

Specialist Light Sources



Cathodeon
The Ultimate Source

SPECIALIST LIGHT SOURCES



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BULB TYPE XENON FLASH LAMPS

INTRODUCTION

Cathodeon manufactures a wide range of cool running xenon flash lamps, devices which efficiently convert electrical energy stored in a capacitor into a high intensity light flash.

Cathodeon xenon flash lamps consist of a compact bulb filled with xenon gas at a range of pressures. As xenon is a very good insulator, a high strike voltage is required to strike an arc, this is usually in the order of 5kV supplied by a separate trigger transformer.

All of the lamps use materials which are specially selected for high performance and long life. They are manufactured using high temperature and high vacuum processing, which ensures a high integrity product. Finally, each lamp is put through rigorous instrument test schedules to ensure that quality standards are consistently met.

Cathodeon offer three types of bulb xenon flash lamps of varying fill pressures and sizes. The technical differences of the differing lamps are outlined overleaf.

The main advantages common to all versions of bulb xenon flash lamps are:-

- **Low noise**
- **Excellent flash repeatability**
- **Long life**
- **Reliable starting when used with the appropriate Cathodeon trigger transformer**
- **Accurate arc position and discharge pattern**
- **Cool running**

Certain models of the Cathodeon range of xenon flash lamps may be filled alternatively with krypton and supplied with a range of windows.

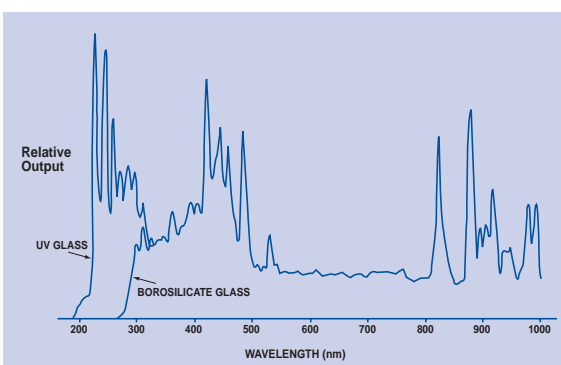
WARNING - Flashes in the range of 1-10Hz may induce dangerous reactions in sensitive people.

SPECTRAL OUTPUT

Xenon lamps have a spectral distribution which ranges from the ultraviolet through the visible to the infrared, making them one of the few wide band illumination sources available. The spectral output, especially in the low UV, depends on the window material used. Spectral transmission ranges for available envelope/window materials are:-

- UV glass: 200 - 3500nm**
- Borosilicate glass: 300 - 4500nm**

Fig 1 Spectral Distribution

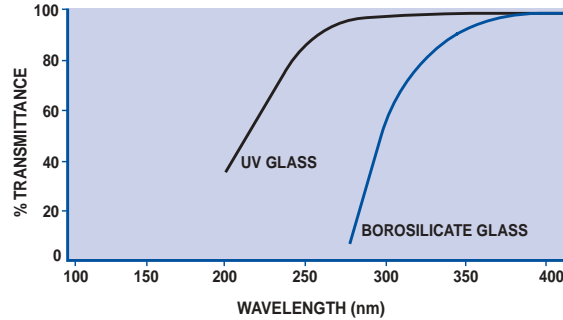


WINDOW MATERIAL

The windows of bulb lamps can either be made out of borosilicate glass or UV glass. The spectral transmission ranges for available envelope/window materials are given below:-

- UV glass: 200 - 3500nm**
- Borosilicate glass: 300 - 4500nm**

Fig 2 Window Transmission



INTERNAL CONSTRUCTION

The electrodes are made of a tungsten matrix which contains barium, calcium and aluminium. The tungsten material carries the electrical load, whilst the other elements raise the efficiency of the cathode by lowering its work function. The electrodes can be either horizontally or vertically opposed with respect to the multi-pin lamp base, the position being dictated by the operating mode is either side output (S) or end output (E).

Xenon lamps are renowned for having unstable arcs, especially lamps with large electrode spacings where it is more likely that the arc will wander. For this reason, trigger electrodes are employed along the electrode gap to ensure optimum flash propagation when the specified voltage is applied across the electrodes. This voltage is applied to each trigger electrode in a timed sequence across the electrode gap, after the main discharge voltage is established between the anode and cathode. The arc position is established by the trigger discharges and therefore is more stable. The high striking voltage needed to initiate a discharge is also lowered by the action of these trigger electrodes.

Cathodeon trigger electrodes are unique in that they are positioned behind the electrode gap. This gives a straight arc as viewed through the window. Any degradation with time moves the arc only in the focal plane and not in a lateral position.

Also positioned in the bulb is a sparker, which is connected into the trigger circuit. The sparker flashes first, which then triggers the cathode and each consecutive trigger electrode. It provides UV light which releases photoelectrons from the cathode and trigger wires when it flashes, helping the main discharge to fire.

ARC LENGTHS

Cathodeon bulb type xenon flash lamps can be manufactured with any arc gap in the range 1.5mm to 10mm.

Experimentation on lamps with different arc gaps indicates that optimal arc stability, leading to high signal to noise ratios, is achieved with arc gaps in the 2.0mm to 5.0mm range. Lamps within this range, utilise two or three trigger electrodes to stabilise the arc across the gap, combining

XENON LAMPS

APPLICATIONS

Whilst xenon lamps are suitable for many white light industrial applications the high quality, high performance range of Cathodeon xenon lamps is expressly intended for photometric instrumentation applications such as:-

UV / visible spectrophotometry

Fluorescence spectroscopy

Liquid chromatography

Photo-acoustic spectroscopy

Colour analyzers

Medical instrumentation

These lamps will have many other potential uses in situations where controlled, repeatable, high intensity broadband illumination is desired.

XENON LAMPS

BULB TYPE XENON FLASH LAMPS

high performance with significantly improved lifetime. With arc gaps less than 2.0mm, the area of instability around the electrode where the arc joins the cathode is a large proportion of the total arc gap. In addition, it becomes almost a physical impossibility to fit more than one trigger electrode.

With arc lengths greater than 8.0mm the lamps are simply less efficient due to light collecting difficulties.

Sputtering of the electrodes occurs in lamps of all arc gaps due to the high currents involved. This sputtered material is distributed onto the envelope of the lamp, lowering the transmission and therefore the output. Lifetime is shortened through a combination of a darkened envelope and sputtered electrodes.

ENERGY OUTPUT

There are two limitations to the energy that can be dissipated in the lamps:-

1. The single pulse energy is limited by physical damage to the electrodes and the bulb, the energy is calculated by equation (i) $J = \frac{1}{2}CV^2$, where J is the energy per flash in Joules, C is the discharge capacitance in Farads and V is the charging Voltage.
2. The average dissipation energy is limited by thermal considerations equation (ii) $P = F \times J$, where P is the average power, F is the flash repetition frequency in Hertz and J is the energy per flash in Joules.

As can be seen, the power is directly proportional to the energy per flash (equation i) and the flash repetition frequency (equation ii). Using equations (i) and (ii), it can be seen that by increasing either the voltage or the discharge capacitance, the power can be increased. Increasing the voltage will have a more significant effect on power than if the discharge capacitance is increased, however increasing the voltage is limited by problems of insulation and arcing. If capacitance is used to increase the power, both rise time and pulse width increase. This greater pulse width will give rise to more local heating, hence there can be more rapid damage to the electrodes. With a high energy flash, the frequency can not be high as well. Therefore a choice has to be made whether to have a very bright flash at a low frequency or have a dimmer flash at a higher frequency.

REPETITION RATE

Cathodeon provides two types of flash lamp power supply which provide either:-

- (a) Fixed 50Hz operation
- (b) 50 - 100 Hz variable plus a switched external trigger input

The major consideration for repetition rate is that lamp life decreases more rapidly with increasing frequency and/or power input. Bulb lamps will run optimally even with single-shot operation, due to the internal triggering system.

Although lamps will theoretically run up to 1KHz or more (assuming power levels are kept within the specified limits from equations i & ii), it is difficult to ensure reliable operation at these frequencies, so it is advisable to contact Cathodeon regarding any operation above our standard maximum of 100Hz.

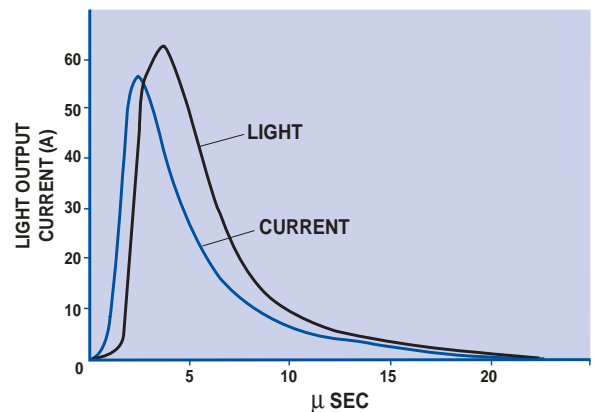
The main problems at higher frequencies are:-

- (a) Loss of voltage due to charging time in DC charging systems
- (b) Hold-on, where the lamps goes into DC conduction rapidly destroying itself and/or the power supply
- (c) Localised heating of electrodes and trigger wires which may shorten life

PULSE WIDTH

Half-height pulse widths are usually in the range of 2-5 μ S for the normal range of lamp operation. Changes of capacitor or voltage values have an effect on this parameter, in addition, changes in inductance in the system will alter the time constant and thus the discharge time. The higher the capacitance the longer the pulse.

