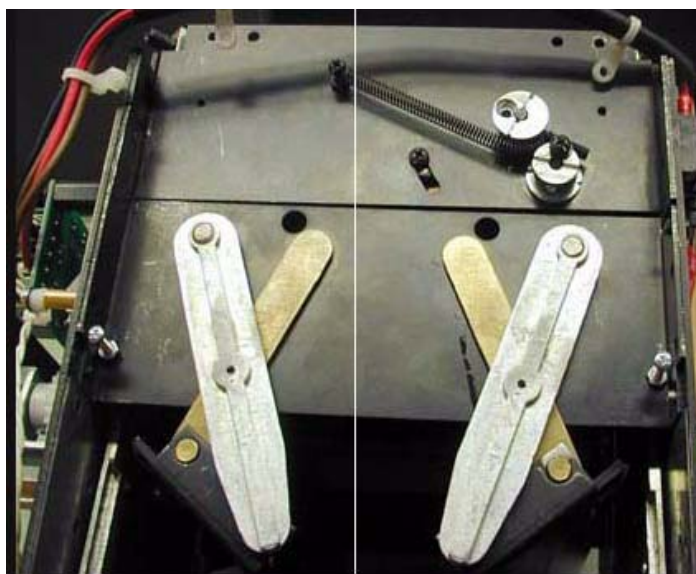
OPEN stop

- Remove the collimator covers - See Chapter - **COVER REMOVAL**.
- Remove the two lateral, leaded panels.

Long Shutters

- Loosen the two screws on the right side of the collimator. See **Figure: Long shutters**.
- Activate the light field and open the shutters to 43cm (17") projection at 90 cm (36").
- Tighten the two screws until they touch the shutter support levers.
- Open and close the shutters several times and make sure that both levers touch the screws.
- Tighten the fixing nut on the screw.

Fig. 3. Long shutters



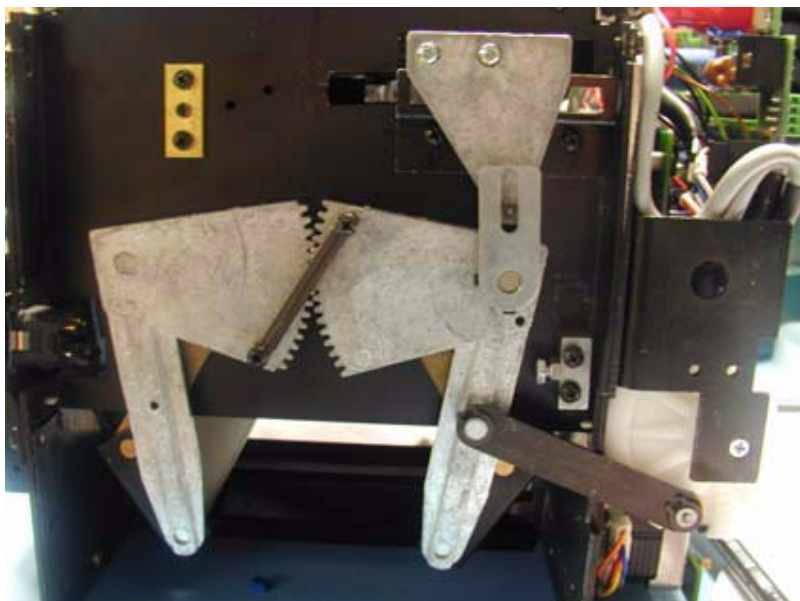
Cross Shutters

- Tighten the screw on the left side of the collimator. See **Figure: Cross Shutters**.

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- Activate the light field and open the shutters to 43cm (17") projection at 90 cm (36").
- Loosen the screw until the head touches the shutter support lever.
- Open and close the shutters several times and make sure that both levers touch the screws.
- Tighten the fixing nut on the screw.

Fig. 4.- Cross Shutters



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Potentiometer Adjustment

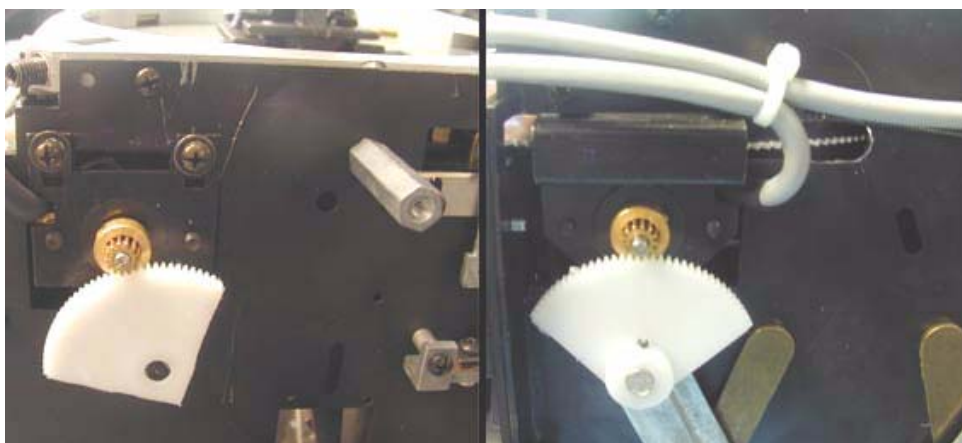
Potentiometers are located as follows:

Cross: right lateral wall - to access remove the cover - See Chapter - **COVER REMOVAL**.

Long : Back wall, upper left side - to access remove the rear cover
See Chapter - **COVER REMOVAL**.

Adjustment is performed by loosening the Allen screw on the gear and turning the potentiometer shaft. See **Figure: Pot Long and Cross Shutters**.

Fig. 5. Potentiometer Long shutters and Potentiometer Cross shutters



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K - COMPLIANCE VERIFICATION

MINIMUM FILTRATION REQUIREMENT:

To indicate compliance with 21 CFR, sub-chapter J, part 1020 of Performance Standard it is necessary for the assembler to perform a series of tests.

Description of test methods are illustrated in this chapter but factors, such as experience, availability of equipment and tolerance on compliance are referred directly to the Safety Standards covering Electromedical equipment.

WARNING:

THE FOLLOWING PROCEDURES REQUIRE THAT X-RADIATION BE PRODUCED. TAKE ADEQUATE PRECAUTIONS THAT NO PART OF HUMAN BEING IS EXPOSED TO X-RADIATION, DIRECT OR INDIRECT.

The above HVL requirements can be met if it is demonstrated that the aluminium equivalent in the primary beam is not less than that shown in the following table:

Tabella 1: Minimum Filtration Requirement - Beam Quality (Hvl)

Designed operating range (kVp)	Measured Operating Potential (Kvp)	Minimum Hvl (Mm. Of Al) X-ray System
Below 50	30	0.3
	40	0.4
	50	0.5
From 51 a70	51	1.2
	60	1.3
	70	1.5
Above 71	71	2.1
	80	2.3
	90	2.5
	100	2.7
	110	3.0
	120	3.2
	130	3.5
	140	3.8
	150	4.1

The information contained in the above table was extracted from the Code of Federal Regulations FDA 21 1020.30 (m).

Type 1100 Aluminium Alloy (as given in " ALUMINUM STANDARDS AND DATA" verification of compliance)**Visual determination of half-value layer (hvl)**

The above HVL requirements can be met if it is demonstrated that the aluminium equivalent in the primary beam is not less than that shown in the following Total Filtration table:

Tabella 2: Total Filtration Of Primary Beam In Aluminium Equivalence

Operating Voltage (kVp)	Total Filtration (mm.Al.Equivalent)
Below 50	0.5
From 51 to 70	1.5
Over 70	2.2

The Aluminium equivalence of each component in the primary beam (x-ray tube and housing, beam limiting device and any additional filtration in the system) is specified on the component, in the technical data attached to the component or can be measured. Determine the total aluminium equivalence in the primary beam and make sure that it is equal or greater than those specified in the above **Table 2 (Total Filtration of Primary Beam in Aluminium Equivalence)**.

Quick-check of minimum filtration requirement at a particular kvp

If the total inherent filtration cannot be seen, then the HVL must be obtained with the following procedures:

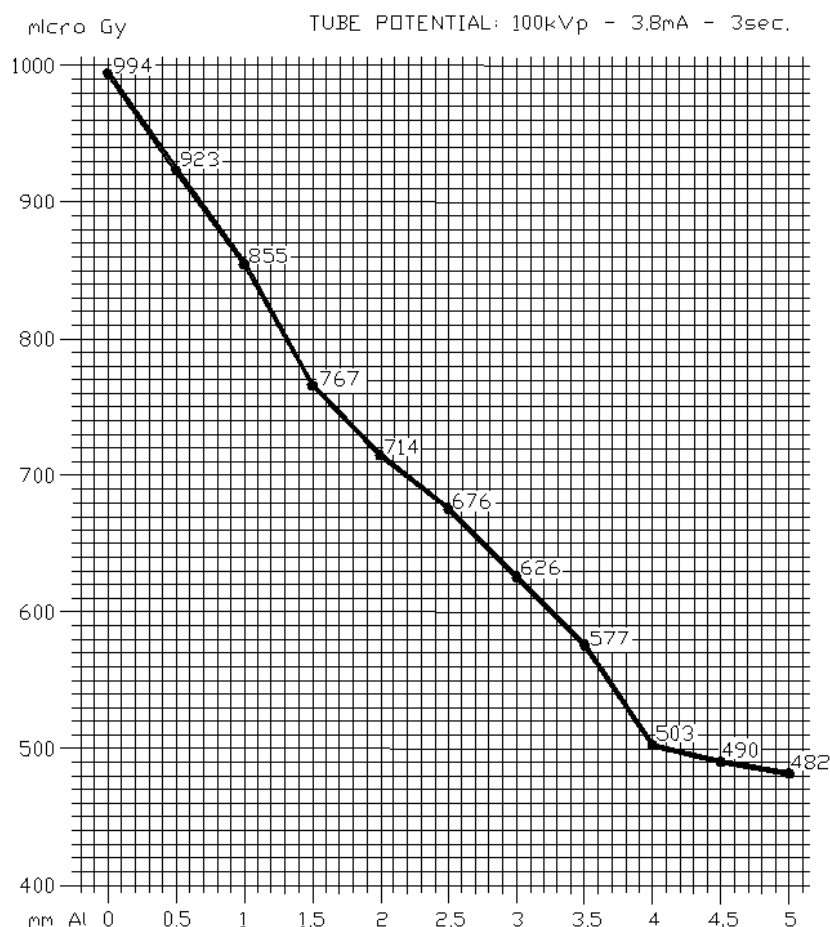
The HVL in millimetres of aluminium in the system under test must be compared with those specified in **Table 1 (Minimum Filtration Requirement - Beam Quality (HVL))** and must be greater than or equal to the values shown in the table.

- Direct the central x-ray beam perpendicular and in the center of a RAD-Check instrument. Determine the exact distance from the x-ray tube focal spot to the window of the collimator (273 mm - 10.75"). Place the input area of the RAD-CHECK at an equal distance from the collimator window. Collimate the beam to an area slightly larger than the detector.
- Make an exposure at a pre-selected technique factor of 90 kVp and appropriate mA and time values with no added filtration in the beam; record the reading.
Using the type 1100 Aluminium Alloy, tape a total of 2.5 mm of Aluminium to the window of the collimator. Make an exposure using the same technique factors; record the reading.
- Verify that the radiation read with the 2.5 mm Al in the beam is greater or equal to 50% of the radiation read with no filtration in the beam.

Standard absorber method

The HVL determination obtained from the following procedures are to be compared with those illustrated in the **Table 1 - (Minimum Filtration Requirement - Beam Quality (HvI))**. The hvl in millimeters of aluminium obtained during the test must be greater or equal than the values listed in the above mentioned table.

- Direct the central x-ray beam perpendicular and in the center of a RAD-Check instrument. Determine the exact distance from the x-ray tube focal spot to the window of the collimator (273 mm - 10.75"). Place the input area of the RAD-CHECK at an equal distance from the collimator window. Collimate the beam to an area slightly larger than the detector.
- Select a tube potential of 100 kVp and appropriate mA and seconds, with no added filtration in the beam make an exposure and record the reading. Using a set of several sheets of 1100 Aluminium Alloy, each having a thickness of 0.5 or 1.0 mm, tape the filtration to the window of the collimator. Make an exposure for each increments of filtration and record the reading.
- Plot the exposure readings (log scale) versus the total added filtration thickness on semilog paper; see the sample hereunder.



- d) Verify that HLV values in the useful beam for the above specific tube potential is not less than the values shown in **Table 1**.

VISUAL DEFINITION OF X-RAY VERSUS LIGHT FIELD

Chapter: **COLLIMATOR CALIBRATION** - paragraph **Light-field to x-ray field alignment**.

FIELD SIZE INDICATION

Chapter: **ADJUSTMENTS** - paragraph **Field Size Indication**.

CROSSHAIR ALIGNMENT

Chapter : **ADJUSTMENTS** - paragraph **Crosshair alignment**.

LIGHT FIELD ILLUMINATION INTENSITY.

- a) When a light field simulating the X-Ray field is used the illumination provided at 100 cm. cannot be less than : 160 lux (21 CFR 1020.31 (d) (2) (ii))
- b) Place the Focus of the X-Ray tube at 100 cm. from the table top where the light field has been projected. Open the collimator's shutters to assure that each quadrant of the light field is larger than the measuring area of the photometer.
- c) Check that the voltage specified by the manufacturer is applied to the lamp, make certain that all surfaces in the light beam are clean and unobstructed.
- d) Place a photometer capable of reading up to 160 lux in the centre of each of the four quadrants of the light field.
- e) Turn on the light beam and read the light intensity, subtract to it the ambient lighting, previously determined.
- f) Verify that the average illumination is higher than 160 lux.
- g) Verify that the contrast ratio is performed between two points:
 - the first point at 3mm outside the edge of the light field
 - the second point at 3mm inside the edge of the light field.These measurements are to be performed with the probe of the luxmetre set at 1mm aperture.
- h) Record the measured values including all data regarding the instrument and voltage employed.

L - OPERATION INSTRUCTIONS

Light/x-ray field setting

- Check the number related to field dimensions/FFD setting from the table on the front panel.
- Rotate the knobs and, with the knob index, follow the tags of the scale.
- Do not force the knobs.
- The collimator is ready to operate
- Activate the light field by pressing the related pushbutton on the front panel.

WARNING:

PROLONGED LIGHTING WITHOUT ALLOWING THE LAMP TO COOL CAUSES THE COLLIMATOR TO OVERHEAT IN THE AREA NEAR THE LAMP.

FOR EMERGENCIES: MAXIMUM LIMIT ADVISED IS 5 SUCCESSIVE LAMP OPERATIONS. ALLOW THE COLLIMATOR TO COOL (ABOUT 10 MIN.)

THE OPERATOR MUST AVOID OVERHEATING THE COLLIMATOR AND CARE MUST BE TAKEN NOT TO SCORCH HIMSELF OR THE PATIENT.

The collimator has been designed to operate as follows:

- Supply constantly connected during operation of the equipment.
- Lamp ON time for the light field is factory set at 30s (tol 20%). It is adjustable from 15 to 45 seconds via a trimmer on the timer board.
- Two ON/OFF cycles should normally be followed by an idle time of 4 minutes to allow for cooling time (i.e: 1 minute ON/ 4 minutes OFF).
- The field is set by the two knobs on the front panel by following the indications of the scale with the knob index or visually with the light field.

Tabella su pannello frontale / Table on the Front Panel.

