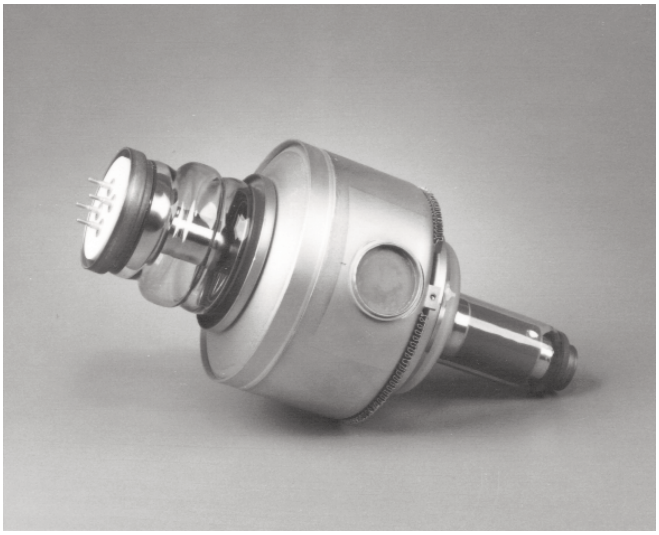
VARIAN
medical systems

X-RAY
PRODUCTS

G-1077/G-1078
Rotating Anode X-Ray Tube



Tubes Radiogénes à Anode Tournante
Röntgenröhre mit rotierender Anode
Tubos de Rayos-X con Ánodo Giratorio

Note: Document originally drafted in the English language.

Product Description

The G-1077 is a 4.25" (108 mm) 150 kV, 740 kJ (1.0 MHU) maximum anode heat content, rotating anode insert. This metal center section insert is designed for radiography, cineradiography , digital and film screen angiography procedures. The insert features a 7° rhenium-tungsten facing on molybdenum with a graphite backed target and is available with the following nominal focal spots:

0.6 - 1.0
IEC 60336

Reference Axis:
Perpendicular to port face.

Nominal Anode Input Power
Small - 48 kW IEC 60613
Large - 90 kW IEC 60613
For the equivalent anode input power of 235 Watt

This insert is intended for use in B-160H housings.

G-1078 models have grid control capability.

Grid Control Voltages:
Typical Bias Voltage for Cutoff at 150 kV ..... -3700Vdc

Grid Voltage for Exposure ... 0 Vdc

Description du Produit

Le tube G-1077, à anode tournante de 108 mm, (4,25 pouces), 150 kV, avec une capacité calorifique maximale de 740 kJ (1.0 MUC). Cette section métallique centrale a été conçue pour les procédures radiographiques, cinéradiographiques et angiographiques numériques et sur film. L'tube est pourvu d'une anode avec pente de 7° en rhènium - tungstène sur une base de molybdéne et avec un doublage de graphite. Il est disponible avec les foyers suivantes:

0,6 - 1,0
CEI 60336

Référence Axe:
Perpendiculaire à la face de sortie.

Puissance anodique nominale de l'anode
Petit foyer - 48 kW CEI 60613
Grand foyer - 90 kW CEI 60613
Pour la puissance anodique d'equilibre thermique de 235 Watts

Ce tube est essentiellement destiné à être employé dans les gaines B-160H.

Les Modèles G-1078 ont une fonction de commande de grille.

Potentiel de controle de grille:
Voltage typique pour coupure et 150 kV ..... -3700 Vcc

Voltage de grille pendant exposition ..... 0 Vcc

Produktbeschreibung

Die G-1077 ist eine 4.25" (108 mm) Doppelfokus Drehanoden-Röntgenröhre, mit einer Anoden Wärmespeicherkapazität von 740 kJ (1.0 MHU) und einer max. Spannungsfestigkeit von 150 kV. Diese Einsatz mit metallischem Mittielteil wurde für Radiographie-, Röntgenkinematographie-, digitale und Filmangiographieverfahren entwickelt. Der rückseitig graphitbeschichtete Rhenium-Wolfram- und Molybdän Anodenteller besitzt einen Winkel von 7°. Folgende Brennfleckkombination ist lieferbar:

0.6 - 1.0
IEC 60336

Referenz Axes:
Senkrecht zum strahlenaustrittsfenster.

Nominale Anodenbezugsleistung
Klein - 48 kW IEC 60613
Gross - 90 kW IEC 60613
Gilt bei einer Aquivalent - Anodenleistung von 235 Watt

Die Röntgenröhre ist für den Einbau in die B-160H vorgesehen.

Modell G-1078 ist mit Gittersteuerungsfunktion ausgestattet.

Gittersteuerspannungen:
Typische Vorspannung für Abschaltung bei 150 kV ..... -3700Vdc

Gitterspannung für Belichtung .. 0 Vdc

Descripcion del Producto

El G-1077 es un tubo de ánodo giratorio de 108 mm (4.25"), 150 kV, 740 kJ (1.0 MUC). Este tubo de metal en la parte central es diseñado especificamente para radiografía, cineradiográphica, digital, y procedimientos de angiografía con pelicula de pantalla. El blanco emisor es una combinación de renio, tungsteno y molibdeno con grafito en la parte posterior con un rayo central de 7 grados. Disponible con las siguientes combinaciones de marcas focales:

0.6 - 1.0
IEC 60336

Referencia de Axes:
Perpendicular a la abertura facial.

Potencia nominal de entrada del anodo
Foco fine - 48 kW IEC 60613
Foco grueso - 90 kW IEC 60613
Para una potencia equivalente del anodo de 235 W

Este tubo es diseñado, para uso en los encajes B-160H.

El modelo G-1078 tiene capacidad para de rejillas controlar los electrones.

Voltaje de Rejillas Controlada:
Voltaje controlado tipico con interruptor a 150 kV ..... -3700 Vdc

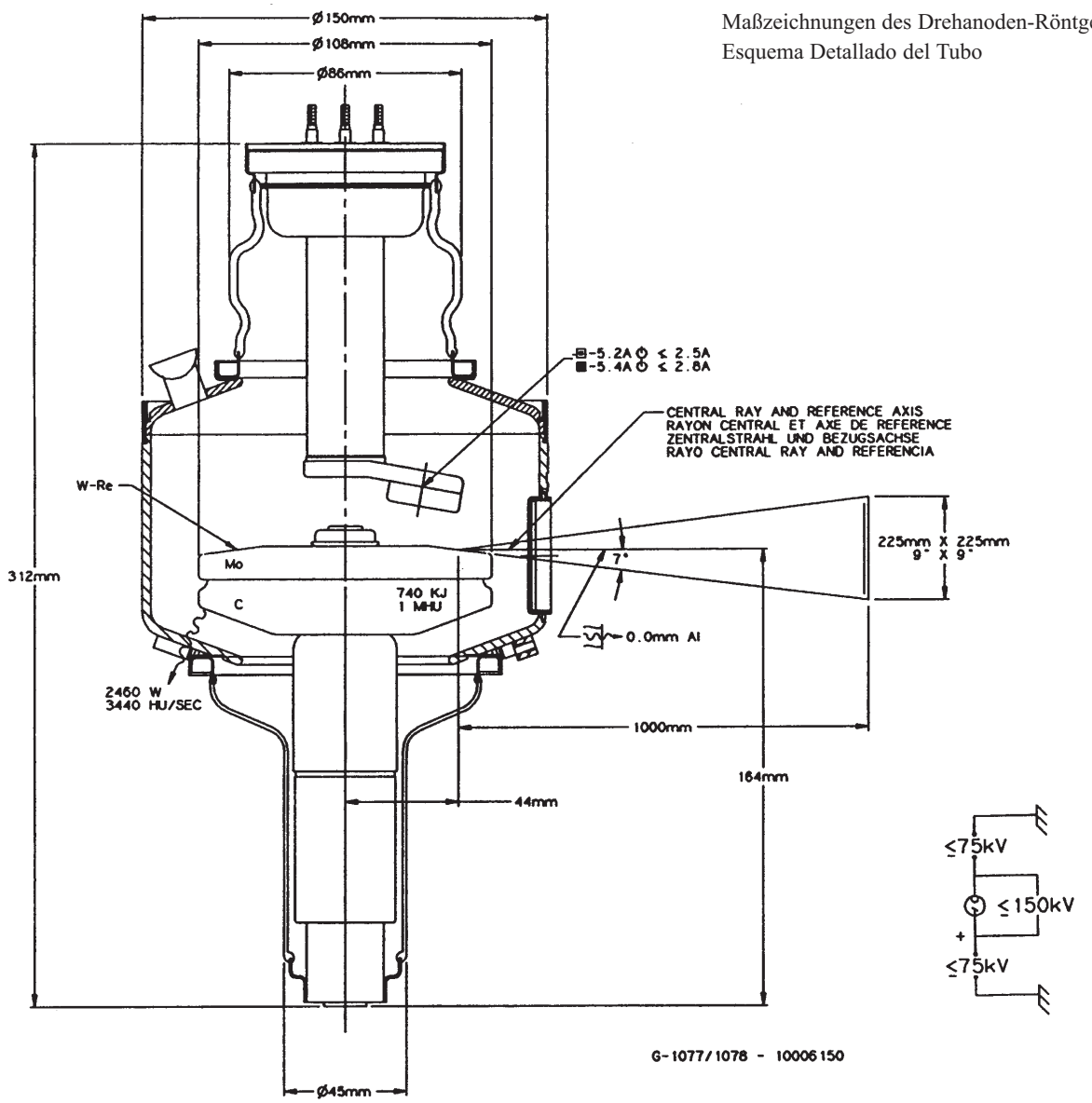
Voltaje de rejillas con exponición .....0 Vdc

