



Certificate of Calibration



0478

FEL LAMP F-1291 ABSOLUTE SPECTRAL IRRADIANCE

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FOR: NERC Field Spectroscopy Facility
University of Edinburgh
Grant Institute
King's Buildings
West Mains Road
Edinburgh
EH9 3JW
United Kingdom

DESCRIPTION: The lamp was an Optronics Laboratories FEL tungsten halogen filament lamp, type OL FEL-U, of nominal power 1 kW.

IDENTIFICATION: The number F-1291 was marked on the rear of the lamp base.

DATES OF CALIBRATION: 24th June 2014 to 3rd July 2014

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a coverage probability of approximately 95 %. The uncertainty evaluation has been carried out in accordance with UKAS requirements.

Reference: 2014040396/IB4-14

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Date of issue: 14 August 2014

Signed: 

(Authorised Signatory)

Checked by:  SSK

Name: A Blackmore

on behalf of NPLML

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MEASUREMENTS

The removable alignment jig was placed vertically in the lamp mount, using a spirit level balanced on the top of the alignment jig to set the vertical alignment. The lamp mount was then adjusted so that the measurement axis, defined as the axis passing through and perpendicular to the centre of the measurement aperture, passed through the centre of the alignment marks on the jig and was perpendicular to the jig. The jig was then carefully removed from the mount and the lamp inserted in its place. The calibration refers to the absolute spectral irradiance at a distance of 0.500 m, measured from the front face of the alignment jig.

The lamp was operated from an actively stabilised dc power supply at 8.000 A. The polarity of the electrical current was as marked on the lamp, it was not changed. The lamp was ramped up and run for 30 minutes before measurements commenced. The voltage was monitored during measurement and is given for checking purposes only.

Spectral irradiance measurements were made over the range 250 nm to 1000 nm with an instrument bandwidth of approximately 5 nm (FWHM) and from 1000 nm to 2500 nm with an instrument bandwidth of approximately 10 nm (FWHM). Measurements were made against a series of NPL standard lamps calibrated against the NPL₂₀₁₀ spectral irradiance scale.

Ambient temperature during measurement was in the range $22^{\circ}\text{C} \pm 2^{\circ}\text{C}$.

RESULTS

The table on pages 4 to 7 gives values for the spectral irradiance in $\text{mW m}^{-2} \text{nm}^{-1}$ at 10 nm intervals over the wavelength range 250 nm to 2500 nm.

Values for the chromaticity coordinates and correlated colour temperature, calculated from the unrounded spectral data, appear in the table below, together with the measured lamp voltage.

Parameter	Value	Uncertainty
x	0.4335	± 0.0011
y	0.4032	± 0.0003
u	0.2487	± 0.0006
v	0.3470	± 0.0002
Correlated colour temperature	3052 K	$\pm 18\text{ K}$
Voltage	109.9 V	

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UNCERTAINTIES

The total expanded uncertainty of the absolute spectral irradiance calibration was estimated not to exceed the value given in the table on pages 4 - 7 for each individual point.

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, providing a coverage probability of approximately 95 %.

The results and uncertainties quoted refer to on-the-day values, and no allowance has been made for subsequent drift.

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Wave-length	Absolute Spectral Irradiance	Uncertainty	Wave-length	Absolute Spectral Irradiance	Uncertainty
nm	mW m ⁻² nm ⁻¹	%	nm	mW m ⁻² nm ⁻¹	%
250	0.1293	2.5	580	105.3	1.4
260	0.2268	2.4	590	111.1	1.4
270	0.376	2.5	600	116.5	1.4
280	0.593	2.3	610	122.0	1.4
290	0.910	2.2	620	127.4	1.4
300	1.338	2.1	630	132.6	1.4
310	1.904	2.1	640	137.7	1.4
320	2.625	2.1	650	142.7	1.4
330	3.54	2.1	660	147.4	1.4
340	4.69	2.1	670	152.0	1.4
350	6.08	2.0	680	156.5	1.4
360	7.71	2.0	690	162.0	2.1
370	9.60	2.0	700	165.2	1.5
380	11.80	2.0	710	168.6	1.4
390	14.28	2.0	720	172.4	1.4
400	17.07	1.9	730	175.8	1.4
410	20.26	1.8	740	179.1	1.4
420	23.69	1.6	750	182.2	1.5
430	27.32	1.6	760	185.1	1.5
440	31.3	1.6	770	187.7	1.5
450	35.6	1.7	780	190.2	1.5
460	40.1	1.6	790	192.2	1.8
470	44.8	1.5	800	194.7	1.1
480	49.7	1.5	810	196.4	1.2
490	54.8	1.5	820	198.2	1.2
500	60.1	1.5	830	199.7	1.1
510	65.6	1.5	840	201.0	1.1
520	71.1	1.5	850	202.3	1.0
530	76.7	1.5	860	203.1	1.0
540	82.4	1.5	870	204.0	1.0
550	88.2	1.4	880	204.7	1.0
560	93.9	1.5	890	205.3	1.1
570	99.6	1.4	900	205.7	1.0

