Philips Halogen Lamps
Product Information

HalogenA
Linear double-ended
PAR HalogenA
LV capsules
Dichroic
Clickline

Provisional
1. General information on Philips Halogen lamps

1.1 Introduction ........................................................................ 4
1.2 Lamp technology and principle of operation ................. 4
1.3 UV radiation (exposure limits) ........................................... 5
1.4 Dimming of Halogen lamps .................................................. 8
1.5 Thermocouple lamps ............................................................. 8
1.6 Environmental aspects .......................................................... 8
1.7 Energy Efficiency Label .......................................................... 8

2. Mains voltage Halogen lamps

2.1 HalogenA lamps

2.1.1 Introduction and description ........................................ 10
2.1.2 Applicable standards ..................................................... 10
2.1.3 Position of components (lamp construction) .............. 11
2.1.4 Lamp cap temperature rise ........................................... 11
2.1.5 PET values ................................................................. 11
2.1.6 Electrical and lighting data ........................................... 12
2.1.7 Lamp dimensions ......................................................... 13
2.1.8 Energy emission .......................................................... 13
2.1.9 Lamp disposal ............................................................. 13
2.1.10 Lifetime performance ................................................ 14
2.1.11 Influence of mains voltage and lamp performance ....... 14
2.1.12 Dimming ................................................................. 14
2.1.13 Fuse (Philips patent) ................................................... 14
2.1.14 Burning positions ....................................................... 14
2.1.15 Safety .................................................................................. 14

2.2 Linear double-ended Halogen lamps

2.2.1 Introduction and description ........................................ 15
2.2.2 Applicable IEC standards ............................................. 15
2.2.3 Position of components (lamp construction) .............. 15
2.2.4 Maximum permissible temperatures ......................... 15
2.2.5 PET values ................................................................. 16
2.2.6 Electrical and lighting data ........................................... 16
2.2.7 Lamp dimensions ......................................................... 17
2.2.8 Luminous intensity distribution .................................. 17
2.2.9 Lamp disposal ............................................................. 17
2.2.10 Lifetime performance ................................................ 17
2.2.11 Influence of mains voltage on lamp characteristics ....... 18
2.2.12 Dimming ................................................................. 18
2.2.13 Fuse (Philips patent) ................................................... 18
2.2.14 Burning positions ....................................................... 18
2.2.15 Spectral ............................................................................. 19

2.3 Mains voltage capsules

2.3.1 Introduction and description ........................................ 20
2.3.2 Applicable IEC standards ............................................. 20
2.3.3 Position of components (lamp construction) .............. 20
2.3.4 Maximum permissible temperature rise .................... 20
2.3.5 PET values ................................................................. 20
2.3.6 Range with electrical and lighting data ...................... 21
2.3.7 Lamp dimensions ......................................................... 21

2.4 PAR HalogenA lamps

2.4.1 Introduction and description ........................................ 23
2.4.2 IEC specifications .......................................................... 23
2.4.3 Position of components (lamp construction) .............. 23
2.4.4 Maximum permissible temperatures ......................... 23
2.4.5 PET values ................................................................. 25
2.4.6 Range ............................................................................. 25
2.4.7 Lamp dimensions and comparison with incandescent reflector lamps .................................................. 25
2.4.8 Electrical and lighting data ........................................... 26
2.4.9 Luminous intensity distribution .................................. 26
2.4.10 Lamp disposal ............................................................. 31
2.4.11 Lifetime performance ................................................ 31
2.4.12 Influence of mains voltage on lamp characteristics ....... 31
2.4.13 Dimming ................................................................. 31
2.4.14 Burning positions ....................................................... 31

2.5 Halogen Reflector Lamps

2.5.1 Introduction and description ........................................ 32
2.5.2 Application IEC standards ............................................. 32
2.5.3 Position of components (lamp construction) .............. 32
2.5.4 PET values ................................................................. 32
2.5.5 Range with electrical and lighting data ...................... 32
2.5.6 Lamp dimensions ......................................................... 33
2.5.7 Luminous intensity distribution .................................. 33
2.5.8 Spectral irradiance, transmitted wavelengths and UV - Block .................................................. 33
2.5.9 Lamp disposal ............................................................. 33
2.5.10 Lifetime performance ................................................ 33
2.5.11 Influence of mains voltage on lamp characteristics ....... 33
2.5.12 Dimming ................................................................. 33
2.5.13 Fuse ................................................................. 33
2.5.14 Burning positions ....................................................... 33

2.6 MasterPAR 20 - Electronic

2.6.1 Introduction and description ........................................ 34
2.6.2 Application IEC standards ............................................. 34
2.6.3 Position of components (lamp construction) .............. 34
2.6.4 Maximum permissible temperatures ......................... 34
2.6.5 PET values ................................................................. 34
2.6.6 Range with electrical and lighting data ...................... 35
2.6.7 Lamp dimensions ......................................................... 35
2.6.8 Luminous intensity distribution .................................. 35
2.6.9 Lamp disposal ............................................................. 37
2.6.10 Lifetime performance ................................................ 37
2.6.11 Influence of voltage on lamp characteristics .......... 38
2.6.12 Dimming ................................................................. 38

2.7 PAR lamps

2.7.1 Introduction and description ........................................ 38
2.7.2 Application IEC standards ............................................. 38
2.7.3 Position of components (lamp construction) .............. 38
2.7.4 Maximum permissible temperatures ......................... 38
2.7.5 PET values ................................................................. 38
2.7.6 Range with electrical and lighting data ...................... 39
2.7.7 Lamp dimensions ......................................................... 39
2.7.8 Luminous intensity distribution .................................. 39
2.7.9 Lamp disposal ............................................................. 39
2.7.10 Lifetime performance ................................................ 39
2.7.11 Influence of voltage on lamp characteristics .......... 40
2.7.12 Dimming ................................................................. 40
Chapter 1

General information on Philips Halogen lamps

2.6.13 Fuse ................................................................. 38
2.6.14 Burning positions ............................................. 38
2.6.15 Safety ................................................................. 38

2.7 Twistline
2.7.1 Introduction and description ................................ 39
2.7.2 Application IEC standards ..................................... 39
2.7.3 Position of components (lamp construction) ...... 39
2.7.4 Maximum permissible temperatures ................. 39
2.7.5 PET values .............................................................. 39
2.7.6 Range with electrical and lighting data ............... 39
2.7.7 Lamp dimensions ................................................. 40
2.7.8 Luminous intensity distribution ....................... 40
2.7.9 Spectral irradiance, transmitted wavelengths and UV-Block ........................................ 41
2.7.10 Lamp disposal ..................................................... 41
2.7.11 Lifetime performance ........................................ 41
2.7.12 Influence of mains voltage on lamp characteristics ... 41
2.7.13 Dimming ............................................................... 42
2.7.14 Fuse ................................................................. 42
2.7.15 Burning position ............................................... 42