La tabella sul pannello frontale consente di ricavare il numero da impostare con l'indice manopole. Il numero da impostare si ottiene incrociando la DFF in uso (freccia verticale) con la riga del formato cassetta in cm o inch (freccia orizzontale)

The table allows to read the number to be set with the knobs.
The number is found by crossing the FFD(SID) in use, value (vertical arrow), with the Cassette size value in cm or inches (horizontal arrow)

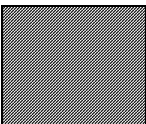
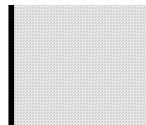
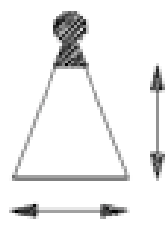
DFF in uso	FFD/SID in use
	
Format desiderato	Format required
	
Impostazione indice manopola	Knob index setting
	

Figura 1 - R302 series

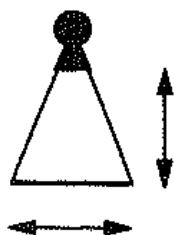
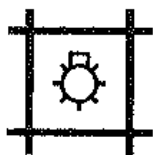


cm	13	18	24	30	35	40	43	
90	14	20	27	33	39	44	47	36"
100	13	18	24	30	35	40	43	40"
120	11	15	20	25	29	33	36	48"
150	9	12	15	20	23	26	28	60"
180	8	10	13	16	19	22	24	72"
200	7	9	12	15	17	20	22	78"
	5"	7"	9.5"	12"	14"	16"	17"	Inch

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Figura 2 - R221



cm	13	18	24	30	35	40	43	
90	14	20	27	33	39	44	47	36"
100	13	18	24	30	35	40	43	40"
150	10	12	16	20	23,5	26,5	28	60"
180	8	10,5	13	16,5	19,5	22	24	72"
	5"	7"	9,5"	12"	14"	16"	17"	Inch

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M - TROUBLESHOOTING

Should the Collimator become faulty do not use it until it is completely repaired.

The use of a faulty collimator might impair the safety of the operator and patient.

Before returning the collimator to Ralco for repair, please make sure that it isn't one of the following problems to cause the fault.

:

problem	cause	solution
The lamp fails to switch ON	The collimator is not supplied correctly	Check supply/ Tension/current/ polarity/ Fuses
	The lamp is faulty	• Check filaments - substitute if necessary.
	The timer is faulty	• Check supply to the timer. • If there is no output tension, substitute the timer
	ON-OFF pushbutton is faulty	Check contacts - substitute if necessary
The lamp fails to switch OFF	The timer is faulty	Substitute the timer.
	The pushbutton is faulty	Substitute the Pushbutton
The collimator is not centred:	The mirror or lamp are not positioned correctly	See Light field to x-ray field alignment Chapter COLLIMATOR CALIBRATION
For manual collimators only: Incorrect field size reading	The knobs are not positioned correctly	Loosen knob screws and adjust - See Chapter - ADJUSTMENTS - Field Size Indication
Shutters do not hold position.	The friction is loose	See Chapter - ADJUSTMENTS - Friction Brake Adjustment.

problem	cause	solution
Shutters fail to position correctly	External electronics faulty	Consult Manual supplied with unit that controls the collimator.
	Potentiometers are faulty or incorrectly calibrated	See potentiometer adjustment procedures or substitute potentiometers as required. See Chapter: SUBSTITUTIONS
Shutters fail to move	The motor is not supplied correctly	Check: power supply, voltage - current - fuses.
	The motor is faulty	Substitute the motor. See SUBSTITUTIONS
	Clutch is loose	Adjust as indicated in Chapter: ADJUSTMENTS.

N - SUBSTITUTION, DISASSEMBLY, TRANSPORT AND STORAGE

SUBSTITUTIONS

Substitution of the lamp.

WARNING: DO NOT IMMEDIATELY TOUCH THE DISSIPATOR WITH YOUR FINGERS IT COULD BE HOT AND CAUSE SEVERE BURNS.

WARNING: DO NOT TOUCH THE LAMP, THE SOCKET, OR THE LAMP BRACKET WITH YOUR FINGER. THEY CAN BE VERY HOT AND CAUSE SEVERE BURNS.

WARNING: DO NOT TOUCH THE LAMP WITH YOUR FINGERS, EVEN WHEN IT IS COLD. OIL FROM YOUR SKIN WILL CAUSE THE LAMP TO CRACK AND POSSIBLY EXPLODE. IF YOU HAVE TOUCHED THE LAMP, WASH OFF THE SURFACE WITH ALCOHOL, THEN HANDLE THE LAMP WITH A PIECE OF PAPER.

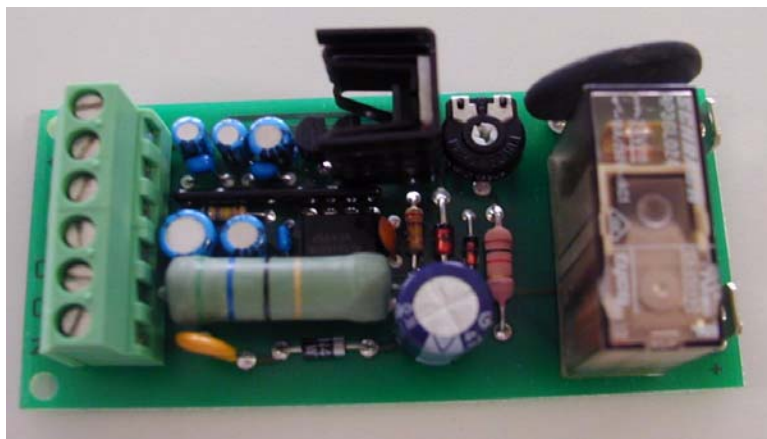
- Disconnect supply
- Remove the back cover - See chapter **COVER REMOVAL**
- Remove the lamp protection heatsink
- Carefully remove the faulty lamp.
- Substitute the lamp with an identical lamp
- Make sure that the lamp pins are completely inserted in the lamp-holder
- Check on light field/x-ray field correspondence
- If necessary remove the lamp, rotate it 180° axially and re-insert

Substitution of the Electronic Timer:

- Disconnect Supply
- Remove the knobs
- Remove the front panel. See Chapter - **COVER REMOVAL** .
- Remove the two screws holding the electronic timer.
- Identify the cables and their position on the terminal board. See Figure in Chapter - **ELECTRICAL POWER CONNECTION**
- Disconnect the cables from the terminal board.
- Install the new timer by proceeding in a reverse order and pay particular attention to the connection of the cables on the 4 or 6-way electric terminal according to the model.

Figura 1 - Timer FM338

images\collimator\timer_104.jpg

Figura 2 - Timer FM431

images\collimator\timer_431.jpg

Substitution of the Laser

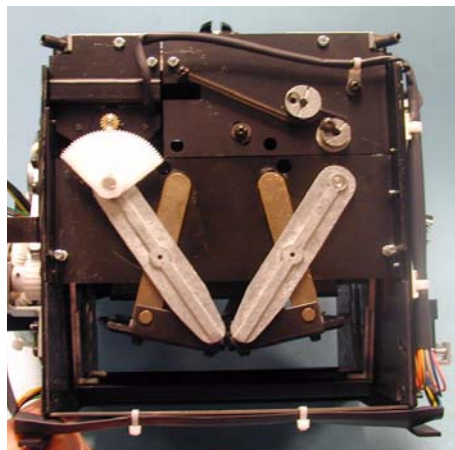
- Disconnect supply
- Remove the cover of the laser and substitute laser with an identical one. See Chapter - **COVER REMOVAL**
- Remount the cover.

SOSTITUZIONE SPECCHIO / SUBSTITUTION OF THE MIRROR

Colimatori motorizzati/Motorised collimators

Fig. 1

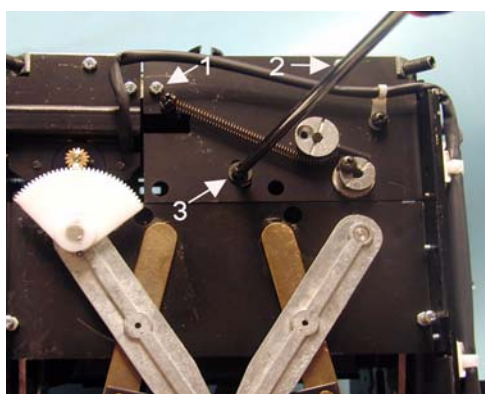
- Rimuovere la copertura, il pannello anteriore e coperchio posteriore del collimatore - Vedi capitolo RIMOZIONE COPERTURA
- Rimuovere le pareti laterali di protezione.
- Rimuovere il fermo albero specchio posto sul lato sinistro del collimatore - Vedi **Fig. 1**



- *Remove the collimator cover, front panel and rear cover, - See chapter COVER REMOVAL*
- *Remove the collimator lateral protection walls.*
- *Remove the mirror shaft stop on the left side of the collimator - see **Fig. 1***

Fig. 2

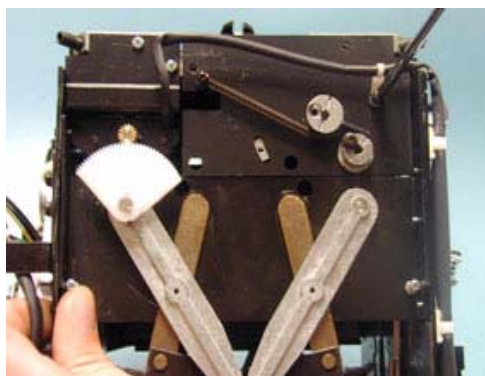
- Rimuovere le due viti sulla parete destra superiore (1, 2) e la vite fermo specchio (3) - Vedi **Fig. 2**



- *Remove the two screws on the upper right partition (1,2) and the mirror stop screw (3) - see **Fig. 2***

Fig. 3

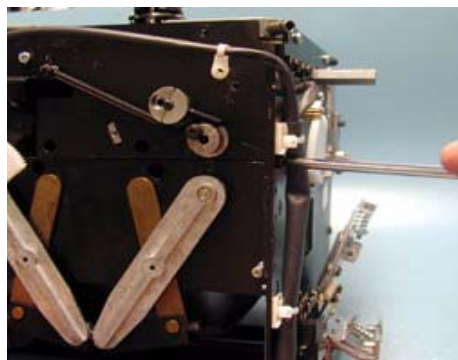
- Rimuovere la vite fissaggio fermacavi - Vedi **Fig. 3**



- *Remove the screw on the cable stops - See **Fig. 3***

Fig. 4

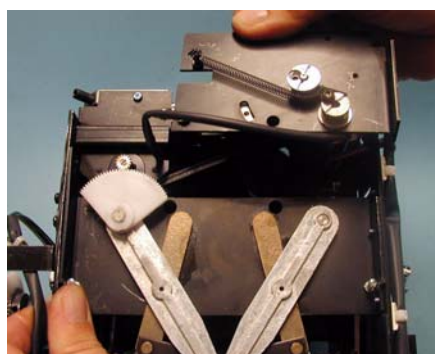
- Rimuovere il fermacavo sulla parete anteriore lato destro parte superiore - Vedi **Fig. 4**



- Remove the cable stop located on front partition - upper righthand side - see **Fig. 4**

Fig. 5

- Rimuovere la vite posta sulla parete posteriore lato sinistro parte superiore del collimatore - Vedi **Fig. 5**



- Remove the screw on the rear partition of the collimator - upper lefthand side - See **Fig. 5**

Fig. 6

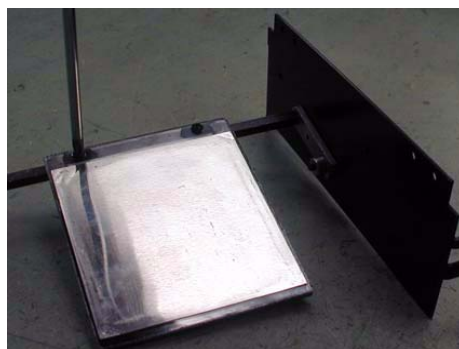
- Sollevare la parte superiore della parete destra - Vedi **Fig. 6**



- Lift the upper part of the righthand partition - See **Fig. 6**

Fig. 7

- Rimuovere le due viti che fermano lo specchio ed il suo supporto all'albero - vedi **Fig. 7**
- Sostituire lo specchio e procedere al montaggio in modo inverso.



- Remove the two screws holding the mirror and its shaft support - See **Fig. 7**
- Substitute the mirror and re-mount in reverse order

Substitution of motors**- Shutter Movement**

- Disconnect supply
- Remove the knobs
- Remove the front panel. See Chapter: **COVER REMOVAL**.
- Unsolder the connecting wires on the motor tabs; identify the cables and their position.
- Unscrew the motor support from the front side
- Substitute the motor with an identical part
- Remount the support with the new motor - do not tighten the screws.
- The plastic gear are not always uniform: a possible deformation could block or stiffen the movement. Check that shutters move from completely open to completely closed evenly and smoothly.
- Allow minimum play between gears.

Substitution of the potentiometers**- Shutter positioning control**

- Disconnect supply to the collimator.
- To identify the potentiometer that needs to be substituted, see **Potentiometer Adjustment** in Chapter: **ADJUSTMENTS**.
- Unscrew the potentiometer support fixing screws.
- Unsolder the wires connecting the potentiometer pins; identify the cables and their position.
- Unscrew the two potentiometer stops and remove the gear on the potentiometer shaft.
- Substitute with an identical potentiometer and mount the gear on the shaft without tightening the screw.
- Sold the wires and remount the potentiometer support.
- Calibrate the potentiometers - See Chapter: **ADJUSTMENTS**.

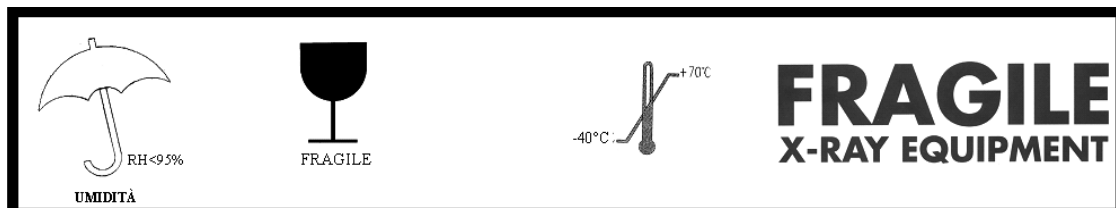
Disassembly

- Disconnect supply to the collimator.
- Remove the rear cover and disconnect the supply cables.
- Loosen the 4 fixing Allen screws on the upper part of the collimator - **care must be taken not to let the collimator fall**.

Transport and storage

- Suitable packing must be provided for the collimator.
- Place the collimator in a plastic bag to avoid packing material from entering the collimator.
- Use an appropriate box for transport, shipment or storage taking care to protect the collimator from rough handling. This will avoid damage to the collimator during transport shipment or storage.
- Limit Storage conditions:
- Ambient Temperature = from -40°C to +70°C
- Relative Humidity = from 10% to 95%

- Atm. Pressure = from 500 a 1060 hPa.



images\collimatori\fig

O - PARTI DI RICAMBIO / SPARE PARTS

NOTA: nell'ordinare le parti di ricambio, il cliente deve specificare il modello ed il numero di serie del collimatore.

NOTE: when ordering spare parts, the customer is requested to specify the collimator model and serial number.