Fig 3 Pulse Width



APPLICATIONS

There are two limitations to the energy that can be dissipated in the lamps:-

1. The single pulse energy where $J = \frac{1}{2}CV^2$
2. The average dissipation energy where $P = F \times J$

BULB TYPE XENON FLASH LAMPS

LAMP SELECTION

This section gives background information, optimum operating conditions and specifications for the Cathodeon range of bulb type xenon flash lamps. The BX range are standard output small bulb xenon lamps for use with a separate trigger transformer. The AX range are high output small bulb xenon lamps for use with a separate trigger transformer and include the EX range extended envelope lamp. The FX range are high output large bulb xenon lamps.

BX RANGE

The BX range consists of small bulb Xenon lamps available with end emitting, or side emitting output. The lamps are designed to run optimally with the separate Cathodeon trigger transformer.

Both end and side output lamps are available with a choice of arc lengths, 2.0mm and 5.0mm. There is a window/envelope choice of either UV transmitting glass (U) or borosilicate glass (B)

Cathodeon recommends a maximum repetition frequency for this lamp of 100Hz. The lamp will operate at much higher frequencies than this, but great care is needed in the power supply to avoid overrunning the lamp. It is advisable to operate the lamp, where possible, at line frequency (50 or 60Hz) to avoid beat effects between the lamp and the mains.

AX (EX) RANGE

The AX range consists of a small bulb lamp filled to a higher pressure than the BX range and is available with end emitting or side emitting output. These higher pressure lamps offer increased light output by a factor of 1.7 over the standard BX lamps for the same power input. They offer low noise, excellent flash repeatability (<2%) and a long lifetime of at least 10^9 flashes depending on operating conditions. The lamp is hard soldered onto the circuit board to ensure the contact resistance is minimised, in view of the higher currents used in these lamps. It is possible to use these lamps with a separate trigger transformer, however, extreme care should be taken in the choice and integrity of the electrical pin to socket contact.

Also available is an extended version of the AX type, known as the EX lamp. As the bulb is extended by an extra 10mm the life of this lamp is much improved due to less sputtered material reaching the window, at the expense of a reduced solid angle. Especially suitable for industrial applications this lamp can last as long as 20,000 hours under optimal running conditions.

FX RANGE

The FX lamps use a larger envelope filled to a high pressure, combining both increased light output with improved lifetime by increasing the space between the arc and the window. The lamps are available with an arc length of 5.0mm, and a window choice of either UV transmitting glass (U), or Borosilicate glass (B).

The lamp is hard soldered onto the circuit board to ensure the contact resistance is minimised, in view of the higher currents used in these lamps.

A ten times increase in output over the standard bulb lamp, combined with a negligible effect on lifetime, means that the FX series lamps are ideal for replacing traditional compact arc lamps in applications where cool running and high arc stability are essential. The level of light available during the flash is roughly equivalent to a 400W CW lamp.

The FX series lamps are capable of operating up to 2kHz, however the Cathodeon C564 power supply permits operation up to 100Hz.

XENON LAMPS

APPLICATIONS

Whilst xenon lamps are suitable for many white light industrial applications the high quality, high performance range of Cathodeon xenon lamps is expressly intended for photometric instrumentation applications such as:-

UV / visible spectrophotometry

Fluorescence spectroscopy

Liquid chromatography

Photo-acoustic spectroscopy

Colour analyzers

Medical instrumentation

These lamps will have many other potential uses in situations where controlled, repeatable, high intensity broadband illumination

is desired.

Fig 4a BXE Series Lamp 'End Emitting'

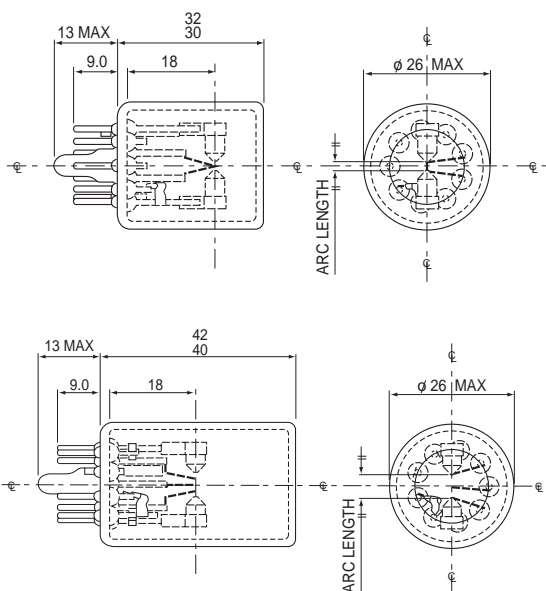


Fig 4c EXE Series Lamp 'End Emitting'

Fig 4b AXE Series Lamp 'End Emitting'

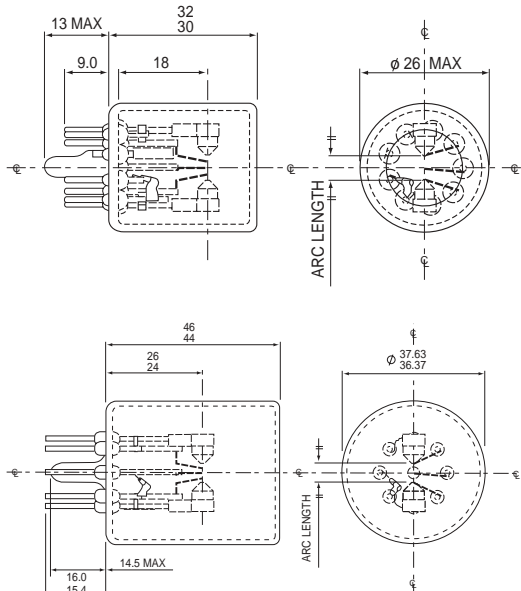
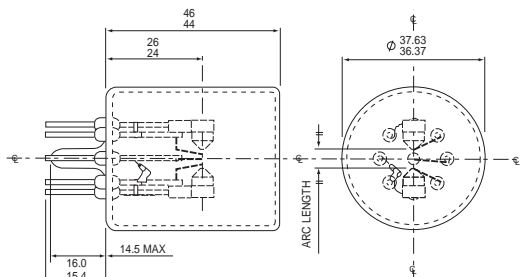
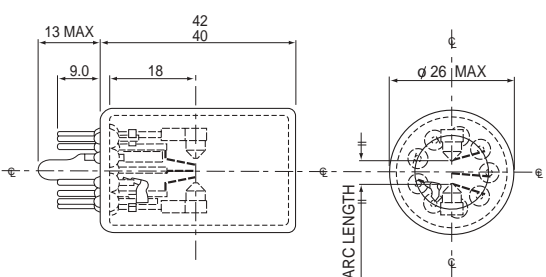


Fig 4d FXE Series Lamp 'End Emitting'



BULB TYPE XENON FLASH LAMPS

XENON
LAMPS

OPTIMUM OPERATING CONDITIONS

	BX RANGE	AX RANGE	FX RANGE
Discharge capacitor	0.47 μ F	1 μ F	1 μ F
Charging voltage	600V	800V	600-1200V
Flash repetition frequency	50Hz	50Hz	100Hz

SPECIFICATIONS

	BX RANGE	AX RANGE	FX RANGE
Cooling	Not required	Not required	Not required
Bulb temperature	100°C	135°C	150°C
Anode voltage operating range	400-1000V DC	600-1000V DC	600-1200V DC
Trigger voltage	5kV (minimum)	5kV (minimum)	5kV (minimum)
Maximum average power	7W	16W	25W
Maximum energy per flash	0.15J	0.32J	2J
Maximum repetition frequency	100Hz	100Hz	200Hz ⁽ⁱⁱⁱ⁾
Light output stability	2% max fluctuation	2% max fluctuation	2% max fluctuation
Light pulse time jitter	200nSec maximum	200nSec maximum	200nSec maximum
Life expectancy	Up to 10 ⁹ flashes ⁽ⁱ⁾	Up to 10 ⁹ flashes ⁽ⁱ⁾	Up to 10 ⁹ flashes ⁽ⁱ⁾
Light pulse width	1-5 μ S ⁽ⁱⁱ⁾	1-5 μ S ⁽ⁱⁱ⁾	1-5 μ S ⁽ⁱⁱ⁾

NOTES

- (i) Dependent on operating conditions and wavelength
(ii) At half pulse height dependent on operating conditions
(iii) This value can be increased to 2000Hz if power is limited to 15W

ORDERING CODES

SERIES	ARC LENGTH	LAMP DESIGNATION		ORDERING CODE
		WINDOW	EMISSION	
BX SERIES	2.00 mm	UV transmitting glass	End emitting	BXE 2 U
			Side emitting	BXS 2 U
		Borosilicate glass	End emitting	BXE 2 B
			Side emitting	BXS 2 B
	5.00 mm	UV transmitting glass	End emitting	BXE 5 U
			Side emitting	BXS 5 U
		Borosilicate glass	End emitting	BXE 5 B
			Side emitting	BXS 5 B
AX SERIES	2.00 mm	UV transmitting glass	End emitting	AXE 2 U
			Side emitting	AXS 2 U
		Borosilicate glass	End emitting	AXE 2 B
			Side emitting	AXS 2 B
	5.00 mm	UV transmitting glass	End emitting	AXE 5 U
			Side emitting	AXS 5 U
		Borosilicate glass	End emitting	AXE 5 B
			Side emitting	AXS 5 B
EX SERIES	2.00 mm	UV transmitting glass	End emitting	EXE 2 U
		Borosilicate glass	End emitting	EXE 2 B
	5.00 mm	UV transmitting glass	End emitting	EXE 5 U
		Borosilicate glass	End emitting	EXE 5 B
FX SERIES	5.00 mm	UV transmitting glass	End emitting	FXE 5 U
			Side emitting	FXS 5 U
		Borosilicate glass	End emitting	FXE 5 B
			Side emitting	FXS 5 B

APPLICATIONS

The C564 B2 is a variable frequency board form power supply suitable for use with the complete range of Cathodeon pulsed xenon lamp range. It allows the flash rate to be set within the limits of 1Hz to 100Hz.