4521 Rev B 01/07

Manufactured by Varian Medical Systems
Fabrique par Varian Medical Systems
Hergestellt von Varian Medical Systems
Fabricado por Varian Medical Systems

G-1077/G-1078
Tube Outline Drawing

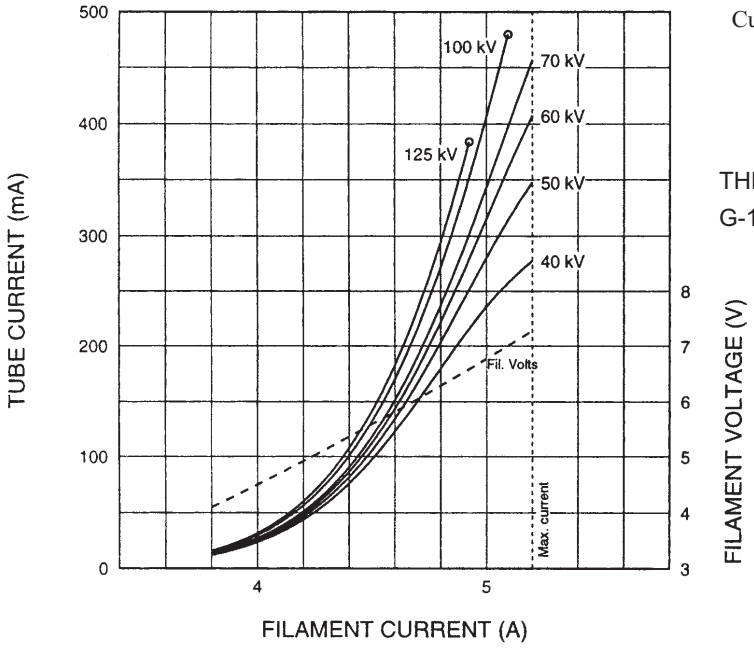
Dessin d'Encombrement de la Tube
Maßzeichnungen des Drehanoden-Röntgenröhre
Esquema Detallado del Tubo



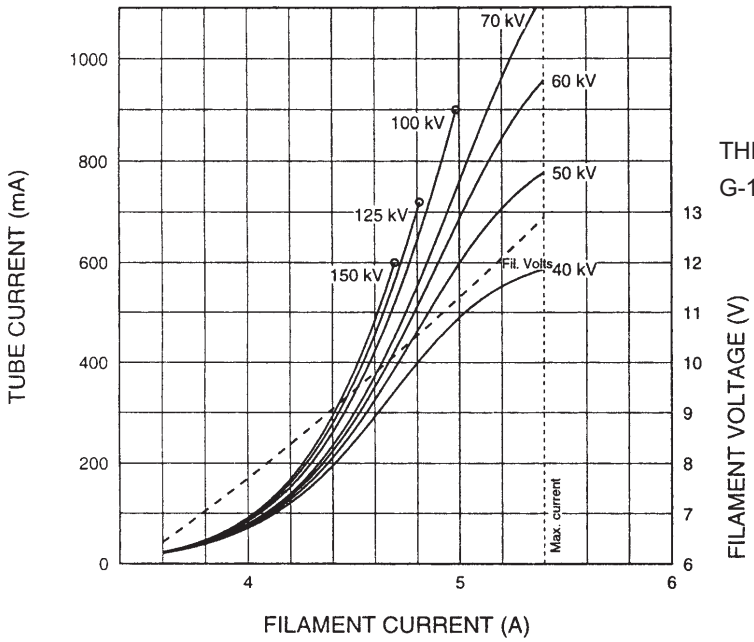
Large - Black Grand - Noir Gross - Schwarz Grande - Negro	Frame or Chasis Masse Chassis Soporte o Chasis
Small -White Petit - Blanc Klein - Weiss Pequeño - Blanco	X-Ray Tube Tube Radiogène Röntgenröhre Tubo de Rayos X
Stand-By Attente Bereitschaft En Espera	Radiation Filter or Filtration Filtre de rayonnement Filterung Filtración de Radiación

3 Ø FULL WAVE

Abaques d' Émissions des Filaments CEI 60613
Heizfadenemissionsdiagramm IEC 60613
Curvas de Emisión de los Filamentos IEC 60613



THREE PHASE EMISSION (± .15 A)
G-1077 0.6 ■



THREE PHASE EMISSION (± .15 A)
G-1077 1.0 ■

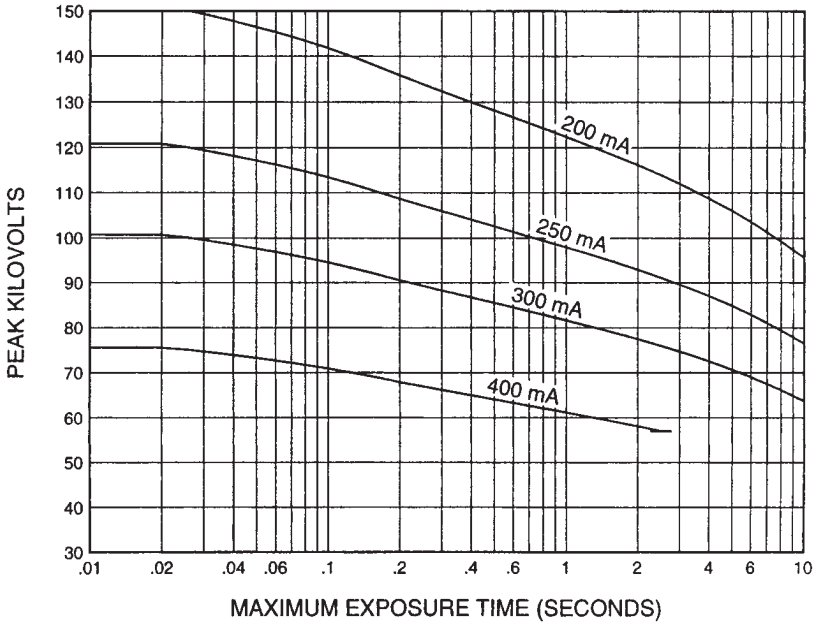
Note:	When using these emission curves for trial exposures, refer to the power rating curves shown for maximum kV, tube emission, filament current, exposure time, and target speed.
Remarque:	Lors de l'utilisation de ces abaques pour des expositions d'essai, référez-vous aux courbes maximales de kV, d'émission du filament, de temps d'exposition et de vitesse de rotation.
Anmerkung:	Wenn Sie diese Emissionskurven für Testaufnahmen verwenden, beziehen Sie sich hierbei auf die entsprechenden Nennleistungskurven für max. kV-Werte, Röhrenemission, Heizstrom, und Anodendrehzahl.
Nota:	Si utiliza estas curvas de emisión para exposiciones de prueba, refiérase a las curvas de gradación de potencia para el máximo de kV, tubo de emisión, corriente en los filamentos, tiempo de exposión, y a las curvas de velocidad del objetivo.

3 Ø Constant Potential ⎓

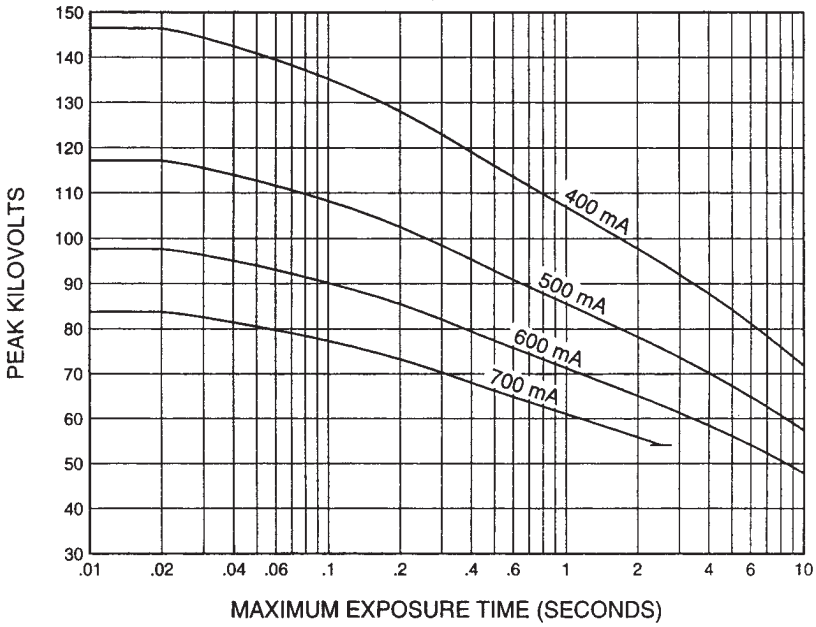
Abaques de Chargepour Pose Unique CEI 60613
Brennfleck - Belastungskurven IEC 60613
Diagramas de Exposición Radiográfica IEC 60613

