

PHILIPS

Retail lighting

MASTERColour CDM



MASTERColour CDM

OEM Guide

To the reader

This is the ninth edition of the CDM OEM Guide. In this update (March 2015) the CDM Evolution range is extended further to include Tm GU6.5 products. Furthermore, for the 4200K range the reflector lamps and the Tm GU6.5 lamps are upgraded to Elite quality.

The OEM Guide includes a lamp-ballast compatibility table so one can find out quickly whether a lamp is suited for electromagnetic ballasts or for electronic ballasts only.

We chose to leave out the light-technical specifications since these are listed in the e-catalogue (www.philips.com).

Extra attention has been given to safety instructions and lamp temperatures that are allowed in a luminaire for reasons of safety or performance.

A chapter is dedicated to the explanation of the graphs that are included in the e-catalogue.

An easy to use troubleshooting guide is included as well.

Feel free to share your comments with your local sales representative.

Updated by Ron Raas and Bart Smets

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General information

1.1 Introduction

MASTERColour CDM (Ceramic Discharge Metal Halide) lamps were introduced in 1994 as a new generation of Compact HID (High Intensity Discharge) lamps. These lamps have a better performance in colour quality, life time and efficacy compared to existing quartz lamps.

In 2007 the CDM-range was extended with the CDM Elite lamps with a performance in a league of its own. They have enhanced efficacy, colour rendering, excellent lumen maintenance, and a quick run up. This is the preferred option for energy savings.

The new MASTERColour CDM Evolution allows you to take the lighting in your shop to the next level. These lamps are the latest chapter in our ongoing commitment to optimizing lighting for the retail environment, and are the natural successor to the well-established and universally-popular CDM and CDM Elite. CDM Evolution offers an unbeatable combination of superior light quality, lowest total cost of ownership and exceptionally long lifetime. The evolution range is extended with the introduction of the Tm GU6.5 lamp (20W and 35W)

The Philips' patented ceramic UV enhancer enables a complete removal of ionizing gas. A significant improvement of ignition behaviour is achieved without affecting light technical properties.

Features of MASTERColour CDM lamps:

- High lamp efficacy
- Crisp white sparkling light
- Very good colour rendering
- Compact size for design flexibility
- Stable colour during life time
- Long life
- Available in very warm white (2500K) warm white (3000K) and cool white (4200K)
- Universal burning position for all single ended lamps*

*) Some lamps have a limitation in burning position for sake of performance. These are mentioned in the product catalogue (www.philips.com).

1.2 Applications

The CDM-lamps are widely used in retail (fashion, furniture and supermarket) accent and down lighting. The outdoor environment (architectural lighting) increasingly benefits from the good light quality.

1.3 Lamp range

The CDM range consists of the following types:

- CDM-T, single ended with a G12 cap and a 19 mm UV-block quartz outer bulb
- CDM-TC, single ended with a G8.5 cap and a 14 mm UV-block quartz outer bulb

- CDM-Tm, single ended miniature lamps with a GU6.5 cap or a PGJ5 twist-and-lock cap. Only the GU6.5 lamps have Elite or Evolution performance.
- CDM-R PAR20 and CDM-R PAR30L, parabolic reflector lamps with an E27 screw cap
- CDM-Rm Mini, a miniature MR16 reflector lamp with a twist-and-lock GX10 cap
- CDM-R111, a beautifully designed reflector lamp with anti-glare cap and a GX8.5 cap
- CDM-TP, a single ended protected lamp, suited for open luminaires
- CDM-TD, double ended with RX7s caps and a 19 mm UV-block outer bulb

The tables below show the product range arranged according to the families in the Philips e-catalogue. In case of reflector lamps the beam angles are also mentioned. The specifications are listed in the product catalogue (www.philips.com).

Table 1 Range of single ended MASTERColour CDM-lamps





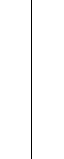



CDM-T				CDM-TC			
Evolution	Elite	CDM	Warm/Fresh	Evolution	Elite	CDM	Warm/Fresh
							
20W	3000K		3000K	3000K		3000K	
35W	3000K	3000K 4200K	3000K 4200K	3000K	3000K 4200K	3000K 4200K	
50W	3000K	3000K 4200K		3000K	3000K 4200K		
70W	3000K	3000K 4200K	2500K 4200K	3000K	3000K 4200K	3000K 4200K	2500K 4000K
100W		3000K 4200K					
150W		3000K 4200K					

Table 2 Range of MASTERColour CDM-lamps with reflector



CDM-Rm Mini		CDM-R PAR20 & PAR30L		CDM-R111	CDM-R111
Elite	CDM	Elite	CDM	Elite	CDM
					
		35W only	35W only		
20W	3000K (10D 25D 40D)				3000K (10D 24D)
35W	3000K/4200K (10D 25D 40D)	4200K (15D 25D 40D)	3000K/4200K (10D 30D)	3000K/4200K (10D 24D 40D)	3000K/4200K (10D 24D 40D)
50W	3000K (25D 40D 60D)		3000K/4200K (10D 30D 40D)	3000K (10D 24D 40D)	
70W			3000K/4200K (10D 30D 40D)	3000K (10D 24D 40D)	3000K/4200K (10D 24D 40D)

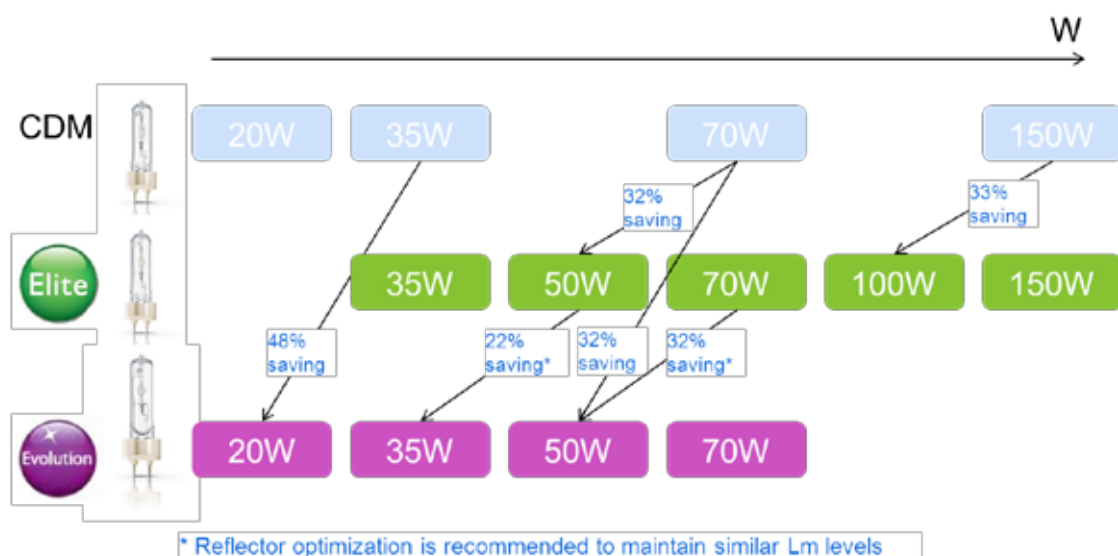
Table 3 Range of mini, doubled ended, and protected CDM-lamps

	CDM-Tm Mini Evolution GU6.5	CDM-Tm Mini Elite GU6.5	CDM-Tm Mini GU6.5	CDM-Tm Mini PGJ5	CDM-TD (Essential)	CDM-TP PG12
						
20W	3000K		3000K	3000K		
35W	3000K	3000K 4200K		3000K		
50W		3000K 4200K				
70W					3000K 4200K	3000K 4200K
150W					3000K 4200K	3000K 4200K

1.4 Up-lamping options (energy saving)

Although in general CDM lamps are already in Energy Efficacy class A+ according to The European Commission Regulation (EU) No. 874/2012 [link](#), the introduction of the new Elite and Evolution offers some very interesting uplamping options. The numbers are only valid if electronic ballasts are used. Up-lamping of the T-versions of CDM 35W and 70W operated on EM-ballasts to Elite is also possible.

The scheme below shows the CDM towards Elite and Evolution up-lamping options for 3000K lamps.



1.5 Ballast range


















MASTERColour CDM lamps need gear to ignite the lamp and to control the current supplied to the lamp. The gear can be fully electronic, with all components integrated in one ballast, or conventional. Conventional gear consists of a copper/iron inductor to control the current, an ignitor for starting the lamp, and a capacitor to make the current and voltage change polarity simultaneously i.e. power factor correction.






















Full electronic gear replaces the conventional gear, ignitor and capacitor with one electronic unit. There is a wide variety of electronic gear offerings. The Philips range consists of:

- The PrimaVision: High quality, compact size ballasts for optimal and reliable performance of CDM-lamps. The PrimaVision Economy is new. This Economy ballast offers a cost effective solution.
- PrimaVision mini: Miniature size ballasts that free up the boundaries of creativity and innovation in luminaire design
- AspiraVision: The mark of excellence in HID electronic gear technology. Intelligent, easy to use and simple to install with additional voltage drop detection that prevents the ballast from switching off in case of a mains voltage drop. This range of ballasts has improved thermal performance to ensure a long life time even in temperature-critical luminaires. Furthermore, these ballasts feature SOFT START which allows using more ballasts with one circuit breaker.

A complete overview of the Philips drivers is listed in the e-catalogue (Gear Selection Tool). With this tool you can also find which ballast is suitable for a specific lamp.