Cod.	Descrizione	Description
RO 002	Distanziale in ferro, spessore 1.5mm	Spacer, steel, 1,5mm
RS 006	Lampada alogena, 24 V-100 W	Lamp, 24V-100W
RS 033	Porta lampada in ceramica	Lampholder, ceramic
RS 047	Pulsante fino a n.s. 13027	Pushbutton up to s.n. 13027
RS 063	Temporizzatore elettronico FM 338 – 24V	Timer, electronic, FM338-24V
RS 092	Lampada alogena, 12 V 100 W	Lamp, 12V - 100W
RS 178	Manopola sinistra	Knob, left
RS 204	Temporizzatore elettronico FM338 – 12V	Timer, electronic, FM338-12V
RS 312	Manopola destra	Knob, right
RS 390	Copertura	Cover
RS 393	Pannello antipolvere	Panel, antidust
RS 394	Guida destra per accessori.	Guide for accessories, right
RS 395	Guida sinistra per accessori.	Guide for accessories, right
RS 402	Pannello laterale piombato	Guide for accessories, left
RS 403	Copertura superiore "mezzaluna"	Cover, upper, semicircular
RS 404	Viti fissaggio copertura T.S. M3X22	Screws, fixing for cover, TSM3x22
RS 422	Pannello frontale piombato	Panel, front, leaded
RS 423	Coperchio posteriore piombato	Cover, rear, leaded
RS 424	Cornice plastica	Frame, plastic
RS 649	Metro retraibile in acciaio	Tape measure, steel, retractable
RS 427	Motore Minimotor 2224 ratio 79.4:1	Motor Minimotor 2224 ratio 79.4:1
RS 282	Potenziometro 157S102 1 Kohm	Potentiometer 157S102 1Kohm
RS 797	Pannello frontale dal n.s. 13028	Front panel from s.n. 13028

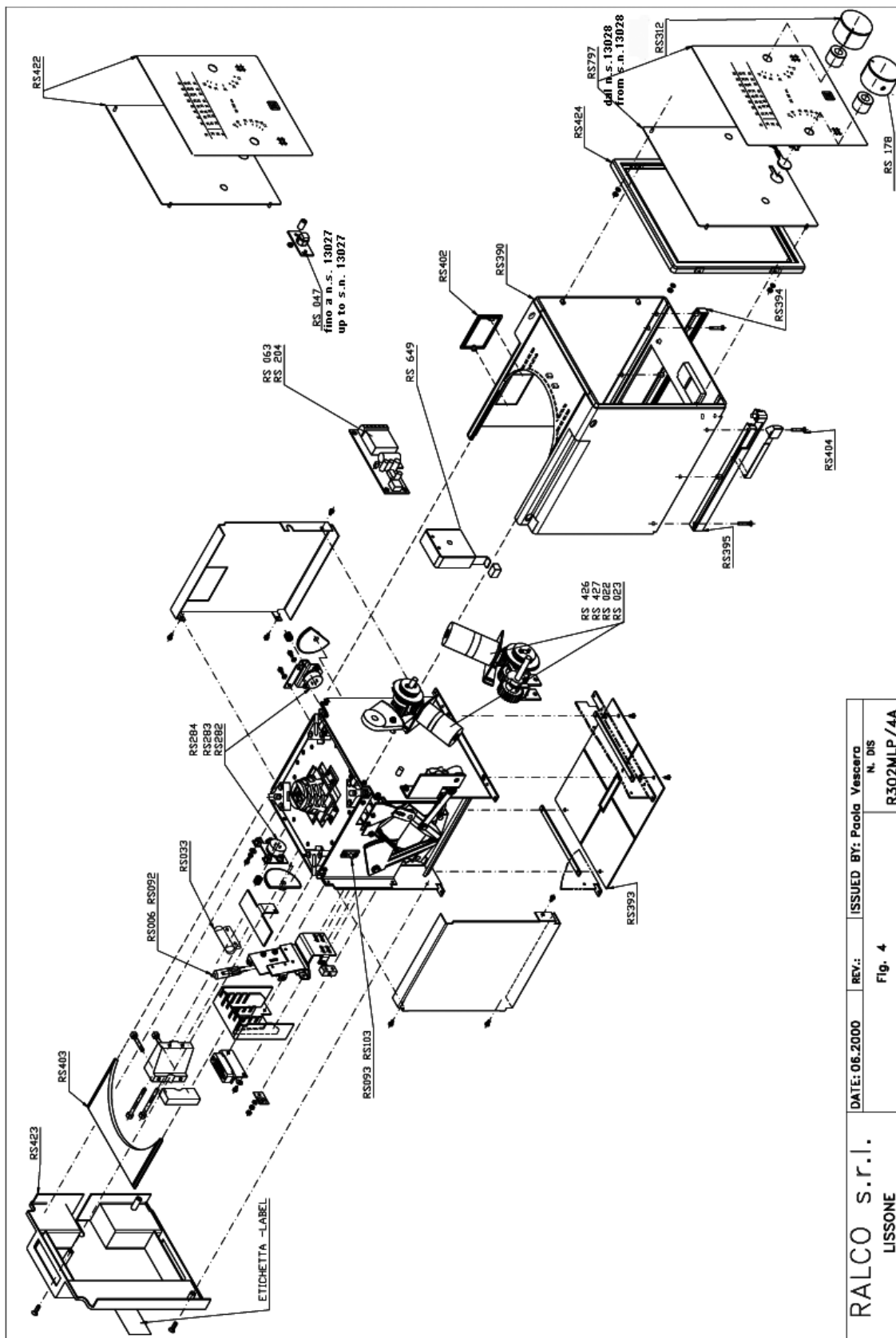
ricambi_302_MLP.fm

Etichetta/Label

etichetta\etichetta_302MLP_

Ralco S.r.l.	Via dei Tigli 13/G 20046 BIASSONO (MILAN) ITALY
BEAM LIMITING DEVICE Collimator type: R 302 MLP/A s/n:	Min. inherent filtration Al. equiv.: 2 mm Al / 75 IEC 60622/1989 X-Ray rating up to: 160 kVp Supply : 24 V AC/DC 6.6A 50/60Hz 24 V DC 0.5 A
Date of manufacture:	CE 0051   

Esploso / Parts Breakdown:



RALCO S.r.l. LISSONE	DATE: 06.2000	REV.:	ISSUED BY: Paola Vascara	N. DIS
	Fig. 4		R302MLP/4A	

P - ROUTINE MAINTENANCE

To ensure constantly safe performance of the collimator and its compliance with applicable regulations, a maintenance program is indispensable.

It is the Owner's responsibility to supply or arrange for this service.

Cleaning recommendations

- The collimator housing must be cleaned as prescribed by the sanitary regulations followed by the operator.
- Disconnect supply
- Use non abrasive cleaning products.
Care must be taken to prevent liquid from entering the collimator. **N.B. the collimator cover is not watertight.**
- **Do not** re-apply power if inflammable liquids have leaked into the collimator. See the following Maintenance Instructions.

Recommended maintenance programme:

Ralco suggests a yearly servicing programme. However shorter intervals are advisable when the collimator is subject to heavy workloads.

- Re-calibration of the collimator will be necessary whenever the x-ray tube is changed or at each substitution of the lamp used to simulate the light field. Calibration procedures must be performed as described in this manual .
- Check that the screws and tabs which serve to secure the collimator to the flange/ tube adapter are correctly tightened.
- Remove the covers and panels from collimator. Inspect the moving parts for signs of wear or damage.
- Check the electric system and substitute parts that show wear.
- Check the Lexan panel and substitute if necessary.
- Clean the collimator with a soft cloth paying particular attention to the Lexan window. Do not use abrasive or inflammable cleaning products.
- Sparingly lubricate the moving parts using graphite oil.
- Wipe away all excess oil and remount the cover.

IMPORTANT: MAKE SURE TO TIGHTEN THE M6 ALLEN SCREWS SECURING THE CONTROL TABS.

APPROPRIATE TIGHTENING OF THE 4 ALLEN SCREWS ENSURES SECURE MOUNTING OF THE COLLIMATOR. TIGHTENING FORCE USED MUST NOT EXCEED 0.50 NM.

NOTE: IF THE COLLIMATOR IS TO BE MOUNTED ON A ROTATING FLANGE, USE A TIGHTENING FORCE BETWEEN MIN. 0,50 NM AND MAX. 0.75 NM.

Q - GENERAL

REPAIRS

- Return the collimator to Ralco at the customer's expense if the unit is out of warranty.
- Provide the collimator with a detailed description (in Italian or English) of the functional problems and/or faults. It is important to indicate whether a repair or a complete overhaul is required.
- Our Quality Control will test the collimator.
- If the repair involved is extensive, Ralco will contact the customer to advise on the repair or possible substitution.

END OF LIFE DISPOSAL

Your collimator contains materials which can be recycled and reused. Specialised companies can recycle your product to increase the amount of reusable materials and to minimise the amount of materials to be disposed of.

The collimator does not contain polluting materials or products with the exception of the lead that composes the shutters - avoid direct contact with lead especially for prolonged periods.

It is recommended that you observe Local Laws regulating the disposal of your old set. Should this prove impossible, return the collimator to Ralco at the purchaser's expense and Ralco will take care of its correct disposal.

The product requires correct disposal at the end of its life-cycle and according to the current standards; it cannot be considered as normal waste. The unit must be disposed of through certified environmental management concerns or, should you need to replace the unit with new equipment, returned to Ralco. Please contact us if you require further information.

The product contains lead which can be highly contaminating if dispersed incorrectly. The following symbol signified that the products conforms to the environmental requirements of directives 202/95/EC, 2002/96/EC, 2003/108/EC; it must be disposed of correctly at the end of its life-cycle.



WARRANTY

Ralco undertakes to replace and repair any collimator part during a period of 24 months from the date of invoice and cover the labour costs involved.

The warranty applies provided the product has been handled properly in accordance with its operating instructions; presentation is required of the original invoice indicating the date of purchase, the model and serial number as well as other documents originally supplied with the set.

The warranty does not apply if:

- The documents have been altered in any way or made illegible;
- The model or production number on the product has been altered, deleted, removed or made illegible;
- Repairs or product modifications and alterations have been performed by unauthorised persons;
- Damage is caused by misuse or neglect, incorrect installation or accidental damage including but not limited to lighting, water or fire.
- Use of unoriginal spare parts and accessories.

In-warranty spares will be available only upon return to Ralco, at the customer's expense, of the parts considered to be faulty to allow assess the cause of the fault.

Components not covered by this warranty:

Consumable items such as lamps.

Items not produced by Ralco; these items will be accorded to warranty granted by the constructor:

- Motors - 1 year
- Potentiometres: 1 year
- Electronic boards: 1 year
- Laser 12 months

Ralco reserves the right to decide if the collimator is to be repaired or substituted.

Defective material is to be sent to:

RALCO SRL
VIA DEI TIGLI 13/G
20046 BIASSONO (MI) - ITALIA
FAX: ++39-039-2497.799
EMAIL: RALCO@RALCO.IT

SAFETY/RESPONSIBILITY

Ralco adheres to the directives governing manufacturers of electro-medical equipment:

Directive 93/42 CEE para.10 -Legislative Decree n° 46 para.10

Ralco shall not be held responsible when instructions provided in the present manual are not complied with.

Ralco shall not be held responsible if the collimator relates to one or several of the following instances:

- The unit is of Ralco construction to client specifications (no CE marking)
- The unit has been modified by the OEM or end user.
- The unit has been installed without respecting the instructions provided in this manual.
- The unit is used without respecting the instructions provided in this manual.
- The unit has not been subject to routine functional inspection.
- The unit has not been subject to routine maintenance.
- The unit has been repaired with unoriginal spare parts.
- Ralco shall decline all responsibility for any damage, direct or indirect, caused to persons or things by inappropriate accessories.

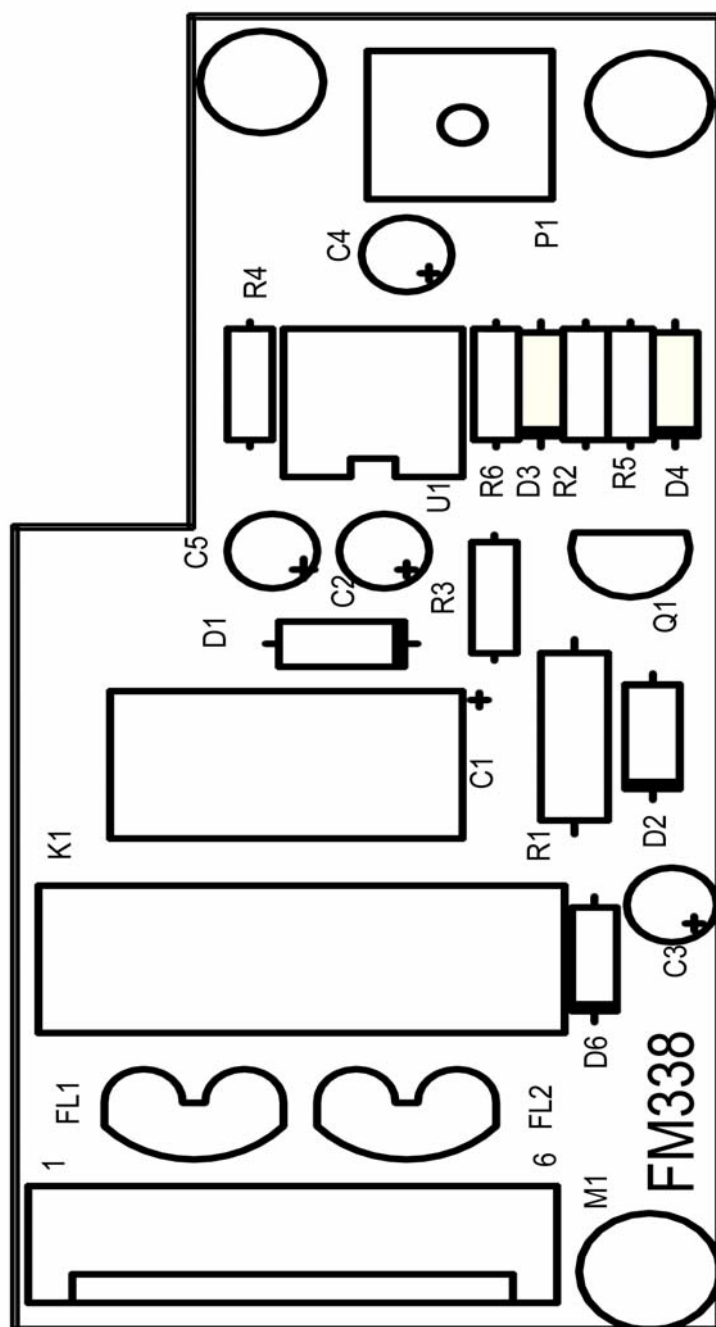
INFORMATION REGARDING ACCIDENTS THAT HAVE OCCURED WHILE USING THE RADIOLOGICAL COLLIMATOR MUST BE REPORTED IMMEDIATELY TO RALCO SRL.