50 Hz

Nominal Focal Spot Size - 0.6 ■



Nominal Focal Spot Size - 1.0 ■



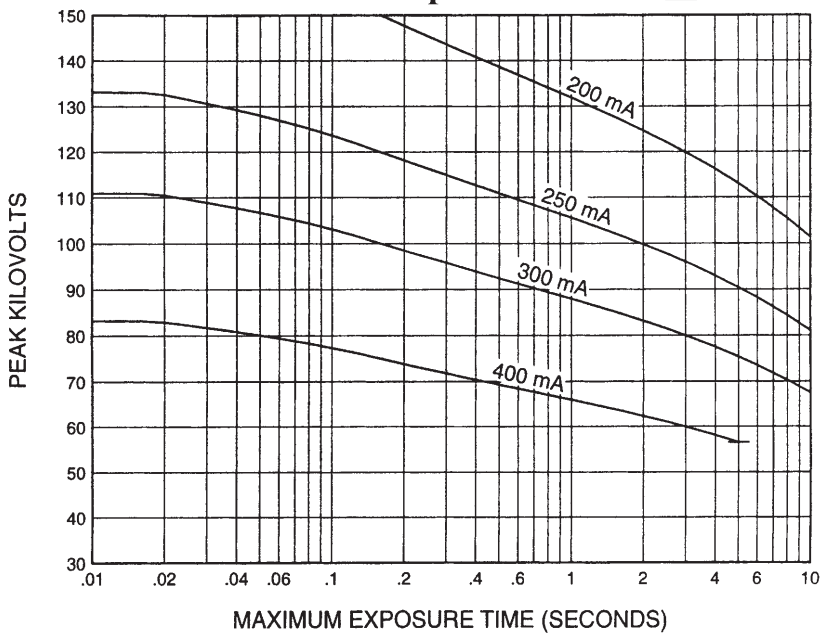
Nominal anode input power for the anode heat content 40%. IEC 60613	Puissance calorifique nominale de l'anode: 40%, CEI 60613	Thermische Anodenbezugsleistung bei einer Wärmespeicherung von 40%. IEC 60613	Aproximadamente el poder de penetracion para obtener un almacenaje de calor del anodo de 40%. IEC 60613

3 Ø Constant Potential ⎓

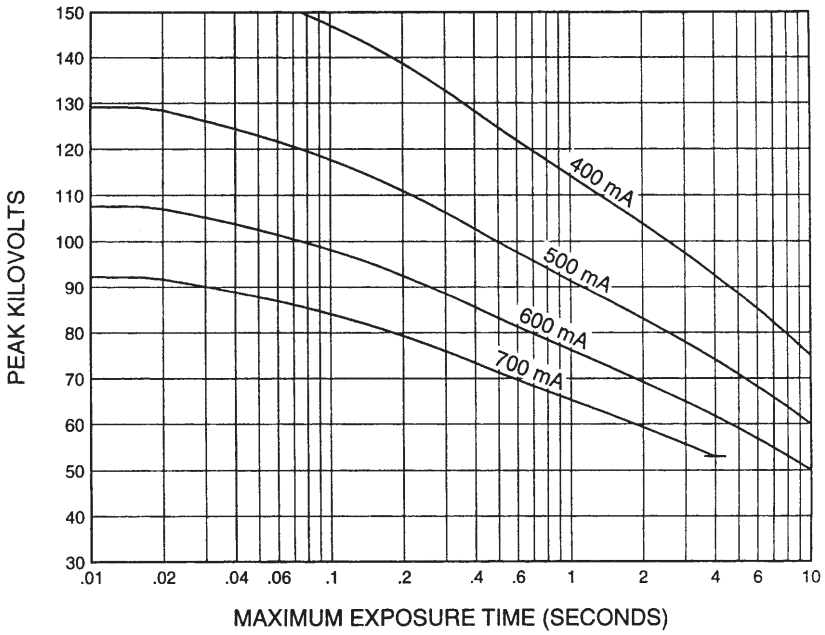
Abaques de Chargepour Pose Unique CEI 60613
Brennfleck - Belastungskurven IEC 60613
Diagramas de Exposición Radiográfica IEC 60613

60 Hz

Nominal Focal Spot Size - 0.6 ■



Nominal Focal Spot Size - 1.0 ■



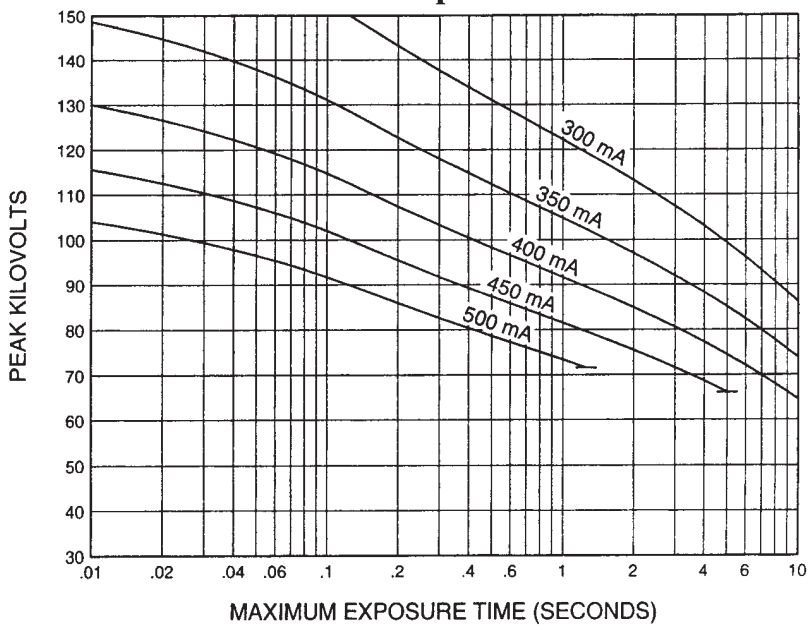
Nominal anode input power for the anode heat content 40%. IEC 60613	Puissance calorifique nominale de l'anode: 40%, CEI 60613	Thermische Anodenbezugsleistung bei einer Wärmespeicherung von 40%. IEC 60613	Aproximadamente el poder de penetracion para obtener un almacenaje de calor del anodo de 40%. IEC 60613

3 Ø Constant Potential ⎓

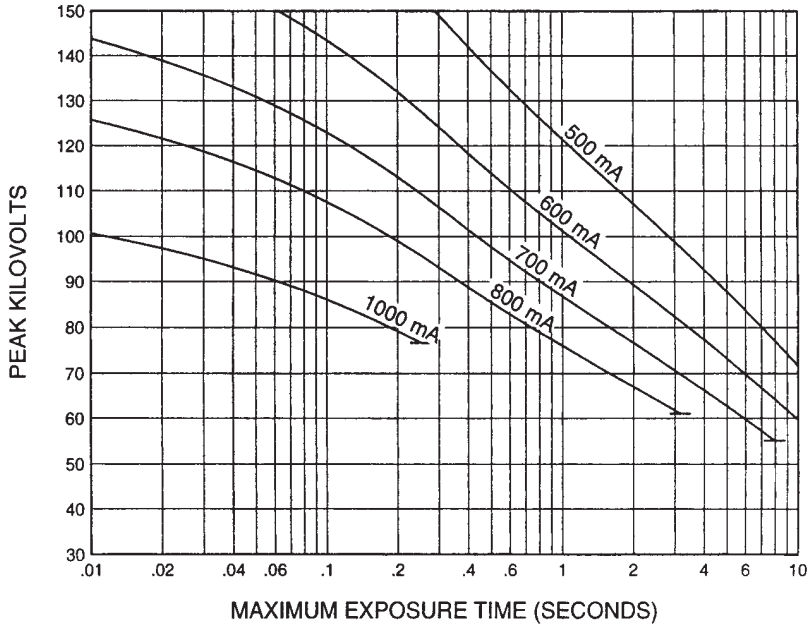
Abaques de Chargepour Pose Unique CEI 60613
Brennfleck - Belastungskurven IEC 60613
Diagramas de Exposición Radiográfica IEC 60613

150 Hz

Nominal Focal Spot Size - 0.6 ■



Nominal Focal Spot Size - 1.0 ■



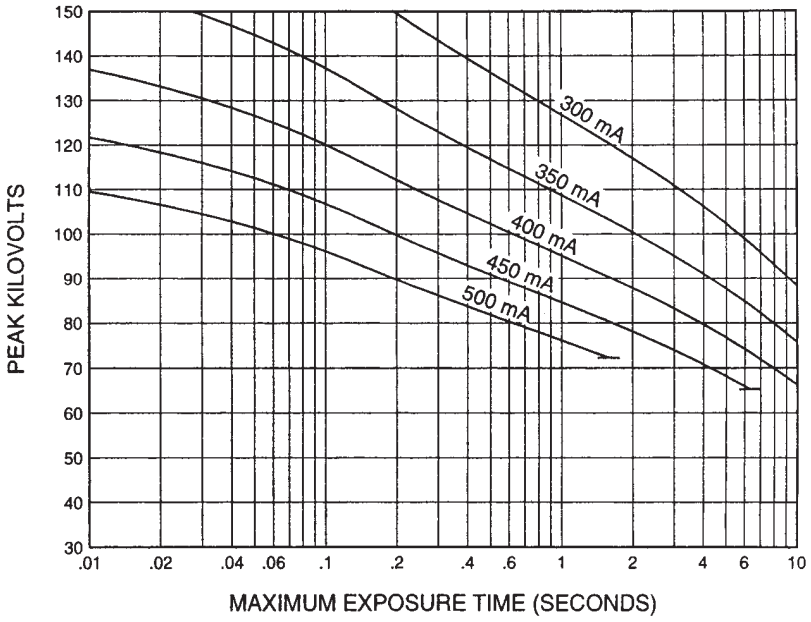
Nominal anode input power for the anode heat content 40%. IEC 60613	Puissance calorifique nominale de l'anode: 40%, CEI 60613	Thermische Anodenbezugsleistung bei einer Wärmespeicherung von 40%. IEC 60613	Aproximadamente el poder de penetracion para obtener un almacenaje de calor del anodo de 40%. IEC 60613