2.8 Clickline
2.8.1 Introduction and description ................................ 43
2.8.2 Application IEC standards ..................................... 43
2.8.3 Position of components (lamp construction) ...... 43
2.8.4 Maximum permissible temperatures ................. 43
2.8.5 PET values .............................................................. 43
2.8.6 Range with electrical and lighting data ............... 43
2.8.7 Lamp dimensions ................................................. 44
2.8.8 Spectral irradiance, transmitted wavelengths and UV-Block ........................................ 44
2.8.9 Lamp disposal ..................................................... 44
2.8.10 Lifetime performance ........................................ 44
2.8.11 Influence of mains voltage on lamp characteristics ... 44
2.8.12 Dimming ............................................................... 44
2.8.13 Fuse ................................................................. 44
2.8.14 Burning position ............................................... 44

3. Low voltage Halogen lamps
3.1 Low voltage Halogen Capsule lamps
3.1.1 Introduction and description ................................ 46
3.1.2 Applicable IEC standards ..................................... 46
3.1.3 Position of components (lamp construction) ...... 46
3.1.4 Maximum permissible temperatures ................. 46
3.1.5 PET values .............................................................. 46
3.1.6 Electrical and lighting data .................................... 47
3.1.7 Lamp dimensions ................................................. 48
3.1.8 Luminous intensity distribution ....................... 48
3.1.9 Spectral distribution ............................................ 49
3.1.10 Lamp disposal ..................................................... 49
3.1.11 Lifetime performance ........................................ 49
3.1.12 Influence of lamp voltage on lamp characteristics ... 50
3.1.13 Dimming ............................................................... 50
3.1.14 Burning positions ............................................... 50

3.2 Dichroic lamps
3.2.1 Introduction and description ................................ 51
3.2.2 Applicable IEC standards ..................................... 51
3.2.3 Position of components (lamp construction) ...... 51
3.2.4 Maximum permissible temperatures ................. 51
3.2.5 PET values .............................................................. 51
3.2.6 Electrical and lighting data .................................... 51
3.2.7 Lamp dimensions ................................................. 54
3.2.8 Photometric data ................................................. 54
3.2.9 Spectral distribution ............................................ 54
3.2.10 Lamp disposal ..................................................... 54
3.2.11 Lifetime performance ........................................ 54
3.2.12 Influence of lamp voltage on lamp characteristics ... 57
3.2.13 Dimming ............................................................... 57
3.2.14 Burning position ............................................... 57

3.3 Low-voltage dichroic reflector Diamondline Pro
3.3.1 Introduction and description ................................ 58
3.3.2 Applicable IEC standards ..................................... 58
3.3.3 Maximum permissible temperatures ................. 58
3.3.4 PET values .............................................................. 58
3.3.5 Lamp dimensions ................................................. 58
3.3.6 Electrical and lighting data .................................... 58
3.3.7 Photometric data ................................................. 58
3.3.8 Lamp disposal ..................................................... 58
3.3.9 Lifetime performance ........................................ 58
3.3.10 Influence of lamp voltage on lamp characteristics ... 58
3.3.11 Dimming ............................................................... 58
3.3.12 Burning position ............................................... 58

3.4 Aluminium reflector lamps
3.4.1 Introduction and description ................................ 60
3.4.2 Applicable IEC standards ..................................... 60
3.4.3 Maximum permissible temperatures ................. 60
3.4.4 PET values .............................................................. 60
3.4.5 Electrical and lighting data .................................... 61
3.4.6 Lamp dimensions ................................................. 61
3.4.7 Photometric data ................................................. 65
3.4.8 Lamp disposal ..................................................... 64
3.4.9 Lifetime performance ........................................ 64
3.4.10 Influence of lamp voltage on lamp characteristics ... 65
3.4.11 Dimming ............................................................... 65
3.4.12 Burning position ............................................... 65
3.4.13 Minimum required lamp space ....................... 65

3.5 Aluminium reflector lamps - ALR 111
3.5.1 Introduction and description ................................ 66
3.5.2 Applicable IEC standards ..................................... 66
3.5.3 Maximum permissible temperatures ................. 66
3.5.4 PET values .............................................................. 66
3.5.5 Lamp dimensions ................................................. 66
3.5.6 Electrical and lighting data .................................... 67
3.5.7 Photometric data ................................................. 67
3.5.8 Lamp disposal ..................................................... 69
3.5.9 Lifetime performance ........................................ 69
1 - General information on Philips Halogen Lamps

1.1 Introduction
Philips Halogen lamps produce a pure, white, sparkling light, as light is emitted and intense at any lighting installation using these lamps exudes character and charm and assumes a state-of-the-art elegance. The incandescent appeal of Halogen lamps gives a location new zest and energy. The principle of operation and the construction of Halogen lamps enable it to provide the following customer benefits compared to normal incandescent lamps:
• Longer life
• Whiter light
• Higher efficiency
• No bulb blackening

This makes the Philips Halogen lamps the ideal choice for a wide range of applications: in shops, homes, hotels, restaurants, commercial interiors, museums, art galleries etc.

Philips Halogen lamps can be grouped as follows:
- Low voltage lamps: Capsules, Dichroics, Aluminium reflector lamps.

1.2 Lamp technology and principle of operation
A - Incandescent (GLS) lamp principle
The light generation mechanism of the Halogen lamp is the same as that of a common incandescent (GLS) lamp; i.e. an electrical current is passed through a filament of relatively high resistance heats it to a glowing condition (incandescence). A part of the total energy is converted into heat.
The higher the current passing through the filament, the higher its temperature. This in turn increases the portion of visible light and ultraviolet radiation per unit of electrical power (Watt) consumed by the lamp and the 'whiteness'.

Unfortunately the temperature cannot be increased indefinitely as the filament would melt at approx. 3400° C. Although the tungsten filament does not melt at normal operating temperatures (which are below 3400° C), it does vaporise.
The metal vapour produced will condense on the cooler regions of the lamp, thus producing a dark film on the bulb wall. This film reduces the light output of the lamp. The bulb of the GLS lamp is therefore made as large as possible (taking into consideration the cost aspects) in order to spread the deposited film over a large area. The metal vapourisation process continues to erode the filament until it eventually burns through (see figure 1.1). The vapourisation rate decreases as the pressure of the gas surrounding the filament increases. This vacuum would create the worst conditions. The strength of the thin soda-lime glass bulb limits the pressure which can be used in a GLS lamp to about 1 atmosphere. GLS lamps are therefore generally filled with an inert gas (e.g. argon-nitrogen mixture) at a pressure of about one atmosphere.