POWER SUPPLY FOR XENON FLASH LAMPS

TYPE C564 B2

The C564 B2 is a variable frequency board form power supply suitable for use with the complete range of Cathodeon pulsed xenon lamp range. It allows the flash rate to be set within the limits of 1Hz to 100Hz. The supply is normally set at the factory to cover a smaller range e.g. 1 octave of frequency. This enables a higher pulse output power to be chosen than would be allowed if the full frequency range was made available. The maximum pulse power is set at the factory to suit the individual customer requirements and lamp type. This power supply has an external drive facility and when this is to be used customers are warned not to exceed the lamp power rating. The power supply itself is self limiting so cannot be damaged by driving at too high a frequency.

SPECIFICATIONS

Lamp Supply Voltage 850V

Anode Capacitor Chosen to suit frequency range to be used

Output Pulse length 1 μ S to 20 μ S.
Dependent on discharge capacitor size

Peak Current Up to 500A

Repetition Rate 1-100 Hz

Power Max average power 25W
Peak pulse power 2.0J
Lamp Trigger Pulse 5KV min

Input Trigger 5V TTL internal adjustment for positive or negative edge synchronisation
BNC socket on front panel

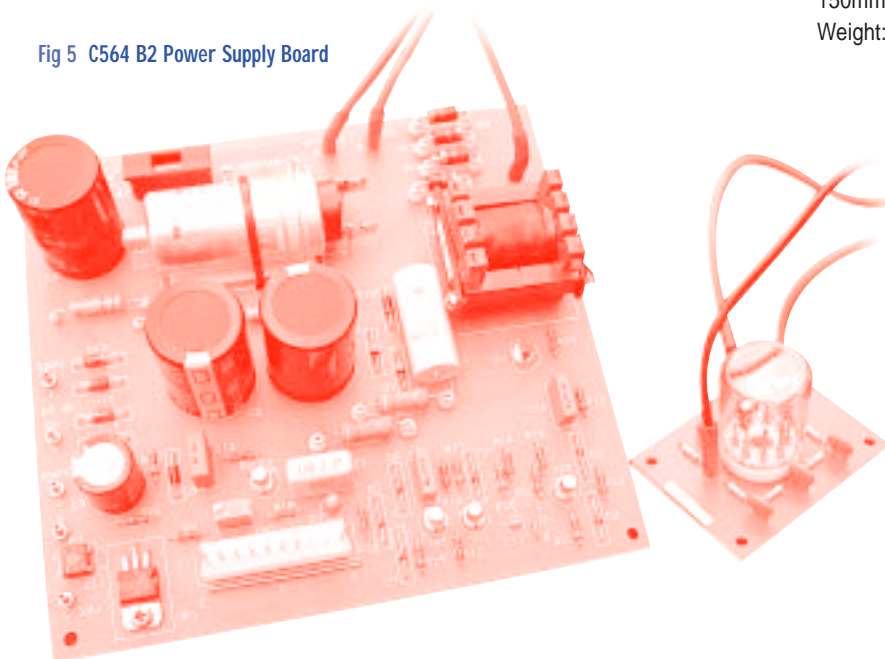
Lamp Connections Via multipin connector on rear panel

Input Requirements 110, 130, 220, 240V (\pm 10%rms)
50/60Hz

Dimensions Mains transformer
120mm x 105mm x 100mm high
Weight: 4.35kg

Circuit Control Unit
150mm x 110mm x 40mm high
Weight: 0.215kg

Fig 5 C564 B2 Power Supply Board



ORDERING CODES

POWER SUPPLY

Variable frequency board from pulsed xenon lamp power supply

ORDERING CODE

C564 B2

XENON LAMPS

APPLICATIONS

Whilst xenon lamps are suitable for many white light industrial applications the high quality, high performance range of Cathodeon xenon lamps is expressly intended for photometric instrumentation applications such as:-

UV / visible spectrophotometry

Fluorescence spectroscopy

Liquid chromatography

Photo-acoustic spectroscopy

Colour analyzers

Medical instrumentation

These lamps will have many other potential uses in situations where controlled, repeatable, high intensity broadband illumination is desired.

CONTINUOUS SHORT ARC XENON LAMP

XENON LAMPS

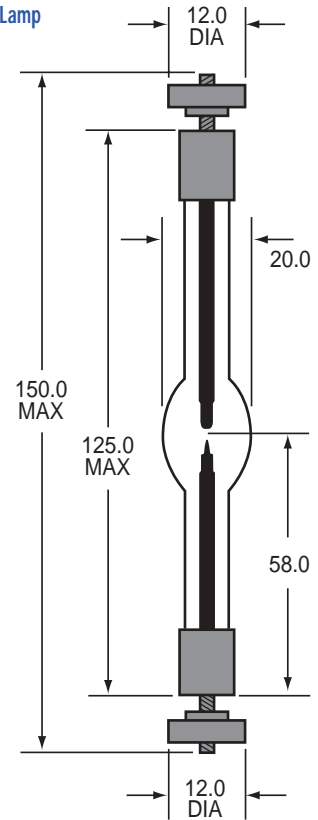
INTRODUCTION

Cathodeon offers a range of continuous xenon lamps, from 50W to 7000W. These lamps can be used in many white light illumination applications, however these sources require bulky, complex power supplies and produce high levels of heat, rendering them unsuitable for many high sensitivity opto-electronic applications. Cathodeon does offer a stable long life 150W lamp specifically for instrumental applications.

The HSX 150 range is electrically compatible with all 150W lamps currently on the market so offering an excellent solution for applications requiring a xenon point source with high radiance, broad spectral output and high stability.

There are four different HSX lamps, with arc lengths of 2.0mm or 2.5mm, and arc tube material of either fused silica or ozone-free silica. They offer exceptional stability and have an average service life of 2000 hours with minimum arc shift over this period. Therefore they are especially suited to analytical instrumentation.

Fig 6 HSX Series Lamp



SPECIFICATIONS

PARAMETER	TYPE 1	TYPE 2	TYPE 3	TYPE 4
Operating power (W)	150	150	150	150
Arc tube material	Fused silica	Ozone fused silica	Fused silica	Ozone free silica
Arc gap (mm)	2.5	2.5	2.0	2.0
Voltage (V)	20 ± 2	20 ± 2	18 ± 2	18 ± 2
Current (A)	7.5 ± 0.5	7.5 ± 0.5	8.5 ± 0.5	8.5 ± 0.5
Ignition voltage (Nominal, kV)	25	25	25	25
Output (Nominal, Lumens)	2600	2600	2600	2600
Average Life (hours)	2000	2000	2000	2000

ORDERING CODES

LAMP TYPE	ORDERING CODE
Type 1	HSX150-1
Type 2	HSX150-2
Type 3	HSX150-3
Type 4	HSX150-4

APPLICATIONS

The HSX lamps with exceptional noise and stability performance are particularly suitable for challenging applications such as:-

Spectrophotometry

Fluorescence

Graphic arts

Microscope illumination

Solar simulation

Colour analyzers

Densitometers

INTRODUCTION

Cathodeon has designed a range of high quality rugged low pressure gas discharge lamps primarily for use in photoionisation detectors (PID).

DC lamps are available in a 35mm diameter mainly for use in equipment manufactured by HNu, and in a 20mm diameter suitable for use in all other applications of DC photoionisation lamps.

Fig 7a PKS Lamp

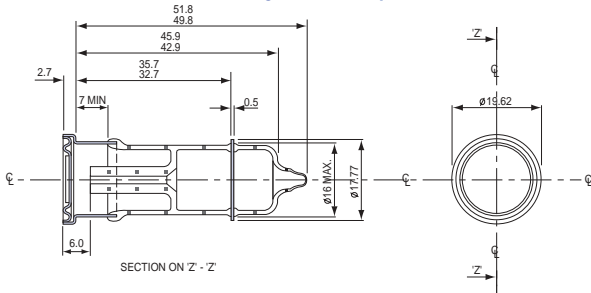
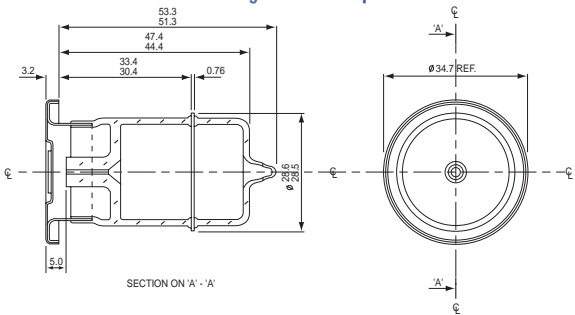
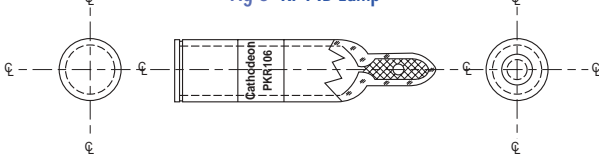


Fig 7b PKL Lamp



In addition, Cathodeon offers **RF excited** photoionisation lamps of 1/2 inch diameter providing a lower cost source of ionising energy of comparable output depending on operating conditions. At 250mW input power, the RF PID lamp has a threefold increase in efficiency over a DC lamp.