Table 4 Electronic ballast range

	Built in luminaire /S	Placed on the ceiling /I	PCB-version /P		Plug and power /C
CDM-Tm 20W mini PGJ5	HID-PV m PGJ5 20 /S (LPF and HPF) 	HID-PV m PGJ5 20 /I (LPF) 	HID-PV m PGJ5 20 /P (LPF) 		
CDM 20W	HID-PV m 20 /S (HPF)  HID-PV C 20/S 	HID-PV m 20 /I (HPF) 			
CDM-Tm 35W mini PGJ5	HID-PV m PGJ5 35 /S 	HID-PV m PGJ5 35 /I 			
CDM 35W	HID-PV C 35 /S HID-PV E 35 /S  HID-PV m 35 /S  HID-PV 2x35 /S 	HID-AV C 35 /I HID-PV C 35 /I HID-PV E 35 /I  HID-PV m 35 /I  HID-PV 2x35 /I 	HID-PV C 35 /P  HID-PV 2x35 /P 		HID-AV C 35 /C HID-PV C 35 /C 

					
CDM 50W	HID-PV C 50 /S HID-PV E 50 /S  HID-PV m 50 /S 	HID-AV C 50 /I HID-PV C 50 /I 	HID-PV C 50 /P 		HID-AV C 50/C HID-PV C 50/C 
CDM 70W	HID-PV C 70 /S HID-PV E 70 /S  HID-PV 2x70 /S 	HID-AV C 70 /I HID-PV C 70 /I HID-PV E 70 /I  HID-PV 2x70 I 	HID-PV C 70 /P 		HID-AV C 70 /C HID-PV C 70 /C 
CDM 35 50 70W Triple Wattage	HID-AV C 35-70 /S 	HID-AV C 35-70 /I 			HID-AV C 35-70 /C 
CDM 100W	HID-PV C 100 /S 	HID-PV C 100 /I SOFT START 			
CDM 150W	HID-PV C 150 /S 	HID-PV C 150 /I 			













A full electronic unit such as the HID-PV has the following advantages compared to electromagnetic systems:

- Less energy consumption over life because the lamp power is kept constant
- Less energy consumption because of lower ballast losses
- Life time extension: Electronic ballast protects the lamp against overloads
- Faster run up and better lumen maintenance performance
- Special circuitry is built into the ballast to protect the unit itself, the lamp, and the installation against end-of-life effects of the lamps such as uncontrolled arcing in the outer-bulb (see discussion about End of Life phenomena in section 5.12)
- Small dimensions and low weight
- Simple wiring
- High power factor to reduce the reactive power
- Suitable for a range of rated voltage inputs

- Even less colour spread between individual lamps. The unit eliminates the influence of mains voltage deviations and tolerances of ballast impedances and delivers constant power to the lamp.
- Elimination of mains frequency flicker which is sometimes visible to the human eye
- Elimination of mains frequency noise

The table below shows the magnetic ballast range. All ballasts are equipped with a thermo-switch.

Table 5 Magnetic ballast range and ignitors

	Ballast	Ignitor	Capacitor
35W	BMH 35 range 	SND58 	6 μ F 
70W	BMH 70 range 	SND58 	12 μ F 
150W	BSN/BMH MK4 	SKD 578 	18 μ F 
250W	BSN/BMH MK4 range 	SKD578 	32 μ F 

2 Lamp-ballast compatibility

For the sake of performance we recommend the use of Philips electronic ballasts, if available.

Table 6 Single ended MASTERColour CDM-lamps








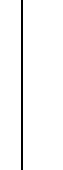





	Evolution	Elite	CDM-T CDM	Warm/Fresh	Evolution	Elite	CDM-TC CDM	Warm/Fresh
								
20W	EL only		EL only		3000K		EL only	
35W	EL only	EL+EM	3000K EL+EM 4200K EL only		3000K	EL only	3000K EL+EM 4200K EL only	
50W		EL only				EL only		
70W		EL+EM	EL+EM	EL only		EL only	EL only	EL only
100W		EL only						
150W		EL only	EL+EM					

Table 7 MASTERColour CDM-lamps with reflector

	CDM-Rm Mini Elite	CDM CDM	CDM-R PAR20 & PAR30L Elite	CDM CDM	CDM-R111	CDM-R111 Elite
						
			35W only	35W only		
20W		EL only			EL only	
35W	EL only	EL only	EL + EM	3000K EL+EM 4200K EL only	3000K EL+EM 4200K EL only	EL+EM
50W	EL only		EL only			EL only
70W			EL + EM	3000K EL+EM 4200K EL only	EL only	EL only

Table 8 Miniature, doubled ended, and protected CDM-lamps

	CDM-Tm Elite Mini GU6.5	CDM-Tm Mini GU6.5	CDM-Tm Mini PGJ5	CDM-TD	CDM-TP
					
20W		EL only			
22W			PGJ5 ballast*)		
35W	EL only	EL only	PGJ5 ballast*)		
50W	Philips EL only**)				
70W				EL+EM	EL+EM
150W				EL+EM	EL+EM

*) The PGJ5 lamp is not rated for 5 kV ignition pulses. A special PGJ5 version of the ballast is available.

**) When these lamps have a leaky arc tube (end of life) high temperatures can be expected. To be sure that the electronic ballast timely switches off when deviating electronic behaviour occurs, an electronic driver from Philips has to be used.

3 Standards

International worldwide electrical standards for lighting have been written by the IEC (International Electrotechnical Commission). www.iec.ch

Some products are not standardised at all (such as new lamps and products exclusive to Philips), and some products are standardised in a particular region.

Identical national standards exist for European countries. These are laid down by CENELEC. www.cenelec.org These EN standards have the same numbering as the IEC standards.

Most other countries copy IEC standards into their own national standards, sometimes with small local deviations.

The standards are split up into safety standards and performance standards.

The safety standards deal with aspects such as:

- Electrical hazards
- Thermal hazards
- Optical hazard
- UV-radiation
- Relevant test procedures

The performance standards deal with:

- Dimensions
- Interchangeability
- Luminous flux
- Colour and colour rendering
- Service life
- Relevant test procedures

Lamp standards			
Safety		Performance	
62035	Discharge lamps (excluding fluorescent lamps – Safety specifications	61167	Metal halide lamps

Caps, lamp holders and gauges	
60061 – 1	Lamp caps and holders together with gauges for the control of interchangeability and safety; Part 1: General requirements and tests
60061 – 2	Lamp caps and holders together with gauges for the control of interchangeability and safety; Part 2: General requirements and tests
60061 – 3	Lamp caps and holders together with gauges for the control of interchangeability and safety; Part 3: General requirements and tests
60061 – 4	Lamp caps and holders together with gauges for the control of interchangeability and safety; Part 4: General requirements and tests
60238	Edison screw lamp holders
60399	Barrel thread for lamps holders with shade holder ring
60838	Miscellaneous lamp holders

Standards for accessories			
Safety		Performance	
61048	Auxiliaries for lamps – Capacitors for use in tubular fluorescent and other discharge lamp circuits – General and safety requirements	61049	Auxiliaries for lamps – Capacitors for use in tubular fluorescent and other discharge lamp circuits – Performance requirements
61347-1	Lamp control gear – Part 1: General and safety requirements	-	-
61347-2-1	Lamp control gear – Part 2-1: Particular requirements for starting devices (other than glow starters)	60297	Auxiliaries for lamps - Starting devices (other than glow starters) – performance requirements
61347-2-9	Lamp control gear – Part 2-9: Particular requirements for ballasts for discharge lamps (excluding fluorescent lamps)	60923	Auxiliaries for lamps – Ballasts for discharge lamps (excluding tubular fluorescent lamps) – Performance requirements
61347-2-12	Lamp control gear – Part 2-12: Particular requirements for d.c. and a.c. supplied electronic ballasts for discharge lamps (excluding fluorescent lamps)		

Luminaires	
60598 – 1	Luminaires – Part 1: General requirements and tests
60068-2-6 Fc 60068-2-29 Eb	Vibration and bump tests

EMC	
CISPR15	Limits and methods of measurement of radio disturbance characteristics of electrical lighting and similar equipment
61547	Equipment for general lighting purposes – EMC immunity requirements
61000-3-2	Electromagnetic compatibility (EMC) – Part 3-2: Limits –Limits for harmonic current emissions (equipment input current ≤ 16 A per phase)

Relevant European directives	
2006/95/EC	Electrical equipment designed for use within certain voltage limits
2011/65/EU	Restriction of the use of certain Hazardous Substances in electrical and electronic equipment
2009/125/EC	Ecodesign requirements for energy-related products
2004/108/EC	Electromagnetic compatibility
2012/19/EU	Waste Electrical and Electronic Equipment

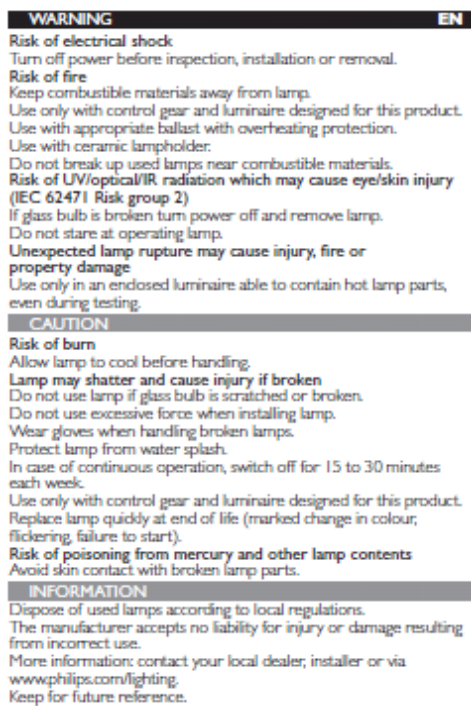
Our products carry the CE-marking based on fulfilling the requirements of the relevant European directives. Products with a CE-marking may circulate freely within the European Community. CE-certificates and MSDS-sheets are available for all our lamps from your local sales representative.