B - The Halogen lamp principle
The Halogen lamp principle is conceptually simple (refer to figure 1.2). Halogen gas is added to the gas filling of these lamps. This Halogen gas combines with the evaporated tungsten filament to form tungsten-halide molecules. The lamp is constructed in such a way that the wall temperature of the glass bulb remains above 250° C. By doing this the tungsten-halide molecules are prevented from condensing on the inner bulb wall. As a result, the wall remains clean. However, the tungsten-halide molecules migrate close to the filament and this causes them to dissociate into tungsten and Halogen gas. The tungsten is deposited on the filament and the Halogen is freed, hence both are available to repeat the cycle. Unfortunately the process is not exactly regenerative. The temperature at which the dissociation (and thus the redoposition) occurs is lower than the temperature of vapourisation. Thus the tungsten atoms move away from the hottest part of the filament towards the ends which are cooler. This leads to a thin spot which ultimately causes lamp failure (in the same way as in a GLS lamp).

The cycle results in the lamp characteristics remaining much more constant than in a GLS lamp (i.e. better lamp lumen maintenance). The Halogen lamps operate at much higher filling gas pressure (typically 5 to 10 atmospheres) and thus the filament vaporises much slower than in a GLS lamp. However, the new low pressure halogen lamps (capsules) combine all the halogen advantages with an operating pressure below 2.5 bar. If a Halogen lamp were operated at the same filament temperature as a GLS lamp, its filament life would be several times that of the GLS lamp. Halogen lamp manufacturers use this gain partly to obtain a whiter colour appearance and for a higher light output per Watt. The balance of the gain is used to extend the life time of the Halogen lamp.

To contain the higher gas pressure of the Halogen lamps, the bulbs must be considerably stronger than those of GLS lamps. In addition, the Halogen cycle will only function if the bulb wall temperature is kept between 250° C and 950° C during operation (in comparison the GLS lamp operates at a bulb temperature of about 100° C). To achieve higher bulb strength and higher gas pressures in practice the Halogen bulb must be:
• be positioned much closer to the filament.
• have a smaller diameter and thicker wall.
• be of a material with a higher strength and temperature resistance than the soda-lime bulb of the GLS lamp.

The Halogen lamp bulbs are typically small in size and are made of Quartz.

1.3 UV radiation (exposure limits)

Light sources can emit ultraviolet (UV) radiation and when exceeding certain UV exposure limits irritate the human skin and eyes.

Exposure limits
Since 1971 the American Conference of Governmental Industrial Hygienists (ACGIH) promulgated exposure limits connected to UV radiation. The ACGIH limits relate to UV radiation in the wavelength range from 200 to 400 nm. For this purpose the range is divided into two segments:
1. From 200 to 315 nm.
2. From 315 to 400 nm.

This is commonly referred to as UV-C plus UV-B. The Halogen cycle results in the lamp characteristics remaining much more constant than in a GLS lamp (i.e. better lamp lumen maintenance). UV-A doses for Philips halogen lamps are given in the diagram in figure 1.3.

For the UV-A segment of the spectrum we do not make use of PET values, but the following doses are recommended by the ACGIH:
1. Exposure time < 1000 seconds: maximum dose 10000 J /m2
2. Exposure time > 1000 seconds: maximum dose 10 W/m2

For general lighting we have to comply with number 2 above. UV-A doses for Philips halogen lamps are given in the diagram in figure 1.3.

Philips Halogen lamps without UV absorbent shield (double ended capsules, open dichroic reflector lamps) are given in following table:

<table>
<thead>
<tr>
<th>Lamp type</th>
<th>PET values (1000 lux) in hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>PET values (1000 Lux) in hours</td>
<td></td>
</tr>
<tr>
<td>Double-ended</td>
<td>3</td>
</tr>
<tr>
<td>Open dichroic</td>
<td>20</td>
</tr>
</tbody>
</table>

From 1996 onwards, Philips capsules lamps are supplied in Low pressure (incl. UV-Block) execution which means that the PET values of these lamps will be ≥ 100 hours.

PET values of Philips halogen lamps with a UV absorbent shield (closed reflector and double-envelope lamps) or UV-Block lamps are given in the following table.

Note: In IEC the UV irradiation is described as HNODSH < 30 J/m2 at 24 hrs exposure time and 100 lux.

The photobiological effects of UV-C and UV-B are much greater than those of UV-A. As a result, a different judgement is applied in deriving the maximum permissible exposure limits. Radiation between 200 and 315 nm is weighted against the so-called 'eye-skin' action spectrum. The result is a limited exposure time for people using the lighting installation, which must be calculated. The maximum number of exposure hours is called PET value (Permissible Exposure Time). Since the ACGIH PET values are intended to assure a safe working environment during an 8 hour work-day, the PET value for the normal lighting installation must be longer than 8 hours and will be prolonged to 24 hours.

PET values are given in hours/1000 lux. The PET values of Philips halogen lamps with UV absorbent shield (double ended capsules, open dichroic reflector lamps) are given in following table.

<table>
<thead>
<tr>
<th>Lamp type</th>
<th>PET values (1000 LUX) in hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>PET values (at 1000 LUX) in hours</td>
<td></td>
</tr>
<tr>
<td>HALOGENA</td>
<td>≥ 100</td>
</tr>
<tr>
<td>Aluminium reflector</td>
<td>≥ 100</td>
</tr>
<tr>
<td>MASTERLINE ES</td>
<td>≥ 100</td>
</tr>
<tr>
<td>STANDARDLINE dichroic</td>
<td>≥ 100</td>
</tr>
<tr>
<td>Dichroic</td>
<td>≥ 100</td>
</tr>
<tr>
<td>Hard glass Capsules</td>
<td>≥ 100</td>
</tr>
<tr>
<td>Ss (5 W)</td>
<td>≥ 100</td>
</tr>
<tr>
<td>Low pressure or UV-block Capsules</td>
<td>≥ 100</td>
</tr>
<tr>
<td>PAR HALOGENA</td>
<td>≥ 100</td>
</tr>
<tr>
<td>TWISTime</td>
<td>≥ 100</td>
</tr>
<tr>
<td>MasterPAR-E</td>
<td>≥ 100</td>
</tr>
<tr>
<td>Mains voltage Capsules (UV-block)</td>
<td>≥ 100</td>
</tr>
</tbody>
</table>

For general lighting we have to comply with number 2 above. UV-A doses for Philips halogen lamps are given in the diagram in figure 1.3.