R - FIGURE E SCHEMI / FIGURES AND DIAGRAMS

NOTA: NEL CASO LO SCHEMA ELETTRICO DA VOI RICHIESTO FOSSE DIVERSO DA QUELLO STANDARD - SI PREGA CONSULTARE GLI ALLEGATI

NOTE: SHOULD THE ELECTRIC DIAGRAM REQUESTED BY YOU DIFFER FROM THE STANDARD UNIT SUPPLIED - PLEASE SEE THE ATTACHMENTS

Fig. 1 - Timer FM338 - Montaggio / Layout



figure_drgs.fm

figure_drgs.fm

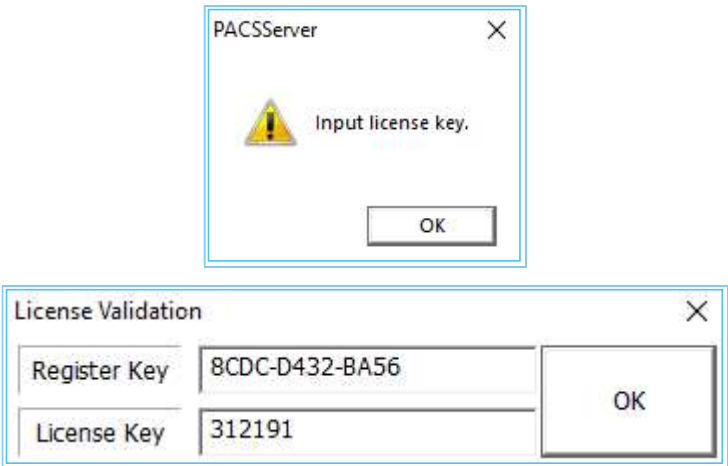


INFORMAZIONI PER IL COSTRUTTORE: Nell'intento di garantire e migliorare la qualità del nostro prodotto, includiamo il presente modulo per consentirvi di segnalare eventuali non conformità o disagi riscontrati nell'installazione e nel successivo utilizzo del nostro collimatore. Vi preghiamo di spedire a carico della RALCO srl, Via Dei Tigli 13/G, 20046 Biassono (mi) - Italia	INFORMATION FOR THE MANUFACTURER The following form is provided for your comments and suggestings with regards to the collimator so that we may ensure and improve the quality of our production. Should you have any comments and/or suggestions, please mail the form, post-free, to RALCO srl, via Dei Tigli 13/G, 20046 Biassono (mi) - Italia
DATA/DATE:	
CLIENTE/CUSTOMER	
INFORMAZIONI RIGUARDANTI EVENTUALI INCIDENTI VERIFICATISI CON L'UTILIZZO DEL COLLIMATORE RADIOLOGICO: La direttiva 93/42/cee prevede che incidenti (quali la morte o grave peggioramento dello stato di salute di un paziente) che vedano coinvolto il collimatore radiologico qui descritto, vengano segnalati al Ministero della Sanità e al Costruttore. Il presente modulo serve per segnalare alla ralco srl tali eventualità con spedizione del modulo a carico del destinatario.	INFORMATION REGARDING POSSIBLE ACCIDENTS THAT MAY HAVE OCCURRED WHILE USING THE COLLIMATOR. Directive 93/42/cee states that accidents (such as death or grevious injury to a patient) that involve the collimator described herein, must be reported to the mlnistry Of Health and to the Manufacturer. The present form is provided to report to Ralco srl post-free, accidents of the type stated in the directive.
DATA/DATE	
CLIENTE/CUSTOMER:	

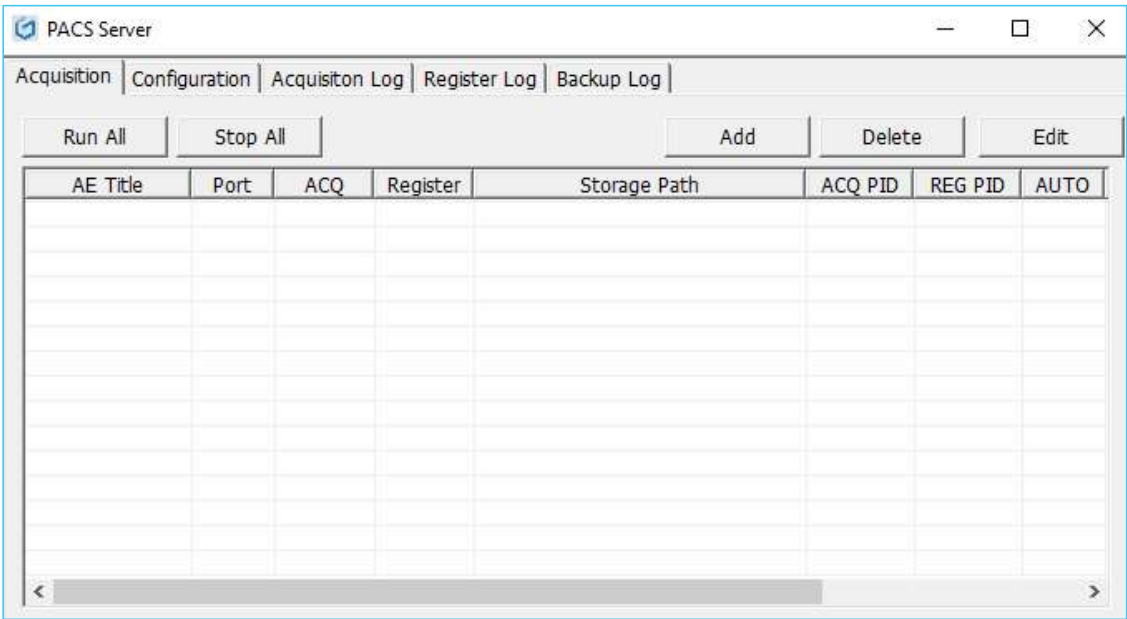
2.3 SERVER

- 1. Run the GEMPACS Server shortcut on the desktop.

The first time you run it, the License Key input message window appears. Press the OK button to display the License Key input window.



- 2. First run screen.



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Date: 2025.07.11 14:03:44 EEST
Reason: MoldSign Signature
Location: Moldova
MOLDOVA EUROPEANĂ



- System Control Menu (7 inch Touch Screen LCD, Not applicable to TS-FC2 (Motorized))

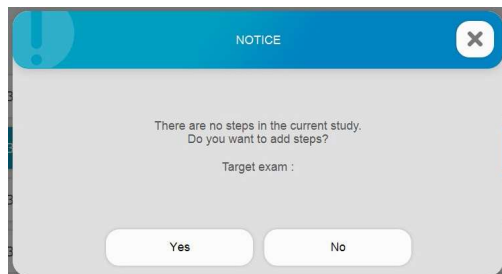
<Tube head with manual tube rotation Type>	<Tube head with motorized tube rotation Type>

①	Generator status indicator		X-ray large focus Status display
			X-ray small focus Status display
			Error Status display
			Warning Status display
			X-Ray Prep Status display
			X-Ray Exposure Status display
②	Bucky status indicator		Non-Bucky Status display
			Table Bucky Status display
			Stand Bucky Status display
③	Position information		Table SID Indicator
			Wall stand SID Indicator
			Tube rotation angle indicator

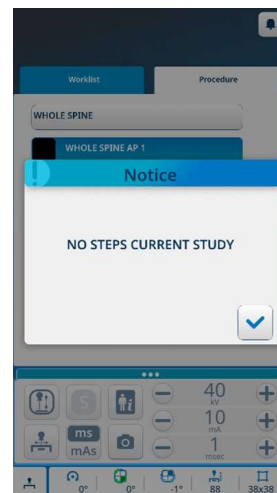


NOTE

Show the Pop-up if Pop Up is displayed in RADMAX



< RADMAX >



< THU >

- Auto Filter Selection & Indicator Menu (7 inch Touch Screen LCD, Not applicable to TS-FC2 (Motorized))



①	Auto filter selection & indicator	Choice the filter on the GUI. The filter is rotated to the selected position.
②	Auto collimation size selection & indicator	Choice the light field size of the collimator. The knob is automatically adjusted to the size you select. The indicator shows the light field size of the collimator.

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Location: Moldova

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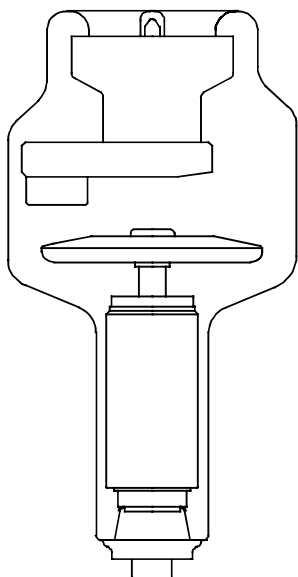


Documentazione Tubo a raggi X

Tube Documentation

Documentation du Tube

RTM 101 HS 0.6/1.2



Nr. di matricola
Tube No.
Nr de série

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Location: Moldova

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Questa documentazione deve essere fornita all'utilizzatore del complesso tubo-guaina
The contents of this documentation must be transmitted to the user of the tube-assembly
Le contenu de cette documentation doit être transmis à l'utilisateur de la gaine équipée

Documentazione N° Documentation N° N° de Documentation	Revisione Edition Version	Data di edizione Date of release Date de l'édition	Testo originale Original text Texte original
101S6C	B	26.03.2021	italiano / italian / italien

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<http://www.iae.it> e-mail: iaexray@iae.it





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Dichiarazione di conformità

Questo prodotto soddisfa i requisiti essenziali della direttiva 93/42/CEE in accordo alle norme IEC 60613, IEC 60336, IEC 60522, IEC 60601-1, IEC 60601-1-3, IEC 60601-2-28.

Declaration of conformity

This tube fulfils the essential requirements of the directive 93/42/EEC according to standard IEC 60613, IEC 60336, IEC 60522, IEC 60601-1, IEC 60601-1-3, IEC 60601-2-28.

Confirmation de conformité

Ce tube remplit les exigences essentielles de la directive 93/42/CEE en accord avec les normes IEC 60613, IEC 60336, IEC 60522, IEC 60601-1, IEC 60601-1-3, IEC 60601-2-28.



Caratteristiche - Specifications - Spécifications

Macchie focali Focal spot Foyer	0.6 1.2	IEC 60336
Velocità di rotazione dell'anodo Anode speed Vitesse de l'anode	50 / 60 Hz 150 / 180 Hz 2450 / 2850 min⁻¹ 8500 / 10000 min⁻¹	
Potenza anodica nominale Nominal anode input power Puissance anodique nominale	26 kW 40 kW 63 kW 100 kW	IEC 60613 (1989)
Potenza anodica nominale in radiografia Nominal radiographic anode input power Puissance anodique radiographique nominale	27 kW 41 kW 63 kW 97 kW	IEC 60613 (2010)
Diametro anodico Anode diameter Diamètre de l'anode	102 mm	
Materiale anodico Anode material Matériau de l'anode	RT-TZM *	
RT = Tungsteno + Renio (5-10%) , TZM = Molibdeno + Titanio (0.40-0.55 %) + Zirconio (0.06-0.12 %) * RT = Tungsten + Rhenium (5-10%) , TZM = Molybdenum + Titanium (0.40-0.55 %) + Zirconium (0.06-0.12 %) RT = Tungstène + Rhénium (5-10%) , TZM = Molybdène + Titane (0.40-0.55 %) + Zirconium (0.06-0.12 %)		
Angolo anodico Anode angle Pente de l'anode	12.5 °	
Campo di radiazione Radiation field Champ de rayonnement	a 70 cm 30 cm a 100 cm 43 cm	
Filtrazione permanente Permanent filtration Filtration permanent	0.7 mm Al / 75 kV	IEC 60522
Capacità termica anodica Maximum anode heat content Chaleur maximale accumulée dans l'anode	300 kJ 400 kHU	IEC 60613 (1989)
Dissipazione termica continua Continuous heat dissipation Dissipation thermique continue	1000 W 80 000 HU/min	
Dissipazione termica massima Maximum heat dissipation Dissipation thermique maximale	1500 W 120 000 HU/min	
Alta tensione nominale Nominal X-ray tube voltage Haute tension nominale	150 kV	IEC 60613 (2010)
Massima corrente di filamento Max. filament current Courant dans le filament max.	5.4 A	

I dati forniti nella presente documentazione si intendono riferiti a:

The data indicated in this documentation refer to:

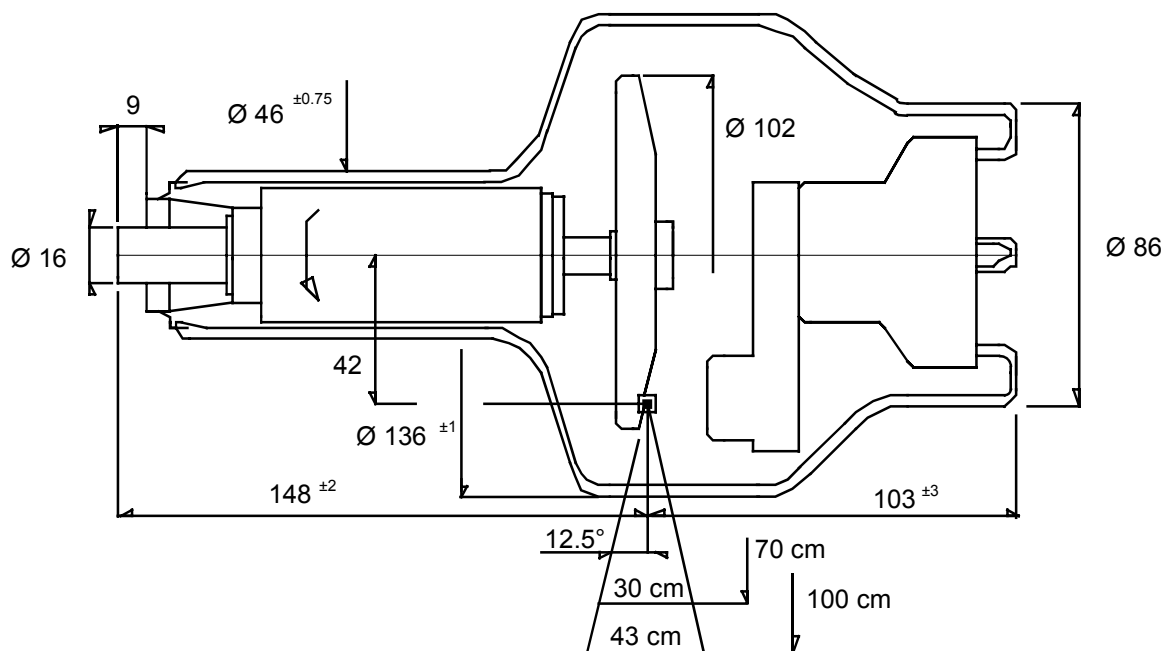
Les données indiquées dans cette documentation sont calculés pour:

Potenza anodica di equilibrio termico	% della capacità termica anodica	
Equivalent anode input power	% of maximum anode heat content	33%
Puissance anodique d'équilibre thermique	% de chaleur max. accumulée dans l'anode	

