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TUNGSTEN HALOGEN LAMPS

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

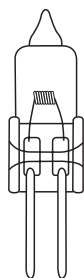


Fig 13b
Axial Filament

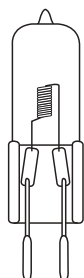
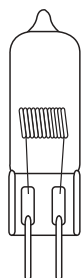


Fig 13c
Solid Filament



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.

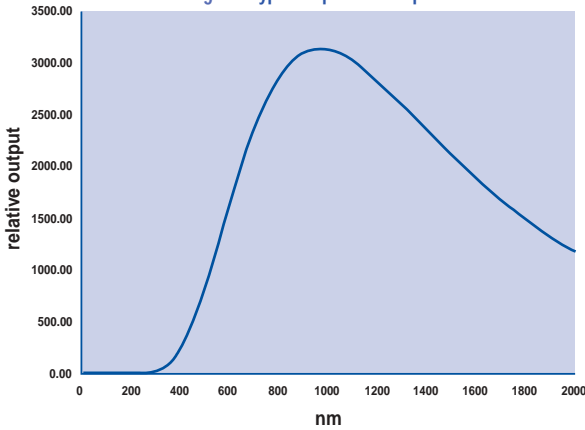
APPLICATIONS

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).

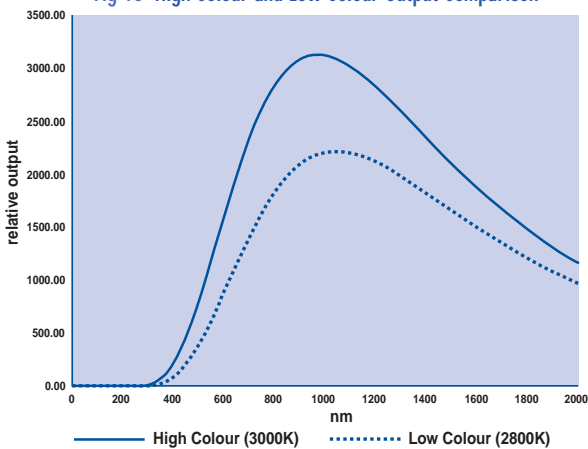
Fig 15 Typical Spectral Output



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

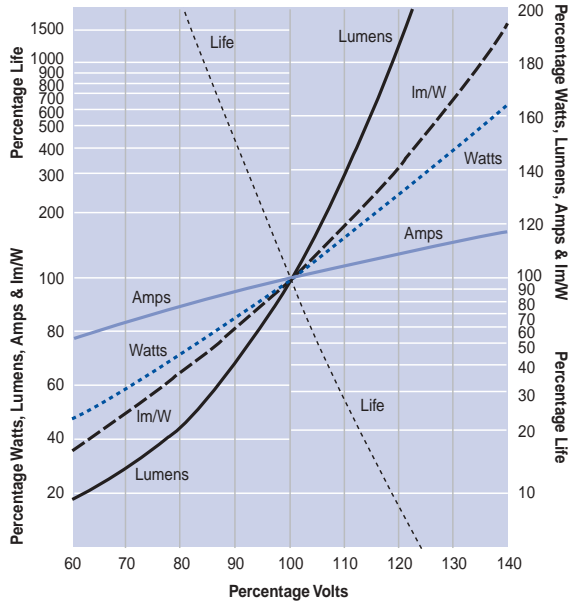


DERATING VOLTAGE

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.