HORIBA Scientific

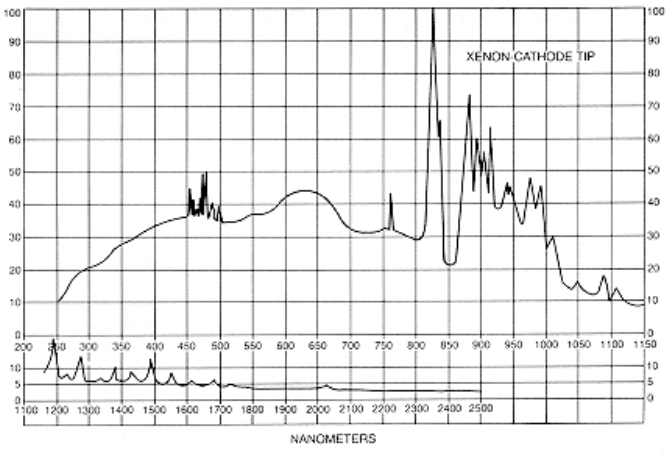
# Arc Lamp Brightness Chart and Solar Conversions (Includes KiloArc™)

| | | | Brightness Inside the FWHM Diameter | | |
|---|---|---|---|---|---|
| **Light Source, Lamp & Reflector Combinations** | **Optical Power (W)** | **Spot Size FWHM (mm)** | **Power Density inside FWHM diameter (W/mm^2)** | **Power Density inside FWHM diameter (W/cm^2)** | **Suns inside FWHM diameter (suns)** |
| PowerArc™ 100 W Hg f/1 reflector | 10 | 0.9 | 7.86 | 786.35 | 7863.49 |
| PowerArc™ 100 W Hg f/2.5 reflector | 10 | 1.2 | 4.42 | 442.32 | 4423.21 |
| PowerArc™ 75 W Xe f/1 reflector | 7.5 | 1.5 | 2.12 | 212.31 | 2123.14 |
| PowerArc™ 150 W Xe f/1 reflector | 15 | 2.6 | 1.41 | 141.33 | 1413.33 |
| KiloArc™ 1000 W Xe f/4.5 reflector | 100 | 8 | 1.00 | 99.52 | 995.22 |
| PowerArc™ 100 W Hg f/4.5 reflector | 10 | 3.4 | 0.55 | 55.10 | 550.99 |
| PowerArc™ 75 W Xe f/2.5 reflector | 7.5 | 3.2 | 0.47 | 46.65 | 466.51 |
| PowerArc™ 150 W Xe f/2.5 reflector | 15 | 5.8 | 0.28 | 28.40 | 284.01 |
| PowerArc™ 75 W Xe f/4.5 reflector | 7.5 | 5.4 | 0.16 | 16.38 | 163.82 |
| PowerArc™ 150 W Xe f/4.5 reflector | 15 | 10.5 | 0.09 | 8.67 | 86.66 |

# Arc Lamp Spectrum Band Pass Intensity Charts

To determine how much light the PowerArc™ delivers in a specific wavelength region for a given lamp refer to the following spectral output curves for the xenon and mercury-xenon arc lamps. These curves provide an estimation of the percentage of the total optical output power for a given wavelength range of the emitted light from the lamp.

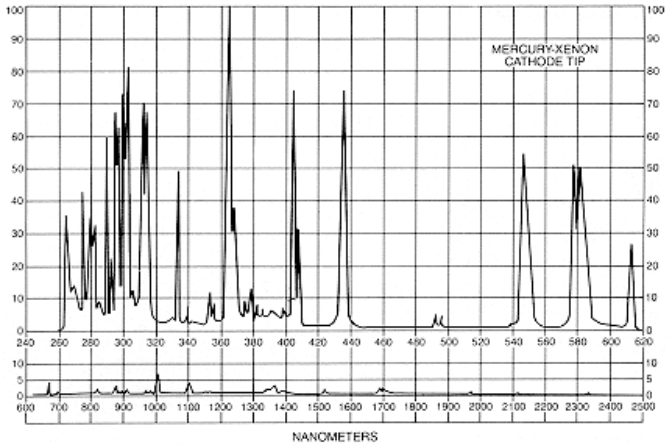
## Xenon Arc Lamp Spectrum



## Xenon Arc Lamp Intensity Chart

| Wavelength | % output | Wavelength | % output | Wavelength | % output | Wavelength | % output |
|---|---|---|---|---|---|---|---|
| 250-300 | 2.489 | 750-800 | 4.682 | 1250-1300 | 0.896 | 1750-1800 | 0.345 |
| 300-350 | 3.540 | 800-850 | 8.914 | 1300-1350 | 0.705 | 1800-1850 | 0.306 |
| 350-400 | 4.577 | 850-900 | 6.284 | 1350-1400 | 0.931 | 1850-1900 | 0.306 |
| 400-450 | 5.245 | 900-950 | 6.788 | 1400-1450 | 0.919 | 1900-1950 | 0.306 |
| 450-500 | 5.626 | 950-1000 | 5.848 | 1450-1500 | 1.118 | 1950-2000 | 0.268 |
| 500-550 | 5.214 | 1000-1050 | 2.871 | 1500-1550 | 0.701 | 2000-2050 | 0.345 |
| 550-600 | 5.729 | 1050-1100 | 1.953 | 1550-1600 | 0.513 | 2050-2100 | 0.230 |
| 600-650 | 6.472 | 1100-1150 | 1.402 | 1600-1650 | 0.515 | 2100-2150 | 0.230 |
| 650-700 | 5.649 | 1150-1200 | 1.593 | 1650-1700 | 0.552 | 2150-2200 | 0.230 |
| 700-750 | 4.862 | 1200-1250 | 0.846 | 1700-1750 | 0.428 | TOTAL | 100.000 |