4 Luminaire design

4.1 How to operate your lamp safely

The safety information is included in the Instructions for use leaflet.

Our instructions for use leaflets have been written in English, French, German, Spanish, Portuguese, Chinese, and Russian.



WARNING indicates hazardous situations, if not avoided, could result in death or serious injury

CAUTION indicates hazardous situations, if not avoided, could result in minor or moderate injury

INFORMATION is used to address practices that are not related to personal injury



Universal burning position
Position de fonctionnement universelle
Universelle Brennpunkt
Posición de funcionamiento universal
Posição universal de acesa
“一般” 燃焼位置
Стандартное положение для горящей лампы

Made in Belgium
Fabriqué en Belgique
Hergestellt in Belgien
Fabricada en Bélgica
Fabricada na Bélgica
比利时制造
Сделано в Бельгии

Disposal information (do not dispose as domestic waste)

Burning position information

Country of origin

Our safety instructions are listed below.

4.1.1 Risk of Electrical shock

- Use lamp holders that are rated for the ignition voltage of the ballast
- If TC-lamps are used we recommend the use of G8.5 lampholder with a collar for sake of electrical safety
- All our lamps are suitable for use in class II luminaires. Any metal parts of these lamps satisfy class II requirements.
- Rm can be retrofitted into class III luminaires when used with independent ballasts

4.1.2 Risk of fire

- To prevent the risk of fire use the lamp with an appropriate ballast (see also discussion about End Of Life phenomena in section 5.12)
- In some circumstances the temperature of the lampholder may exceed 250°. Therefore we recommend the use of ceramic lampholders with appropriate insulation of the wires. For safety reasons, only heat-resistant lamp wires should be used which have silicon or PTFE (teflon) insulation. Other materials like e.g. PVC are not allowed. The same applies to fixed wires pre-attached to a lamp socket.
- The distance between a reflector lamp and an illuminated object must be more than 40 cm to avoid temperatures higher than 90°C (determined using the method described in IEC60598)

4.1.3 Risk of optical/UV/IR-radiation

- Thanks to our choice of UV-block materials our lamps have an effective UV-output of less than 2 mW/klm. This corresponds with the maximum Permissible Exposure Time of 8 hours at 500 lux. Special protective measures for luminaires are not mandatory. Lamps with a shattered or ruptured outer bulb must not be used.
- We classify our CDM-lamps in Risk group 2 regarding blue light hazard. To prevent damage of the retina by blue light, do not stare into operating lamps. Use protective eyewear if needed. Luminaire optics will never increase the blue light hazard but it is possible, due to losses or diffusion in the optical design that a luminaire using a Risk Group 2 lamp may be classified as Risk Group 1. This can be confirmed by measurement. Alternatively the luminaire maker can use the lamp ETHR value to calculate a safe distance for viewing his luminaire. The ETHR value for 3000K lamps is 2000 lux and for 4200K lamps it is 1200 lux.

4.1.4 Risk of lamp rupture

- All CDM lamps except the CP, R111, R, and Rm types must be operated in an enclosed luminaire that is able to contain hot lamp parts

4.2 How to get the best out of your lamp

This section describes the information that is needed to design or choose a luminaire that gets the best out of your lamp. For more specifications the reader is referred to the product catalogue (www.philips.com).

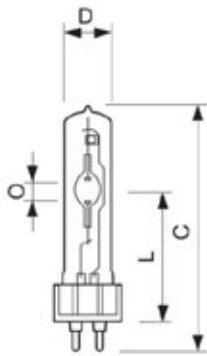
The section below lists the maximum allowed temperatures for our CDM-lamps. In a number of cases temperature limits have been set for safety reasons. Lamp temperatures must not exceed these limits.

4.2.1 T-lamps

4.2.1.1 Cap

T-lamps have a G12 pin cap.

4.2.1.2 Dimensions

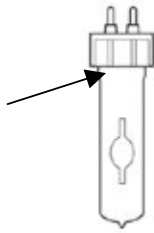
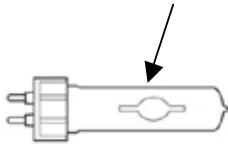


	Arc length (O) (mm)	Light centre length (L) nom (mm)	Overall lamp length (C) max (mm)	Lamp diameter (D) max (mm)
20W to 100W	4 to 9	56	103	20
150W	8 to 9	56	110	20
250W	11	73	135	25

4.2.1.3 Maximum temperatures

We set limits on the pinch temperature because the metal components in the pinch can oxidise and cause short life. The temperature of the critical point is limited to 300°C. Since this point is not accessible in a T-lamp we specify 350°C at the nearest accessible point.

We set limit on maximum outer bulb temperature as an indication of the temperature of the discharge tube. If the discharge tube gets too hot this may result in short life or poor performance.

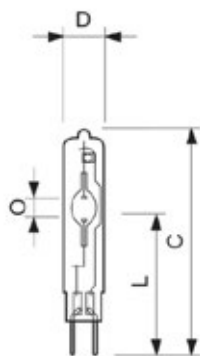
	Maximum pinch temperature (°C) to be measured in base up burning position	Maximum outer bulb temperature (°C) To be measured in horizontal burning position
		
20W	In our experience we never reach 350°C. No need to measure.	250
35W		500
50W	350	500
70W		500
100W		550
150W		650
250W		700

4.2.2 TC-lamps

4.2.2.1 Cap

TC-lamps have a G8.5 pin cap

4.2.2.2 Dimensions

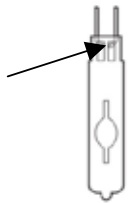
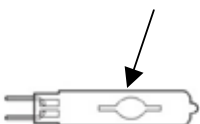


	Arc length (mm)	Light centre length (L) nom (mm)	Overall lamp length (C) max (mm)	Lamp diameter (D) max (mm)
20W to 70W	4 to 9	52	85	outer bulb 15 pinch 17

4.2.2.3 Maximum temperatures

We set limits on the pinch temperature because the metal components in the pinch can oxidise and cause short life.

We set limit on maximum outer bulb temperature as an indication of the temperature of the discharge tube. If the discharge tube gets too hot this may result in short life or poor performance.

	Maximum pinch temperature (°C) to be measured in base up burning position	Maximum outer bulb temperature (°C) To be measured in horizontal burning position
		
20W	300	320
35W		500
50W		550
70W		550*

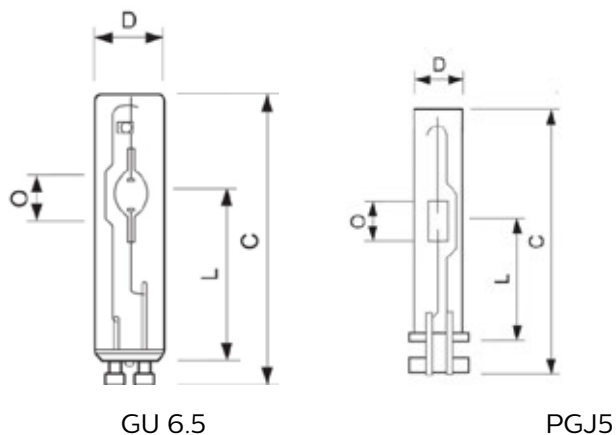
*) The CDM-TC 70W/942 lamp has a gas-filled outer bulb. The maximum allowed outer bulb temperature is 700°C. For all other CDM-TC 70W lamps, including both CDM-TC Elite 70W 3000K and 4200K lamps, please refer to the table above.

4.2.3 Tm Mini lamps

4.2.3.1 Cap

Tm-lamps are available with GU6.5 cap and PGJ5 caps.

4.2.3.2 Dimensions

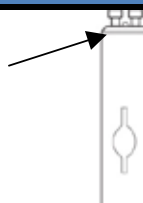
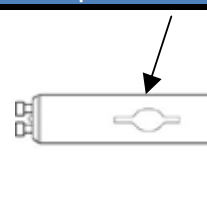
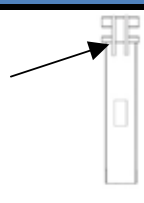
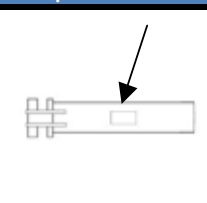


	Arc length (mm)	Light centre length (L) nom (mm)	Overall lamp length (C) max (mm)	Lamp diameter (D) max (mm)
GU 6.5:20W to 50W	4 to 6	30	57	13.3
PGJ5 20W and 35W	3 to 4	22.6	52	11.2

4.2.3.3 Maximum temperatures

We set limits on the cap temperature because the metal components can oxidise and cause short life.

We set limit on maximum outer bulb temperature as an indication of the temperature of the discharge tube. If the discharge tube gets too hot this may result in short life or poor performance. For higher powers the temperature of the outer bulb is limited by the properties of the glass.