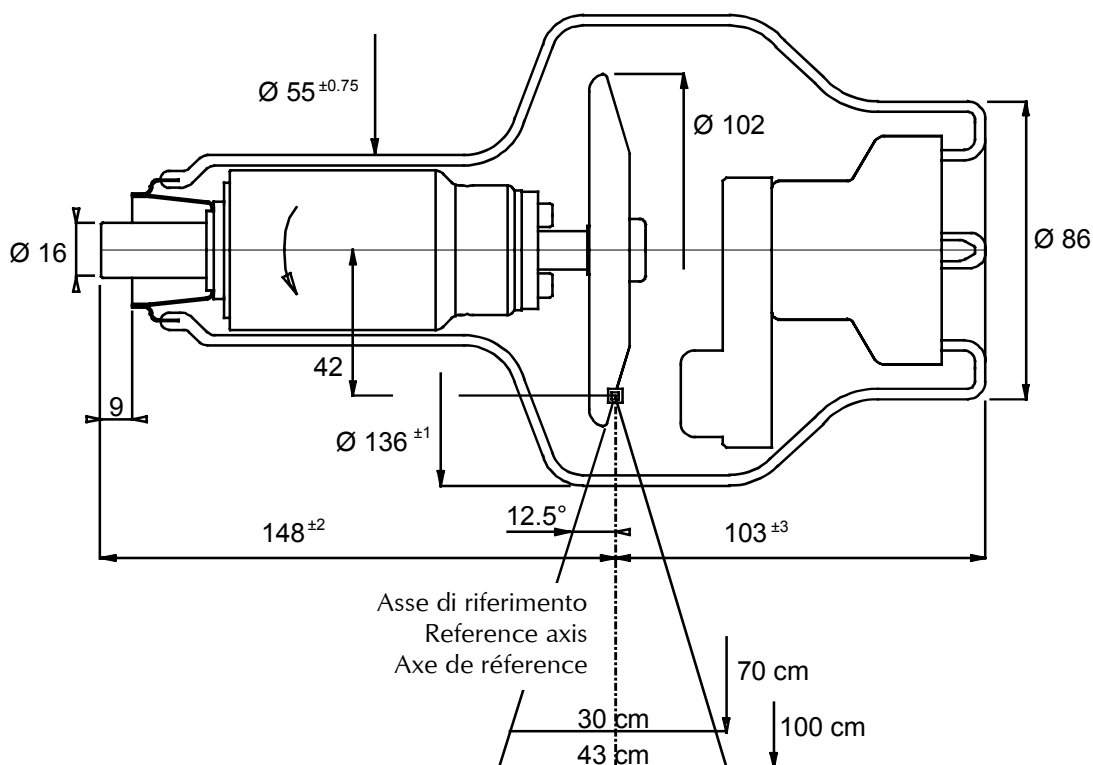


	trasporto e stoccaggio transportation and storage transport et stockage	funzionamento operation opération	
Limiti di temperatura Temperature limits Limites de température	-10°C ÷ +80°C	+10°C ÷ +40°C	
Limiti di umidità Humidity limits Limites d'humidité	max. 80%	max. 75%	
Limiti di pressione Pressure limits Limites de pression	500 ÷ 1060 hPa	700 ÷ 1060 hPa	

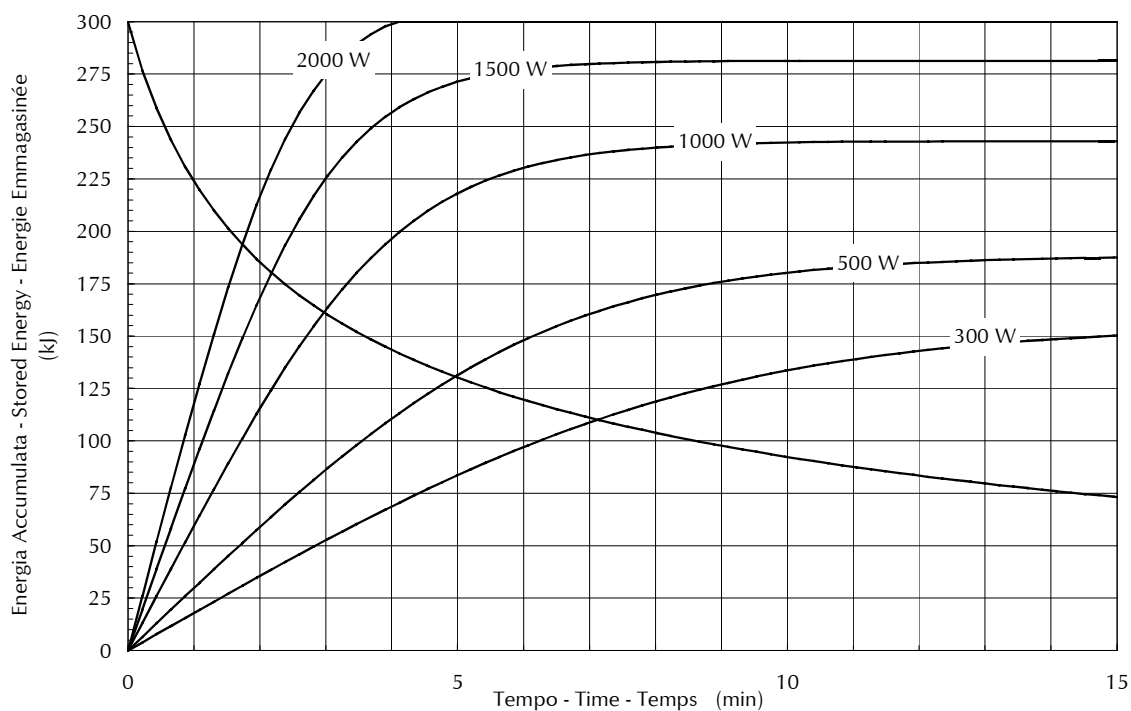
Versione standard - Standard version - Version standard



**Versione speciale per sostituzione in cuffie GE-CGR e SIEMENS
Special version for reloading in GE-CGR and SIEMENS housings
Version spéciale pour remise en gaine GE-CGR et SIEMENS**



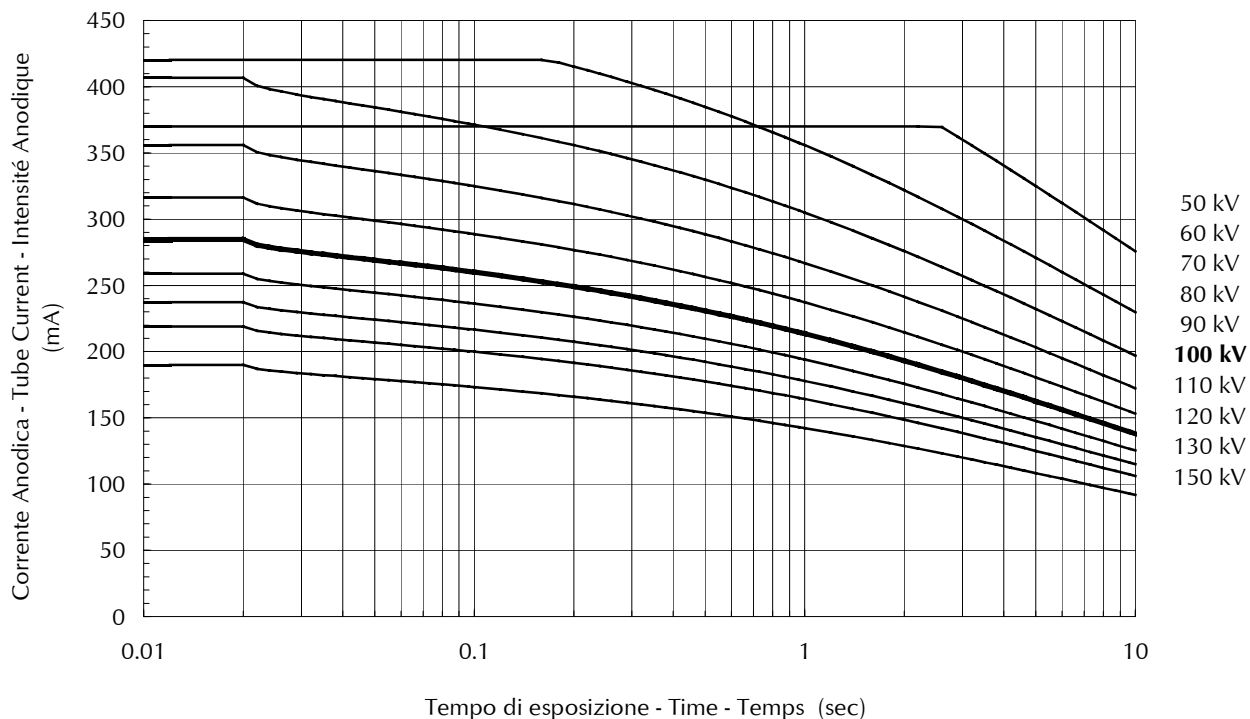
Curve di riscaldamento e raffreddamento dell'anodo
Anode heating and cooling curves
Courbes d'échauffement et de refroidissement de l'anode
IEC 60613 (1989)





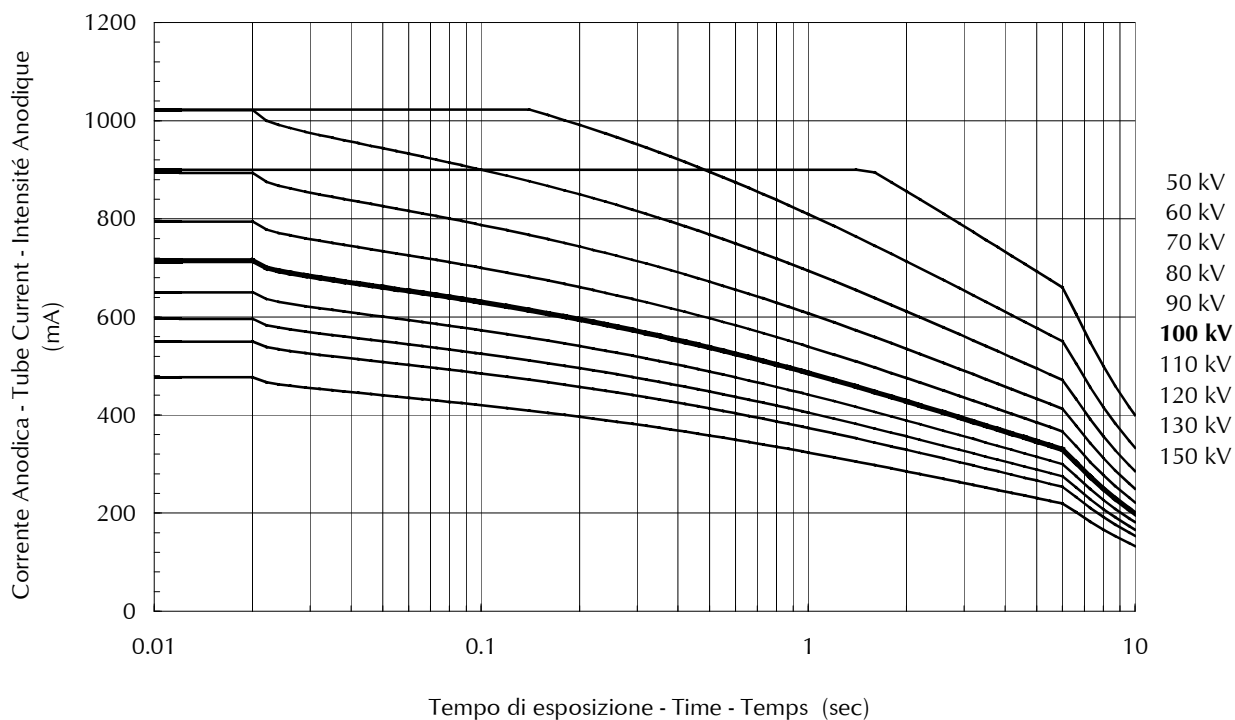
CURVE DI CARICO SINGOLO - SINGLE LOAD RATING - ABAQUE DE CHARGE UNIQUE

▣ **0.6 - 3 Ø - 50 / 60 Hz - IEC 60613 (1989) (2010)**



CURVE DI CARICO SINGOLO - SINGLE LOAD RATING - ABAQUE DE CHARGE UNIQUE

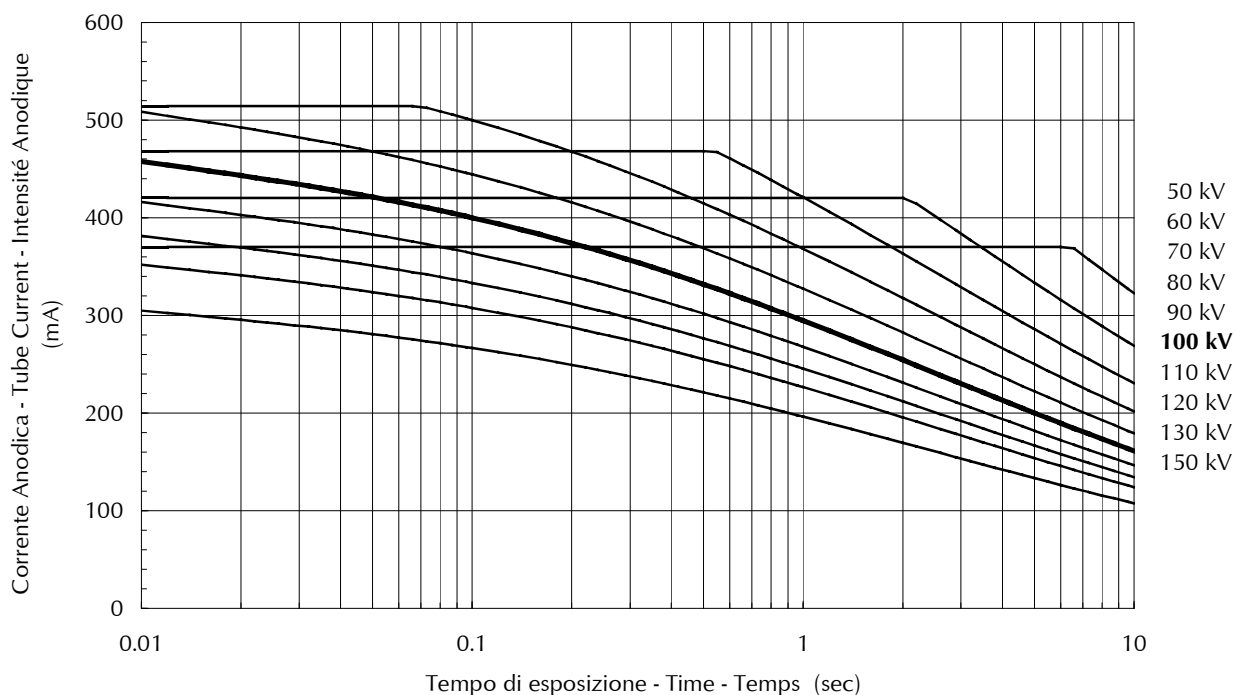
■ **1.2 - 3 Ø - 50 / 60 Hz - IEC 60613 (1989) (2010)**