Remark: Most glass shields intended for absorbtion of UV-B and UV-C radiation are transparent to UV-A radiation.
Safety requirements

A - Lamps for consumer purposes which have an integral outer envelope do not require special precautions:

<table>
<thead>
<tr>
<th>PICTURE</th>
<th>DESCRIPTION</th>
<th>INSTRUCTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="brilliantline.png" alt="Picture" /></td>
<td>Brilliantline PRO Standard dichroic</td>
<td>No precautions necessary</td>
</tr>
<tr>
<td><img src="lowvoltage.png" alt="Picture" /></td>
<td>Low voltage aluminium refl. lamp with front glass “Aluminium Reflector”</td>
<td>No precautions necessary</td>
</tr>
<tr>
<td><img src="mainsvoltage.png" alt="Picture" /></td>
<td>Mains voltage reflector lamp “PAR HalogenA”</td>
<td>No precautions necessary</td>
</tr>
<tr>
<td><img src="mainsvoltage.png" alt="Picture" /></td>
<td>Mains voltage reflector lamp “Twistline”</td>
<td>No precautions necessary</td>
</tr>
<tr>
<td><img src="mainsvoltage.png" alt="Picture" /></td>
<td>Mains voltage reflector lamp “MasterPAR-E”</td>
<td>No precautions necessary</td>
</tr>
<tr>
<td><img src="mainsvoltage.png" alt="Picture" /></td>
<td>Mains voltage double envelope lamp “HalogenA”</td>
<td>No precautions necessary</td>
</tr>
<tr>
<td><img src="mainsvoltage.png" alt="Picture" /></td>
<td>Mains voltage capsule “Clickline”</td>
<td>No precautions necessary</td>
</tr>
</tbody>
</table>

B - Lamps for consumer purposes without integral outer envelope should normally be used in shielded luminaires, as recommended by IEC:

<table>
<thead>
<tr>
<th>PICTURE</th>
<th>DESCRIPTION</th>
<th>INSTRUCTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="lowvoltage.png" alt="Picture" /></td>
<td>Low voltage dichroic lamp with front glass “MASTERline ES”</td>
<td>No precautions necessary</td>
</tr>
<tr>
<td><img src="lowvoltage.png" alt="Picture" /></td>
<td>Low voltage dichroic lamp “open dichroic”</td>
<td>Should be used in a luminaire with protective front glass</td>
</tr>
<tr>
<td><img src="lowvoltage.png" alt="Picture" /></td>
<td>Low pressure capsule</td>
<td>No precautions necessary</td>
</tr>
<tr>
<td><img src="lowvoltage.png" alt="Picture" /></td>
<td>UV-Block capsules</td>
<td>Should be used in a luminaire with protective front glass</td>
</tr>
<tr>
<td><img src="mainsvoltage.png" alt="Picture" /></td>
<td>Mains voltage B 15d single ended lamp (UV-Block)</td>
<td>Should be used in a luminaire with protection against touching of the lamp</td>
</tr>
<tr>
<td><img src="mainsvoltage.png" alt="Picture" /></td>
<td>Mains voltage double ended linear lamp “Plusline/Linear”</td>
<td>Should be used in a luminaire with front glass</td>
</tr>
</tbody>
</table>

Figure 1.4

Figure 1.5
1.4 Dimming of Halogen lamps

When halogen lamps are dimmed, the power in the lamp is reduced. At a certain point the power reduces below the required level. This is due to the fact that the temperature inside the lamp bulb falls below the required level. The evaporation of the filament goes on Nevertheless, at a lower rate due to the reduced current. This will now lead to blackening and temperature differences on the bulb wall just like in normal GLS lamps.

For that reason, lamp producers advise not to keep the lamps in a dimmed condition all the time. Frequent operation of the lamps at full power is advisable to avoid this blackening of the bulb.

Dimming low-voltage halogen lamps is not a straightforward matter, due to the presence of a transformer. Traditionally, in many cases wall dimmers are used to dim the lighting level of incandescent lamps. With one restriction this kind of dimmer can be used for conventional magnetic transformers, the restriction being that a burning lamp must be present. If this is not the case, the transformer will heat up to very high temperatures. This can result in a blown fuse, if present, or melting or damaging of the luminaire.

Electronic transformers need dimmers capable of handling capacitive loads. Due to the presence of the EMI filter the dimmer load changes from inductive (for conventional/magnetic transformers) to capacitive (for electronic transformers).

A conventional dimmer intended for use with incandescent lamp/conventional transformers cannot work properly with this capacitive load. Phenomena like hum, light flicker, sudden rise of lighting level while dimming, or even destruction of dimmer and/or electronic halogen transformers can happen. For this reason special phase-cut dimmers are required to regulate the lighting level of electronic halogen transformers. The dimmer has to be connected in the phase-line. The own power consumption of the dimmer causes a reduction in the maximum achievable brilliance.

1.5 Thermocouple lamps

Philips lamps equipped with thermocouples can be used during:

- design
- testing
- selection
- evaluation of a luminaire for measuring temperatures.

Philips can provide thermocouple lamps in accordance with IEC 682 of:

- capsules
- reflector lamps
- flood lamps

These thermocouple lamps can be made available to Original Equipment Manufacturers against specific request.

Temperature measurements are important because:

- excess pinch (base) temperatures cause premature lamp failures.
- pinch temperature is a complex function of luminaire design, construction, burning position and ventilation.
- trend towards compact luminaires increases the technical challenge for OEM's and lamp specifiers.

1.6 Environmental aspects

A - Energy consumption

Light is largely a matter of energy; product life cycle analysis show that approximately 90% of the effect of light sources on the environment is represented by their energy consumption during usage. Materials, production process, and disposal at the end of life are responsible for only the remaining 10%. This includes the energy and materials used during production and the effects of spent products, the packaging and transportation activities.

1.7 Energy Efficiency Label

This label is the result of a European Commision directive 92/75/EEC relating to electricity used by household electric lamps supplied directly from the mains. This does not include the following lamps:

- those with Luminous Flux > 6500lm.
- Those with input power ≤ 4 watts, or reflector lamps.

An example of the label is shown below.

There is a formula to calculate which classification a lamp falls into, shown below:

When not Class A, a reference wattage WR is calculated:

\[ W_r = 0.88 \sqrt{\Omega} + 0.049 \Omega \]

(when \( \Omega \) is > 34 lumens)

where \( \Omega \) is the lumen output of the lamp.