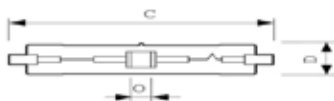
	Maximum cap temperature (°C) to be measured in base up burning position	Maximum outer bulb temperature (°C) To be measured in horizontal burning position	Maximum cap temperature (°C) to be measured in base up burning position	Maximum outer bulb temperature (°C) To be measured in horizontal burning position
				
20W	250	380	250	380
35W	250	450	250	450
50W	250	500	This lamp is neither available nor in development.	

4.2.4 TD-lamps

4.2.4.1 Cap

TD-lamps are double-ended with RX7s-caps, designed for horizontal operation. Tilting up to 45° is allowed but not recommended.

4.2.4.2 Dimensions

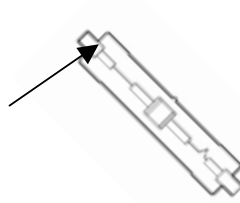
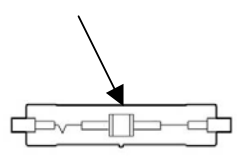


	Arc length (mm)	Overall lamp length (C) max (mm)	Lamp diameter (D) max (mm)
70W	8	118	22
150W	10	135	22

4.2.4.3 Maximum temperatures

We set limits on the pinch temperature because the metal components in the pinch can oxidise and cause short life.

We set limit on maximum outer bulb temperature as an indication of the temperature of the discharge tube. If the discharge tube gets too hot this may result in short life or poor performance.

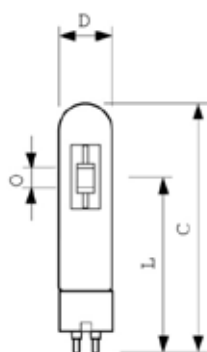
	Maximum pinch temperature (°C) to be measured 45° burning position	Maximum outer bulb temperature (°C) To be measured in horizontal burning position
		
70W	300	500
150W		650

4.2.5 TP-lamps

4.2.5.1 Cap

TP-lamps are available with a PG12-2 pin cap.

4.2.5.2 Dimensions



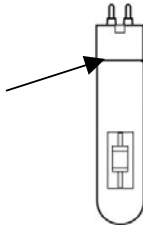
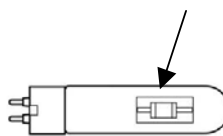
G12-2

	Arc length (mm)	Light centre length (L) nom (mm)	Overall lamp length (C) max (mm)	Lamp diameter (D) max (mm)
70W and 150W PG12-2	6 to 9	91	149	

4.2.5.3 Maximum temperatures

We set limits on the cap temperature because of limitations of the solder and cement that we use for the fixation of the cap.

We set limit on maximum outer bulb temperature as an indication of the temperature of the discharge tube. If the discharge tube gets too hot this may result in short life or poor performance. For higher powers the temperature of the outer bulb is limited by the properties of the glass.

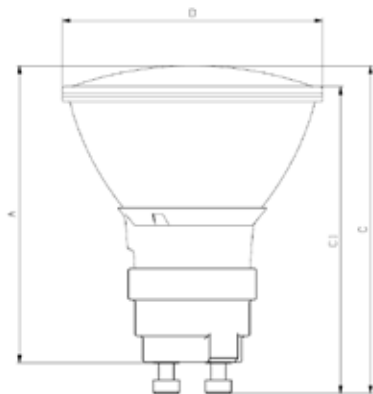
	Maximum cap temperature (°C) to be measured in base up burning position	Maximum outer bulb temperature (°C) To be measured in horizontal burning position
		
70W	210	380
150W	210	450

4.2.6 Rm Mini lamps

4.2.6.1 Cap

These lamps have a GX10 twist-lock cap.

4.2.6.2 Dimensions




	Reference length (A) max (mm)	Overall lamp length (C) max (mm)	Lamp length to rim (C1) max (mm)	Lamp diameter (D) max (mm)
All Rm-lamps	59	65.4	60.9	50.7

4.2.6.3 Maximum temperatures

We set limits on maximum neck temperature as an indication of the temperature of the discharge tube. If the discharge tube gets too hot this may result in short life or poor performance.

The flame seal construction of the Philips lamp means that there is no practical limitation on the rim temperature.

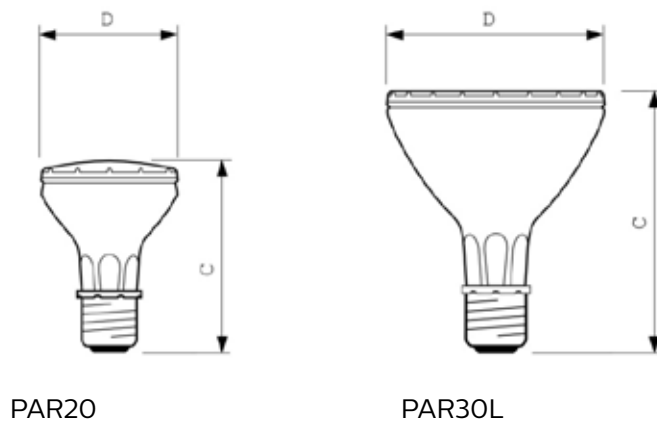
Maximum neck temperature (°C) To be measured in base up burning position	
	
20W	215
35 and 50W	315

4.2.7 R-lamps

4.2.7.1 Cap

These lamps are available with E27 caps.

4.2.7.2 Dimensions

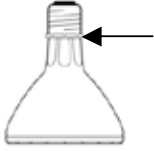
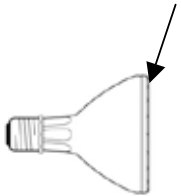



	Overall lamp length (C) max (mm)	Lamp diameter (D) max (mm)
R20 E27	95	65
R30 E27	123	97

4.2.7.3 Maximum temperatures

We set limits on the cap and rim temperature because of limitations of the solder and cement that we use for the fixation of the cap and the lens.

We set limit on maximum outer bulb temperature as an indication of the temperature of the discharge tube. If the discharge tube gets too hot this may result in short life or poor performance.

	Maximum cap temperature (°C) to be measured in base up burning position	Maximum temperature (°C) Rim To be measured in horizontal burning position	Maximum neck bulb temperature (°C) To be measured in base up burning position
			
All PAR20 and PAR30	210	160	300

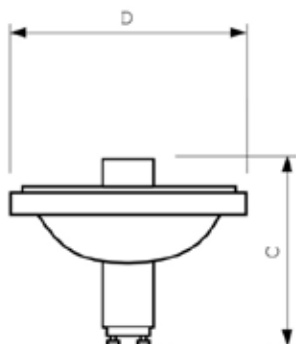
4.2.8 R111-lamps

4.2.8.1 Fixation

These lamps have a GX8.5 twist-lock cap and have been designed to be mounted using a standardised reflector rim which has the same dimensions as in the Halogen ALUline 111.

In luminaire designs that do not use the rim for mounting, extreme care must be taken to avoid damaging the glass safety sleeve inside the lamp neck.

4.2.8.2 Dimensions

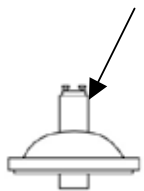
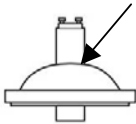
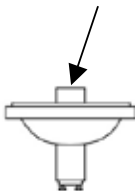


	Overall lamp length (C) max (mm)	Lamp diameter (D) max (mm)
20W to 70W	95	111

4.2.8.3 Maximum temperatures

We set limits on the cap temperature because of limitations of the cement that we use for the fixation of the cap.

We set limit on reflector neck and anti-glare cap as an indication of the temperature of the discharge tube. If the discharge tube gets too hot this may result in short life or poor performance.

	Maximum cap temperature (°C) to be measured in base up burning position	Maximum temperature (°C) Reflector neck To be measured in horizontal burning position	Maximum anti-glare cap temperature (°C) To be measured in base down burning position
			
20W	In our experience we never reach critical temperatures. No need to measure.		
35W	180	200	350
70W			400

4.3 How to perform temperature measurements

4.3.1 Outer bulb

For temperature measurements a method is proposed for standardisation by the European lamp manufacturers. The proposal is included in Chapter 8.

4.3.2 Pinch

A method is described in IEC 60682 (Edition 1:1980+A1:1987+A2:1997).

4.3.3 Other spots

The method for other spots on the lamp such as the rim or the neck of a reflector lamp is similar to the method described for the pinch. We prefer to drill a small hole to anchor the junction as mentioned in section 3.2 of the IEC60682 standard.

Lamps with attached thermocouples are available on request with your local sales representative

4.4 Other attention points for luminaire design

To avoid unwanted yellow stains and images of the field wire in the beam, we recommend the use of faceted optics and/or a front glass with small lenslets. Narrow beams and lamps in horizontal burning position are worst case with respect to these stains. The CDM Evolution lamps have no salt pool while operating thus having a so-called clean beam. Yellow stains are avoided.

Be careful when applying anti-glare caps. Locally, the temperature of the lamp may increase which may lead to short life.

Highly confined luminaires may cause short life and/or increased lumen depreciation. Be sure that the maximum allowed temperatures are not exceeded.

Use appropriate cables between the ballast and the lamp. The cables have to be able to withstand the rated ignition voltage generated by the ballast and high operating temperature conditions. Too long cables may cause poor ignition performance; therefore the applicable ballast design-in sheet has to be consulted regarding maximum cable length. Mains and lamp cables should be kept separated as much as possible in order to prevent EMC non-compliance.

5 Additional lamp information

This chapter explains the additional lamp information and the graphs that are available in the e-catalogue.