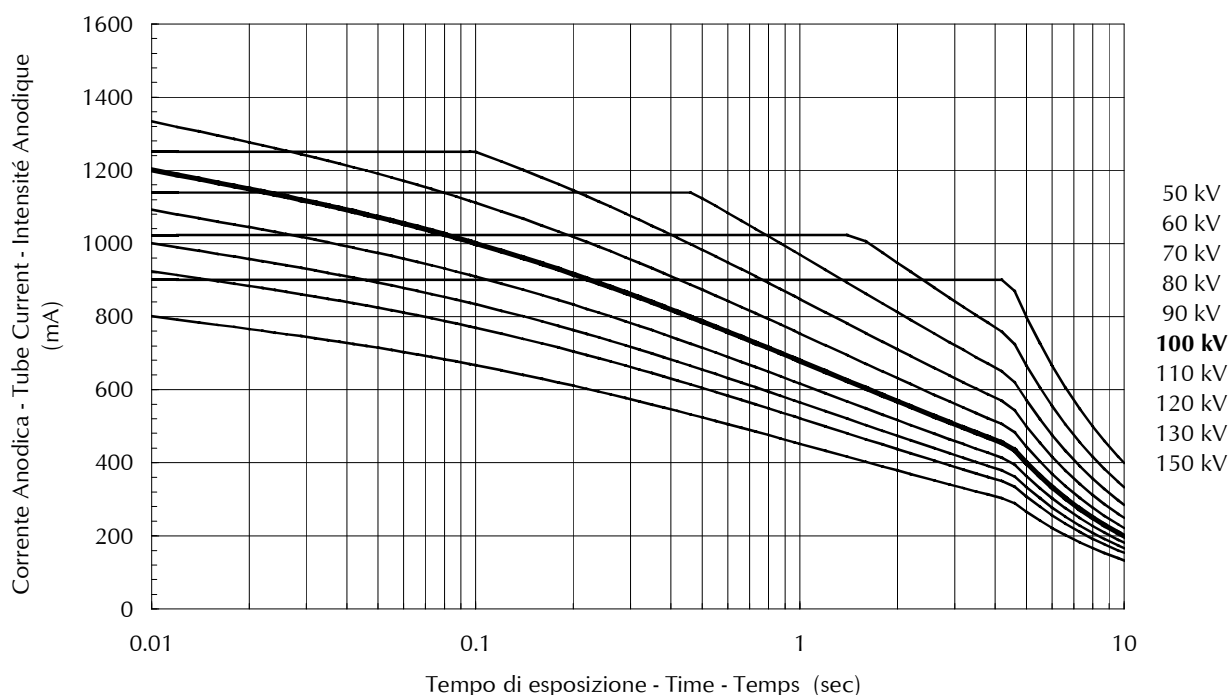
CURVE DI CARICO SINGOLO - SINGLE LOAD RATING - ABAQUE DE CHARGE UNIQUE

▣ **0.6 - 3 Ø - 150 / 180 Hz - IEC 60613 (1989) (2010)**



CURVE DI CARICO SINGOLO - SINGLE LOAD RATING - ABAQUE DE CHARGE UNIQUE

■ **1.2 - 3 Ø - 150 / 180 Hz - IEC 60613 (1989) (2010)**





Abaco per carichi in serie - Serial load rating - Abaque de charges successives

0.6 - 3 Ø - 50 / 60 Hz

Potenza ammessa sul tubo in kW, per serie di n esposizioni, con frequenza z e durata di ogni esposizione in sec Anode input power as a function of n (N° of exposures in series), z (exp. rate per sec), the exposure time (sec) Puissance anodique en fonction de n (N° d'exp. de la série), z (cadence d'exp. par sec), temps d'exposition (sec)																
z	0.010	0.020	0.030	0.040	0.050	0.060	0.080	0.100	0.120	0.140	0.160	0.180	0.200	0.220	0.250	n
1	22.4	22.4	22.0	21.7	21.5	21.3	21.0	20.8	20.6	20.4	20.2	20.1	19.8	19.5	19.2	5
2	22.3	22.3	22.0	21.7	21.5	21.3	21.0	20.6	20.2	19.8	19.5	19.1	18.8	18.5	18.0	
3	22.2	22.2	21.9	21.7	21.4	21.1	20.6	20.2	19.7	19.3	18.9	18.5	18.1	17.7	17.2	
4	22.1	22.1	21.8	21.5	21.2	20.9	20.3	19.8	19.3	18.8	18.4	18.0	17.5	17.1	16.6	
5	22.0	22.0	21.7	21.4	21.0	20.7	20.1	19.5	19.0	18.5	18.0	17.5	17.1	-	-	
10	22.0	21.8	21.3	20.8	20.4	20.0	19.2	18.5	-	-	-	-	-	-	-	
15	22.0	21.6	21.0	20.5	20.0	19.5	-	-	-	-	-	-	-	-	-	10
30	21.9	21.1	20.4	-	-	-	-	-	-	-	-	-	-	-	-	
1	22.3	22.3	22.0	21.7	21.5	21.3	21.0	20.6	20.2	19.8	19.5	19.1	18.8	18.5	18.0	10
2	22.1	22.1	21.8	21.5	21.2	20.9	20.3	19.8	19.3	18.8	18.4	17.9	17.5	17.1	16.6	
3	22.0	22.0	21.6	21.2	20.9	20.5	19.9	19.2	18.7	18.1	17.6	17.1	16.7	16.2	15.6	
4	22.0	21.9	21.4	21.0	20.6	20.2	19.5	18.8	18.2	17.6	17.0	16.5	16.0	15.5	14.9	
5	22.0	21.8	21.3	20.8	20.4	19.9	19.1	18.4	17.7	17.1	16.5	16.0	15.5	-	-	
10	22.0	21.4	20.7	20.1	19.5	19.0	18.0	17.1	-	-	-	-	-	-	-	
15	21.9	21.1	20.3	19.6	18.9	18.3	-	-	-	-	-	-	-	-	-	20
30	21.6	20.5	19.5	-	-	-	-	-	-	-	-	-	-	-	-	
1	22.1	22.1	21.8	21.5	21.2	20.9	20.3	19.8	19.3	18.8	18.4	17.9	17.5	17.1	16.5	20
2	22.0	21.9	21.4	21.0	20.6	20.2	19.5	18.8	18.1	17.5	17.0	16.5	16.0	15.5	14.9	
3	22.0	21.7	21.1	20.6	20.2	19.7	18.9	18.1	17.4	16.7	16.1	15.5	15.0	14.5	13.8	
4	22.0	21.5	20.9	20.3	19.8	19.3	18.4	17.5	16.7	16.0	15.4	14.8	14.2	13.7	13.0	
5	22.0	21.3	20.7	20.1	19.5	19.0	18.0	17.0	16.2	15.5	14.8	14.2	13.6	-	-	
10	21.8	20.8	19.9	19.1	18.4	17.7	16.5	15.5	-	-	-	-	-	-	-	
15	21.5	20.4	19.4	18.5	17.7	16.9	-	-	-	-	-	-	-	-	-	40
30	21.1	19.6	18.3	-	-	-	-	-	-	-	-	-	-	-	-	
1	22.0	21.9	21.4	21.0	20.6	20.2	19.5	18.8	18.1	17.5	17.0	16.5	16.0	15.5	14.9	40
2	22.0	21.5	20.9	20.3	19.8	19.3	18.4	17.5	16.7	16.0	15.4	14.8	14.2	13.7	13.0	
3	22.0	21.2	20.5	19.9	19.2	18.7	17.6	16.6	15.8	15.0	14.3	13.7	13.1	12.6	11.8	
4	21.9	21.0	20.2	19.5	18.8	18.1	17.0	16.0	15.1	14.3	13.5	12.9	12.3	11.8	11.0	
5	21.7	20.8	19.9	19.1	18.4	17.7	16.5	15.4	14.5	13.7	12.9	12.3	11.7	-	-	
10	21.3	20.1	19.0	18.0	17.0	16.2	14.8	13.6	-	-	-	-	-	-	-	
15	21.1	19.6	18.3	17.1	16.1	15.3	-	-	-	-	-	-	-	-	-	60
30	20.4	18.5	16.9	-	-	-	-	-	-	-	-	-	-	-	-	
1	22.0	21.7	21.1	20.6	20.2	19.7	18.8	18.1	17.3	16.7	16.1	15.5	15.0	14.5	12.8	60
2	22.0	21.2	20.5	19.9	19.2	18.7	17.6	16.6	15.8	15.0	14.3	13.7	13.1	12.6	11.8	
3	21.8	20.9	20.1	19.3	18.6	17.9	16.7	15.7	14.8	14.0	13.2	12.6	12.0	11.4	10.7	
4	21.7	20.6	19.7	18.8	18.1	17.3	16.1	15.0	14.0	13.2	12.4	11.7	11.1	10.6	9.9	
5	21.5	20.4	19.4	18.5	17.6	16.9	15.5	14.4	13.4	12.5	11.8	11.1	10.5	-	-	
10	21.0	19.6	18.3	17.1	16.1	15.2	13.7	12.5	-	-	-	-	-	-	-	
15	20.7	19.0	17.5	16.2	15.1	14.2	-	-	-	-	-	-	-	-	-	80
30	19.9	17.7	16.0	-	-	-	-	-	-	-	-	-	-	-	-	
1	22.0	21.5	20.9	20.3	19.8	19.3	18.4	17.5	16.7	16.0	15.4	14.1	12.7	11.6	10.2	80
2	21.9	21.0	20.2	19.5	18.8	18.1	17.0	16.0	15.1	14.3	13.5	12.6	11.4	10.3	9.1	
3	21.7	20.6	19.7	18.8	18.1	17.3	16.1	15.0	14.0	13.2	12.4	11.7	10.9	9.9	8.7	
4	21.5	20.3	19.3	18.4	17.5	16.7	15.4	14.2	13.2	12.4	11.6	10.9	10.3	9.7	8.5	
5	21.3	20.1	19.0	17.9	17.0	16.2	14.8	13.6	12.6	11.7	11.0	10.3	9.7	-	-	
10	20.8	19.1	17.7	16.5	15.4	14.5	12.9	11.7	-	-	-	-	-	-	-	
15	20.4	18.5	16.9	15.5	14.4	13.4	-	-	-	-	-	-	-	-	-	100
30	19.6	17.1	15.3	-	-	-	-	-	-	-	-	-	-	-	-	
1	22.0	21.3	20.7	20.1	19.5	19.0	17.9	17.0	16.2	15.3	13.4	11.9	10.7	9.8	8.6	100
2	21.7	20.8	19.9	19.1	18.4	17.7	16.5	15.4	14.5	13.4	11.7	10.4	9.4	8.5	7.5	
3	21.5	20.4	19.4	18.5	17.6	16.9	15.5	14.4	13.4	12.5	11.1	9.9	8.9	8.1	7.1	
4	21.3	20.1	19.0	17.9	17.0	16.2	14.8	13.6	12.6	11.7	10.8	9.6	8.7	7.9	6.9	
5	21.2	19.8	18.6	17.5	16.5	15.7	14.2	13.0	12.0	11.1	10.3	9.5	8.5	-	-	
10	20.6	18.8	17.3	16.0	14.9	13.9	12.3	11.0	-	-	-	-	-	-	-	
15	20.2	18.1	16.4	15.0	13.8	12.8	-	-	-	-	-	-	-	-	-	150
30	19.2	16.7	14.7	-	-	-	-	-	-	-	-	-	-	-	-	
1	21.9	21.0	20.3	19.6	18.9	18.3	17.1	16.1	13.4	11.5	10.1	9.0	8.1	7.3	6.5	150
2	21.5	20.4	19.4	18.5	17.6	16.9	15.5	13.4	11.2	9.6	8.4	7.4	6.7	6.1	5.4	
3	21.3	19.9	18.8	17.7	16.8	15.9	14.5	12.5	10.4	8.9	7.8	6.9	6.2	5.7	5.0	
4	21.0	19.6	18.3	17.1	16.1	15.2	13.7	12.0	10.0	8.6	7.5	6.7	6.0	5.5	4.8	
5	20.9	19.2	17.8	16.6	15.6	14.7	13.1	11.8	9.8	8.4	7.3	6.5	5.9	-	-	
10	20.2	18.1	16.4	15.0	13.8	12.8	11.1	9.9	-	-	-	-	-	-	-	
15	19.6	17.3	15.4	13.9	12.7	11.6	-	-	-	-	-	-	-	-	-	300
30	18.6	15.7	13.6	-	-	-	-	-	-	-	-	-	-	-	-	
1	21.5	20.4	19.4	18.5	17.6	16.9	13.5	10.8	9.0	7.7	6.8	6.0	5.4	4.9	4.3	300
2	21.0	19.6	18.3	17.1	16.1	13.4	10.1	8.1	6.7	5.8	5.0	4.5	4.0	3.7	3.2	
3	20.7	19.0	17.5	16.2	14.3	11.9	8.9	7.2	6.0	5.1	4.5	4.0	3.6	3.3	2.9	
4	20.4	18.5	16.9	15.5	13.4	11.2	8.4	6.7	5.6	4.8	4.2	3.7	3.3	3.0	2.7	
5	20.2	18.1	16.4	15.0	12.8	10.7	8.0	6.4	5.4	4.6	4.0	3.6	3.2	-	-	
10	19.2	16.6	14.7	13.1	11.8	9.8	7.3	5.9	-	-	-	-	-	-	-	
15	18.6	15.7	13.6	12.0	10.7	9.5	-	-	-	-	-	-	-	-	-	300
30	17.3	13.9	11.6	-	-	-	-	-	-	-	-	-	-	-	-	