Fig 8 RF PID Lamp



GENERAL CONSTRUCTION

DC lamps: In DC PID lamps the gas discharge is initiated by the application of 1500V between the anode and cathode and is confined to a capillary of 1.5mm diameter within the glass envelope and excites the natural resonance frequencies of the gas. Operating currents for the lamp are in the area of 0.1mA to 2.0mA.

Cathodeon's 20mm diameter photoionisation lamps with the S type window flange are designed to be compatible with virtually all photoionisation instruments except those supplied by HNu. This flange has an outer lip that facilitates sealing to the cell surface with a viton O ring.

In addition, Cathodeon offers its A type window flange which has an exceptionally smooth front face to minimise band broadening effects in the analytical cell.

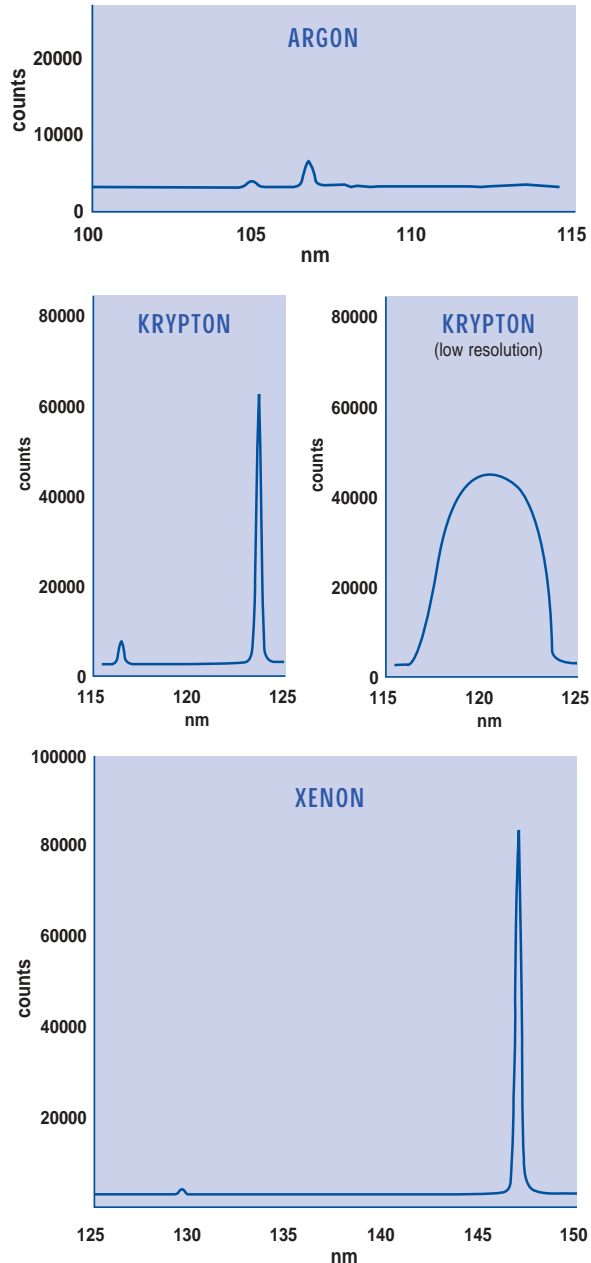
RF lamps: These lamps consist of a glass envelope and an appropriate hard sealed window. They may be energised by subjecting them to low energy (typically in the 100mW

region) electromagnetic fields in the frequency range 200kHz to 14MHz and above. Nominal performance occurs using a 10mm diameter antenna of Eu-Cu wire close wound around the glass envelope energised with a 13MHz frequency source.

GAS FILL

Cathodeon photoionisation lamps are available with a variety of gas fills including argon, krypton, xenon and deuterium gases. When used with the windows detailed below, outputs are equivalent to the photon energies quoted.

Fig 9 Relative Spectral Output - Argon/Krypton/Xenon



Earlier research has suggested that a krypton gas fill when combined with a magnesium fluoride window creates a lamp with an output of 10.2eV. However, recent use of vacuum monochromators with superior resolution have shown the output of krypton to be two lines 116.5 and 123.6nm equivalent to 10.0 and 10.6eV respectively. When following methodologies in published papers it should be noted that any photoionisation lamp filled with krypton will have given both 10.0 and 10.6eV whilst any reference to 10.2eV will refer either to erroneous results from a krypton filled lamp or to a

APPLICATIONS

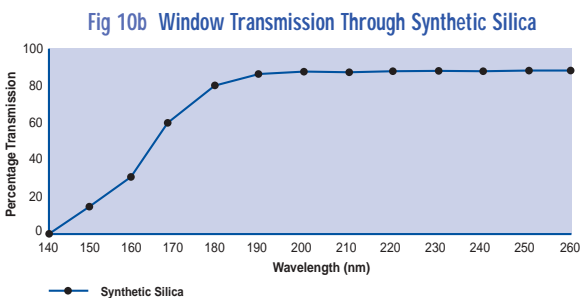
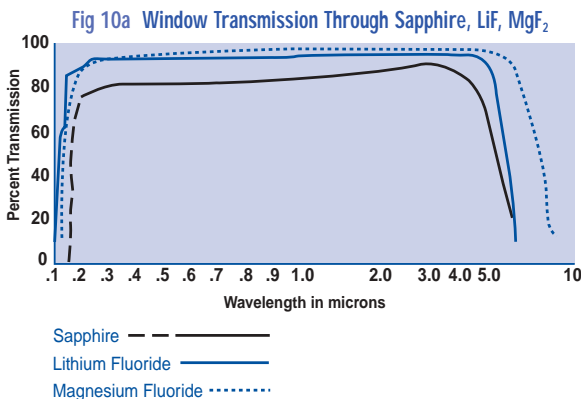
Photoionisation lamps are most commonly used in gas chromatography, trace gas monitoring, portable gas analysis and mass spectrometry sample ionisation. With new applications constantly developing in volatile gas analysis, Cathodeon is both willing and able to collaborate with instrument design engineers on novel products based on our low pressure gas discharge and RF excited technologies

PHOTOIONISATION LAMPS

deuterium filled lamp that does give a genuine output at this photon energy, albeit at a substantially lower energy.

WINDOWS

All Cathodeon PID lamps are available with magnesium fluoride, lithium fluoride, sapphire and Spectrosil windows. Magnesium fluoride is the most common window material, providing excellent deep ultra violet transmission with reasonable lifetime.



Cathodeon's unique processing technique allows the use of a thinner magnesium fluoride window improving transmission and therefore improving life due to a reduction in the density of light absorbing colour centres. Lithium fluoride is used in combination with an argon gas fill to provide an 11.8eV photon energy lamp. However, there are severe restrictions to the use of such lamps from the hygroscopic nature of the crystal itself and the available sealing technologies. These restraints combined limit the lamp to operating at room temperature, and operating current of no more than 0.2mA, an expected life of less than 200 hours and a limited shelf life of a few weeks.

Sapphire is available in combination with a xenon gas fill to selectively provide the 8.4eV line, whilst attenuating the stronger 9.6eV line. Whilst not normally used in photoionisation lamps, applications requiring only low photon energies (below 6.9eV) are possible with Spectrosil windows.

PROCESSING

DC lamps: Through Cathodeon's unique sealing and high temperature processing regimes, the lamps have high energy, whilst precise electrode alignment ensures high stability.

Cathodeon has specifically developed its own high temperature seal for this window material, enabling the use of higher temperature processing during the manufacture of the lamp leading to a cleaner lamp, improving both output and lifetime.

Cathodeon 35mm PID lamps combine all the features of the smaller lamp described above in a physical size comparable to instruments manufactured by HNu and others using the same sized lamp.

TESTING

DC lamps: All lamps are leak tested prior to gas filling, together with a close visual inspection of the envelope and window. They are then exposed to a 23 hour preliminary aging cycle to remove oxidised layers from metal surfaces, before being put through a simulated gas chromatograph to check the minimum sensitivity. Failure to reach expected standards in any test leads to rejection of the lamp.

RF lamps: Again, leak testing and visual inspections are carried out to check the integrity of each lamp. To ensure a high output against background noise, a spectral purity test is carried out using a vacuum monochromator.

SPECIFICATIONS

DC lamps

For practical convenience of electrical operation, the DC PID lamp window flange (anode) is held at Earth potential whilst the cathode ring is supplied with a negative ignition and operating potential.

Ignition voltage: **1500V**

Maximum operating current: **2mA**

Minimum operating current: **0.2mA**

Typical operating voltage at maximum current: **320V to 370V DC**

Maximum operating temperature: **350°C**

Ignition time: **1-2 Sec**

RF lamps

When operated with a power supply at a 13MHz operating frequency (as described below).

Range of operating current: **80-150mA**

Range of operating voltage: **15-24V DC**

Maximum operating temperature: **350°C**

Ignition time: **100mSec**

POWER SUPPLY

DC lamps: The C200 1500V power supply combined with a series resistor of 0.8-5.0MΩ is sufficient to power the lamp. The series resistor (usually 3.5MΩ) reduces the current of the lamp to a reasonable operating level of about 0.5mA

RF lamps: The C210 power supply is a PCB mounted system operating nominally at 13MHz at a power level of approximately 0.5W. The power supply is coupled to the lamp by means of a closely coupled, screened antenna.