An energy efficiency index \( E \) is then set as:

\[ E = \frac{W}{W_r} \]

Where \( W \) is the power input into the lamp in Watts.
2.1 - HalogenA lamps

2.1.1 Introduction and description

The double-envelope HalogenA lamps contain a compact quartz burner with a linear tungsten filament and internal fuse. The filament is fixed in the quartz tube by means of indentations in the tube. The tube is placed axially in a single-ended normal glass outer envelope which is filled with a mixture of inert gases (to avoid corrosion) and equipped with a standard GLS lamp cap. Unlike other Halogen lamps, the HalogenA lamps can be touched with bare hands. The outer envelope minimizes UV radiation and therefore a glass cover on the luminaire is not necessary.

<table>
<thead>
<tr>
<th>Benefits</th>
<th>Features</th>
</tr>
</thead>
</table>
| Fully interchangeable in GLS lamp sockets of same wattage ratings (can be used to upgrade existing GLS points) | • same lamp caps as GLS lamps
• no transformer required
• universal burning position
• comparable lamp dimensions
• outer lamp envelope temp. comparable to GLS lamps
| Lower integral costs | • no front glass required
• low lamp cap temperatures
• no extra fuse required in luminaire
• uses cheap, easy to source lamp-holders
• no tramo required |

Applications

The HalogenA lamps are ideally suited for a wide variety of applications, some of which are given below:

1. HalogenA BTT lamps:
   • task lighting (reading and free standing luminaires)
   • general lighting (wall washers and uplighters)
   The small HalogenA BTT are primarily for use in living rooms and bedrooms in both suspended and wall mounted luminaires.

2. HalogenA-T lamps (T20 and 32): the slim design of these lamps makes them suitable for shops, hotels, restaurants, offices and homes in:
   • task lighting (reading and free standing luminaires)
   • general lighting (wall washers and uplighters)
   • accent lighting (spots)
   • decorative lighting (small luminaires and furniture)

3. HalogenA Candle lamps: the special shape of these lamps is ideal for decorative applications such as chandeliers (both suspended and wall mounted)

4. HalogenA Globe lamps: suitable for hotels, restaurants (entrance halls and passages, above tables), bars, public halls, shops and for tasklighting in homes.

5. HalogenA Reflector lamps: suitable for homes, hotels, restaurants, bars, shops for down- and accentlighting.

2.1.2 Applicable standards

The applicable standards for HalogenA lamps are:

IEC 432-1 and 432-2

2.1.3 Position of components

Figure 2.1 shows the construction details and components of a HalogenA BTT lamp:

2.1.4 Lamp cap temperature rise

IEC 432-1 and 432-2 give the maximum allowable lamp temperature rise for various lamp wattages and classes.

<table>
<thead>
<tr>
<th>Standards for caps</th>
<th>E27: 60 W</th>
<th>E14: 40 W</th>
<th>B15d: 40 W</th>
</tr>
</thead>
<tbody>
<tr>
<td>100/150 W</td>
<td>∆Ts 25 max. 120 K</td>
<td>∆Ts 25 max. 130 K</td>
<td>∆Ts 25 max. 135 K</td>
</tr>
<tr>
<td>60 W</td>
<td>∆Ts 25 max. 130 K</td>
<td>∆Ts 25 max. 140 K</td>
<td>∆Ts 25 max. 145 K</td>
</tr>
</tbody>
</table>

Note:
1. 100 W with E14 are not yet specified in IEC 432-1 (IEC proposal for the same is however under preparation). However the values for these Philips lamps are even below the max. temperatures for 60 W versions given in the specifications.
2. E11 lamps are specified in IEC 357 and 61-1 although an exception is made for Europe. "Lamps with caps E12, E17, E26/24, E26/25 are excluded from this European standard" (Reason: These lamp/holder fit system do not comply with the European safety requirements).

2.1.5 PET values

For the PET values for all Philips Halogen lamps refer to chapter 1.3 in the brochure.

Spectral distribution

All HalogenA lamps have an integral outer envelope and thus the UV radiation from these lamps is of no importance. A typical spectral power distribution diagram is given in figure 2.2.
2.1.6 Electrical and lighting data