3 Ø Constant Potential ⎓

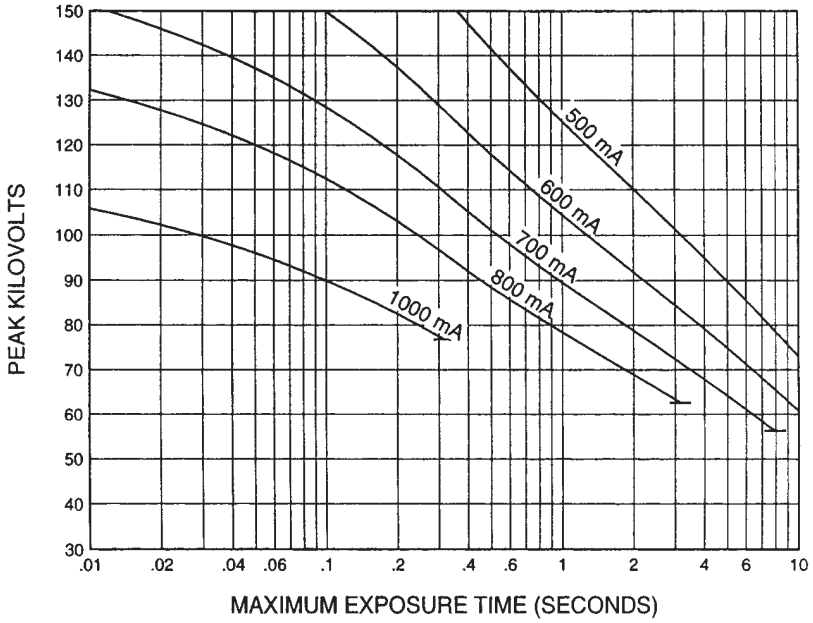
Abaques de Chargepour Pose Unique CEI 60613
Brennfleck - Belastungskurven IEC 60613
Diagramas de Exposición Radiográfica IEC 60613

180 Hz

Nominal Focal Spot Size - 0.6 ■



Nominal Focal Spot Size - 1.0 ■



Nominal anode input power for the anode heat content 40%. IEC 60613	Puissance calorifique nominale de l'anode: 40%, CEI 60613	Thermische Anodenbezugsleistung bei einer Wärmespeicherung von 40%. IEC 60613	Aproximadamente el poder de penetracion para obtener un almacenaje de calor del anodo de 40%. IEC 60613

CINERADIOGRAPHIC RATINGS

HOW TO USE CINERADIOGRAPHIC CHARTS

General: With the Cineradiographic rating chart we can determine the maximum allowable kW of the Cine pulse, or with a given kW determine maximum time in seconds the Cine run can progress.

The Most common way of using the charts is to determine maximum time of any expected Cine run and maximum duty factor. With a known duty factor and Cine run time kW can easily be determined.

Definition of Terms
Time in seconds: Total time of one Cine run, usually 5 to 12 seconds.

Duty Factor in Percent (DF%): Actual time during one second the x-ray tube is producing x-rays. If we select a 4 msec pulse width and 60 exposures per second the x-ray tube will be producing x-rays for a total of 240 msec each second or 24% of the time. The higher the DF number, the more load placed on the x-ray tube.

Peak Pulse Power: Peak energy in watts of any one Cine Pulse. Can be any combination of kV and mA allowed by Radiographic and Filament Emission curves.

Example: 80 kV at 400 mA equals

80,000 V x 0.4 A = 32,000 W or 32 kW

USING THE CINE RATING CHARTS:

G-1077 150/160 Hz 3 Phase 1.0 Focal Spot

Example: Determine maximum kW allowed with the following known factors:
Maximum Pulse Width ..... 4 msec
Exposures per Second 60
Maximum Cine Run Time ... 10 seconds

Calculate Duty Factor: (DF%)

$$DF\% = \frac{\text{Pulse Width (mSec) x Frames per Second}}{10}$$

$$DF\% = \frac{\text{4 msec x 60 exp/sec}}{10} = \frac{240}{10} = 24\%$$

Refer to Rating Chart G-1077 150/180 Hz 3 Phase 1.0 Focal Spot:

At bottom of chart find 10 second line. Move vertically to intersection with 24% DF curve. Make a horizontal reference to left side of rating chart and note kW rating of 60 kW.

We now know each pulse during the cine run can have a maximum rating of 60 kW under conditions given in example.

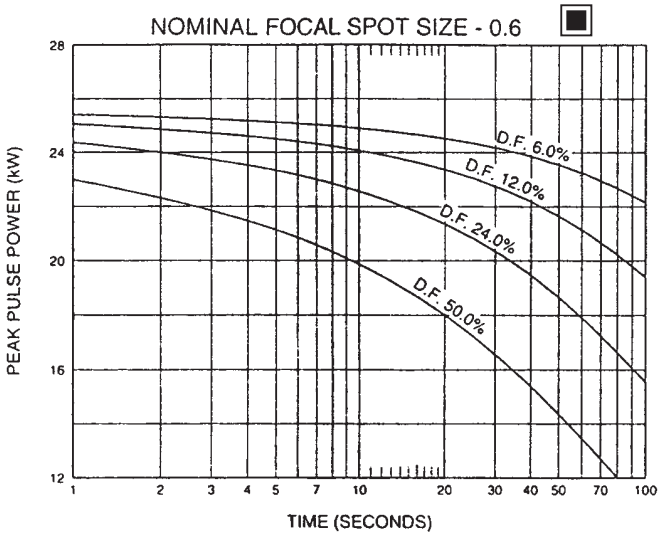
kW = kV x mA. The kW of the exposure can be any combination of mA and kV allowed by the Radiographic and Filament Emission Charts.

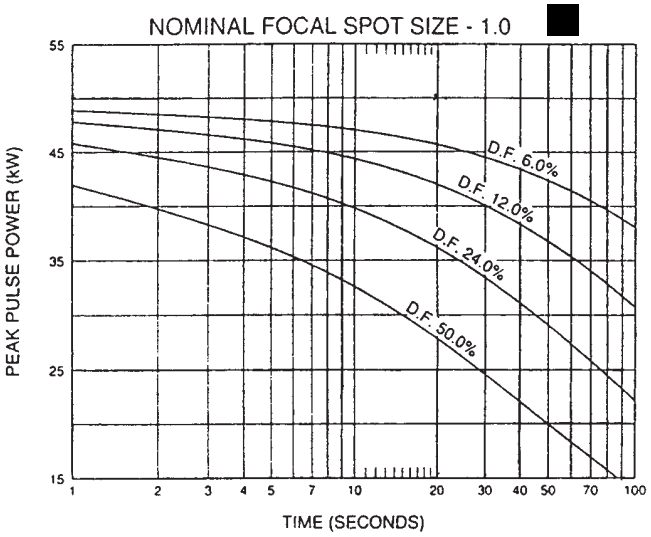
The Cine rating charts are usable to 100% anode heat storage. The start of Cine run should be below 70% and heat storage. Exceeding 100% anode heat storage will cause anode track erosion with high risk of tube destruction.

3 Ø Constant Potential ⎓

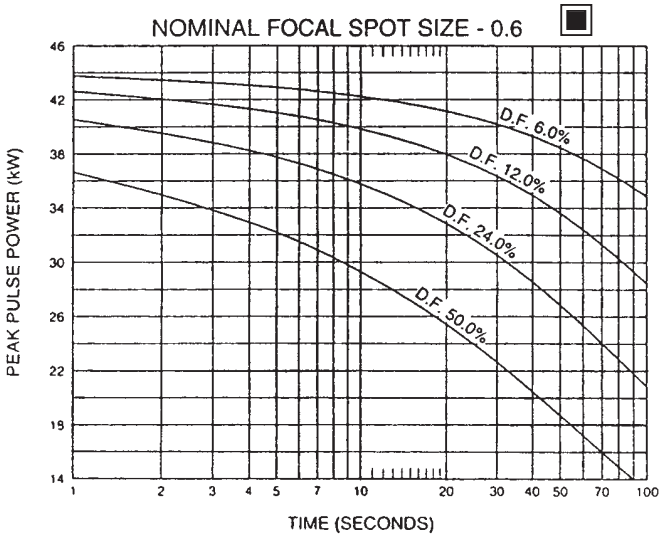
Abaques d'Expositions CEI 60613
Belastungskurven IEC 60613
Diagramas de Exposición IEC 60613

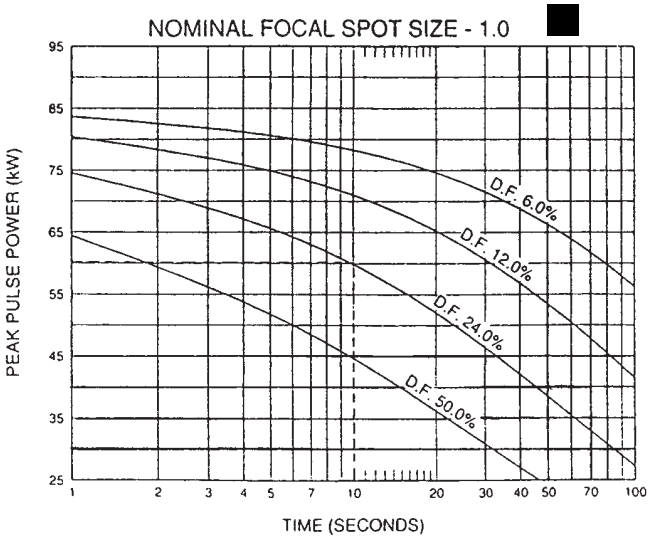
50/60 Hz





150/180 Hz





Nominal anode input power for the anode heat content 70%. IEC 60613	Puissance calorifique nominale de l'anode: 70%, CEI 60613	Thermische Anodenbezugsleistung bei einer Wärmespeicherung von 70%. IEC 60613	Aproximadamente el poder de penetracion para obtener un almacenaje de calor del anodo de 70%. IEC 60613

ANGIOGRAPHIC RATINGS

HOW TO USE ANGIOGRAPHIC CHARTS

General: Serial Radiography puts a severe demand on the x-ray tube due to the large number of exposures made in rapid succession. Intervals between exposures are fixed and so short that it is not possible for the anode track to cool to any extent during the exposure series. Therefore, the temperature of the anode track increases from exposure to exposure. The kW values used in the angiographic charts have been determined to prevent damage to the anode. The angiographic rating charts are usable to 100% anode heat storage. Exceeding 100% anode heat storage will cause anode track erosion with high risk of tube destruction.