5.1 Manufacturing information

Our lamps have been marked with:

- The Philips brand
- The type of lamp including power and colour code
- UV-BLOCK
- A factory symbol

Factory symbols	
☾	Brazil
☐	Shanghai
☐☐	Turnhout
☐☐	PRC
☐☐	Poland
☐☐	Japan
☐☐	USA

- Date code (consisting of a year number and a month letter code)
- Country of origin
- Wheely bin logo (see 5.13 about disposal)

5.2 Optical and geometrical data sets

Three-dimensional CAD models are available on request from your local sales representative.

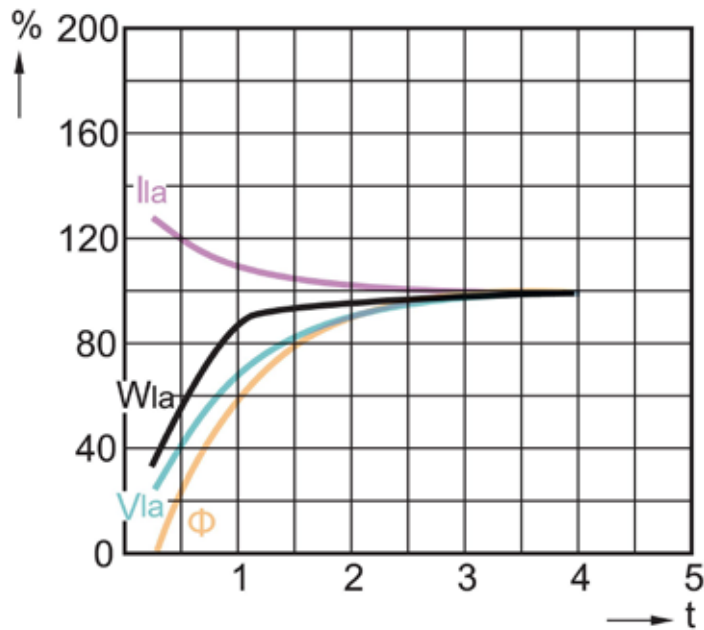
If desired, we can supply ray sets and light distributions in Eulumdat and IES-formats.

5.3 Run up

The CDM-lamp needs some time to run up. In the picture below the lamp needs 2 minutes to run up to full lumen output. It is normal that the colour of the light is greenish for a while and that some flashes occur.

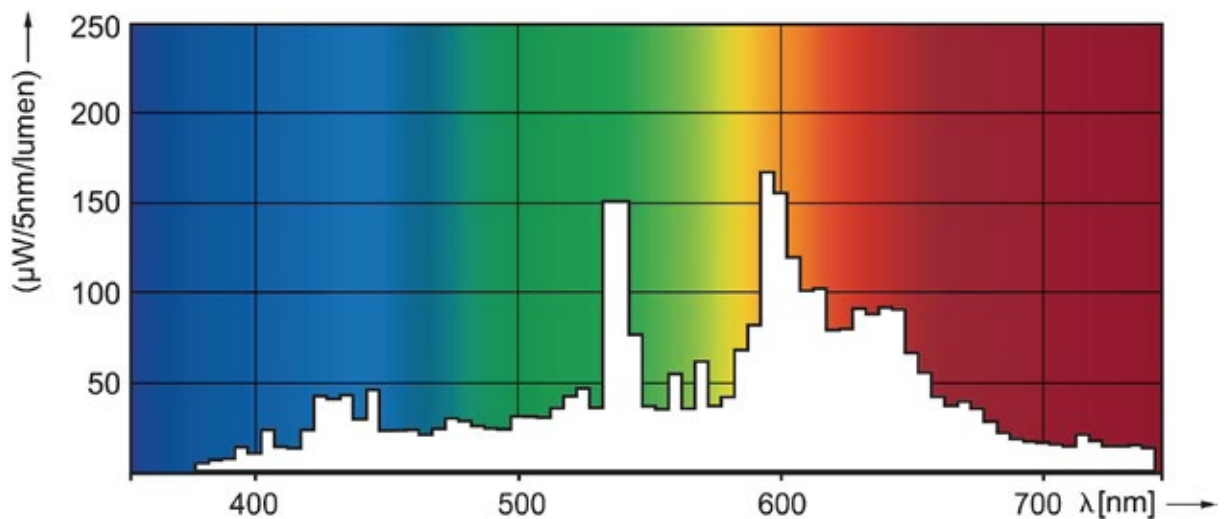
The graph below shows the evolution of some electrical (lamp power, lamp voltage, lamp current) and light technical properties (luminous flux, colour rendering) during run up.

The run up time depends on the run up current.



5.4 Spectral energy distribution

The spectral energy distribution shows the emitted radiation of the visible light.

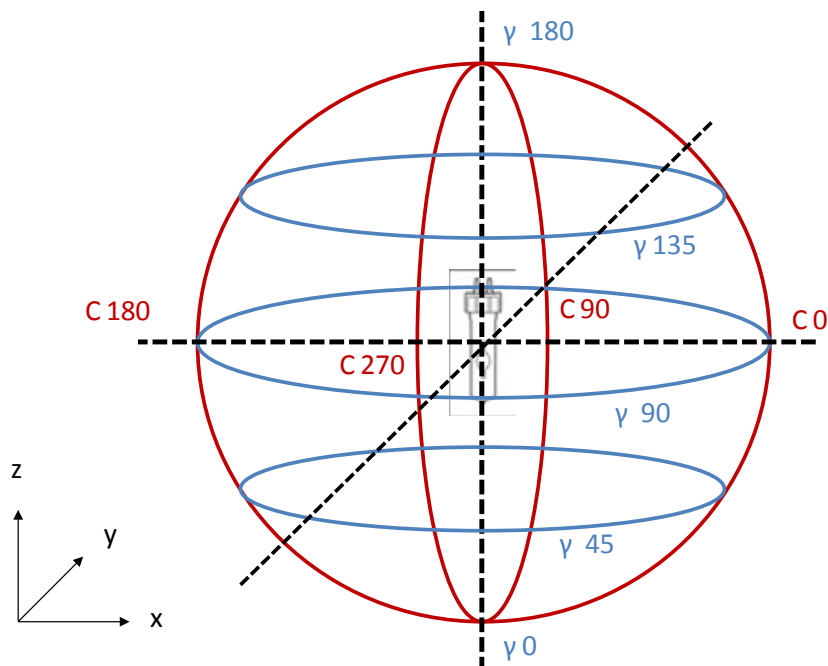


5.5 Light distribution

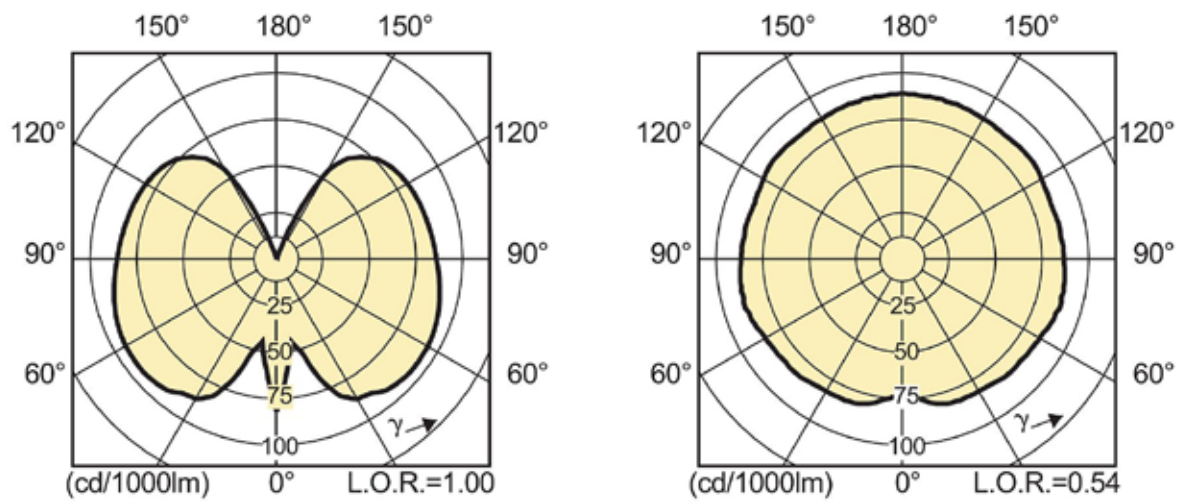
The polar light distribution diagram shows the luminous intensity as a function of the angle.

The C-plane system (red circles) equals a globe with a vertical axis. C-angles (C-planes) are valid from 0° to 360°; γ-Angles (cones) are valid from 0° (south pole) to 180° (north pole).

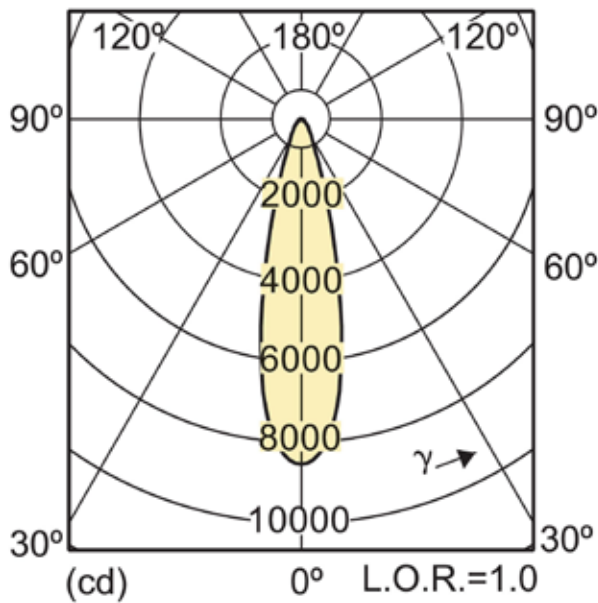
The lamp is placed in the centre of the sphere.