<table>
<thead>
<tr>
<th>Type</th>
<th>Voltage (V)</th>
<th>Wattage (W)</th>
<th>Lumen (lm)</th>
<th>Bulb output and finish</th>
<th>Lamp cap shape</th>
<th>E.E.L</th>
</tr>
</thead>
<tbody>
<tr>
<td>13635</td>
<td>220</td>
<td>60</td>
<td>840</td>
<td>BTT40 CL</td>
<td>E14</td>
<td>D</td>
</tr>
<tr>
<td>13947</td>
<td>230/240</td>
<td>60</td>
<td>840</td>
<td>BTT46 CL</td>
<td>E27</td>
<td>D</td>
</tr>
<tr>
<td>13948</td>
<td>230/240</td>
<td>60</td>
<td>840</td>
<td>BTT46 CL</td>
<td>B22</td>
<td>D</td>
</tr>
<tr>
<td>13645</td>
<td>230/240</td>
<td>100</td>
<td>1600</td>
<td>BTT46 CL</td>
<td>E27/B22</td>
<td>D</td>
</tr>
<tr>
<td>13649</td>
<td>230/240</td>
<td>150</td>
<td>2550</td>
<td>BTT46 CL</td>
<td>120</td>
<td>E</td>
</tr>
<tr>
<td>13949</td>
<td>230/240</td>
<td>60</td>
<td>780</td>
<td>BTT46 OPAL</td>
<td>120</td>
<td>E</td>
</tr>
<tr>
<td>13950</td>
<td>230/240</td>
<td>100</td>
<td>1450</td>
<td>BTT46 OPAL</td>
<td>E27</td>
<td>E</td>
</tr>
<tr>
<td>13650</td>
<td>230/240</td>
<td>100</td>
<td>1450</td>
<td>BTT46 OPAL</td>
<td>E27/B22</td>
<td>E</td>
</tr>
<tr>
<td>13640</td>
<td>230</td>
<td>60</td>
<td>780</td>
<td>G95 OPAL</td>
<td>E27</td>
<td>E</td>
</tr>
<tr>
<td>13954</td>
<td>230</td>
<td>60</td>
<td>840</td>
<td>T20 CL</td>
<td>E14</td>
<td>D</td>
</tr>
<tr>
<td>14001</td>
<td>230</td>
<td>40</td>
<td>500</td>
<td>T20 FR</td>
<td>E14</td>
<td>E</td>
</tr>
<tr>
<td>14003</td>
<td>230</td>
<td>40</td>
<td>800</td>
<td>T20 FR</td>
<td>E14</td>
<td>E</td>
</tr>
<tr>
<td>14005</td>
<td>230</td>
<td>60</td>
<td>840</td>
<td>T20 CL</td>
<td>E14</td>
<td>D</td>
</tr>
<tr>
<td>14006</td>
<td>230</td>
<td>60</td>
<td>800</td>
<td>T20 FR</td>
<td>E14</td>
<td>E</td>
</tr>
<tr>
<td>14007</td>
<td>230</td>
<td>100</td>
<td>1600</td>
<td>T20 CL</td>
<td>E14</td>
<td>D</td>
</tr>
<tr>
<td>13640</td>
<td>230</td>
<td>100</td>
<td>1600</td>
<td>T20 CL</td>
<td>E14</td>
<td>D</td>
</tr>
<tr>
<td>13665</td>
<td>230</td>
<td>60</td>
<td>840</td>
<td>T20 CL</td>
<td>E14</td>
<td>D</td>
</tr>
<tr>
<td>13946</td>
<td>230/240</td>
<td>150</td>
<td>2550</td>
<td>T20 CL</td>
<td>E27</td>
<td>D</td>
</tr>
<tr>
<td>13945</td>
<td>230/240</td>
<td>100</td>
<td>1450</td>
<td>T20 CL</td>
<td>E27</td>
<td>D</td>
</tr>
<tr>
<td>13656</td>
<td>230</td>
<td>60</td>
<td>780</td>
<td>T32 FR</td>
<td>E27</td>
<td>E</td>
</tr>
<tr>
<td>13946</td>
<td>230/240</td>
<td>40</td>
<td>500</td>
<td>CG35 CL</td>
<td>E14/B22</td>
<td>D</td>
</tr>
<tr>
<td>13656</td>
<td>230</td>
<td>60</td>
<td>840</td>
<td>CG35 CL</td>
<td>E14/B22</td>
<td>D</td>
</tr>
<tr>
<td>13947</td>
<td>230</td>
<td>40</td>
<td>500</td>
<td>BS35 CL</td>
<td>E14</td>
<td>D</td>
</tr>
<tr>
<td>14017</td>
<td>230</td>
<td>40</td>
<td>500</td>
<td>BS35 CL</td>
<td>E14</td>
<td>D</td>
</tr>
<tr>
<td>14018</td>
<td>230</td>
<td>40</td>
<td>500</td>
<td>BS35 FR</td>
<td>E14</td>
<td>E</td>
</tr>
<tr>
<td>14020</td>
<td>230</td>
<td>60</td>
<td>840</td>
<td>BS35 CL</td>
<td>E14</td>
<td>D</td>
</tr>
<tr>
<td>14021</td>
<td>230</td>
<td>60</td>
<td>800</td>
<td>BS35 FR</td>
<td>E14</td>
<td>E</td>
</tr>
<tr>
<td>14019</td>
<td>230</td>
<td>60</td>
<td>800</td>
<td>BS35 FR</td>
<td>E14</td>
<td>E</td>
</tr>
<tr>
<td>14026</td>
<td>230</td>
<td>60</td>
<td>650 C.d</td>
<td>BS47 FR</td>
<td>E27</td>
<td>N/A</td>
</tr>
<tr>
<td>14027</td>
<td>230</td>
<td>100</td>
<td>1300 C.d</td>
<td>BS47 FR</td>
<td>E27</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Notes:
1. 120 V available on request.
2. Filament length 20-23 mm.
3. Average life 2000 hours.
4. Cap meets the standard (IEC 61) for normal GLS lamps.
5. CL=CLEAR and FR=FROSTED
6. For E.E.L classification see section 1.7.

2.1.7 Lamp dimensions

A diagram showing the typical energy emission of Halogen A T20 (clear and frosted) lamps is given in figure 2.4.

2.1.8 Energy emission

A diagram showing the typical energy emission of Halogen A T20 (clear and frosted) lamps is given in figure 2.4.

2.1.9 Lamp disposal

Refer chapter 1.6 of the brochure.
2.2 - Linear double-ended Halogen lamps

2.2.1 Introduction and description

PLUSline

Double-ended mains voltage linear Halogen lamps with a coiled-coil filament and a clear tubular (UV block for small types) quartz bulb. The lamps rated up to 500 W (ie. Compact and Small range) are equipped with two built-in arc preventing fuses. The lamps are shock-resistant and have universal burning positions as they have double supports held by indent in the quartz tube. All the lamps have R7s lamp caps except the 2000 W lamps which have Fa4 lamp caps.

Linear

Double-ended mains voltage linear halogen lamp with single-coil filament and a clear tubular quartz bulb. The lamps are equipped with R7s lamp cap.

2.2.2 Applicable IEC standards

The applicable IEC standards for double-ended linear Halogen lamps is: IEC 357, IEC 432.

2.2.3 Position of components (lamp construction)

2.1.10 Lifetime performance

A - Lifetime: A typical life expectancy curve for Mains voltage Halogen lamps is given in figure 2.5

B - Lamp lumen depreciation: A typical lamp lumen depreciation curve for Mains voltage Halogen lamps is given in figure 2.6

2.1.11 Influence of mains voltage and lamp performance

The graphs in figure 2.7 show the relationship between lamp voltage and other lamp operating parameters. The curve shows that a 5 % overvoltage reduces the lamp-life by half.

2.1.12 Dimming

All HalogenA lamps can be dimmed, see also chapter 1.4.

2.1.13 Fuse (Philips patent)

The Philips HalogenA lamps are provided with fuse in the lamp cap and with arc preventing fuses in the pinch of the burner. Incidentally an arc can occur at the end of life of a lamp. These fuses serve to extinguish the arc before the temperature reaches the critical limit. These fuses are not electrical but work by physically extinguishing the arc when it reaches them. This design and base fuse is covered by a Philips patent.

2.1.14 Burning positions

All HalogenA lamps have a universal burning position which makes them suitable for a wide range of applications.

2.1.15 Safety

Since all Philips HalogenA lamps are provided with an integral outer envelope, these lamps can be used in open luminaires (ie. luminaires without outer glass covers). For outdoor applications, waterproof luminaires have to be used.

Applications of PLUSline lamps

PLUSline lamps are ideally suited for a variety of applications such as: Floodlighting, Wallwashing, Uplighting and Tasklighting

The application areas include both Indoor (Homes, Shops, Museums, Sports halls, Factories etc.) and Outdoor (Sports grounds, Car parks, Billboards, Construction sites, security lighting etc.)