Definition of Terms

Number of Exposures in Series: The number of exposures made in succession or the number of exposures made during one contrast injection.

Exposure Rate: The number of exposures made per second. For a series of exposures where the exposure rate changes, it must be assumed that all exposures will be made at the maximum rate. For example, if during a series 10 exposures will occur at one per second and 30 exposures at 4 per second use the kW ratings in the 40 exposure column at 4 per second rate.

Exposure Time: Time in seconds of each exposure.

USING THE CHARTS:

Select Correct Chart:

3 phase generator
60 or 180 Hz
0.6 or 1.0 Focal Spot

Note: 180 Hz rotor speed recommended for all angiography.

Determine the number of exposures in Series: With cut film angiography the number of exposures are known, however in Digital Angiography the number of exposures commonly are not known. When determining the number of exposures assume worst case or past history.

Note: Most angiographic x-ray tubes fail from underestimating the number of exposures made in a series.

Determine kW of each exposure in Series: Referring to chart —find block under “Number of Exposures in Series” that is greater than or equal to expected number of exposures in Series. On left side directly opposite this block under “Exposure Rate per Second” column, select maximum rate per second that will be used for the exposure series. At the intersection of exposure rate and exposure time in seconds, find maximum kW allowed for each exposure.

kW = pkV x mA: The kW of the exposure can be any combination of mA and pkV allowed by the Radiographic and Filament Emission charts.

For Example: 80 pkV and 500 mA = 40 kW

Example: From chart G-1077 180 Hz 3 Phase 1.0 Focal Spot, determine kW allowed with following known factors.
Maximum number of exposures 40
Exposure time .050 second (50 milliseconds)
Maximum Exposures per second 4

From chart find 40 exposure block. On left side directly opposite this block under “Exposure Rate per Second” column, select 4 exposures per second. Find .050 seconds at top of chart. At intersection of exposure rate line and exposure time, find 60.8 kW.

0.6 Focal Spot 3Ø 7 Degrees 50/60 Hz
0.6 Dimension Focale 3Ø 7 Degrés 50/60 Hz
0.6 Brennpunkt 3Ø 7 Grad 50/60 Hz
0.6 De Marcas Focales 3Ø 7 Grados 50/60 Hz

Caractéristoques Pour L'Angiographie CEI 60613
Angiographische Nennleistungen IEC 60613
Gradaciones Angiografica IEC 60613

EXPOSURE RATE PER SECOND	TUBE LOAD (kW) AS A FUNCTION OF THE EXPOSURE TIME (SEC.) OF THE INDIVIDUAL RADIOGRAPHS OF THE SERIES															NUMBER OF EXPOSURES IN SERIES
	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	0.225	0.250	
1	25.7	25.6	25.2	24.9	24.6	24.3	23.8	23.4	23.0	22.6	22.3	22.0	21.7	21.4	21.1	
2	25.6	25.5	25.1	24.7	24.4	24.1	23.5	23.0	22.6	22.2	21.8	21.5	21.2	20.8	20.5	
3	25.6	25.4	25.0	24.5	24.2	23.8	23.2	22.7	22.2	21.8	21.4	21.0	——	——	——	
4	25.6	25.3	24.8	24.4	24.0	23.6	23.0	22.4	21.9	21.4	——	——	——	——	——	10
8	25.4	25.0	24.4	23.8	23.3	22.9	——	——	——	——	——	——	——	——	——	
15	25.2	24.6	23.7	23.0	——	——	——	——	——	——	——	——	——	——	——	
30	24.8	23.8	——	——	——	——	——	——	——	——	——	——	——	——	——	
1	25.6	25.5	25.0	24.6	24.2	23.9	23.3	22.8	22.4	21.9	21.5	21.2	20.8	20.4	20.0	
2	25.6	25.3	24.9	24.4	24.0	23.6	23.0	22.4	21.9	21.4	21.0	20.5	20.2	19.7	19.3	
3	25.5	25.2	24.7	24.2	23.8	23.4	22.7	22.0	21.4	20.9	20.4	20.0	——	——	——	
4	25.5	25.1	24.5	24.0	23.5	23.1	22.3	21.7	21.0	20.5	——	——	——	——	——	20
8	25.2	24.7	24.0	23.3	22.7	22.2	——	——	——	——	——	——	——	——	——	
15	24.9	24.1	23.2	22.3	——	——	——	——	——	——	——	——	——	——	——	
30	24.4	23.2	——	——	——	——	——	——	——	——	——	——	——	——	——	
1	25.5	25.2	24.7	24.2	23.7	23.3	22.5	21.9	21.3	20.7	20.2	19.7	19.3	18.8	18.3	
2	25.4	25.1	24.5	23.9	23.4	23.0	22.1	21.4	20.8	20.2	19.6	19.1	18.6	18.1	17.6	
3	25.4	25.0	24.3	23.7	23.1	22.7	21.8	21.0	20.3	19.6	19.0	18.5	——	——	——	
4	25.3	24.8	24.1	23.5	22.9	22.4	21.4	20.6	19.8	19.2	——	——	——	——	——	40
8	25.0	24.3	23.5	22.7	21.9	21.3	——	——	——	——	——	——	——	——	——	
15	24.7	23.6	22.5	21.5	——	——	——	——	——	——	——	——	——	——	——	
30	24.0	22.5	——	——	——	——	——	——	——	——	——	——	——	——	——	
1	25.4	25.0	24.3	23.7	23.2	22.7	21.8	21.0	20.3	19.7	19.1	18.5	18.0	17.4	16.9	
2	25.3	24.8	24.1	23.5	22.9	22.4	21.4	20.6	19.8	19.1	18.5	17.9	17.4	16.8	16.2	
3	25.2	24.7	23.9	23.2	22.6	22.0	21.0	20.1	19.3	18.6	17.9	17.3	——	——	——	
4	25.2	24.6	23.8	23.0	22.3	21.7	20.7	19.7	18.9	18.1	——	——	——	——	——	60
8	24.9	24.0	23.0	22.1	21.3	20.6	——	——	——	——	——	——	——	——	——	
15	24.5	23.3	22.0	20.9	——	——	——	——	——	——	——	——	——	——	——	
30	23.7	22.0	——	——	——	——	——	——	——	——	——	——	——	——	——	
1	25.3	24.8	24.0	23.3	22.7	22.2	21.2	20.3	19.5	18.8	18.1	17.5	16.9	16.3	15.7	
2	25.2	24.6	23.8	23.1	22.4	21.8	20.8	19.8	19.0	18.2	17.5	16.9	16.3	15.7	15.1	
3	25.1	24.5	23.6	22.8	22.1	21.5	20.4	19.4	18.5	17.7	17.0	16.3	——	——	——	
4	25.0	24.3	23.4	22.6	21.9	21.2	20.0	19.0	18.1	17.3	——	——	——	——	——	80
8	24.7	23.8	22.7	21.7	20.8	20.1	——	——	——	——	——	——	——	——	——	
15	24.3	23.0	21.6	20.4	——	——	——	——	——	——	——	——	——	——	——	
30	23.5	21.6	——	——	——	——	——	——	——	——	——	——	——	——	——	
1	25.2	24.5	23.7	23.0	22.3	21.7	20.5	19.6	18.7	17.9	17.2	16.6	16.0	15.3	14.3	
2	25.1	24.4	23.5	22.7	22.0	21.3	20.1	19.1	18.2	17.4	16.7	16.0	15.4	14.7	14.1	
3	25.0	24.2	23.3	22.4	21.7	21.0	19.8	18.7	17.8	16.9	16.2	15.5	——	——	——	
4	24.9	24.1	23.1	22.2	21.4	20.7	19.4	18.3	17.3	16.5	——	——	——	——	——	100
8	24.6	23.5	22.4	21.3	20.4	19.6	——	——	——	——	——	——	——	——	——	
15	24.2	22.7	21.3	20.0	——	——	——	——	——	——	——	——	——	——	——	
30	23.3	21.3	——	——	——	——	——	——	——	——	——	——	——	——	——	
1	24.9	24.0	23.0	22.1	21.2	20.5	19.2	18.0	17.0	16.1	14.9	13.2	11.9	10.6	9.5	
2	24.8	23.9	22.8	21.8	20.9	20.1	18.8	17.6	16.6	15.7	14.9	13.2	11.9	10.6	9.5	
3	24.7	23.7	22.6	21.6	20.6	19.8	18.4	17.2	16.2	15.3	14.4	13.2	——	——	——	
4	24.6	23.6	22.4	21.3	20.4	19.5	18.1	16.8	15.8	14.9	——	——	——	——	——	150
8	24.3	23.0	21.6	20.4	19.4	18.4	——	——	——	——	——	——	——	——	——	
15	23.8	22.1	20.5	19.1	——	——	——	——	——	——	——	——	——	——	——	
30	22.9	20.7	——	——	——	——	——	——	——	——	——	——	——	——	——	

Note:
1. (kW) of Exposure Equals mA x kV. For Example: 70 kV x 300 mA = 21 kW.
2. Exposures less than .010 seconds will have a kW rating same as .010 seconds.