The picture below shows the light distribution of a CDM-T lamp. The left picture shows a C-plane. The right picture shows data for $\gamma = 90^\circ$ (the equator).



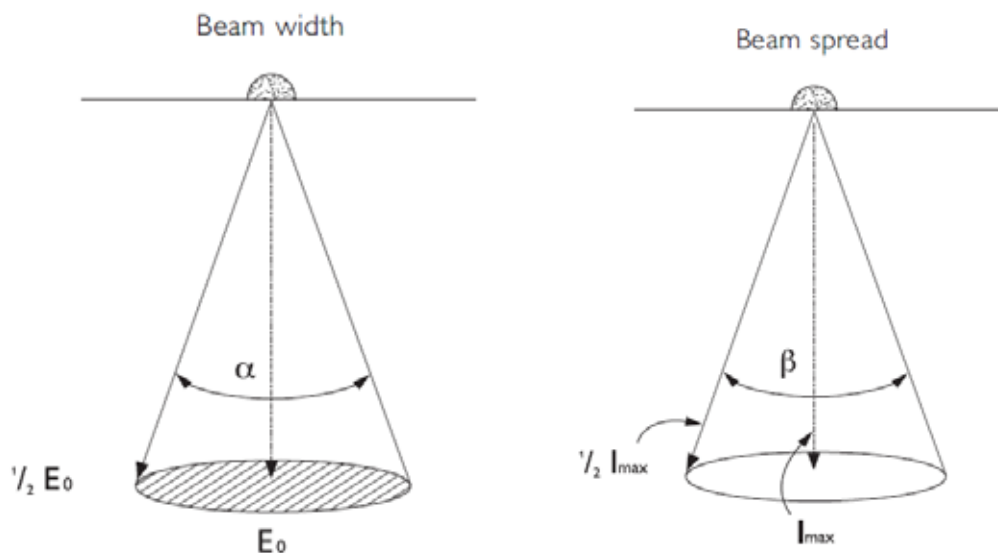
The picture below shows the light distribution of a reflector lamp. The lens is faced towards the south pole.



5.6 Beam diagram (reflector lamps only)






The $\frac{1}{2} E_0$ angle alpha (beam width) is the angle at which the illuminance (lux) is 50% of the maximum value in the centre of the beam.

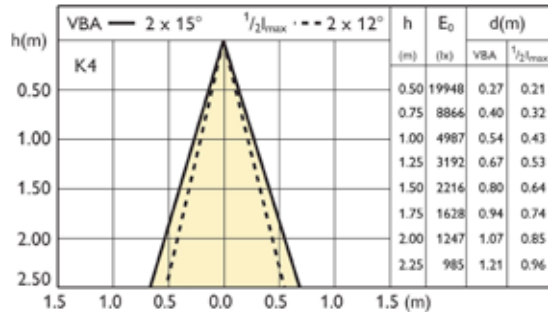
The $\frac{1}{2} I_0$ angle beta (beam spread) is the angle at which the luminous intensity (candela) is 50% of the peak value.



The beam diagram shows the characteristics of the light beam produced by a reflector lamp or a luminaire. It gives the beam spread angle ($\frac{1}{2} I_{max}$), the diameter of the light spot under the $\frac{1}{2} I_{max}$ heading (dashed lines), and the diameter of the spot of which the boundary has a luminous intensity (candela) of 50% of the maximum value. This is the visual beam diameter. These values are given for a number of heights.

The K-factor is mentioned in the upper left corner. It describes the sharpness of the beam.

K factor	Effect	
1	No spill light Shutters or barn doors are needed.	
2	Sharp spot Dramatic or theatrical	
3	Strong spot	
4	Visible spot	
5	No visible spot	








5.7 Visual impact diagram (reflector lamps only)

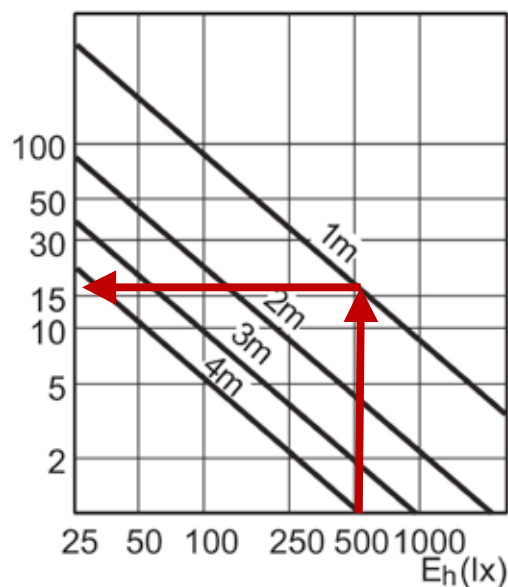
The graph below shows an example of a visual beam diagram. It is useful to determine the effect of accent lighting.

The visual impact diagram shown below is from a CDM-Rm Mini Elite 35W/930 reflector lamp.

The horizontal and vertical axes represent the horizontal illuminance and the accent factor respectively. The accent factor is the ratio of the lighting level in the spot and the general lighting level.

The table below shows the meaning of the accent factor. The pictures show the effects using a K2 spot.

Accent factor	Effect	
2	Noticeable	
5	Low theatrical	
15	Theatrical	
30	Dramatic Low general lighting levels only.	
>50	Very dramatic Low general lighting levels only.	



If the horizontal illuminance is 500 lux we will obtain an accent factor of 15 if we place the lamp or luminaire at 1 metre from the object. In this example.

5.8 Fading

The extent of damage to materials caused by light radiation (fading,) depends on:

- Sensitivity of the material expressed by a sensitivity function
- Spectral radiation distribution of the light source expressed by a damage factor
- Illuminance
- Exposure time

The materials can be divided into three classes

Class	Sensitivity
Very sensitive	Textiles, costumes, water colours, tapestries, prints and drawings, stamps, manuscripts, wall paper, dyed leather, gouache
Sensitive	Oil and tempera paints, leather (not dyed), horn, bone, ivory, wood, lacquer
Not sensitive	Metal, stone, glass, ceramics, stained glass, jewellery, enamel

The damage factor is a dimensionless number that expresses the fading caused by a light source relative to another.

The table below shows the damage factor of a few light sources.

Light source	Damage factor
Incandescent lamp	0.08
CDM-R lamp 3000K	0.15 to 0.2
CDM lamp 3000K	0.2 to 0.3
CDM-R lamp 4200K	0.3 to 0.4
CDM lamp 4200K	0.4 to 0.5
Daylight through 4 mm window glass	0.4 to 0.7
Daylight (sunny weather)	0.8
Daylight (overcast sky)	1.5

The fading risk is the product of the damage factor, the illumination level, and exposure time.

Inside a sunny shop window with one hour of exposure and a lighting level of 10000 lux the fading risk is

$$0.50 \times 10000 \times 1 = 5000$$

If a lighting level of 1000 lux is realised in a shop with a 3000K CDM-lamp

The fading risk is

$$0.3 \times 1000 \times 1 = 300$$

Reduction of fading can be realised by:

- Using filters that absorb 300 nm – 400 nm radiation
- Reducing the illuminance by increasing the distance between the lamp and the object or increasing the beam angle, or reducing the wattage
- Reducing the exposure time

5.9 Influence of ambient temperature on lamp performance

Contrary to some fluorescent lamps, the ignition, run up and operation of CDM-lamps are not sensitive to ambient temperatures. In general, the proper functioning of the total system will depend more on the functioning of the electronic components in the ballast.

5.10 Dimming

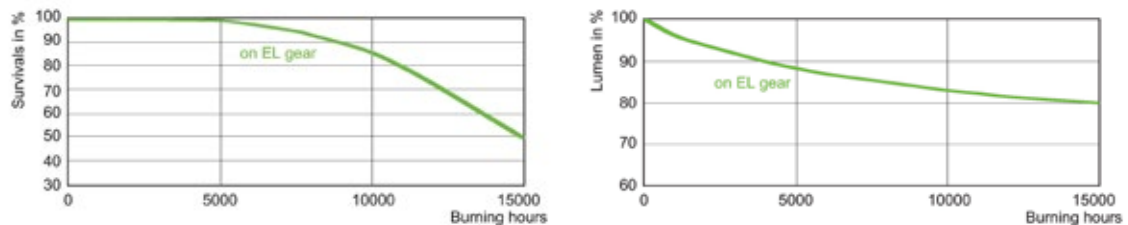
The Elite light boost lamp introduced in 2012 was the first dimmable HID lamp. However because of low interest this lamp is removed from our programme. Due to colour shift towards green, shorter life time, and poor lumen maintenance it is not possible to dim our lamps.

5.11 Hot re-ignition

Shortly after switching off, the lamps need a higher ignition voltage to restart. For safety reasons most lamp caps are not rated for the high voltage that is required. So the lamp should be allowed to cool down until the ignition voltage has dropped to the level produced by the ballast. This can take up to 15 minutes.