Applications of Linear

Linear Halogen lamps are ideally suitable for flood-, up-, tasklighting and wall-washing in homes, shops, hotels, restaurants and security lighting (outdoor).

2.2.4 Maximum permissible temperatures

The maximum permissible temperatures for different parts of the lamp are:

- Pinch: 350°C
- Tube: 900°C (minimum 250°C)

Exceeding these temperatures will influence lifetime negatively.
2.2.5 PET values

Refer chapter 1.3 of the brochure.

2.2.6 Electrical and lighting data

The details for the 230/240 V PLUSline lamps are given below:

<table>
<thead>
<tr>
<th>Type</th>
<th>Wattage (W)</th>
<th>Luminous flux (lm)</th>
<th>Lamp cap</th>
<th>Filament length (mm)</th>
<th>E.E.L.</th>
</tr>
</thead>
<tbody>
<tr>
<td>60T3Q/CL/CP</td>
<td>60</td>
<td>810</td>
<td>R7s-15</td>
<td>28</td>
<td>D</td>
</tr>
<tr>
<td>100T3Q/CL/CP</td>
<td>100</td>
<td>1550</td>
<td>R7s-15</td>
<td>28</td>
<td>D</td>
</tr>
<tr>
<td>150T3Q/CL/CP</td>
<td>150</td>
<td>2550</td>
<td>R7s-15</td>
<td>28</td>
<td>D</td>
</tr>
<tr>
<td>200T3Q/CL/CP</td>
<td>200</td>
<td>3400</td>
<td>R7s-15</td>
<td>28</td>
<td>D</td>
</tr>
<tr>
<td>150T3Q/CL/P</td>
<td>150</td>
<td>2250</td>
<td>R7s-15</td>
<td>62</td>
<td>E</td>
</tr>
<tr>
<td>200T3Q/CL/P</td>
<td>200</td>
<td>3520</td>
<td>R7s-15</td>
<td>62</td>
<td>D</td>
</tr>
<tr>
<td>300T3Q/CL/P</td>
<td>300</td>
<td>5600</td>
<td>R7s-15</td>
<td>62</td>
<td>D</td>
</tr>
<tr>
<td>500T3Q/CL/P</td>
<td>500</td>
<td>9900</td>
<td>R7s-15</td>
<td>62</td>
<td>N/A</td>
</tr>
<tr>
<td>750T3Q/CL/P</td>
<td>750</td>
<td>16900</td>
<td>R7s-15</td>
<td>124</td>
<td>N/A</td>
</tr>
<tr>
<td>1000T3Q/CL/P</td>
<td>1000</td>
<td>24200</td>
<td>R7s-15</td>
<td>124</td>
<td>N/A</td>
</tr>
<tr>
<td>1500T3Q/CL/P</td>
<td>1500</td>
<td>36300</td>
<td>R7s-15</td>
<td>174</td>
<td>N/A</td>
</tr>
<tr>
<td>2000T3Q/CL/P</td>
<td>2000</td>
<td>48400</td>
<td>Fe4</td>
<td>207</td>
<td>N/A</td>
</tr>
</tbody>
</table>

Notes:
1. Voltage: 230 V, 240 V (120 V on request)
2. Average life: 2000 hours
3. Average life 60 W: 1500 hours

The details for the 230/240 V linear lamps are given below:

<table>
<thead>
<tr>
<th>Type</th>
<th>Wattage (W)</th>
<th>Luminous flux (lm)</th>
<th>Lamp cap</th>
<th>Filament length (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>200T3Q/CL</td>
<td>200</td>
<td>2820</td>
<td>R7s</td>
<td>1500</td>
</tr>
<tr>
<td>300T3Q/CL</td>
<td>300</td>
<td>4480</td>
<td>R7s</td>
<td>1500</td>
</tr>
<tr>
<td>500T3Q/CL</td>
<td>500</td>
<td>7920</td>
<td>R7s</td>
<td>1500</td>
</tr>
</tbody>
</table>

Notes:
1. Voltage: 230 V, 240 V (120 V on request)
2. Average life: 2000 hours
3. Average life 60 W: 1500 hours

2.2.7 Lamp dimensions

![Figure 2.10]

2.2.8 Luminous intensity distribution

The luminous intensities distribution for a 300 W Plusline double-ended linear Halogen lamp is given below:

![Figure 2.11]

2.2.9 Lamp disposal

Refer chapter 1.6 in this brochure.

2.2.10 Lifetime performance

A - Lifetime
Typical life expectancy curves for double-ended linear Halogen lamps is given in figure 2.12 below (2000 h. lamps):

![Figure 2.12]

B - Lamp lumen depreciation
Typical lamp lumen depreciation curves for double-ended linear Halogen lamps is shown in figure 2.13 below (2000 h. lamps):

![Figure 2.13]
2. Philips PLUSline lamps provide security to the user by their nature of being suitable for any burning position i.e. the user can have peace-of-mind while using the lamp in any luminaire position. Although the Philips PLUSline linear Halogen lamps (≤500 W) have the advantage of universal burning position. However, the heat distribution in the luminaire will change if held outside the normal horizontal tolerance of ± 15° and hence care must be taken that parts of the luminaire do not exceed the specified temperature levels.

The extent of pinch temperature variation with different burning positions for some of the lamps is given below:

<table>
<thead>
<tr>
<th>Type</th>
<th>Position</th>
<th>Temperature °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>200 W</td>
<td>vertical</td>
<td>top 200°</td>
</tr>
<tr>
<td></td>
<td></td>
<td>bottom 115°</td>
</tr>
<tr>
<td></td>
<td>horizontal</td>
<td>145°</td>
</tr>
<tr>
<td>300 W</td>
<td>vertical</td>
<td>top 225°</td>
</tr>
<tr>
<td></td>
<td></td>
<td>bottom 145°</td>
</tr>
<tr>
<td></td>
<td>horizontal</td>
<td>170°</td>
</tr>
<tr>
<td>500 W</td>
<td>vertical</td>
<td>top 310°</td>
</tr>
<tr>
<td></td>
<td></td>
<td>bottom 210°</td>
</tr>
<tr>
<td></td>
<td>horizontal</td>
<td>240°</td>
</tr>
</tbody>
</table>

2.2.13 Fuse (Philips patent)

When a filament burns through (i.e. at the end of its life), it is possible that an electric arc develops in the gap. Then two things can happen: firstly the current will increase drastically till a level at which the molybdenum foil (part of the pinch) melts. At this point, the pinch temperature becomes so high that the pinch weakens and the lamp explodes. This entire process occurs so quickly that an external fast-acting electrical fuse will, in general, not function fast enough to stop this phenomenon. Secondly, if the arc continues for a certain time, the temperature and the pressure inside the bulb increases to a point at which the lamp explodes. The arc preventing fuses provided in Philips Halogen lamps are not electrical fuses, which melt when they become too hot due to excessive current flow. Instead they work by physically extinguishing the arc when it reaches them. This is covered by a Philips patent.