Remarque:
1. (kW) en exposition égale kV x mA. Par exemple: 70 kV x 300 mA = 21 kW.
2. Les expositions inférieures à 0.010 sec. ent les mémes valuers en kW que celles de 0.010 sec.

Anmerkungen:
1. (kW) der Belichtung is gleich mA x kV Zum Beispiel: 70 kV x 300 mA = 21 kW.
2. Belichtungen von weniger als .010 Sekunden haben die gleichen kW Werte wie die von .010 Sekunden.

Nota:
1. (kW) De exposición se calcula multiplicando mA x kV-por ejemplo: 70 kV x 300 mA = 21 kW.
2. Para exposición de menos de .010 segundos, el resultado en (kW) seria lo mismo que el de .010 segundos.

Nominal anode input power for the anode heat content 70%. IEC 60613

Puissance calorifique nominale de l'anode: 70%, CEI 60613

Thermische Anodenbezugsleistung bei einer Wärmespeicherung von 70%. IEC 60613

Aproximadamente el poder de penetracion para obtener un almacenaje de calor del anode de 70%. IEC 60613

0.6 Focal Spot 3Ø 7 Degrees 150/180 Hz
0.6 Dimension Focale 3Ø 7 Degrés 150/180 Hz
0.6 Brennpunkt 3Ø 7 Grad 150/180 Hz
0.6 De Marcas Focales 3Ø 7 Grados 150/180 Hz

Caractéristoques Pour L'Angiographie CEI 60613
Angiographische Nennleistungen IEC 60613
Gradaciones Angiografica IEC 60613

EXPOSURE RATE PER SECOND	TUBE LOAD (kW) AS A FUNCTION OF THE EXPOSURE TIME (SEC.) OF THE INDIVIDUAL RADIOGRAPHS OF THE SERIES															NUMBER OF EXPOSURES IN SERIES
	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	0.225	0.250	
1	44.1	42.7	41.6	40.8	40.0	39.3	38.1	37.1	36.1	35.3	34.5	33.8	33.2	32.5	31.8	
2	44.0	42.4	41.3	40.3	39.5	38.7	37.4	36.2	35.2	34.2	33.4	32.6	31.9	31.1	30.4	
3	43.9	42.2	40.9	39.9	39.0	38.1	36.7	35.4	34.3	33.3	32.4	31.6	—	—	—	
4	43.7	42.0	40.6	39.5	38.5	37.6	36.0	34.7	33.5	32.4	—	—	—	—	—	10
8	43.2	41.1	39.4	38.0	36.8	35.7	—	—	—	—	—	—	—	—	—	
15	42.6	39.9	37.8	36.1	—	—	—	—	—	—	—	—	—	—	—	
30	41.5	38.0	—	—	—	—	—	—	—	—	—	—	—	—	—	
1	43.9	42.3	41.1	40.1	39.2	38.4	36.9	35.7	34.6	33.6	32.6	31.8	31.0	30.2	29.4	
2	43.8	42.0	40.7	39.5	38.5	37.6	36.1	34.7	33.4	32.3	31.3	30.4	29.6	28.7	27.8	
3	43.6	41.7	40.3	39.0	37.9	37.0	35.2	33.7	32.4	31.3	30.2	29.3	—	—	—	
4	43.4	41.4	39.9	38.5	37.4	36.3	34.5	32.9	31.5	30.3	—	—	—	—	—	20
8	42.8	40.3	38.4	36.7	35.3	34.1	—	—	—	—	—	—	—	—	—	
15	41.9	38.8	36.4	34.3	—	—	—	—	—	—	—	—	—	—	—	
30	40.5	36.4	—	—	—	—	—	—	—	—	—	—	—	—	—	
1	43.6	41.6	40.2	38.9	37.8	36.8	35.0	33.4	32.0	30.8	29.7	28.7	27.8	26.7	25.8	
2	43.4	41.3	39.7	38.3	37.1	36.0	34.0	32.3	30.9	29.6	28.4	27.3	26.4	25.3	24.3	
3	43.2	40.9	39.2	37.7	36.4	35.2	33.1	31.4	29.8	28.5	27.3	26.2	—	—	—	
4	43.0	40.6	38.7	37.2	35.8	34.5	32.3	30.5	28.9	27.5	—	—	—	—	—	40
8	42.2	39.3	37.1	35.1	33.5	32.0	—	—	—	—	—	—	—	—	—	
15	41.2	37.5	34.7	32.4	—	—	—	—	—	—	—	—	—	—	—	
30	39.4	34.6	—	—	—	—	—	—	—	—	—	—	—	—	—	
1	43.2	41.0	39.3	37.8	36.5	35.3	33.3	31.5	29.9	28.6	27.3	26.2	25.2	24.1	23.1	
2	43.0	40.6	38.8	37.2	35.8	34.5	32.3	30.5	28.8	27.4	26.1	25.0	24.0	22.8	21.8	
3	42.8	40.3	38.3	36.6	35.1	33.8	31.5	29.5	27.8	26.3	25.0	23.9	—	—	—	
4	42.6	39.9	37.8	36.0	34.4	33.0	30.6	28.6	26.9	25.4	—	—	—	—	—	60
8	41.8	38.6	36.0	33.9	32.1	30.6	—	—	—	—	—	—	—	—	—	
15	40.6	36.7	33.6	31.1	—	—	—	—	—	—	—	—	—	—	—	
30	38.6	33.6	—	—	—	—	—	—	—	—	—	—	—	—	—	
1	42.9	40.4	38.5	36.8	35.4	34.0	31.8	29.8	28.1	26.6	25.3	24.2	22.3	19.9	17.9	
2	42.7	40.0	38.0	36.2	34.6	33.2	30.8	28.8	27.1	25.6	24.2	23.0	22.0	19.9	17.9	
3	42.4	39.7	37.5	35.6	33.9	32.5	30.0	27.9	26.1	24.6	23.2	22.1	—	—	—	
4	42.2	39.3	37.0	35.0	33.3	31.8	29.2	27.1	25.3	23.7	—	—	—	—	—	80
8	41.4	37.9	35.2	32.9	31.0	29.3	—	—	—	—	—	—	—	—	—	
15	40.2	35.9	32.7	30.1	—	—	—	—	—	—	—	—	—	—	—	
30	38.1	32.7	—	—	—	—	—	—	—	—	—	—	—	—	—	
1	42.6	39.9	37.7	35.9	34.3	32.9	30.4	28.3	26.5	25.0	22.3	19.9	17.9	15.9	14.3	
2	42.3	39.5	37.2	35.3	33.6	32.1	29.5	27.4	25.6	24.0	22.3	19.9	17.9	15.9	14.3	
3	42.1	39.1	36.7	34.7	32.9	31.3	28.7	26.5	24.7	23.1	21.7	19.9	—	—	—	
4	41.9	38.7	36.2	34.1	32.3	30.6	27.9	25.7	23.9	22.3	—	—	—	—	—	100
8	41.0	37.3	34.4	32.0	30.0	28.2	—	—	—	—	—	—	—	—	—	
15	39.8	35.3	31.9	29.2	—	—	—	—	—	—	—	—	—	—	—	
30	37.6	32.0	—	—	—	—	—	—	—	—	—	—	—	—	—	
1	41.8	38.5	35.9	33.7	31.9	30.2	27.4	23.8	19.9	17.0	14.9	13.2	11.9	10.6	9.5	
2	41.5	38.1	35.4	33.1	31.2	29.5	26.7	23.8	19.9	17.0	14.9	13.2	11.9	10.6	9.5	
3	41.3	37.7	34.9	32.6	30.6	28.8	25.9	23.6	19.9	17.0	14.9	13.2	—	—	—	
4	41.1	37.3	34.4	32.0	30.0	28.2	25.3	22.9	19.9	17.0	—	—	—	—	—	150
8	40.2	35.9	32.7	30.0	27.9	26.0	—	—	—	—	—	—	—	—	—	
15	38.9	33.9	30.2	27.3	—	—	—	—	—	—	—	—	—	—	—	
30	36.6	30.6	—	—	—	—	—	—	—	—	—	—	—	—	—	

Note:
1. (kW) of Exposure Equals mA x kV. For Example: 70 kV x 300 mA = 21 kW.
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Nominal anode input power for the anode heat content 70%. IEC 60613

Puissance calorifique nominale de l'anode: 70%, CEI 60613

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Aproximadamente el poder de penetracion para obtener un almacenaje de calor del anode de 70%. IEC 60613

1.0 Focal Spot 3Ø 7 Degrees 50/60 Hz
1.0 Dimension Focale 3Ø 7 Degrés 50/60 Hz
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1.0 De Marcas Focales 3Ø 7 Grados 50/60 Hz

Caractéristoques Pour L'Angiographie CEI 60613
Angiographische Nennleistungen IEC 60613
Gradaciones Angiografica IEC 60613