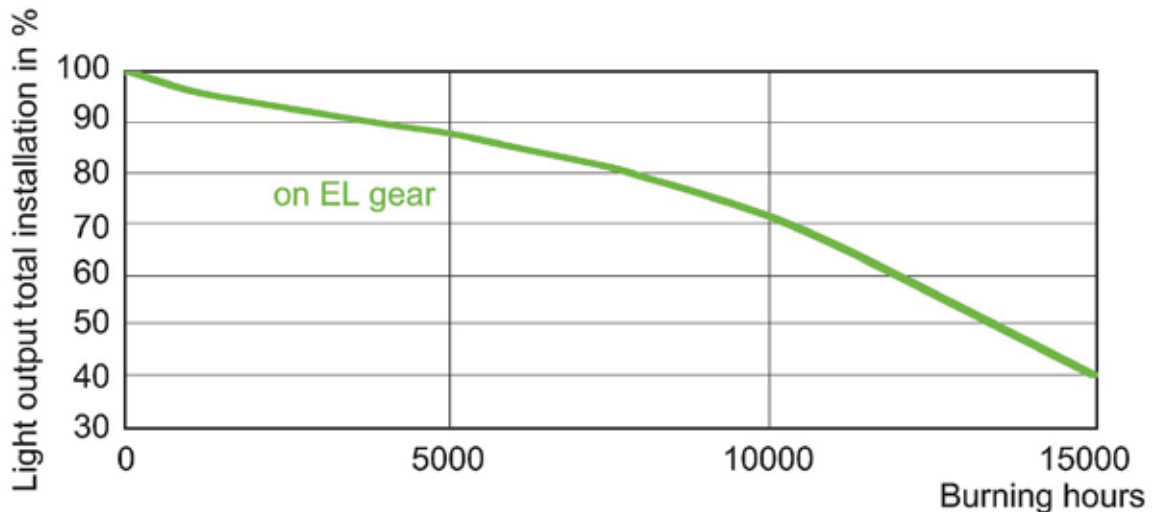
5.12 Life time

The graphs below shows the survival rate and the lumen maintenance curve. In this case at 15000 hours maximum 50% of the lamps have failed, so B50 is 15000h, at which the lumen maintenance is 80%.



The product of the survival rate and lumen maintenance is used to determine to service life or economic lifetime. The graph is shown below.

In this example the service life would be 10000 hours if 70% output is the limit for group replacement.



One of the main reasons for lumen depreciation is blackening of the discharge tube by electrode material that is transported to the discharge tube wall by the chemical processes in the discharge tube. Accelerated blackening can be caused by:

- Operating the lamps at reduced or increased power
- Frequent switching
- Confined luminaires
- Badly designed optic that reflects the light back on the discharge tube

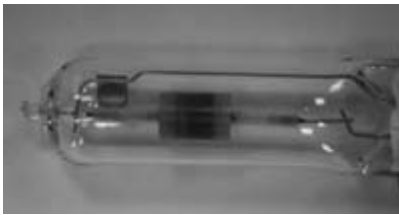


Figure 1 Blackened CDM-lamp

The lamp will eventually fail due to one or sometimes a combination of the following mechanisms that are more likely to occur as the lamps gets older.

- Leaky discharge tube
- Worn out electrodes in the discharge tube
- Leaky outer bulb
- Broken leads
- Damage to the cap contacts due to arcing in the lamp holder
- Extinguishing due to increased re-ignition voltage

If the discharge tube gets leaky the contents including the fill gas escape into the outer bulb. The lamp will go through the following stages.

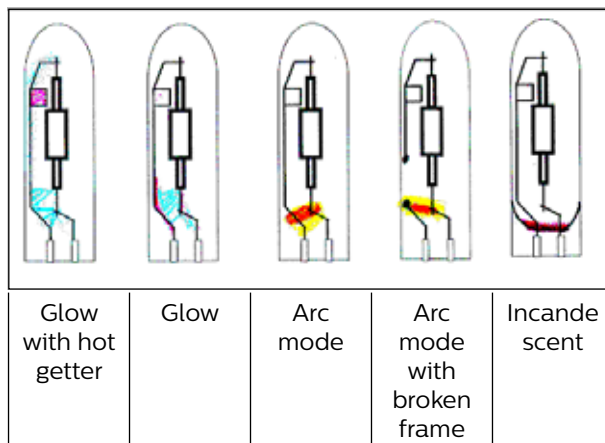


Figure 2 End of Life modes. From left to right glow discharge with hot getter, glow discharge, arc mode, arc mode with broken frame, incandescent mode.

Low voltage arc

- It does not always occur but if it does it can last for hours
- It occurs in the discharge tube
- The lamp voltage is low 10-30V
- The lamp current is symmetric and limited to the run up current
- If the currents are high overheating of the ballast and series ignitors can occur

Glow

- It can last for many hours
- Bluish weak light around all metal parts in the lamp
- The getter can turn red hot
- During ignition pulses streamers occur on the outer bulb wall
- The lamp voltage is approximately 200V and the currents are low but asymmetric
- Sputtering of metal
- If the current are high series ignitors can get overheated

If the starting gas pressure in the outer bulb is sufficiently high the low voltage arc or glow may transform into an arc.

Arc

- It can last for many hours
- Bright white light
- Low voltage 20V but high asymmetric currents
- Very high lamp temperature possible ($>500^{\circ}\text{C}$)
- If the currents are high overheating of the ballast and series ignitors can occur
- High temperature of lampholder and wires possible

If a sufficiently thick metal layer is deposited by the sputtering and arcing processes an incandescent mode can occur.

Incandescent

- It can last for days
- White light
- Lamp voltage 30-140V. Electrical operation quite similar to normal operation
- Very high lamp temperature possible ($>500^{\circ}\text{C}$)
- High temperature of lampholder and wires possible

Glow and arc discharges can be detected because the voltage and current deviate from the levels of normal lamp operation. For lamps that we suspect from reaching high temperatures when they have a leaky arc tube, we prescribe electronic ballasts that feature timely switching off when deviating electric behaviour occurs. For all other lamps we allow electromagnetic ballasts as long as they are protected against high (asymmetric) currents.

5.13 Disposal of lamps

Our gas discharge lamps are subject to the 2012/19/EU WEEE directive (waste of electrical and electronic equipment). This directive applies in all Member States of the European Union and Norway and Switzerland. The purpose of this directive is to prevent waste or to reduce it by re-using or re-cycling. The producers of products subject to WEEE are responsible for the financing of environmentally sound disposal of the product at the end-of-life stage.

These product are marked with the wheely bin logo.



Practically it means that:

- Manufacturers and importers of electronic and electrical equipment are responsible for compensating the collection, recovery and treatment of WEEE costs
- Consumers can return their products free of charge to the collection points
- Only licenced operators will be able to handle and recover WEEE waste

6 Additional ballast information

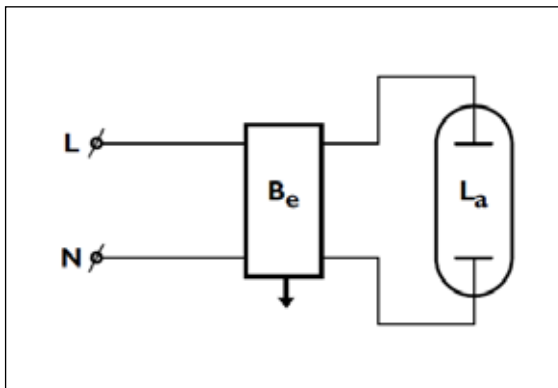
6.1 Electronic ballasts

6.1.1 Influence of the mains voltage on lamp performance when using electronic ballasts.

For the Philips (220–240V) units, the lamp wattage and luminous flux are constant for input voltage variations between 198V and 254V.

Two lamp operation of CDM lamps on one ballast. The Philips HID-PrimaVision Compact range has been extended with twin ballasts for the CDM 35W and CDM 70W lamps. With this ballast the two lamps are operated in parallel, both lamps are ignited and controlled independently. This guarantees the same benefits and features as compared with the operation of CDM lamps on the HID-PV single lamp ballast.

The wiring diagram is shown below.



6.1.2 Influence of operating frequency on lamp performance

When selecting a ballast for CDM lamps, special attention should be paid to the operating frequency of the unit,

- 50Hz conventional system: generally accepted for most CDM lamps although in visually demanding applications or when used in general lighting, lamp flicker can be a problem
- Electronic ballasts operating with low frequencies (50–400Hz) and a block current wave, referred to as Low Frequency Square Wave (LFSW) are in general suitable
- Using high frequency (>1 kHz) electronic ballasts may lead to acoustic resonances of the discharge arc with disturbing flicker, short lamp life or even rupturing of the discharge tube
- Very high frequency electronic ballasts, above the critical frequency (200–600kHz depending on the lamp wattage/type) avoids problems of acoustic resonance, however care needs to be taken with radiated emission of the system. Furthermore, highly accelerated electrode wear and therefore reduced lifetime often observed with lamps that are not specially designed for very high frequency operation.
- Philips does not have HF and VHF-ballasts for CDM-lamps in the market. We cannot guarantee good performance of our lamps if operated on a third party VHF-ballast.

6.2 Conventional (CuFe) systems

6.2.1 Introduction

The type of copper/iron ballasts (insulation, taps) depends on the type of system used, both systems are suitable for proper lamp operation.

The MASTERColour CDM lamps normally need a system with an ignition peak of min. 3.5 kV to ensure a good starting of the lamp.