Abaco per carichi in serie - Serial load rating - Abaque de charges successives

■ 1.2 - 3 Ø - 50 / 60 Hz

Potenza ammessa sul tubo in kW, per serie di n esposizioni, con frequenza z e durata di ogni esposizione in sec Anode input power as a function of n (N° of exposures in series), z (exp. rate per sec), the exposure time (sec) Puissance anodique en fonction de n (N° d'exp. de la série), z (cadence d'exp. par sec), temps d'exposition (sec)																
z	0.010	0.020	0.030	0.040	0.050	0.060	0.080	0.100	0.120	0.140	0.160	0.180	0.200	0.220	0.250	n
1	56.0	56.0	54.6	53.6	52.8	52.2	51.2	50.4	49.7	49.1	48.5	48.0	47.2	46.3	45.2	5
2	55.5	55.5	54.6	53.6	52.8	52.2	51.1	49.7	48.5	47.3	46.1	45.0	44.0	43.0	41.6	
3	55.2	55.2	54.2	53.3	52.4	51.5	49.9	48.3	46.9	45.5	44.2	43.0	41.8	40.7	39.2	
4	54.9	54.9	53.8	52.7	51.7	50.8	48.9	47.2	45.6	44.1	42.7	41.4	40.2	39.0	37.4	
5	54.6	54.6	53.4	52.3	51.2	50.1	48.1	46.3	44.6	43.0	41.5	40.1	38.9	-	-	
10	54.6	53.7	52.0	50.5	49.1	47.7	45.2	43.0	-	-	-	-	-	-	-	
15	54.6	53.0	51.1	49.3	47.7	46.1	-	-	-	-	-	-	-	-	-	10
30	54.2	51.5	49.1	-	-	-	-	-	-	-	-	-	-	-	-	
1	55.5	55.5	54.6	53.6	52.8	52.2	51.0	49.7	48.4	47.2	46.1	45.0	44.0	43.0	41.6	
2	54.9	54.9	53.8	52.7	51.7	50.7	48.9	47.2	45.6	44.1	42.7	41.4	40.1	39.0	37.3	
3	54.6	54.4	53.1	51.8	50.6	49.5	47.3	45.4	43.6	41.9	40.4	38.9	37.6	36.4	34.6	
4	54.6	54.0	52.5	51.1	49.7	48.5	46.1	44.0	42.0	40.3	38.6	37.1	35.7	34.4	32.7	
5	54.6	53.6	52.0	50.4	49.0	47.6	45.1	42.8	40.8	38.9	37.2	35.7	34.2	-	-	
10	54.6	52.3	50.1	48.1	46.3	44.6	41.5	38.9	-	-	-	-	-	-	-	20
15	54.1	51.3	48.8	46.5	44.4	42.5	-	-	-	-	-	-	-	-	-	
30	53.0	49.3	46.1	-	-	-	-	-	-	-	-	-	-	-	-	
1	54.9	54.9	53.8	52.7	51.7	50.7	48.9	47.1	45.5	44.1	42.7	41.3	40.1	38.8	34.2	
2	54.6	53.9	52.5	51.0	49.7	48.4	46.1	44.0	42.0	40.2	38.6	37.1	35.7	34.4	32.6	
3	54.6	53.3	51.5	49.8	48.3	46.8	44.2	41.8	39.7	37.7	36.0	34.4	32.9	31.6	29.8	
4	54.6	52.7	50.7	48.9	47.2	45.6	42.7	40.1	37.9	35.8	34.0	32.4	30.9	29.5	27.7	40
5	54.6	52.2	50.1	48.1	46.2	44.5	41.4	38.8	36.4	34.3	32.5	30.8	29.3	-	-	
10	53.6	50.4	47.6	45.1	42.8	40.8	37.2	34.2	-	-	-	-	-	-	-	
15	52.9	49.1	45.9	43.1	40.6	38.3	-	-	-	-	-	-	-	-	-	
30	51.3	46.5	42.5	-	-	-	-	-	-	-	-	-	-	-	-	
1	54.6	53.9	52.5	51.0	49.7	48.4	46.1	43.9	37.9	32.5	28.4	25.2	22.7	20.7	18.2	60
2	54.6	52.7	50.7	48.9	47.1	45.5	42.7	40.1	35.6	30.5	26.7	23.7	21.4	19.4	17.1	
3	54.4	51.8	49.5	47.3	45.4	43.6	40.3	37.6	34.8	29.9	26.1	23.2	20.9	19.0	16.7	
4	53.9	51.0	48.4	46.1	44.0	42.0	38.6	35.7	33.2	29.5	25.8	23.0	20.7	18.8	16.5	
5	53.6	50.4	47.6	45.1	42.8	40.7	37.2	34.2	31.6	29.3	25.7	22.8	20.5	-	-	
10	52.2	48.1	44.5	41.4	38.8	36.4	32.5	29.3	-	-	-	-	-	-	-	
15	51.2	46.4	42.4	39.0	36.2	33.7	-	-	-	-	-	-	-	-	-	80
30	49.1	43.1	38.3	-	-	-	-	-	-	-	-	-	-	-	-	
1	54.6	53.3	51.5	49.8	48.3	46.8	40.1	32.1	26.8	22.9	20.1	17.8	16.1	14.6	12.8	
2	54.4	51.8	49.5	47.3	45.4	43.6	36.7	29.4	24.5	21.0	18.4	16.3	14.7	13.4	11.8	
3	53.8	50.7	48.0	45.5	43.3	41.3	35.6	28.5	23.7	20.3	17.8	15.8	14.2	12.9	11.4	
4	53.3	49.8	46.8	44.2	41.8	39.6	35.0	28.0	23.3	20.0	17.5	15.6	14.0	12.7	11.2	100
5	52.8	49.1	45.8	43.0	40.5	38.3	34.5	27.7	23.1	19.8	17.3	15.4	13.9	-	-	
10	51.2	46.4	42.4	39.0	36.1	33.7	29.6	26.4	-	-	-	-	-	-	-	
15	50.1	44.5	40.1	36.4	33.4	30.8	-	-	-	-	-	-	-	-	-	
30	47.6	40.8	35.7	-	-	-	-	-	-	-	-	-	-	-	-	
1	54.6	52.7	50.7	48.9	47.1	42.4	31.8	25.5	21.2	18.2	15.9	14.1	12.7	11.6	10.2	150
2	53.9	51.0	48.4	46.1	43.9	37.9	28.4	22.7	18.9	16.2	14.2	12.6	11.4	10.3	9.1	
3	53.3	49.8	46.8	44.2	41.8	36.3	27.3	21.8	18.2	15.6	13.6	12.1	10.9	9.9	8.7	
4	52.7	48.9	45.5	42.7	40.1	35.6	26.7	21.4	17.8	15.3	13.3	11.9	10.7	9.7	8.5	
5	52.2	48.0	44.5	41.4	38.7	35.1	26.3	21.1	17.6	15.1	13.2	11.7	10.5	-	-	
10	50.4	45.1	40.7	37.2	34.2	31.6	25.7	20.5	-	-	-	-	-	-	-	
15	49.1	43.0	38.3	34.5	31.4	28.8	-	-	-	-	-	-	-	-	-	300
30	46.4	39.0	33.7	-	-	-	-	-	-	-	-	-	-	-	-	
1	54.6	52.2	50.0	48.0	42.9	35.8	26.8	21.5	17.9	15.3	13.4	11.9	10.7	9.8	8.6	
2	53.6	50.4	47.6	45.0	37.4	31.2	23.4	18.7	15.6	13.4	11.7	10.4	9.4	8.5	7.5	
3	52.8	49.1	45.8	43.0	35.6	29.7	22.3	17.8	14.8	12.7	11.1	9.9	8.9	8.1	7.1	
4	52.2	48.0	44.5	41.4	34.7	28.9	21.7	17.4	14.5	12.4	10.8	9.6	8.7	7.9	6.9	150
5	51.7	47.1	43.3	40.1	34.2	28.5	21.4	17.1	14.2	12.2	10.7	9.5	8.5	-	-	
10	49.7	44.0	39.4	35.7	32.6	27.6	20.7	16.5	-	-	-	-	-	-	-	
15	48.3	41.8	36.8	32.9	29.8	27.2	-	-	-	-	-	-	-	-	-	
30	45.4	37.6	32.1	-	-	-	-	-	-	-	-	-	-	-	-	
1	54.0	51.2	48.7	40.3	32.3	26.9	20.2	16.1	13.4	11.5	10.1	9.0	8.1	7.3	6.5	300
2	52.8	49.1	44.6	33.5	26.8	22.3	16.7	13.4	11.2	9.6	8.4	7.4	6.7	6.1	5.4	
3	51.9	47.6	41.6	31.2	25.0	20.8	15.6	12.5	10.4	8.9	7.8	6.9	6.2	5.7	5.0	
4	51.2	46.4	40.1	30.1	24.1	20.0	15.0	12.0	10.0	8.6	7.5	6.7	6.0	5.5	4.8	
5	50.6	45.4	39.2	29.4	23.5	19.6	14.7	11.8	9.8	8.4	7.3	6.5	5.9	-	-	
10	48.3	41.8	36.8	28.0	22.4	18.7	14.0	11.2	-	-	-	-	-	-	-	
15	46.7	39.4	34.1	27.6	22.0	18.4	-	-	-	-	-	-	-	-	-	300
30	43.4	34.9	29.2	-	-	-	-	-	-	-	-	-	-	-	-	
1	52.8	49.1	36.0	27.0	21.6	18.0	13.5	10.8	9.0	7.7	6.8	6.0	5.4	4.9	4.3	
2	51.2	40.3	26.9	20.2	16.1	13.4	10.1	8.1	6.7	5.8	5.0	4.5	4.0	3.7	3.2	
3	50.0	35.8	23.8	17.9	14.3	11.9	8.9	7.2	6.0	5.1	4.5	4.0	3.6	3.3	2.9	
4	49.1	33.5	22.3	16.7	13.4	11.2	8.4	6.7	5.6	4.8	4.2	3.7	3.3	3.0	2.7	
5	48.3	32.1	21.4	16.1	12.8	10.7	8.0	6.4	5.4	4.6	4.0	3.6	3.2	-	-	300
10	45.4	29.4	19.6	14.7	11.8	9.8	7.3	5.9	-	-	-	-	-	-	-	
15	43.3	28.5	19.0	14.2	11.4	9.5	-	-	-	-	-	-	-	-	-	
30	39.4	27.6	18.4	-	-	-	-	-	-	-	-	-	-	-	-	



Abaco per carichi in serie - Serial load rating - Abaque de charges successives

0.6 - 3 Ø - 150 / 180 Hz

Potenza ammessa sul tubo in kW, per serie di n esposizioni, con frequenza z e durata di ogni esposizione in sec Anode input power as a function of n (N° of exposures in series), z (exp. rate per sec), the exposure time (sec) Puissance anodique en fonction de n (N° d'exp. de la série), z (cadence d'exp. par sec), temps d'exposition (sec)																
z	0.010	0.020	0.030	0.040	0.050	0.060	0.080	0.100	0.120	0.140	0.160	0.180	0.200	0.220	0.250	n
1	36.6	35.5	34.7	34.2	33.7	33.3	32.6	32.0	31.5	31.0	30.6	30.3	29.8	29.2	28.3	5
2	36.6	35.5	34.7	34.2	33.7	33.3	32.6	31.8	30.8	29.9	29.0	28.2	27.4	26.6	25.6	
3	36.6	35.5	34.7	34.2	33.7	33.3	32.0	30.7	29.6	28.5	27.5	26.6	25.8	25.0	23.8	
4	36.6	35.5	34.7	34.2	33.4	32.7	31.2	29.8	28.6	27.5	26.4	25.5	24.6	23.7	22.6	
5	36.6	35.5	34.7	33.9	33.0	32.1	30.5	29.1	27.8	26.6	25.5	24.5	23.6	-	-	
10	36.5	35.0	33.7	32.4	31.3	30.2	28.3	26.6	-	-	-	-	-	-	-	
15	36.1	34.4	32.8	31.4	30.1	28.9	-	-	-	-	-	-	-	-	-	
30	35.4	33.1	31.1	-	-	-	-	-	-	-	-	-	-	-	-	10
1	36.6	35.5	34.7	34.2	33.7	33.3	32.6	31.8	30.8	29.9	29.0	28.2	27.4	26.6	25.6	
2	36.6	35.5	34.7	34.2	33.4	32.6	31.2	29.8	28.6	27.5	26.4	25.4	24.5	23.7	22.5	
3	36.6	35.5	34.5	33.5	32.6	31.6	30.0	28.5	27.1	25.8	24.7	23.7	22.7	21.8	20.6	
4	36.6	35.3	34.1	32.9	31.8	30.8	29.0	27.4	25.9	24.6	23.4	22.4	21.4	20.5	19.3	
5	36.5	35.0	33.7	32.4	31.2	30.2	28.2	26.5	25.0	23.6	22.4	21.3	20.4	-	-	
10	35.8	33.9	32.1	30.5	29.1	27.8	25.5	23.6	-	-	-	-	-	-	-	
15	35.4	33.1	31.0	29.3	27.7	26.2	-	-	-	-	-	-	-	-	-	
30	34.4	31.4	28.9	-	-	-	-	-	-	-	-	-	-	-	-	20
1	36.6	35.5	34.7	34.2	33.4	32.6	31.2	29.8	28.6	27.5	26.4	25.4	24.5	23.7	22.5	
2	36.6	35.3	34.1	32.9	31.8	30.8	29.0	27.4	25.9	24.6	23.4	22.4	21.4	20.5	19.3	
3	36.3	34.7	33.3	31.9	30.7	29.6	27.5	25.8	24.2	22.8	21.6	20.5	19.5	18.6	17.4	
4	36.1	34.3	32.6	31.2	29.8	28.6	26.4	24.5	22.9	21.5	20.2	19.1	18.1	17.2	16.0	
5	35.8	33.9	32.1	30.5	29.1	27.8	25.5	23.6	21.9	20.4	19.2	18.1	17.1	-	-	
10	35.0	32.4	30.2	28.2	26.5	25.0	22.4	20.4	-	-	-	-	-	-	-	
15	34.4	31.4	28.8	26.7	24.8	23.2	-	-	-	-	-	-	-	-	-	
30	33.1	29.3	26.2	-	-	-	-	-	-	-	-	-	-	-	-	40
1	36.6	35.3	34.1	32.9	31.8	30.8	29.0	27.4	25.9	24.6	23.4	22.4	21.4	20.5	18.2	
2	36.1	34.3	32.6	31.2	29.8	28.6	26.4	24.5	22.9	21.5	20.2	19.1	18.1	17.2	16.0	
3	35.6	33.5	31.6	30.0	28.4	27.1	24.7	22.7	21.0	19.6	18.3	17.2	16.2	15.3	14.2	
4	35.3	32.9	30.8	29.0	27.4	25.9	23.4	21.4	19.7	18.2	16.9	15.8	14.9	14.0	12.9	
5	35.0	32.4	30.2	28.2	26.5	25.0	22.4	20.3	18.6	17.1	15.9	14.8	13.9	-	-	
10	33.9	30.5	27.8	25.5	23.6	21.9	19.2	17.1	-	-	-	-	-	-	-	
15	33.1	29.2	26.2	23.7	21.7	20.0	-	-	-	-	-	-	-	-	-	
30	31.4	26.7	23.2	-	-	-	-	-	-	-	-	-	-	-	-	60
1	36.3	34.7	33.3	31.9	30.7	29.6	27.5	25.8	24.2	22.8	20.1	17.8	16.1	14.6	12.8	
2	35.6	33.5	31.6	30.0	28.4	27.1	24.7	22.7	21.0	19.6	18.3	16.3	14.7	13.4	11.8	
3	35.1	32.6	30.5	28.6	26.9	25.4	22.9	20.8	19.1	17.6	16.4	15.3	14.2	12.9	11.4	
4	34.7	31.9	29.6	27.5	25.8	24.2	21.6	19.5	17.7	16.3	15.1	14.0	13.1	12.3	11.2	
5	34.4	31.4	28.8	26.7	24.8	23.2	20.5	18.4	16.7	15.3	14.1	13.0	12.1	-	-	
10	33.1	29.2	26.2	23.7	21.7	20.0	17.2	15.2	-	-	-	-	-	-	-	
15	32.1	27.8	24.5	21.9	19.8	18.1	-	-	-	-	-	-	-	-	-	
30	30.2	25.0	21.3	-	-	-	-	-	-	-	-	-	-	-	-	80
1	36.1	34.3	32.6	31.2	29.8	28.6	26.4	24.5	21.2	18.2	15.9	14.1	12.7	11.6	10.2	
2	35.3	32.9	30.8	29.0	27.4	25.9	23.4	21.4	18.9	16.2	14.2	12.6	11.4	10.3	9.1	
3	34.7	31.9	29.6	27.5	25.8	24.2	21.6	19.5	17.7	15.6	13.6	12.1	10.9	9.9	8.7	
4	34.3	31.2	28.6	26.4	24.5	22.9	20.2	18.1	16.4	15.0	13.3	11.9	10.7	9.7	8.5	
5	33.9	30.5	27.8	25.5	23.5	21.9	19.2	17.1	15.4	14.0	12.8	11.7	10.5	-	-	
10	32.4	28.2	25.0	22.4	20.3	18.6	15.9	13.9	-	-	-	-	-	-	-	
15	31.4	26.7	23.2	20.5	18.4	16.7	-	-	-	-	-	-	-	-	-	
30	29.2	23.7	20.0	-	-	-	-	-	-	-	-	-	-	-	-	100
1	35.8	33.9	32.1	30.5	29.1	27.8	25.5	21.5	17.9	15.3	13.4	11.9	10.7	9.8	8.6	
2	35.0	32.4	30.2	28.2	26.5	25.0	22.4	18.7	15.6	13.4	11.7	10.4	9.4	8.5	7.5	
3	34.4	31.4	28.8	26.7	24.8	23.2	20.5	17.8	14.8	12.7	11.1	9.9	8.9	8.1	7.1	
4	33.9	30.5	27.8	25.5	23.5	21.9	19.2	17.1	14.5	12.4	10.8	9.6	8.7	7.9	6.9	
5	33.4	29.8	26.9	24.5	22.5	20.8	18.1	16.0	14.2	12.2	10.7	9.5	8.5	-	-	
10	31.8	27.4	24.0	21.4	19.3	17.5	14.9	12.9	-	-	-	-	-	-	-	
15	30.7	25.8	22.2	19.5	17.4	15.7	-	-	-	-	-	-	-	-	-	
30	28.5	22.7	18.9	-	-	-	-	-	-	-	-	-	-	-	-	150
1	35.4	33.1	31.0	29.2	27.6	26.2	20.2	16.1	13.4	11.5	10.1	9.0	8.1	7.3	6.5	
2	34.4	31.4	28.8	26.7	24.8	22.3	16.7	13.4	11.2	9.6	8.4	7.4	6.7	6.1	5.4	
3	33.6	30.2	27.3	25.0	23.0	20.8	15.6	12.5	10.4	8.9	7.8	6.9	6.2	5.7	5.0	
4	33.1	29.2	26.2	23.7	21.7	20.0	15.0	12.0	10.0	8.6	7.5	6.7	6.0	5.5	4.8	
5	32.6	28.4	25.3	22.7	20.6	18.9	14.7	11.8	9.8	8.4	7.3	6.5	5.9	-	-	
10	30.7	25.8	22.2	19.5	17.4	15.7	13.1	11.2	-	-	-	-	-	-	-	
15	29.4	24.0	20.3	17.5	15.5	13.8	-	-	-	-	-	-	-	-	-	
30	26.9	20.8	17.0	-	-	-	-	-	-	-	-	-	-	-	-	300
1	34.4	31.4	28.8	26.7	21.6	18.0	13.5	10.8	9.0	7.7	6.8	6.0	5.4	4.9	4.3	
2	33.1	29.2	26.2	20.2	16.1	13.4	10.1	8.1	6.7	5.8	5.0	4.5	4.0	3.7	3.2	
3	32.1	27.8	23.8	17.9	14.3	11.9	8.9	7.2	6.0	5.1	4.5	4.0	3.6	3.3	2.9	
4	31.4	26.7	22.3	16.7	13.4	11.2	8.4	6.7	5.6	4.8	4.2	3.7	3.3	3.0	2.7	
5	30.7	25.8	21.4	16.1	12.8	10.7	8.0	6.4	5.4	4.6	4.0	3.6	3.2	-	-	
10	28.4	22.7	18.9	14.7	11.8	9.8	7.3	5.9	-	-	-	-	-	-	-	
15	26.9	20.8	17.0	14.2	11.4	9.5	-	-	-	-	-	-	-	-	-	
30	24.0	17.5	13.8	-	-	-	-	-	-	-	-	-	-	-	-	