EXPOSURE RATE PER SECOND	TUBE LOAD (kW) AS A FUNCTION OF THE EXPOSURE TIME (SEC.) OF THE INDIVIDUAL RADIOGRAPHS OF THE SERIES															NUMBER OF EXPOSURES IN SERIES
	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	0.225	0.250	
1	49.7	49.3	48.2	47.3	46.5	45.7	44.4	43.3	42.2	41.3	40.4	39.6	38.9	38.0	37.1	
2	49.5	48.9	47.8	46.7	45.8	44.9	43.4	42.1	40.9	39.9	38.9	38.0	37.1	36.1	35.2	
3	49.3	48.6	47.3	46.1	45.1	44.2	42.5	41.0	39.8	38.6	37.5	36.6	——	——	——	
4	49.2	48.4	47.0	45.7	44.5	43.5	41.7	40.1	38.7	37.5	——	——	——	——	——	10
8	48.7	47.5	45.7	44.1	42.7	41.4	——	——	——	——	——	——	——	——	——	
15	48.1	46.3	44.1	42.2	——	——	——	——	——	——	——	——	——	——	——	
30	47.3	44.9	——	——	——	——	——	——	——	——	——	——	——	——	——	
1	49.4	48.8	47.5	46.4	45.4	44.5	42.8	41.4	40.1	39.0	37.9	36.9	36.0	34.9	33.9	
2	49.2	48.4	47.0	45.7	44.5	43.5	41.7	40.1	38.6	37.3	36.2	35.1	34.1	32.9	31.8	
3	49.0	48.0	46.4	45.0	43.7	42.6	40.6	38.8	37.3	35.9	34.7	33.5	——	——	——	
4	48.8	47.6	45.9	44.4	43.0	41.8	39.6	37.7	36.1	34.6	——	——	——	——	——	20
8	48.2	46.5	44.3	42.4	40.7	39.2	——	——	——	——	——	——	——	——	——	
15	47.3	44.9	42.2	39.9	——	——	——	——	——	——	——	——	——	——	——	
30	46.0	42.6	——	——	——	——	——	——	——	——	——	——	——	——	——	
1	48.9	47.9	46.3	44.8	43.5	42.3	40.2	38.4	36.8	35.3	34.0	32.8	31.6	30.4	29.2	
2	48.7	47.4	45.6	44.0	42.6	41.3	39.0	37.0	35.3	33.7	32.3	31.0	29.9	28.5	27.3	
3	48.5	47.0	45.0	43.2	41.7	40.3	37.8	35.7	33.9	32.3	30.8	29.5	——	——	——	
4	48.2	46.6	44.5	42.6	40.9	39.4	36.8	34.6	32.7	31.0	——	——	——	——	——	40
8	47.5	45.2	42.6	40.3	38.3	36.6	——	——	——	——	——	——	——	——	——	
15	46.4	43.2	40.0	37.3	——	——	——	——	——	——	——	——	——	——	——	
30	44.6	40.2	——	——	——	——	——	——	——	——	——	——	——	——	——	
1	48.5	47.1	45.1	43.4	41.8	40.5	38.0	35.9	34.0	32.4	30.9	29.6	28.4	26.5	23.8	
2	48.2	46.6	44.5	42.6	40.9	39.4	36.8	34.5	32.6	30.9	29.4	28.0	26.8	25.4	23.8	
3	48.0	46.1	43.8	41.8	40.0	38.4	35.6	33.3	31.3	29.6	28.0	26.7	——	——	——	
4	47.8	45.7	43.2	41.1	39.2	37.5	34.6	32.2	30.2	28.4	——	——	——	——	——	60
8	46.9	44.2	41.2	38.7	36.6	34.7	——	——	——	——	——	——	——	——	——	
15	45.7	42.0	38.5	35.6	——	——	——	——	——	——	——	——	——	——	——	
30	43.7	38.8	——	——	——	——	——	——	——	——	——	——	——	——	——	
1	48.1	46.3	44.1	42.1	40.3	38.8	36.0	33.7	31.7	30.0	27.9	24.8	22.3	19.9	17.9	
2	47.8	45.8	43.4	41.3	39.4	37.7	34.9	32.4	30.4	28.6	27.0	24.8	22.3	19.9	17.9	
3	47.5	45.3	42.7	40.5	38.5	36.8	33.8	31.3	29.2	27.4	25.8	24.4	——	——	——	
4	47.3	44.8	42.1	39.8	37.7	35.9	32.8	30.3	28.1	26.3	——	——	——	——	——	80
8	46.4	43.3	40.1	37.4	35.1	33.1	——	——	——	——	——	——	——	——	——	
15	45.1	41.1	37.3	34.3	——	——	——	——	——	——	——	——	——	——	——	
30	42.9	37.6	——	——	——	——	——	——	——	——	——	——	——	——	——	
1	47.7	45.5	43.1	40.9	38.9	37.2	34.3	31.8	29.7	25.5	22.3	19.9	17.9	15.9	14.3	
2	47.4	45.0	42.4	40.0	38.0	36.2	33.2	30.6	28.5	25.5	22.3	19.9	17.9	15.9	14.3	
3	47.1	44.5	41.7	39.3	37.2	35.3	32.1	29.6	27.4	25.5	22.3	19.9	——	——	——	
4	46.9	44.1	41.1	38.6	36.4	34.5	31.2	28.6	26.4	24.5	——	——	——	——	——	100
8	46.0	42.5	39.1	36.2	33.8	31.7	——	——	——	——	——	——	——	——	——	
15	44.6	40.2	36.3	33.1	——	——	——	——	——	——	——	——	——	——	——	
30	42.3	36.7	——	——	——	——	——	——	——	——	——	——	——	——	——	
1	46.7	43.8	40.7	38.1	35.9	33.9	29.8	23.8	19.9	17.0	14.9	13.2	11.9	10.6	9.5	
2	46.4	43.3	40.1	37.3	35.0	33.0	29.6	23.8	19.9	17.0	14.9	13.2	11.9	10.6	9.5	
3	46.1	42.8	39.4	36.6	34.2	32.2	28.7	23.8	19.9	17.0	14.9	13.2	——	——	——	
4	45.9	42.3	38.9	36.0	33.5	31.4	27.9	23.8	19.9	17.0	——	——	——	——	——	150
8	44.9	40.7	36.9	33.7	31.1	28.9	——	——	——	——	——	——	——	——	——	
15	43.5	38.4	34.1	30.7	——	——	——	——	——	——	——	——	——	——	——	
30	41.1	34.8	——	——	——	——	——	——	——	——	——	——	——	——	——	

Note:
1. (kW) of Exposure Equals mA x kV. For Example: 70 kV x 300 mA = 21 kW.
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G-1077/G-1078
Angiographic Ratings IEC 60613

1.0 Focal Spot 3Ø 7 Degrees 150/180 Hz
1.0 Dimension Focale 3Ø 7 Degrés 150/180 Hz
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1.0 De Marcas Focales 3Ø 7 Grados 150/180 Hz

Caractéristoques Pour L'Angiographie CEI 60613
Angiographische Nennleistungen IEC 60613
Gradaciones Angiografica IEC 60613