The ignition voltage should be applied at least once per half-cycle of the mains voltage. The minimum voltage peak value for ignition of the lamps is 3.5 kV. This means that normally the ignitor generates a peak of approximately 4 kV, in order to ensure the minimally 3.5 kV required ignition-pulse.

Care must be taken that the peak value does not exceed 5 kV; this is typically the maximum value for the standard components used in a luminaire. Also lamp holders, like the E27 holder for the CDM-R lamps, must be rated for 5kV use (see CDM-R chapter). Above 5 kV, arcing may occur between electrical components which may cause damage.

6.2.2 Ballasts for conventional systems

For 220-240V applications, inductive (reactor type) ballasts are suitable for use as conventional ballasts for MASTER Colour CDM lamps. Use the appropriate tap for the actual supply voltage.

For 100-125V and 200V applications, ballasts with internal ignitors are needed to supply a sufficient open circuit voltage to the lamps.

Based on IEC 61167, it is mandatory to use in the circuit a protection device against overheating, e.g. a thermo-protected ballasts. The prescribed safety device will protect the system if, at End of Life of the lamp, prolonged high currents occur in the circuit.

6.2.3 Capacitors

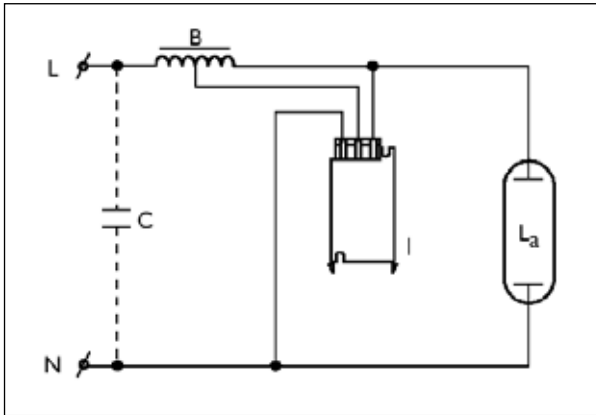
For power factor correction we use a capacitor. Use the specified value and working voltage.

6.2.4 Ignitors

6.2.4.1 Semi-parallel ignitor

With the semi-parallel ignitor – as recommended by Philips – the ignition-pulse is generated by the ignitor in combination with the ballasts coil. The ballasts have for this purpose a special ignitor tap and are insulated adequately to withstand the ignition-voltages. Because the lamp current does not run through the ignitor and no pulse transformer is needed the power losses in the ignitor are negligible, there will be no humming and at the end of lamp life the ignitor will not be damaged.

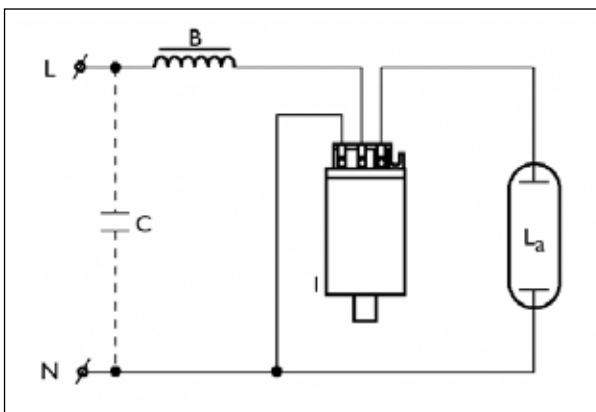
Furthermore this system offers the possibility of remote installation of the ballasts because the maximum allowable cable-capacitance is 1000pF (typical distance up to 10 metres).



The Philips system is based on the ignitor SN58 T15 (for all types) and a Thermo protected (TS) ballast. The system generates the minimum required ignition peak of 3.5kV with a desired pulse-width. A version with a timer of 15 minutes is required for greater system safety and user comfort (see Annex 8).

6.2.4.2 Super-imposed pulse or series system

In the series (or super-imposed pulse) ignitor circuit, the ignitor is equipped with an internal transformer, which superimposes the ignition voltage on the line voltage across the lamp. The maximum permitted load capacitance of the cable to the lamp is normally low, which limits the distance between lamp and ignitor. (Typically: maximum 100 pF cable capacitance, this will be about 1 metre). The advantages of a series system are that the ignitor and the lamp can be placed separated from the ballast and the capacitor and that the ballast is not subject to ignition voltage stress. In outdoor applications the lamp and ignitor are mounted in the luminaire on top of the pole whereas the heavy ballast and the capacitor are placed in a more accessible spot.



7 Trouble shooting

7.1 No instant light

- The lamp needs some time to run up (1 – 3 minutes). (see section 5.3 for more information)
- It is normal that some lamps need a few seconds for ignition

7.2 No light at all

- Check the wiring
- Check the lamp holder
- Try to operate the lamp with another ballast or try replacing the lamp
- If all else fails the lamp has reached end-of-life. This can be caused by:
 - A leaky discharge tube. Metallic and yellowish stains are visible on the inside of the outer bulb.
 - Broken electrode. Sometimes this is audible when shaking the lamp.
 - Broken connections in the frame due to mechanical load or oxidation due to a leaky outer bulb. In the latter case the frame materials also turn dark grey or black.

7.3 Extinguishing

- The re-ignition voltage increased over life and can no longer be sustained by the ballast. The lamp needs to be replaced.
- Some lamps are specified for electronic ballasts only because they will extinguish early in life if operated on an electromagnetic ballast

7.4 Not enough light and/or wrong colour

- When the light is bluish and weak and generated in the outer bulb the discharge tube is leaky and the lamp must be replaced
- When the light is green, the lamp is operated at too low power (wrong ballast) or the outer bulb is leaky (failed lamp). In the latter case the frame materials turn dark grey to black.
- The lamp is very old and shows blackening of the discharge tube

7.5 Colour difference between lamps

- Allow the lamps to stabilise
- Check if all of the lamps are the same type and make
- It is normal that some colour difference exists between old and new lamps
- Lamps operated in different burning orientations have slightly different colours

7.6 Different colours in the light beam

- Check if the discharge tube is placed well in focus
- A yellow stain is observed if the lamp is operated horizontally in a reflector that does not mix the light sufficiently. This can happen if the reflector is smooth or if the facets are too large.

7.7 Too short life

- The lamp has been operated at too high power
- The lamp has been operated in a luminaire that reflects the light back on the discharge tube
- The lamp has been operated at a too high temperature for example in a confined luminaire

7.8 Shattered lamp

- This is a very rare but known failure mode and the reason why enclosed luminaires are required for most of our lamps

7.9 Flicker

- A 50 Hz flicker is sometimes observed when using electromagnetic ballasts. Using electronic ballasts lowers the flickering below a detectable level.

7.10 Noise

- This is sometimes observed with electromagnetic ballasts. It can be avoided by using electronic ballasts.

8 Annex: Measurement of bulb temperatures

Exceeding bulb temperature limits will result in a poor lamp performance (colour, lifetime, lumen maintenance).

A Measurement Conditions

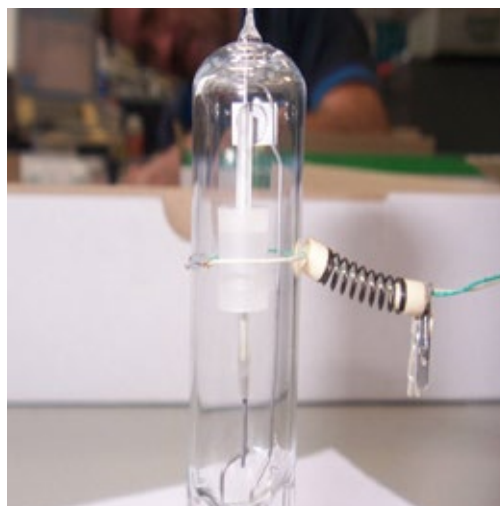
- Bulb temperatures have to be measured in the most unfavourable, but permissible, burning position of the luminaire. A luminaire only applicable for a certain burning position should only be measured in the specified burning position.
- Measurements should be made using thermocouples and suitably prepared lamps as described in section B. These can often be obtained from lamp manufacturers.
- It is recommended to use lamps of a lifetime between 100 and 200 hours to have reliable measurements
- The luminaire/lamp combination should be operated at the rated lamp power as specified on the relevant lamp data sheet at an ambient temperature which is the maximum permitted for the luminaire. It is recommended to obtain this condition by using an electronic driver.
- Rated lamp powers are:

Power	Rated power
20W	20W
35W	39W
70W	73W
150W	150W
250W	250W

- The temperatures can be measured after an adequate run-up period to get a completely stabilized temperature (at least 30 minutes). The obtained temperature has to be compared with the requirements on the lamp data sheet. In cases of doubt it is recommended to measure several lamps.

B Choice and fixation of thermocouples for bulb temperature

- For the measurements as referred to in this document, NiCr thermocouples (type K) are to be used. The thermocouple tip should be welded with a tip smaller than 1mm diameter.



- The fixation of the thermocouples on the lamp should be made using a spring. A good fixation is obtained by ceramic beads and a crocodile clip (see figure). A suitable spring is made using stainless steel type EN 10270-3-1.4310 and has an outside diameter 5mm and length 17mm, giving a force of 7N if compressed by 10mm.
- The lamp bulb should be carefully prepared by cutting a groove in the surface suitable to locate the thermocouple. The groove should be placed so that any support frame in the lamp does not shield the thermocouple from the arc tube. It is very important to fix the thermocouple strictly above the centre of the arc tube, both in axial and radial direction. Small deviations will result in unreliable measurements.