Fig 11 RF Power Supply C210



APPLICATIONS

Cathodeon's unique processing technique allows the use of a thinner magnesium fluoride window improving transmission and therefore improving life due to a reduction in the density of light absorbing colour centres.

WARRANTY

DC lamps: For the same window material the lifetime of both 20 and 35mm diameter lamps is, in practice, the same although the larger gas volume should in theory extend the period before gas clean up limits the performance of the lamp. Lifetime is impacted by both operating current and temperature, as current increases the increased level of deep ultra violet radiation accelerates the formation of colour centres in the window which in turn reduces its transmission and the output drops. Increased window temperature also has a negative impact on life.

RF Lamps: With no metal surfaces to contaminate the gas, Cathodeon RF photoionisation lamps are less susceptible to lifetime limiting gas clean up phenomena. However, these lamps do have a limited gas volume so in addition to our unique high temperature processing Cathodeon uses a getter held in the pump stem to ensure maximum gas purity throughout the life of the lamp. These lamps have been operated in excess of 3000 hrs with no serious degradation. Output at 3000 hrs is approximately 80% of 130 hr output.

Fig 12 DC Lamp Lifetime

CURRENT	TEMPERATURE	LIFE
0.2mA	ambient	>3000 hours
0.5mA	ambient	>2000 hours
0.5mA	300°C	>500 hours

ORDERING CODES**DC LAMPS**

LAMP TYPE	FILL GAS	PHOTON ENERGY (eV)	ORDERING CODE
20mm	Xenon	8.4	PXS 084
20mm	Xenon	9.6	PXS 096
20mm	Krypton	10.6	PKS 106
20mm	Argon	11.8	PAS 118
35mm	Xenon	8.4	PXL 084
35mm	Krypton	10.6	PKL 102
35mm	Argon	11.8	PAL 118

RF LAMPS

FILL GAS	PHOTON ENERGY (eV)	ORDERING CODE
Xenon	8.4	PXR 084
Xenon	9.6	PXR 096
Krypton	10.0	PKR 100
Deuterium	10.2	PDR 102
Krypton	10.6	PKR 106
Argon	11.8	PAR 118

Please note that all 11.8eV lamps (both DC and RF), are constructed using a lithium fluoride window in place of magnesium fluoride.

POWER SUPPLIES

POWER SUPPLY	ORDERING CODE
DC lamp power supply	C200
RF lamp power supply	C210

PHOTOIONISATION LAMPS**APPLICATIONS**

Photoionisation lamps are most commonly used in gas chromatography, trace gas monitoring, portable gas analysis and mass spectrometry sample ionisation. With new applications constantly developing in volatile gas analysis, Cathodeon is both willing and able to collaborate with instrument design engineers on novel products based on our low pressure gas discharge and RF excited technologies

TUNGSTEN HALOGEN LAMPS

INTRODUCTION

Cathodeon offer a range of tungsten halogen lamps which are manufactured to a higher mechanical and optical specification than is normally found with this type of lamp. The lamps offer high colour temperature, high luminous efficacy, superior maintenance and a long life.

Because tungsten halogen lamps from Cathodeon are specifically designed for the analytical market, the quartz used in their manufacture is not doped to restrict the transmission of UV light. Lamps obtained from other manufacturers tend to be designed for the general market where new legislation bans UV transmission. It should therefore be remembered that although this legislation ensures a safer product for general use, it renders the lamp useless for use in spectrophotometers.

The Cathodeon tungsten halogen lamp range at the moment comprises some 35 lamps. However this is not an exhaustive list and Cathodeon invites enquiries from instrument manufacturers to build, design and specify lamps to individual requirements. Lamps can be made pre-focused and with specific colour temperature, voltage, wattage and mechanical tolerances.

GENERAL CONSTRUCTION

Tungsten halogen lamps consist of a sealed quartz envelope housing a tungsten filament and filled with a halogen gas mixture specific to its final application.

Envelope: The lamp consists of a quartz glass envelope inside which is a tungsten filament surrounded with an inert gas combined with an active halogen compound. The dimensions of the glass envelope are specified depending upon the type of filament chosen.

Filaments: These are prepared from high purity AKS doped tungsten wire, specifically manufactured or selected for halogen grade creep resistance. The wire is tested to ensure that it conforms to a specification which controls dimensions, chemical composition and physical properties. Filaments can be formed in axial, transverse or grid configurations. Close attention is given to the physical size of the wire and its pitch and spacing as this determines the electrical and optical properties of the lamp.

Fig 13a
Transverse Filament

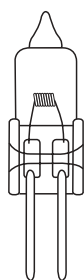


Fig 13b
Axial Filament

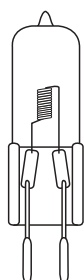
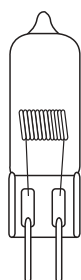


Fig 13c
Solid Filament



Gas fill: Mixtures are normally, argon/halogen, argon/hydrogen/halogen, krypton/halogen or xenon/halogen at pressures of between 2 and 10 bar. As lamp performance depends upon the composition and consistency of the gas mixtures, these are closely monitored on a batch basis.

MANUFACTURING PROCESS

Accurate positioning of the filament is of utmost importance in instrument applications and Cathodeon's unique hand laying of filaments ensures the most accurate positioning possible when the filament is attached to the molybdenum foils which form the hermetic seal within the quartz pinch seal.

Especially when using gas in pressures above atmospheric, it is essential that the pinch seal is leak free. Cathodeon has many years experience in quartz pinch sealing on other products, notably deuterium lamps. This is consistently achieved through accurate control of the pinching parameters and by using foils with a very specific width to thickness ratio.

The sealed lamps are then attached to a vacuum pump, evacuated and filled with the appropriate gas mixture. The lamps are cooled to the temperature of liquid nitrogen to carry out the sealing process. At these low temperatures the gas mixtures condense in the bulb and allow the glass sealing process to be completed. At room temperature gas pressure within the lamp will be 2-10 atmospheres depending on specification.

Each lamp in production is tested to ensure that there is stable performance in both terms of mechanical stability of the coil and the tungsten halogen cycle. From each batch of lamps samples are taken for destructive testing to verify the fill pressure and halogen content of the gas. For each new batch of filaments, sample lamps are made to check that the Lumens per Watt performance conforms to the filament structure. Life testing is carried out periodically on a variety of lamp types to ensure continued high performance in terms of life from the lamps.

Fig 14 Tungsten Halogen Lamp Sealing Station



OPERATION

Tungsten halogen lamps are designed to have relatively long term operation which is dependant on a process known as the tungsten-halogen cycle. The inert gas suppresses tungsten evaporation, while the halogen combines with any tungsten which does evaporate from the filament, so preventing deposition of tungsten on the lamp wall. The compounds formed react on the filament to deposit tungsten and release halogen gas, so repeating the whole process.

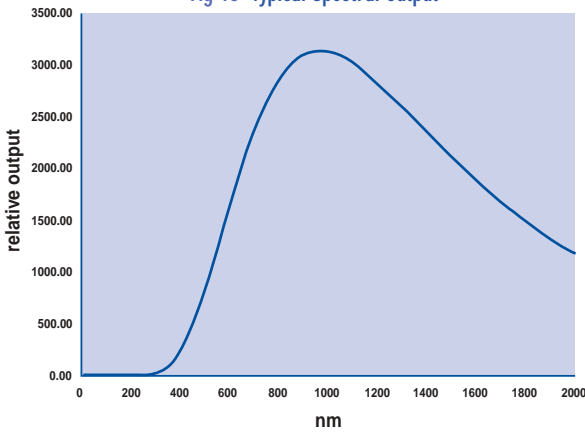
APPLICATIONS

The quartz used in the manufacture of Cathodeon Tungsten Halogen lamps is not doped to restrict the transmission of UV light.

OUTPUT

Light output is achieved by the incandescence of the tungsten filament. Light output is measured in Lumens and is a function of the Wattage, colour temperature and configuration of the filament coil. The efficacy of an incandescent lamp is an important property and is defined as the amount of visible light emitted per unit of electrical energy consumed. Most lamps are specified this way which is commonly expressed as Lumens/Watt (L/W).

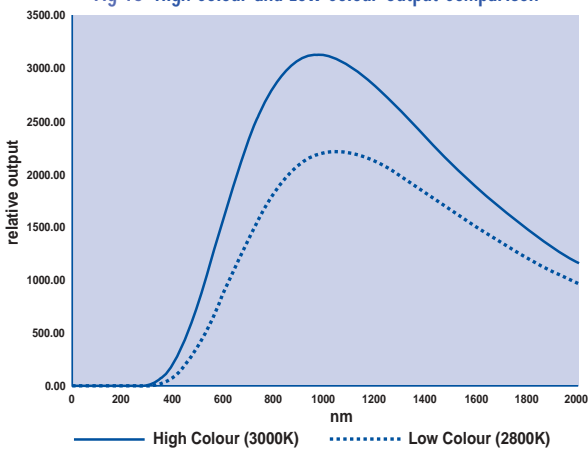
Fig 15 Typical Spectral Output



COLOUR TEMPERATURE

Colour temperature is a measure of the filament temperature, usually in degrees Kelvin, and is the temperature at which a black body must operate to produce the exact colour match of the lamp filament. A higher colour temperature will give higher energy levels in all wavelength regions of the emitted continuum spectrum and especially in the UV region down to 315nm. This is most critical in spectroscopic instruments where the valley between the tail of the deuterium continuum and the leading edge of the tungsten halogen continuum needs to be filled with as much light output as possible. Tungsten halogen lamps from Cathodeon offer a unique combination of highly reproducible colour temperatures together with the use of undoped quartz, ensuring that the 315-340nm 'valley' is filled as much as possible.

