IL1 Quartz Halogen Illuminator User Notes

BENTHAM

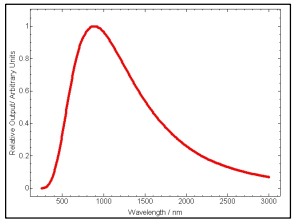
Overview

The IL1 is a general-purpose light source for use in the UV, visible and infra-red spectral regions from 350nm to 2.5µm.

A 100W quartz halogen lamp, controlled by a Bentham 605 current stabilised power supply is employed.

A single quartz condenser lens is used to fill the height and width of the slit and to match to the f/4 optics of the monochromator.

The quartz halogen lamp is unsurpassed for stability by any other source and should always be used where it provides sufficient output in the wavelength region of interest.



Typical IL1 relative output

Mechanical

The IL1 may be coupled directly to the entrance slit of any Bentham monochromator via M3 screws, or can be used in the stand-alone configuration.

The snout of the IL1 has been designed to permit use with a Bentham 218 optical chopper.

Lamp Operation

It is recommended to operate the lamp from a constant current supply such as the Bentham 605/608; the required conditions are as follows:-

Source	Lamp Rating (W)	Current Supply (A)	Typical Operating Voltage (V)
IL1	100	8.500	~11.2

For correct lamp operation, the following should be observed.

- Ensure the correct polarity is respected at all times
- Ensure that the fan is connected at all times
- Do not touch bulb with bare fingers
- Do not run the lamp at a current lower than that at which it was calibrated
- The lamp requires approximately five minutes warm-up time

Furthermore, it is of use to note the voltage displayed on the 605/ 608 LCD. Whilst this is for indication only, it can be used to determine lamp condition: these lamps tend to fail via either catastrophic rupture or bridging of the filament. The former is visibly obvious, yet the latter not necessarily so. Here, adjacent filament struts collapse, short-circuiting part of the filament; at a given current the lamp voltage, and lamp output is therefore reduced.

Replacement Lamp

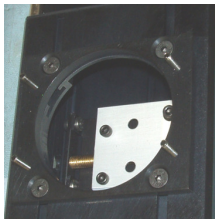
Bentham recommend the following replacement lamp:-

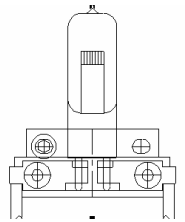
Lamp	Bentham Part No.	Manufacturer	Model
IL1	09101	OSRAM	HLX64623

Lamp Replacement

Lamps should be replaced by the following procedure:-

- Remove snout by undoing the four corner nuts
- Grip the lamp and remove it by pulling, a rocking motion is most successful





Condenser assembly removed, and lamp legs full pushed down to base

•Insert the new lamp making sure that you do not touch the envelope or the lens with your fingers. Again, a rocking motion is best.
•Push the lamp in until both pins are touching the ridge at the base of the ceramic holder Replace the snout and tighten the thumb screws

Lateral adjustment

There shall be found on the right hand wall of the IL1 (looking in direction of output), a hole which reveals small brass plain adjustment screw as seen above. Turning this screw clockwise, anti-clockwise translates the source to the right and left.

Lateral adjustment screw

Vertical adjustment

There is no vertical lamp adjustment, however it is possible to move the position of the condenser lens assembly relative to the lamp.

Loosen the four corner screws and gently reposition the holder of the condenser lens assembly.

Focus adjustment

Translation of the condenser lens along the 'trunk' of the IL1 will change the position of the image of the lamp. It is recommended, in optimising the output and coupling, to monitor a wavelength in Benwin+ to obtain maximum signal. Usually these lamps are set up by obtaining the image of the filament on the grating (at zero order position).

The Quartz Halogen Lamp

During use, an incandescent lamp filament reaches very high temperatures, around 3000K, at which temperature some of the tungsten, of which the filament is composed, evaporates and moves around inside the bulb by convection. Should the envelope be cold, it is likely that the tungsten is deposited thereupon, leading to gradual discolouration, as often seen in such household lamps.

Furthermore, as the tungsten is evaporated, the structure is of the filament is gradually thinned in places, leading to runaway failure: as the resistivity of the thinned sections increase, so does power dissipation and temperature, with as consequence a higher rate of evaporation. These factors conspire to thin the filament further until such point that the filament breaks, or “bridges”.

The quartz halogen lamp was introduced to mitigate these problems with two main design changes brought to promote what is termed the halogen cycle.

Firstly, in order to maintain the envelope at high temperature, it is brought as close to the filament as possible (without melting). Quartz, which can withstand higher temperatures than conventional glass, is used as the envelope material.

Furthermore, the bulb is filled with a halogen gas which combines with the evaporated tungsten from the filament. Provided that the envelope of the bulb is sufficiently hot, the tungsten-halogen compound does not condense thereupon,and eventually returns via convection to the filament, at which point the tungsten is re-incorporated, releasing the halogen to continue the process.

Envelope temperature being important for the halogen cycle to operate, the lamp must be run for long enough to heat up the lamp, and should not be under-run. Operating the lamp at less than 80% of rated voltage will result in failure of the halogen cycle due to the lower bulb temperature.

Furthermore, the orientation of the lamp may become important where the envelope is not equidistant above/ below the filament. Running such a lamp in the pins down orientation is satisfactory since the upper part remains hot through convection, but in the pins down orientation, it is possible that it becomes sufficiently cool to condense tungsten. It is possible to re-evaporate tungsten deposited on the envelope by letting the lamp run at a level at which shall re-initiate the halogen cycle.

The lamp operating conditions provided overleaf lead to moderate under-running along with which comes an increase in lamp lifetime to a few thousand hours.

Finally, whilst the emission of the tungsten filament is close to that of a black body, it should be noted that it is modified by the transmission of the envelope material (without which the filament would quickly oxidise and fail). Quartz transmits over the region 200-3000nm with an absorption feature around 2500nm.

WEEE statement:

Bentham are fully WEEE compliant, registration number is WEE/CB0003ZR.
Should you need to dispose of our equipment please telephone 0113 385 4352 or 4356, quoting account number 135419.

Bentham Instruments Limited
2 Boulton Road, Reading, Berkshire, RG2 0NH, UK
Tel: +44 (0)118 975 1355 Fax: +44 (0)118 931 2971
Email: sales@bentham.co.uk Internet: www.bentham.co.uk