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nm	mW m ⁻² nm ⁻¹	%	nm	mW m ⁻² nm ⁻¹	%
910	205.8	1.0	1240	168.4	1.0
920	206.0	1.0	1250	166.6	1.0
930	205.9	1.0	1260	164.8	1.0
940	205.8	1.0	1270	163.0	1.0
950	205.6	1.0	1280	161.2	1.0
960	205.0	1.0	1290	159.4	1.0
970	204.7	1.0	1300	157.6	1.0
980	204.0	1.0	1310	155.9	1.0
990	203.4	1.0	1320	154.1	1.0
1000	202.6	1.0	1330	152.4	1.0
1010	201.8	1.0	1340	150.7	1.0
1020	200.9	1.0	1350	149.0	1.0
1030	200.0	1.0	1360	147.3	1.0
1040	198.9	1.0	1370	145.6	1.0
1050	197.8	1.0	1380	143.9	1.0
1060	196.7	1.0	1390	142.2	1.0
1070	195.4	1.0	1400	140.5	1.1
1080	194.1	1.0	1410	138.7	1.1
1090	192.8	1.0	1420	136.9	1.2
1100	191.4	1.0	1430	135.2	1.2
1110	190.0	1.0	1440	133.5	1.1
1120	188.5	1.0	1450	131.7	1.0
1130	187.0	1.0	1460	130.1	1.0
1140	185.4	1.0	1470	128.4	1.0
1150	183.8	1.0	1480	126.8	1.0
1160	182.2	1.0	1490	125.2	1.0
1170	180.5	1.0	1500	123.6	1.0
1180	178.8	1.0	1510	122.0	1.0
1190	177.2	1.0	1520	120.4	1.0
1200	175.4	1.0	1530	118.9	1.0
1210	173.7	1.0	1540	117.4	1.0
1220	171.9	1.0	1550	115.8	1.0
1230	170.2	1.0	1560	114.3	1.0

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nm	mW m ⁻² nm ⁻¹	%	nm	mW m ⁻² nm ⁻¹	%
1570	112.8	1.0	1900	73.0	1.3
1580	111.4	1.0	1910	72.0	1.4
1590	109.9	1.0	1920	71.0	1.4
1600	108.5	1.0	1930	70.0	1.4
1610	107.1	1.3	1940	69.0	1.4
1620	105.7	1.3	1950	68.0	1.3
1630	104.3	1.3	1960	67.1	1.3
1640	102.9	1.3	1970	66.2	1.4
1650	101.6	1.3	1980	65.4	1.4
1660	100.2	1.3	1990	64.5	1.3
1670	98.8	1.3	2000	63.6	1.3
1680	97.5	1.3	2010	62.9	1.5
1690	96.2	1.3	2020	62.1	1.5
1700	94.9	1.3	2030	61.4	1.5
1710	93.6	1.3	2040	60.7	1.5
1720	92.4	1.3	2050	60.0	1.5
1730	91.2	1.3	2060	59.1	1.5
1740	90.0	1.3	2070	58.3	1.5
1750	88.8	1.3	2080	57.5	1.5
1760	87.7	1.3	2090	56.7	1.5
1770	86.5	1.3	2100	55.9	1.3
1780	85.4	1.3	2110	55.2	1.9
1790	84.3	1.3	2120	54.5	1.9
1800	83.2	1.3	2130	53.9	1.9
1810	82.1	1.3	2140	53.2	1.9
1820	81.0	1.3	2150	52.6	1.9
1830	80.0	1.3	2160	51.8	2.0
1840	79.0	1.3	2170	51.1	2.0
1850	78.0	1.3	2180	50.4	2.0
1860	76.9	1.3	2190	49.6	2.0
1870	75.9	1.3	2200	48.9	1.3
1880	74.9	1.3	2210	48.2	1.4
1890	74.0	1.3	2220	47.5	1.5

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nm	mW m ⁻² nm ⁻¹	%
2230	46.7	1.5
2240	46.0	1.4
2250	45.3	1.9
2260	44.9	2.3
2270	44.6	2.3
2280	44.2	2.3
2290	43.9	2.3
2300	43.5	1.8
2310	42.8	2.3
2320	42.0	2.4
2330	41.3	2.4
2340	40.6	2.3
2350	39.9	2.3
2360	39.6	2.3
2370	39.2	2.4
2380	38.9	2.4
2390	38.6	2.3
2400	38.3	1.9
2410	37.8	2.4
2420	37.4	2.4
2430	37.0	2.4
2440	36.5	2.4
2450	36.1	2.4
2460	35.6	2.4
2470	35.1	2.5
2480	34.6	2.5
2490	34.0	2.4
2500	33.6	2.0

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