EXPOSURE RATE PER SECOND	TUBE LOAD (kW) AS A FUNCTION OF THE EXPOSURE TIME (SEC.) OF THE INDIVIDUAL RADIOGRAPHS OF THE SERIES															NUMBER OF EXPOSURES IN SERIES
	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	0.225	0.250	
1	84.8	81.1	78.3	76.0	74.0	72.2	69.1	66.4	64.0	61.9	60.0	58.2	56.6	54.8	53.1	
2	84.3	80.2	77.1	74.5	72.2	70.2	66.7	63.7	61.0	58.7	56.6	54.7	53.0	51.0	49.2	
3	83.8	79.3	75.9	73.0	70.6	68.3	64.5	61.3	58.5	56.0	53.8	51.8	—	—	—	
4	83.5	78.6	75.0	71.9	69.2	66.8	62.6	59.1	56.2	53.7	—	—	—	—	—	10
8	82.1	76.3	71.8	68.1	64.9	62.0	—	—	—	—	—	—	—	—	—	
15	80.4	73.4	68.1	63.7	—	—	—	—	—	—	—	—	—	—	—	
30	78.2	69.8	—	—	—	—	—	—	—	—	—	—	—	—	—	
1	84.1	79.7	76.4	73.7	71.3	69.1	65.3	62.1	59.3	56.8	54.5	52.5	50.7	48.6	46.6	
2	83.5	78.7	75.0	71.9	69.2	66.8	62.6	59.1	56.1	53.4	51.0	48.9	47.0	44.8	42.9	
3	82.9	77.6	73.6	70.2	67.3	64.7	60.2	56.5	53.3	50.5	48.1	45.9	—	—	—	
4	82.4	76.7	72.4	68.8	65.6	62.8	58.1	54.1	50.9	48.1	—	—	—	—	—	20
8	80.6	73.7	68.5	64.1	60.4	57.2	—	—	—	—	—	—	—	—	—	
15	78.2	69.8	63.6	58.5	—	—	—	—	—	—	—	—	—	—	—	
30	74.7	64.4	—	—	—	—	—	—	—	—	—	—	—	—	—	
1	82.8	77.4	73.3	69.8	66.7	64.1	59.4	55.6	52.2	49.3	46.8	44.5	42.5	39.7	35.8	
2	82.0	76.2	71.6	67.8	64.6	61.7	56.7	52.7	49.2	46.2	43.7	41.4	39.3	37.1	35.1	
3	81.4	75.0	70.1	66.0	62.5	59.5	54.3	50.1	46.6	43.6	41.0	38.8	—	—	—	
4	80.8	74.0	68.8	64.5	60.8	57.6	52.2	47.9	44.3	41.4	—	—	—	—	—	40
8	78.6	70.5	64.4	59.4	55.3	51.7	—	—	—	—	—	—	—	—	—	
15	75.7	65.9	58.7	53.2	—	—	—	—	—	—	—	—	—	—	—	
30	71.0	59.2	—	—	—	—	—	—	—	—	—	—	—	—	—	
1	81.5	75.3	70.4	66.4	62.9	59.9	54.7	50.4	46.9	42.6	37.2	33.1	29.8	26.5	23.8	
2	80.8	74.0	68.8	64.5	60.8	57.6	52.2	47.8	44.2	41.1	37.2	33.1	29.8	26.5	23.8	
3	80.0	72.8	67.2	62.7	58.8	55.5	49.9	45.5	41.9	38.8	36.2	33.1	—	—	—	
4	79.4	71.7	65.9	61.1	57.1	53.7	48.0	43.5	39.8	36.8	—	—	—	—	—	60
8	77.1	68.1	61.4	56.1	51.7	48.0	—	—	—	—	—	—	—	—	—	
15	73.9	63.2	55.6	49.8	—	—	—	—	—	—	—	—	—	—	—	
30	68.7	56.0	—	—	—	—	—	—	—	—	—	—	—	—	—	
1	80.3	73.3	67.9	63.4	59.6	56.2	50.7	44.7	37.2	31.9	27.9	24.8	22.3	19.9	17.9	
2	79.6	72.0	66.2	61.5	57.5	54.1	48.4	43.9	37.2	31.9	27.9	24.8	22.3	19.9	17.9	
3	78.8	70.8	64.7	59.8	55.7	52.1	46.4	41.8	37.2	31.9	27.9	24.8	—	—	—	
4	78.2	69.7	63.4	58.3	54.0	50.4	44.5	40.0	36.4	31.9	—	—	—	—	—	80
8	75.8	66.0	58.9	53.3	48.8	45.0	—	—	—	—	—	—	—	—	—	
15	72.4	61.0	53.1	47.2	—	—	—	—	—	—	—	—	—	—	—	
30	66.9	53.7	—	—	—	—	—	—	—	—	—	—	—	—	—	
1	79.2	71.4	65.5	60.6	56.6	53.0	44.7	35.8	29.8	25.5	22.3	19.9	17.9	15.9	14.3	
2	78.4	70.2	63.9	58.9	54.6	51.0	44.7	35.8	29.8	25.5	22.3	19.9	17.9	15.9	14.3	
3	77.7	69.0	62.4	57.2	52.9	49.2	43.3	35.8	29.8	25.5	22.3	19.9	—	—	—	
4	77.0	67.9	61.1	55.7	51.3	47.6	41.7	35.8	29.8	25.5	—	—	—	—	—	100
8	74.5	64.2	56.7	51.0	46.3	42.5	—	—	—	—	—	—	—	—	—	
15	71.1	59.2	51.0	45.0	—	—	—	—	—	—	—	—	—	—	—	
30	65.5	51.8	—	—	—	—	—	—	—	—	—	—	—	—	—	
1	76.5	67.2	60.3	54.8	47.7	39.7	29.8	23.8	19.9	17.0	14.9	13.2	11.9	10.6	9.5	
2	75.7	66.0	58.8	53.2	47.7	39.7	29.8	23.8	19.9	17.0	14.9	13.2	11.9	10.6	9.5	
3	75.0	64.8	57.5	51.7	47.1	39.7	29.8	23.8	19.9	17.0	14.9	13.2	—	—	—	
4	74.3	63.8	56.3	50.4	45.8	39.7	29.8	23.8	19.9	17.0	—	—	—	—	—	150
8	71.8	60.2	52.2	46.2	41.4	37.6	—	—	—	—	—	—	—	—	—	
15	68.2	55.4	46.9	40.7	—	—	—	—	—	—	—	—	—	—	—	
30	62.5	48.2	—	—	—	—	—	—	—	—	—	—	—	—	—	

Note:
1. (kW) of Exposure Equals mA x kV. For Example: 70 kV x 300 mA = 21 kW.
2. Exposures less than .010 seconds will have a kW rating same as .010 seconds.

Remarque:
1. (kW) en exposition égale kV x mA. Par exemple: 70 kV x 300 mA = 21 kW.
2. Les expositions inférieures à 0.010 sec. ent les mémes valuers en kW que celles de 0.010 sec.

Anmerkungen:
1. (kW) der Belichtung is gleich mA x kV Zum Beispiel: 70 kV x 300 mA = 21 kW.
2. Belichtungen von weniger als .010 Sekunden haben die gleichen kW Werte wie die von .010 Sekunden.

Nota:
1. (kW) De exposición se calcula multiplicando mA x kV-por ejemplo: 70 kV x 300 mA = 21 kW.
2. Para exposición de menos de .010 segundos, el resultado en (kW) seria lo mismo que el de .010 segundos.

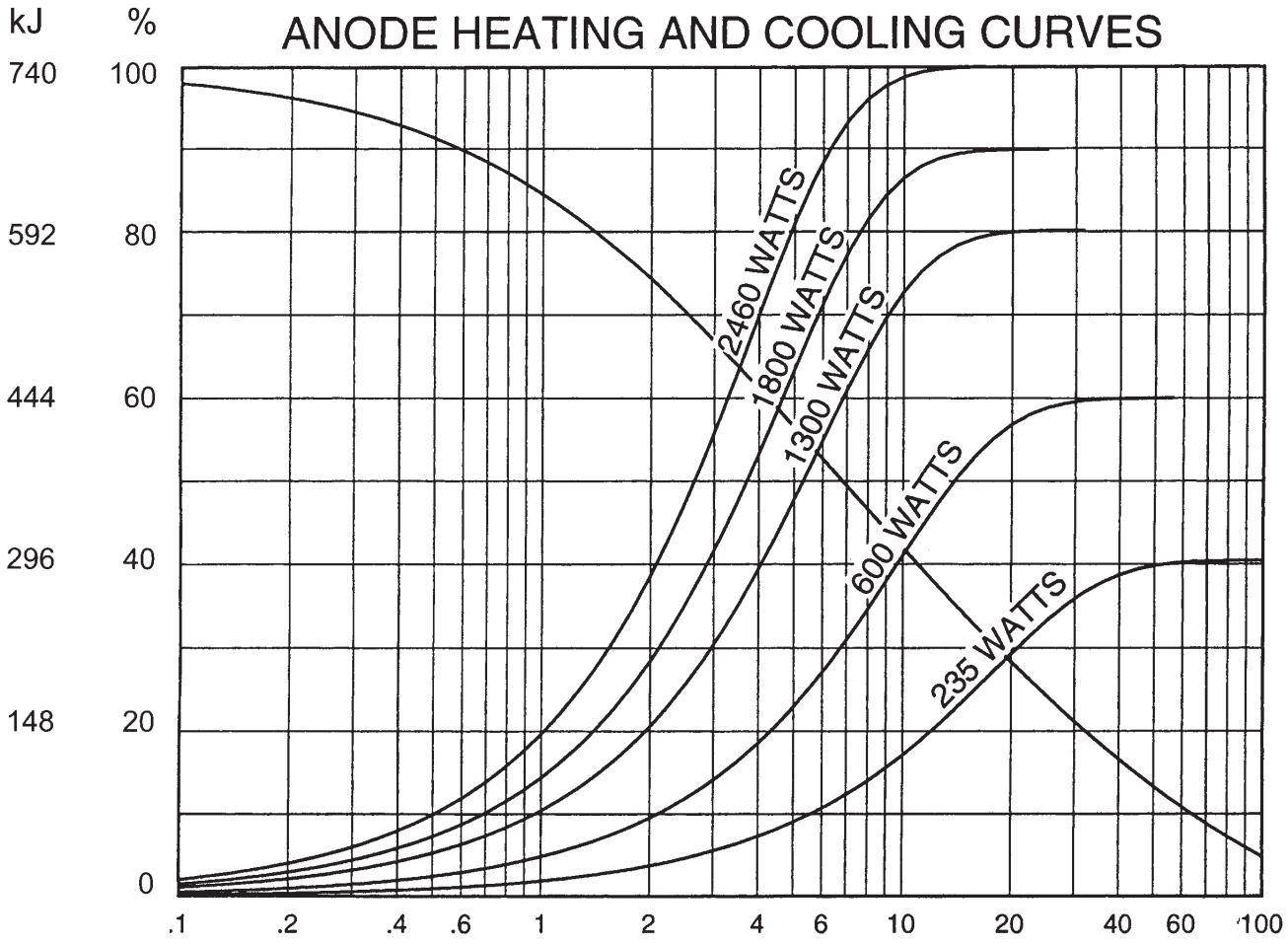
Nominal anode input power for the anode heat content 70%. IEC 60613

Puissance calorifique nominale de l'anode: 70%, CEI 60613

Thermische Anodenbezugsleistung bei einer Wärmespeicherung von 70%. IEC 60613

Aproximadamente el poder de penetracion para obtener un almacenaje de calor del anode de 70%. IEC 60613

Abaques d' Échauffement et de Refroidissement de L'Anode
Anoden Aufheiz - und Abkühlkurven
Curvas de Calentamiento y Enfriamiento del Anodo



Time (Minutes) Durée (Minutes) Zeit (Minuten) Tiempo (Minutos)

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