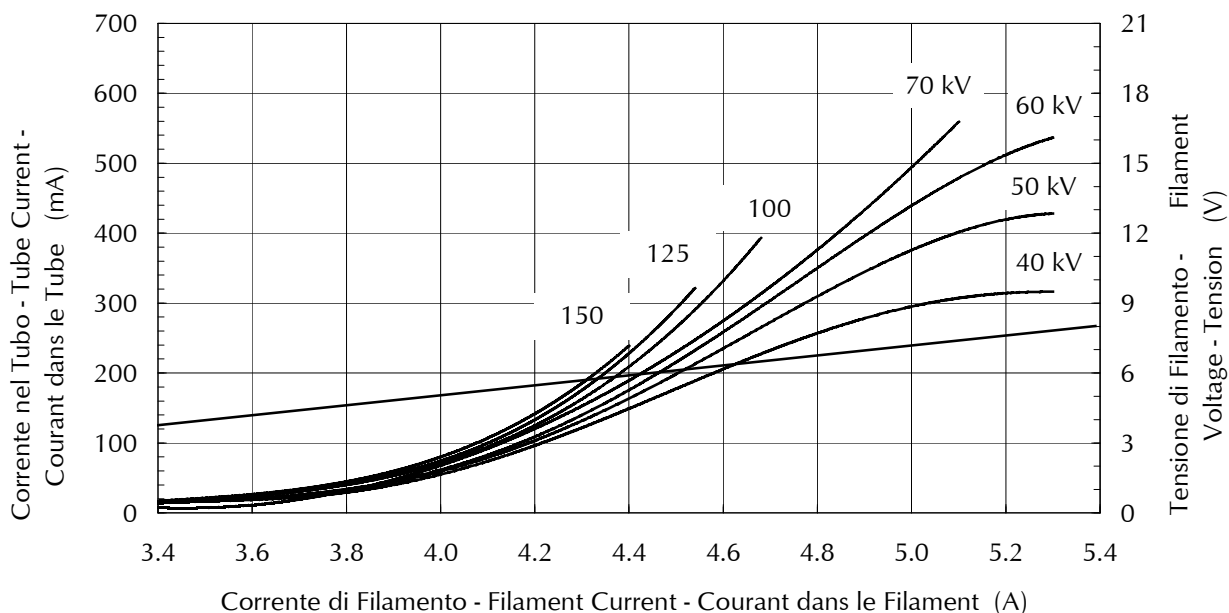
Abaco per carichi in serie - Serial load rating - Abaque de charges successives

■ 1.2 - 3 Ø - 150 / 180 Hz

Potenza ammessa sul tubo in kW, per serie di n esposizioni, con frequenza z e durata di ogni esposizione in sec																
Anode input power as a function of n (N° of exposures in series), z (exp. rate per sec), the exposure time (sec)																
Puissance anodique en fonction de n (N° d'exp. de la série), z (cadence d'exp. par sec), temps d'exposition (sec)																
z	0.010	0.020	0.030	0.040	0.050	0.060	0.080	0.100	0.120	0.140	0.160	0.180	0.200	0.220	0.250	n
1	96.1	91.9	89.3	87.3	85.7	84.3	81.9	80.0	78.3	76.9	75.5	74.4	73.0	71.0	68.2	5
2	96.1	91.9	89.3	87.3	85.7	84.3	81.9	79.5	76.2	73.2	70.4	67.8	65.4	63.2	60.1	
3	96.1	91.9	89.3	87.3	85.7	84.3	79.9	75.8	72.2	68.9	65.9	63.1	60.6	58.2	55.0	
4	96.1	91.9	89.3	87.3	84.9	82.2	77.3	73.0	69.1	65.7	62.5	59.7	57.0	54.7	51.4	
5	96.1	91.9	89.3	86.4	83.3	80.4	75.2	70.7	66.6	63.0	59.8	56.9	54.3	-	-	
10	95.5	90.3	85.6	81.4	77.6	74.1	68.0	62.9	-	-	-	-	-	-	-	
15	94.3	88.2	82.8	78.0	73.8	70.0	-	-	-	-	-	-	-	-	-	
30	91.7	83.8	77.1	-	-	-	-	-	-	-	-	-	-	-	-	
1	96.1	91.9	89.3	87.3	85.7	84.3	81.9	79.5	76.2	73.2	70.4	67.8	65.4	63.1	60.0	10
2	96.1	91.9	89.3	87.3	84.8	82.2	77.3	73.0	69.1	65.6	62.5	59.6	57.0	54.6	51.4	
3	96.1	91.9	88.7	85.1	81.9	78.8	73.4	68.6	64.5	60.8	57.5	54.6	51.9	49.5	46.3	
4	96.1	91.3	87.0	83.1	79.5	76.2	70.4	65.4	61.1	57.3	53.9	50.9	48.3	45.9	42.7	
5	95.5	90.3	85.6	81.4	77.5	74.0	67.9	62.8	58.3	54.5	51.1	48.1	45.5	-	-	
10	93.3	86.4	80.4	75.2	70.7	66.6	59.8	54.3	-	-	-	-	-	-	-	
15	91.6	83.6	76.9	71.1	66.2	61.9	-	-	-	-	-	-	-	-	-	
30	88.2	78.0	70.0	-	-	-	-	-	-	-	-	-	-	-	-	
1	96.1	91.9	89.3	87.3	84.8	82.2	77.3	73.0	69.1	61.0	53.4	47.5	42.7	38.8	34.2	20
2	96.1	91.3	87.0	83.1	79.5	76.2	70.4	65.4	61.0	57.2	51.7	45.9	41.3	37.6	33.1	
3	95.0	89.3	84.3	79.8	75.8	72.2	65.8	60.5	56.0	52.1	48.8	45.4	40.9	37.2	32.7	
4	94.0	87.7	82.2	77.3	73.0	69.1	62.5	57.0	52.4	48.5	45.1	42.2	39.6	37.0	32.5	
5	93.2	86.3	80.4	75.2	70.6	66.6	59.8	54.2	49.6	45.7	42.4	39.5	37.0	-	-	
10	90.3	81.4	74.0	67.9	62.8	58.3	51.1	45.5	-	-	-	-	-	-	-	
15	88.1	77.9	69.8	63.3	57.8	53.3	-	-	-	-	-	-	-	-	-	
30	83.6	71.1	61.9	-	-	-	-	-	-	-	-	-	-	-	-	
1	96.1	91.3	87.0	83.1	79.5	75.7	56.8	45.4	37.9	32.5	28.4	25.2	22.7	20.7	18.2	40
2	94.0	87.7	82.2	77.3	73.0	69.1	53.4	42.7	35.6	30.5	26.7	23.7	21.4	19.4	17.1	
3	92.5	85.1	78.8	73.4	68.6	64.5	52.2	41.8	34.8	29.9	26.1	23.2	20.9	19.0	16.7	
4	91.3	83.1	76.2	70.4	65.4	61.0	51.7	41.3	34.4	29.5	25.8	23.0	20.7	18.8	16.5	
5	90.2	81.3	74.0	67.9	62.7	58.3	51.1	41.1	34.2	29.3	25.7	22.8	20.5	-	-	
10	86.3	75.2	66.6	59.8	54.2	49.6	42.4	37.0	-	-	-	-	-	-	-	
15	83.6	71.1	61.8	54.7	49.1	44.5	-	-	-	-	-	-	-	-	-	
30	77.9	63.3	53.3	-	-	-	-	-	-	-	-	-	-	-	-	
1	95.0	89.3	84.3	79.8	64.2	53.5	40.1	32.1	26.8	22.9	20.1	17.8	16.1	14.6	12.8	60
2	92.5	85.1	78.8	73.4	58.8	49.0	36.7	29.4	24.5	21.0	18.4	16.3	14.7	13.4	11.8	
3	90.8	82.2	75.1	69.1	56.9	47.5	35.6	28.5	23.7	20.3	17.8	15.8	14.2	12.9	11.4	
4	89.3	79.8	72.2	65.8	56.0	46.7	35.0	28.0	23.3	20.0	17.5	15.6	14.0	12.7	11.2	
5	88.1	77.9	69.8	63.2	55.5	46.2	34.7	27.7	23.1	19.8	17.3	15.4	13.9	-	-	
10	83.5	71.1	61.8	54.7	49.1	44.5	34.0	27.2	-	-	-	-	-	-	-	
15	80.4	66.6	56.8	49.6	44.0	39.5	-	-	-	-	-	-	-	-	-	
30	74.0	58.3	48.1	-	-	-	-	-	-	-	-	-	-	-	-	
1	94.0	87.7	82.2	63.6	50.9	42.4	31.8	25.5	21.2	18.2	15.9	14.1	12.7	11.6	10.2	80
2	91.3	83.1	75.7	56.8	45.4	37.9	28.4	22.7	18.9	16.2	14.2	12.6	11.4	10.3	9.1	
3	89.3	79.8	72.2	54.5	43.6	36.3	27.3	21.8	18.2	15.6	13.6	12.1	10.9	9.9	8.7	
4	87.7	77.3	69.1	53.4	42.7	35.6	26.7	21.4	17.8	15.3	13.3	11.9	10.7	9.7	8.5	
5	86.3	75.2	66.6	52.7	42.2	35.1	26.3	21.1	17.6	15.1	13.2	11.7	10.5	-	-	
10	81.3	67.9	58.3	51.1	41.1	34.2	25.7	20.5	-	-	-	-	-	-	-	
15	77.9	63.2	53.2	46.0	40.4	33.9	-	-	-	-	-	-	-	-	-	
30	71.1	54.7	44.5	-	-	-	-	-	-	-	-	-	-	-	-	
1	93.2	86.3	71.5	53.7	42.9	35.8	26.8	21.5	17.9	15.3	13.4	11.9	10.7	9.8	8.6	100
2	90.2	81.3	62.4	46.8	37.4	31.2	23.4	18.7	15.6	13.4	11.7	10.4	9.4	8.5	7.5	
3	88.1	77.9	59.4	44.5	35.6	29.7	22.3	17.8	14.8	12.7	11.1	9.9	8.9	8.1	7.1	
4	86.3	75.2	57.9	43.4	34.7	28.9	21.7	17.4	14.5	12.4	10.8	9.6	8.7	7.9	6.9	
5	84.8	73.0	56.9	42.7	34.2	28.5	21.4	17.1	14.2	12.2	10.7	9.5	8.5	-	-	
10	79.5	65.4	55.1	41.3	33.1	27.6	20.7	16.5	-	-	-	-	-	-	-	
15	75.8	60.5	50.4	40.9	32.7	27.3	-	-	-	-	-	-	-	-	-	
30	68.6	51.9	41.7	-	-	-	-	-	-	-	-	-	-	-	-	
1	91.6	80.7	53.8	40.3	32.3	26.9	20.2	16.1	13.4	11.5	10.1	9.0	8.1	7.3	6.5	150
2	88.1	67.0	44.6	33.5	26.8	22.3	16.7	13.4	11.2	9.6	8.4	7.4	6.7	6.1	5.4	
3	85.6	62.4	41.6	31.2	25.0	20.8	15.6	12.5	10.4	8.9	7.8	6.9	6.2	5.7	5.0	
4	83.5	60.1	40.1	30.1	24.1	20.0	15.0	12.0	10.0	8.6	7.5	6.7	6.0	5.5	4.8	
5	81.8	58.8	39.2	29.4	23.5	19.6	14.7	11.8	9.8	8.4	7.3	6.5	5.9	-	-	
10	75.8	56.0	37.4	28.0	22.4	18.7	14.0	11.2	-	-	-	-	-	-	-	
15	71.7	55.1	36.7	27.6	22.0	18.4	-	-	-	-	-	-	-	-	-	
30	64.0	46.8	36.1	-	-	-	-	-	-	-	-	-	-	-	-	
1	88.1	54.0	36.0	27.0	21.6	18.0	13.5	10.8	9.0	7.7	6.8	6.0	5.4	4.9	4.3	300
2	80.7	40.3	26.9	20.2	16.1	13.4	10.1	8.1	6.7	5.8	5.0	4.5	4.0	3.7	3.2	
3	71.5	35.8	23.8	17.9	14.3	11.9	8.9	7.2	6.0	5.1	4.5	4.0	3.6	3.3	2.9	
4	67.0	33.5	22.3	16.7	13.4	11.2	8.4	6.7	5.6	4.8	4.2	3.7	3.3	3.0	2.7	
5	64.2	32.1	21.4	16.1	12.8	10.7	8.0	6.4	5.4	4.6	4.0	3.6	3.2	-	-	
10	58.8	29.4	19.6	14.7	11.8	9.8	7.3	5.9	-	-	-	-	-	-	-	
15	56.9	28.5	19.0	14.2	11.4	9.5	-	-	-	-	-	-	-	-	-	
30	55.1	27.6	18.4	-	-	-	-	-	-	-	-	-	-	-	-	

Caratteristica di emissione del catodo
Cathode emission characteristic
Caractéristique d'émission de la cathode

■ **0.6 - 3 Ø - (± 0.2 A) - IEC 60613 (1989) (2010)**



Caratteristica di emissione del catodo
Cathode emission characteristic
Caractéristique d'émission de la cathode

■ **1.2 - 3 Ø - (± 0.2 A) - IEC 60613 (1989) (2010)**