Fig 16 High Colour and Low Colour Output Comparison

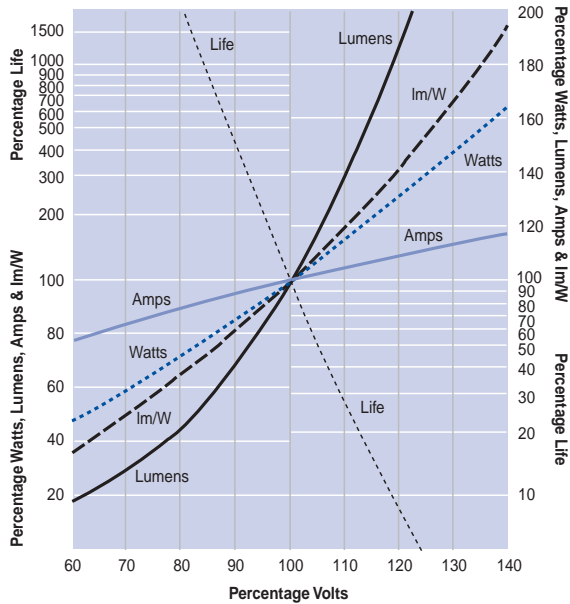


DERATING VOLTAGE

Cathodeon's tungsten lamps have voltages ranging from 6-36V. Each lamp has a specified running voltage at which it should be operated however it is possible to extend the life of a lamp by purposely derating the lamp by a small percentage. Whilst not recommended, derating by 10%

will give a 50% increase in life and conversely increasing by 10% will reduce the life by 50%. However, it must be remembered that derating will reduce gas temperature and the halogen cycle may stop working giving rise to blackening of the envelope, and premature failure of the filament.

Fig 17 How lamp efficacy, lifetime, light output and electrical energy consumed vary with changes in voltage



WARRANTY

The life of a lamp is generally defined as the point at which the lamp fails to light but whilst it may still light there comes a point where the output deteriorates to such a level that it is no longer sufficient for the application. Maintenance is a measure of the degradation of the lamp, and usually refers to the number of hours for the lamp to reach 0.7 of its initial output. The life of a lamp is a function of how fast the tungsten evaporates from the filament and can vary depending on conditions such as thermal shock, vibration, duty cycle, voltage control, cooling and individual fittings for pre alignment or holding.

ORDERING CODES

The following list is a selection of the current most popular lamps however customers are invited to contact Cathodeon with their own specific designs and requirements.

VOLTAGE	WATTAGE	FILAMENT TYPE	ORDERING CODE	EQUIVALENT
6	10	Transverse	CT010T02	M29
6	10	Transverse	CT010T03	M42
12	20	Axial	CT020A01	M86
12	20	Transverse	CT020T01	M47
6.6A	30	Axial	CT030A01	J1/74
12	35	Axial	CT035A01	M75
6.0A	36	Axial	CT036A01	J1/59
6.6A	45	Axial	CT045A01	J1/57
12	50	Axial	CT050A01	M47
12	50	Transverse	CT050T01	M32
12	55	Axial	CT055A01	H1
6.6A	100	Transverse flat grid	CT100T01	J1/58
6.6A	200	Transverse flat grid	CT200T01	J1/39
24	250	Transverse flat grid	CT250T01	A1/223
36	400	Transverse flat grid	CT400T01	A1/239/EVD

TUNGSTEN HALOGEN LAMPS

APPLICATIONS

The output in the visible range of the spectrum ensures that tungsten halogen lamps are highly suitable for use in analytical instrumentation. Used in conjunction with deuterium lamps, they provide the wide ranging output required in UVVIS Spectrophotometers. Alone, they are suitable light sources for simple visible photometers used in the analytical and medical markets.

VACUUM ULTRAVIOLET (VUV) LAMPS

INTRODUCTION

Cathodeon has developed a range of five high stability deuterium arc sources for use as calibration sources in the far ultraviolet. The 10V heater, 1mm arc aperture lamps are designed and built to a rugged construction with magnesium fluoride windows and may be further ruggedised to meet high acceleration forces encountered in space applications. Output extends into the Lyman Alpha region.

GENERAL CONSTRUCTION

There are two overall length options: The longer version is built for the highest light output stability with the window mounted 102mm from the arc source. The light is prevented from being reflected from the sides of the mounting tubes by multiple baffles giving a solid angle of about 10°. The standard version of the lamp is shorter to make it more compact, the cone angle increasing to 15°.

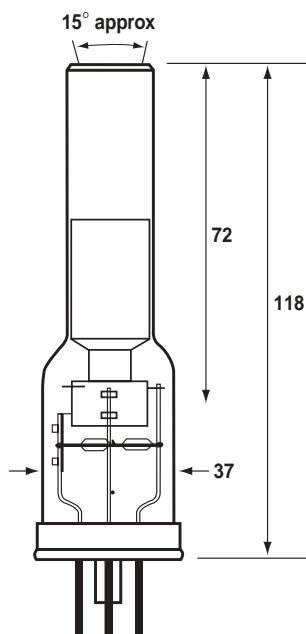


Fig 18 Short Body
Vacuum Ultra-violet Lamp
(Type 3 -V03)

Both versions of the lamp are available with a synthetic silica window for use down to 180nm. Magnesium fluoride lenses are available as an alternative to the flat window to give light collimation.

The use of magnesium fluoride significantly extends the lamp output below the 165nm cut off of synthetic silica. The practical cut off of magnesium fluoride is 112nm, well into the Lyman Alpha region.

The long body lamp V01 is also available without a base, for enclosed vacuum operation. However, vacuum operation is only possible if special arrangements are made to cool the lamp.

SPECIFICATIONS

Heater

10V AC/DC nominal, 1.0A maximum.

Arc initiation

A minimum 60 second operation of the heater is required to warm the emitter, before application of a strike potential of not less than 250V and a current capability of at least 25mA.

Arc run

Recommended running current for the arc is 300mA, though arc currents between 200mA and 500mA may be used. Arc currents above 300mA will shorten the life of the lamp. At currents below 300mA some heater voltage may be needed to maintain arc stability.

Anode voltage

At 300mA/heater off: 60-80V

Colour code

Anode red, heater blue, cathode black

SPECIFICATION	TYPE 1	TYPE 2	TYPE 3	TYPE 4	TYPE 5*
Arc height from window (mm)	102	102	72	72	102
Window material	MgF2	Spectrosil	MgF2	Spectrosil	MgF2
Overall length including base (mm)	146-150	146-150	116-120	116-120	140-144

*Type 5 has less base and is specifically designed for enclosed vacuum operation

ORDERING CODES

LAMP TYPE	ORDERING CODE
Type 1	V01
Type 2	V02
Type 3	V03
Type 4	V04
Type 5	V05

WARRANTY

Vacuum ultra-violet lamps from Cathodeon are covered by warranty for 1 year, or for 500 hours use.

APPLICATIONS

Cathodeon VUV lamps are suitable for all applications that require high stability output down to 112nm.

INTRODUCTION

Cathodeon analytical VUV lamps are derived from the renowned Cathodeon research grade VUV light sources and offer lower cost, more compact versions of these V series lamps. We offer two types: the **F05** and **J59**.

GENERAL CONSTRUCTION

F05 lamp: This is an analytical vacuum ultraviolet light source of compact dimensions for use by researchers and instrument engineers requiring a stable light source emitting in the 112nm to 370nm range. The lamp is of an axial type with an overall length of just 78mm and has a hard sealed magnesium fluoride window extending the deuterium continuum down to 112nm.

J59 lamp: This lamp is a high output side exit type, generally constructed in the same way as an analytical deuterium lamp. A significant modification of the internal structure is a centre plate eyelet that has been added to enhance the output of the 0.5mm parabolic aperture. The magnesium fluoride window is hard sealed to the envelope via a 42mm nose, and affords transmission down to 112nm.

Fig 19 F05 Lamp Dimensions

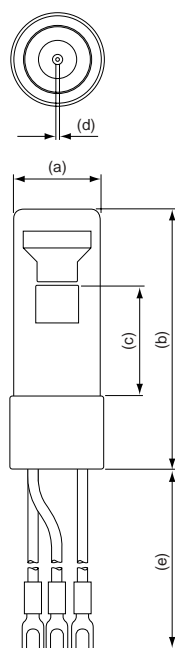
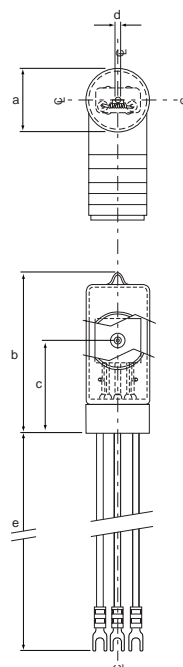


Fig 20 J59 Lamp Dimensions



SPECIFICATIONS

PARAMETER	F05 LAMP	J59 LAMP
External diameter (a)	25-26 mm	28.5-30.5 mm
Overall length (b)	75-81 mm	73 mm
Aperture height (c)	31-35 mm	42 mm
Aperture positional tolerance (d)	1 mm diameter	1 mm diameter
Aperture type	1 mm circular	0.5 mm circular
Dimple type	Standard	Parabolic
ELECTRICAL		
Heater voltage-start (nominal)	10V	9V
Heater voltage operational	Filament off	Filament 7V
Heater current	1A maximum	1.5A maximum
Arc voltage	55-75V	70-90V
Recommended operating temperature	150-190°C	150-190°C
Arc current	300mA	300mA
Strike voltage (25°C)	280V maximum	300V maximum
FINISHING		
Lead length (e)	245-255 mm	195-205 mm
Lead termination	Standard spades 024400	Standard spades 024400
LIGHT OUTPUT		
Window material	MgF ₂	MgF ₂
Drift	2.28% per hour maximum	0.010% per hour maximum
Noise	0.05% peak-peak maximum	0.005% peak-peak maximum
Wavelength range (continuum)	112-370 nm	112-370 nm

ORDERING CODES

LAMP TYPE	ORDERING CODE
Analytical VUV lamp	F05
High output analytical VUV lamp	J59

LIFETIME AND WARRANTY

LAMP TYPE	LIFETIME	WARRANTY
Analytical VUV lamp (F05)	1000 hours	500 hours
High output analytical VUV lamp (J59)	1000 hours	500 hours

ANALYTICAL VACUUM ULTRAVIOLET LAMPS

APPLICATIONS

The F05 axial lamp is used in extending the application of analytical techniques currently using deuterium lamps such as:

High performance liquid chromatography (HPLC)

Capillary zone electrophoresis (CZE)

Fluorescence

Densitometry

Supercritical fluid (SF) chromatography

Silicon device analysis

The J59 lamp is also suitable for the deuterium lamp applications listed above.