## Mercury/Xenon ArcLamp Spectrum




## Mercury/Xenon Arc Lamp Intensity Chart

| Wavelength | % output | Wavelength | % output | Wavelength | % output | Wavelength | % output |
|---|---|---|---|---|---|---|---|
| 260-270 | 2.205 | 380-390 | 0.538 | 500-510 | 0.199 | 800-900 | 3.186 |
| 270-280 | 2.678 | 390-400 | 0.488 | 510-520 | 0.199 | 900-1000 | 2.947 |
| 280-290 | 2.877 | 400-410 | 2.862 | 520-530 | 0.199 | 1000-1100 | 3.942 |
| 290-300 | 4.231 | 410-420 | 0.304 | 530-540 | 0.249 | 1100-1200 | 3.544 |
| 300-310 | 3.883 | 420-430 | 0.319 | 540-550 | 3.325 | 1200-1300 | 2.190 |
| 310-320 | 5.730 | 430-440 | 5.207 | 550-560 | 1.563 | 1300-1400 | 4.580 |
| 320-330 | 0.538 | 440-450 | 0.498 | 560-570 | 0.249 | 1400-1500 | 2.091 |
| 330-340 | 1.572 | 450-460 | 0.199 | 570-580 | 3.463 | 1500-1600 | 2.449 |
| 340-350 | 0.448 | 460-470 | 0.199 | 580-590 | 4.908 | 1600-1700 | 2.051 |
| 350-360 | 0.886 | 470-480 | 0.199 | 590-600 | 0.521 | 1700-1800 | 2.190 |
| 360-370 | 8.403 | 480-490 | 0.229 | 600-700 | 3.467 | 1800-1900 | 1.990 |
| 370-380 | 1.473 | 490-500 | 0.483 | 700-800 | 2.041 | 1900-2000 | 1.990 |

# UV illumination down to 180 nm

Although the spectral output charts above do not show data below 250 nm, the PowerArc can deliver light down to 180 nm, the lowest available wavelength emission of the xenon plasma. Some arc lamps use quartz envelope bulbs that do not transmit UV wavelengths. These lamps are sometimes called ozone free bulbs because they do not emit in the deep UV and hence create ozone when interacting with oxygen in the air. We offer both ozone free and UV enhanced bulb choices, as well as different window materials for the front output of the lamp housing, so that our customers can choose the best components for their requirements.

For requirements below 250 nm please select from one of the two following xenon lamps when requesting your quote.

| Part Number | Description |
|---|---|
| 142 | 75 W suprasil (extended life) xenon arc lamp, output above 180 nm |
| 145 | 150 W xenon arc lamp, output above 210 nm |

# Determining the PowerArc™ Arc Lamp Housings Specific Energy Output for a Given Wavelength

## Example

### How much light does the PowerArc™ arc lamp housing provide with a 75 watt xenon arc lamp in a 5 nm optical bandwidth at 400 nm?

The answer is approximately 37.5 mW and here is how we get that answer as well as a cautionary note about this number.

**Calculation:** The total power of the 75 watt xenon lamp is 7.5 watts broadband (7,500 mW). Referring to the Band Pass Intensity Chart, and graph, for the xenon lamp indicates that at 400 nm there is approximately 5% of the total lamp output in a 50 nm wide band. Therefore in a 5 nm bandwidth at 400 nm there will be approximately 0.5% (1/10th of 50 nm) of the total lamp output. This corresponds to 37.5 mW.

**Caution about available energy:** Remember that not all of this light will be available to you for your application.

**Filter for wavelength selection:** If you use a 5 nm bandpass filter for wavelength selection, then there will also be losses through the filter as well as coupling losses for any optics you incorporate. Therefore you might end up with19 mW of energy to work with.

**Monochromator for wavelength selection:** If you are going to use a monochromator to filter and select the 5 nm output at 400 nm, then there are a number of factors to consider before determining exactly how much light will be available through the monochromator. Specifically the slit size required for a 5 nm bandpass, the grating efficiency curve for the grating used, the f/# matching of the monochromator, and the throughput loss of the monochromator coupling. HORIBA happens to provide a tunable PowerArc™ illuminator that consists of the PowerArc™ lamp housing coupled to a 200 mm focal length monochromator. When using the 75 watt xenon lamp with the f/4.5 ellipsoidal reflector, a considerable amount of light in the original focused spot doesn't even get through the narrow 1.25 mm slits required to obtain a 5nm bandpass with a standard 1,200 l/mm grating. Firstly we have to remember that the 5.4 mm spot is actually the FWHM of the total light focused. This means that approximately half of the total power is outside a 5.4 mm diameter. So, only about 10% of the total focused light gets into the monochromators narrow 1.25 mm slit in the first place. Additionally, depending on the grating used, its wavelength angle, its efficiency curve as well as the coupling loses of the monochromator you will have a total throughput for the monochromator of roughly 30%. This results in about 1 mw of energy delivered through the monochromator at 400 nm in a 5 nm bandpass. Still, 1 mW in a 5 nm bandpass through a monochromator is significantly more than any other commercially available alternative. Refer to the Tunable PowerArc™ web page for the corresponding output curve. Also remember that other monochromator options are available with differing focal lengths and grating resolutions and grating blaze angles that will have an impact of the total throughput.