The lamp provides a higher output than that of the F05 lamp, but less than that emitted by the high power VUV deuterium lamp.

POWER SUPPLIES FOR VUV LAMPS

INTRODUCTION

The Cathodeon deuterium lamp power supplies have very low noise and drift characteristics and use a novel strike circuit to ensure reliable arc initiation of the lamp. They are fully automatic in operation and provide warning of malfunction of the lamp. They are available fully cased, or in component form and will be of particular interest to individual researchers, analytical instrument design teams and low volume manufacturers.

Fig 21 Power Supply For Deuterium Lamps



GENERAL OPERATION

The new C713 power supply fully conforms to the EEC directive 89/336/EEC on electromagnetic compatibility (EMC) and is CE marked. The C713 is a standard cased preset power supply, it runs all Cathodeon continuous deuterium lamps including VUV lamps. It runs the lamps with stabilised direct current heaters and is available for 3V and 10V versions. After switching on, the lamp heater supply is switched to its starting level for a timed period of 60 seconds. After this initial period the anode voltage and strike voltage pulse are applied. When the lamp strikes, the "Lamp on" indicator is illuminated and a timer holds the heater on at full voltage for a further 30 seconds, after which the heater is switched down to a preset level which can range from 0V to about 75% of the start level.

Should the lamp not strike immediately, further attempts are automatically made at 10 second intervals. At each attempt, the "restart" indicator is illuminated, providing a warning that the lamp has not struck. Normal operation is indicated by the "Lamp on" indicator being lit. The supply is preset to run the lamp at an anode current of 300mA, this being the optimum current for the majority of deuterium lamps. This current can be preset by an internal control to values between 230 and 301mA. If the mains supply is interrupted the warm-up cycle is automatically restarted. The supply is fitted with a thermal cut-out to protect the supply in case the outputs are shorted out for an excessive period. If the supply should cut out for this reason it should be switched off and the short removed. If not switched off, a start cycle will be initiated once the supply has cooled down.

SPECIFICATIONS

PARAMETERS	SPECIFICATION
Heater voltage	Start voltage: Preset 3V at 6A DC or 10V at 1A DC Run voltage: Preset internally 0-2.5V DC or 0-7.5V DC
Anode current	Preset internally in the range 230-310mA
Current stability	Long term drift less than 0.3%. Short term drift and ripple less than 0.02%
Maximum lamp operating voltage	100V at 300mA
Strike potential	700V nominal, inductively generated
Indicators	Mains on-green, Lamp restart-red, Lamp on-amber
Thermal cut-out	Operates at 75°C on internal heat sink
Mains input	110, 130, 220, 240V ($\pm 10\%$ rms) selected externally 50/60Hz. Selected on rear panel
Lamp output	Socket at rear, mating plug supplied. Neutrix "AXR"/"XLR" series. Type Xconn3MX
EMC	Complies with 89/336/EEC
Dimensions	260mm x 250mm x 140mm high
Weight	10V version: 5.00kg; 3V version: 5.15kg

OEM VERSION

Both versions of the Cathodeon deuterium lamp power supply are available for OEM use in board form for building into original equipment. These packages include:

C713 3V: (i) Mains transformer, (ii) heatsink with transistors and thermal cutout, (iii) main PCB 'A' usually fixed to the chassis, (iv) PCB 'B' usually fixed to the chassis, (v) PCB 'C' mounted on heatsink (ii), (vi) PCB 'D' usually fixed to chassis, (vii) PCB 'E' mounted to transformer (i), (viii) chassis fuse holder plus fuse, (ix) interconnection leads CN1, CN2 and CN3, (x) 2 LEDs for the front panel, (xi) Filter kit for EMC, (xii) 10 x ferrite beads, (xiii) 1 x 10nF 63V capacitor.

C713 10V: As above with the addition of a heatsink for the voltage regulators situated on PCB 'B' for the 10V version of this power supply.

ORDERING CODES

PRODUCT	ORDERING CODE
3V heater version	C713/3
10V heater version	C713/10
OEM 3V heater version	C713/3/B2
OEM 10V heater version	C713/10/B2

WARRANTY

The C713 power supply from Cathodeon is covered by warranty for one year.

APPLICATIONS

These high stability power supplies are available as either a 3V or a 10V heater version, and are designed to operate all Cathodeon deuterium arc lamps in the recommended manner. In addition, they can also be used with most lamps made by other manufacturers.

INTRODUCTION

Cathodeon's high power deuterium lamps are a source of high energy deep ultraviolet radiation, and subsequently emit a large amount of heat which requires dissipation for optimal lamp performance. Usually, this is achieved via water cooling, although this can present problems associated with water being in close proximity to electrical elements.

The high power deuterium lamp developed and manufactured by Cathodeon is the only air-cooled lamp available in this power range. It is available either with a Spectrosil window giving an output down to 180nm, or a magnesium fluoride window giving an output down to 112nm.

The lamp is a point source with radiation emanating from a 1mm aperture. It is a low noise device in comparison to standard high powered lamps, but slightly more noisy than general analytical lamps.

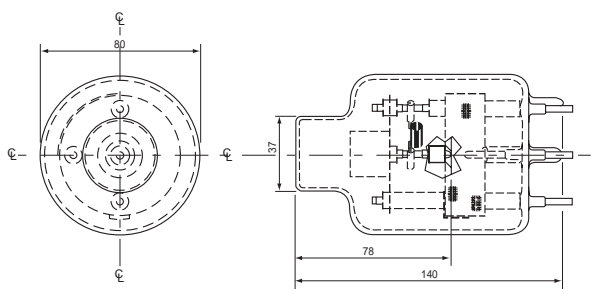
GENERAL CONSTRUCTION

The lamp has a diameter of 80mm, and is available in two versions, either incorporating a Spectrosil window, or a magnesium fluoride window, both hard sealed. The lamp's inherent stability comes from the 1mm source aperture, and the resulting output is limited to an 18° cone angle. It is mounted onto a robust four pin base and the fill gas is deuterium affording output wavelengths of 112-350nm.

Fig 22a High Power Deuterium Lamp



Fig 22b Dimensions of Cathodeon's High Power Deuterium Lamp



SPECIFICATIONS

MECHANICAL

External diameter	80mm ±2mm
Overall length	140mm
Source position with respect to window	Axial 78mm ±2mm
Source aperture	1mm
Aperture type	Deep parabolic
Baffle structure	Cone angle 18°

FINISHING

Four pins (3.125mm diameter) for electrical connection to anode, cathode, heater, aperture plate.

ELECTRICAL

Heater (starting) voltage	3.0 - 3.2V centre tap AC
Heater (run) voltage	2.7 - 3.2V centre tap AC
Heater current	12A
Arc voltage	80 - 110V DC
Arc current	300 - 2500 mA
Strike voltage	400V

LIGHT OUTPUT

Spectral irradiance	32mWm ⁻² nm ⁻¹ @ 300mm
Window material	Spectrosil or magnesium fluoride
Drift	<0.02%
Noise	<0.05%/hour
Wavelength range (UV continuum)	112nm (MgF ₂), 175nm (Spectrosil) - 360nm
Lifetime	1000 hours

ORDERING CODES

PRODUCT	ORDERING CODE
High powered deuterium lamp with Spectrosil window	HPD2
High powered deuterium lamp with magnesium fluoride windows	HPD2MGF

WARRANTY

These lamps are warranted for 250 hours operation within the recommended guidelines.

HIGH POWER DEUTERIUM LAMP

APPLICATIONS

This lamp is suitable for all applications requiring high stability and outputs down to 180nm (Spectrosil) or 112nm (MgF₂), and applications that require a higher level of output than that available from standard analytical lamps. Uses also include the analysis and production of semiconductor devices and light-limited spectroscopic measurements.

POWER SUPPLY & HOUSING FOR HIGH POWER DEUTERIUM LAMPS

INTRODUCTION

The C735 power supply and C731 housing have been designed and manufactured by Cathodeon specifically for use with the HPD2 high power deuterium lamp series.

The housing securely holds the lamp and is fitted with a fan designed to ensure an adequate flow of air around the lamp to maintain optimum operating conditions. It is also fitted with a shutter to prevent inadvertent exposure to hazardous UV radiation and interlocked to the power supply to ensure that the fans are running before the lamp is switched on to avoid overheating.

The power supply has low noise and drift characteristics, and designed to take into account the specific difficulties of providing a stable supply up to 3A. It is fully automatic in operation and provides warning of malfunction of the lamp. It conforms fully with EEC directive 89/336/EEC on electromagnetic compatibility (EMC) and warrants CE marking.

GENERAL OPERATION

With the key switch in the lamp housing in the OFF position, the filament voltage is set to 3V until the white 'htr control' comes on. An initial anode current of 1A is set and the key switch turned ON. The arc will strike within a second of depressing the lamp strike button. Please note that if the lamp is still hot from a previous run, at least five minutes must elapse for the lamp to cool before it can be restarted.

DIMENSIONS

	POWER SUPPLY	HOUSING
Width	440mm	185mm
Depth	440mm	160mm
Height	230mm	280mm
Weight	14.5Kg	3.5Kg

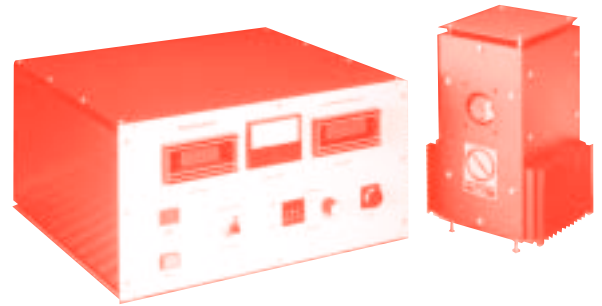
ORDERING CODES

PRODUCT	ORDERING CODE
Power supply	C735
Housing	C731

WARRANTY

The power supply and housing for Cathodeon's high powered deuterium lamp is covered by warranty for one year.

Fig 23 High Power Deuterium Lamp Power Supply and Housing



SPECIFICATIONS

Please note that this power supply is not available for OEM use.

Supply voltage	120-240V, 47-63Hz, single phase earthed neutral
Current waveform	Sinusoidal
Power factor	>95%
Compliance	EMC 89/339/EEC Electrical safety 72/23/EEC

ANODE SUPPLY

Maximum output voltage	140V adjustable by internal preset control
Stabilisation mode	Constant current
Output current	0.5 to 3A adjustable
Stability of output current	Mean value to better than 0.1% hour to hour
Speed of response	100mS
Ballast switch	24V output for relay in lamp housing: operates at adjustable arc current in the region of 1.5-2A

ANODE OVERVOLTAGE STARTER

Initiation	Press button switch on panel
Maximum overvoltage	450V open circuit
Maximum stored energy	2J

CATHODE HEATER SUPPLY

Maximum voltage	0-3.5V AC adjustable, measured at lamp cathode
Maximum rated current	12A
Stability	Better than 5% over supply voltage range
Meter	Analogue voltage

INTERFACE WITH LAMP HOUSING

Interlocks	1. Keyswitch on lamp housing locks off HT and starter 2. Supply for indicator lamp
Supply for fan	24V 1A DC unstabilised
Cable and connector	As required

APPLICATIONS

Both power supply and housing are specifically designed for the high power deuterium lamps, and will run these lamps safely and optimally. The system is suitable for applications which require a much higher output than that afforded by traditional analytical deuterium lamps, such as the analysis and production of semiconductor devices and light-limited spectroscopic measurements.

INTRODUCTION

Cathodeon, in conjunction with Salford University, has developed a deuterium lamp based modulated light source. When mounted within its housing, and driven by its complementary power supply, specifically designed by Cathodeon, the system is capable of modulation in the range of 1MHz - 200MHz. Better than 20% modulation can be achieved as high as 150MHz.

Fig 24a Modulated Deuterium Lamp System



GENERAL CONSTRUCTION

The basic deuterium lamp construction consists of a pin base, onto which the box structure is built. The box structure, made of high purity nickel, contains the anode, the cathode, the 1mm arc aperture and forms the front aperture. Considerable optimisation of the structure has taken place to match its impedance characteristics with those of the radio frequency excitation system.

The lamp is mounted in a specifically designed lamp housing containing the RF power generation system, and is driven by the C740 power supply which offers the capability to fine tune the lamp current voltage and frequency. Replacement lamps can be supplied separately if required, but due to tuning and lamp compatibility considerations, power supplies and lamp housings must be matched at purchase.

GENERAL OPERATION

The system should be powered up with the modulation power switch in the 'off' position. The lamp will strike after a short time, and should be allowed to stabilise for at least five minutes. For optimum performance the lamp current should be set at 330mA. Operation at a lower current may result in unstable modulation, whilst a higher current will both reduce the lifetime of the lamp and lead to a reduction in modulation depth for a given RF output. Once stabilised, the modulation power switch may be turned on, ensuring that the RF output is set to zero. The RF frequency can now be set in the range of 1-200MHz, noting that as RF power is coupled into the lamp arc, impedance changes will cause a drop in lamp voltage. Finally the RF power can be adjusted within the lamp voltage range of 50-55V. An inbuilt bargraph module gives an indication of RF matching and will alert the user if a problem develops.

SPECIFICATIONS

The lamp is a 29mm diameter gas discharge deuterium lamp providing a smooth continuum from 190 to over 400nm. The output emanates from a 1.0mm source and exits the lamp envelope with a cone angle of approximately 15 degrees. Depending on exact operating conditions output is in the area of 2mW/m²/nm at 210nm and 1mW/m²/nm at 300nm. The system is capable of modulation in the range of 1MHz to 200MHz with 90% modulation possible at 20MHz, and better than 20% modulation is possible up to 150MHz.

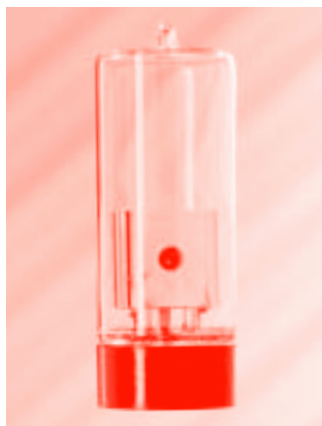


Fig 24b
Modulated Deuterium Lamp

POWER SUPPLY SPECIFICATIONS

Mains input: 110, 130, 220, 240V rms 50/60Hz (selected on rear panel) Fuse 2A (110-130V), or 1A (220-240V).

Auxiliary mains fuse for modulator supply 500mA

Heater voltage:	2V	10A	} Selected internally
	3V	6A	
	7V	1.5A	
	10V	1.5A	
	14V	1A	

The auxiliary heater supply can be selected from the above range to enable continuous running at reduced voltage.

Anode current: This is adjustable over the range 200-750mA. The supply will operate lamps with running voltages from 40-100V. Below 40V a safety circuit reduces the anode current. This is to protect the power supply from excessive dissipation in the event of low resistant loads. Strike potential inductively generated, nominal 700V pulse.

Modulator supply: 24V, 2.4A

Stability: Voltage ripple on the unmodulated lamp supply is less than 0.02% and long term current drift is less than 0.2% at 300mA (after the initial stabilization period of 30 mins).

Indicators: Mains on: **green** Current limit: **red**
Lamp on: **amber** Modulator supply: **amber**
Lamp restart: **amber**

Metering: Digital meter for lamp anode voltage or current.

Lamp output: "Triad 20" nine-way connector.

Dimensions: Width: **367mm** Height: **134.5mm**
Depth: **300mm** Weight: **8Kg**

ORDERING CODES

PRODUCT	ORDERING CODE
Modulated deuterium lamp	J41
Power supply & lamp housing	C740

WARRANTY

The modulated deuterium lamp is covered by warranty for 500 hours for use at 330mA, as per the manufacturers' instructions. Use at differing operating currents will alter the effective lifetime of the lamp.

REFERENCES

Rev. Sci. Instrum. **66** (1) : 48-51 (1995)
Trends in Analytical Chemistry **11** (1) : 32-40 (1992)
Journal of Microscopy **165** (1) : 49-60 (1992)

MODULATED DEUTERIUM LAMP SYSTEM

APPLICATIONS

The system is designed for time resolved fluorescent studies and for researchers with a need for an extremely stable deeply modulated, high frequency ultra violet light source. The system offers a more compact, cost effective alternative to traditional laser based systems.

The Company

Cathodeon Ltd is based in the university city of Cambridge, England, and is the world's leading Specialist in Spectral Source Technology. Its experience in the design and manufacture of vacuum/gas filled electronic components spans over 60 years of changing technology since the company was founded in the mid 1930's. A programme of active fundamental research to improve noise, intensity and lifetime performance, with continuing light source, electronic and mechanical engineering support, enable Cathodeon lamps to meet the most stringent requirements of modern instrumentation and are increasingly the first choice of major instrument manufacturers throughout the world.

The Products

Cathodeon is continuously improving and extending its range of specialist light sources used by the scientific and professional community. Detailed literature, application notes and technical data are available describing all products in the current Cathodeon range of:

- Deuterium Lamps
- Xenon Lamps
- Vacuum Ultra Violet Lamps
- Calibration Lamps
- Filament supports for Mass Spectrometry
- Tungsten Halogen Lamps
- Hollow Cathode Lamps
- Mercury Lamps
- Pulsed Deuterium Lamps
- See Through Hollow Cathode Lamps
- Photoionisation Lamps
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Quality

Cathodeon is committed to customer satisfaction at all levels. The application of Total Quality Manufacturing (TQM) control and rigorous instrument testing, combined with prealignment of lamps, custom packaging and our proven Just-in-time (JIT) delivery procedures, help sustain long term business relationships on all continents.



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