The Philips range of PLUSline lamps (upto 500 W) are provided with 2 built-in arc preventing fuse in each lamp for extra safety. A schematic representation of the arc-preventing fuse is shown below:

2.2.14 Burning positions

Most double-ended linear Halogen lamps must be limited to operation in horizontal burning position to achieve the specified light output, lumen maintenance and lifetime. The Philips PLUSline range of lamps (upto 500 W) however have a universal burning position ± a distinct plus point in favour of this range of lamps. This offers 2 distinct user benefits:

1. The lamps can be used to illuminate the objects truly as per their contours when used with luminaires designed and constructed for operation in any position. This results in optimal illumination of the objects.

2. Philips PLUSline lamps provide security to the user by their nature of being suitable for any burning position i.e. the user can have peace-of-mind while using the lamp in any luminaire position.

The graphics below show the spectral irradiance and the transmitted wavelengths in the case of PLUSline UV Block as compared to the standard linear lamps.

2.2.15 Spectral

The extent of pinch temperature variation with different burning positions for some of the lamps is given below:

2.2.11 Influence of mains voltage on lamp characteristics

2.2.12 Dimming

All Philips double-ended linear Halogen lamps can be dimmed, see also chapter 1.4.

Note: Both large Linear halogen lamps and Linear lamps have limited burning position (+/- 15°)
2.3 - Mains voltage capsules

2.3.1 Introduction and description
A range of mains voltage Halogen capsules available in clear/frosted with UV Block versions having B15d bayonet caps.

Features and benefits

<table>
<thead>
<tr>
<th>Benefits</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upto 15% more light than GLS lamps</td>
<td>• higher luminous efficacy</td>
</tr>
<tr>
<td>Pure bright light</td>
<td>• colour temp. 2900° K</td>
</tr>
<tr>
<td>Excellent colour rendition</td>
<td>• Ra=100</td>
</tr>
<tr>
<td>Long lamp life</td>
<td>• upto 2000 burning hours</td>
</tr>
<tr>
<td>Constant light output over life</td>
<td>• no end blackening</td>
</tr>
<tr>
<td>Ease of installation</td>
<td>• compact, mains voltage</td>
</tr>
<tr>
<td>Economical source for small, light-weight luminaires</td>
<td>• Halogen lamp</td>
</tr>
<tr>
<td>Ideal for a wide variety of applications</td>
<td>• choice of lamp wattages</td>
</tr>
<tr>
<td>Safety base</td>
<td>• fuse incorporated in lamp</td>
</tr>
</tbody>
</table>

Applications
Main voltage Halogen capsules are suitable for a variety of applications where high intensities are required from compact Halogen lamps with economical light weight luminaires. These include Accent/spot lighting for small objects and shop-windows security lighting, garden and park lighting, building-site floodlighting etc.

2.3.2 Applicable IEC standards
- IEC 432-1
- IEC 432-2

2.3.3 Position of components (lamp construction)

2.3.4 Maximum permissible temperature rise

The maximum permissible temperature rise for these lamps are:
- Bulb: 900°C (minimum 250°C)
- Pinch: 350°C

2.3.5 PET values

Refer chapter 1.3 of this brochure.

Spectral distribution
The curve below shows the absolute flux measurements for a 230 V 100 W Mains voltage capsule and clearly shows the insignificant levels of UV radiation from these lamps.

2.3.6 Range with electrical and lighting data

The mains voltage Halogen capsules are available in 75 W, 100 W and 150 W in both clear and frosted versions, the details of these lamps are given below:

<table>
<thead>
<tr>
<th>Type</th>
<th>Wattage (W)</th>
<th>Voltage (V)</th>
<th>Luminous Flux (lm)</th>
<th>Finish</th>
<th>Average life (h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12120W</td>
<td>75</td>
<td>230</td>
<td>975</td>
<td>clear</td>
<td>2000</td>
</tr>
<tr>
<td>12123W</td>
<td>75</td>
<td>230</td>
<td>910</td>
<td>frosted</td>
<td>2000</td>
</tr>
<tr>
<td>12119W</td>
<td>100</td>
<td>230</td>
<td>1400</td>
<td>clear</td>
<td>2000</td>
</tr>
<tr>
<td>12122W</td>
<td>100</td>
<td>230</td>
<td>1300</td>
<td>frosted</td>
<td>2000</td>
</tr>
<tr>
<td>12121W</td>
<td>150</td>
<td>230</td>
<td>1900</td>
<td>frosted</td>
<td>2000</td>
</tr>
</tbody>
</table>

Notes:
1. All lamps have B15d caps in accordance with IEC 61-1
2. Colour temperature of the lamps is 2900 K

2.3.7 Lamp dimensions

Refer chapter 1.6 of this brochure.

2.3.8 Luminous intensity distribution

The typical luminous intensity distribution of a 230 V/75 W Mains voltage capsule is given in figure 2.18

2.3.9 Lamp disposal

Refer chapter 1.6 of this brochure.

2.3.10 Lifetime performance

A - Lifetime
The Life expectancy of the mains voltage capsules is given in the curve in figure 2.21

B - Lumen maintenance

Figure 2.17
Figure 2.18
Figure 2.19
Figure 2.20
Figure 2.21
Figure 2.22
2.4 - PAR HalogenA lamps

2.4.1 Introduction and description
A family of Halogen reflector lamps consisting of a mains voltage single-ended hard glass burner optimally positioned in a Parabolic, Aluminium coated, pressed glass Reflector. The lamps have a unique WISO reflector (Philips patent), which produces a nice homogeneous light beam of high intensity, ideal for accent/display and general lighting.

Features and benefits

<table>
<thead>
<tr>
<th>Benefits</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>All user benefits of halogen lamps</td>
<td>• more light output</td>
</tr>
<tr>
<td></td>
<td>• higher luminous efficacy</td>
</tr>
<tr>
<td></td>
<td>• sparkling, crisp, white light</td>
</tr>
<tr>
<td></td>
<td>• colour temp. 2900° K</td>
</tr>
<tr>
<td></td>
<td>• excellent colour rendition (Ra=100)</td>
</tr>
<tr>
<td></td>
<td>• reduced maintenance cost</td>
</tr>
<tr>
<td></td>
<td>• longer lamp life (2500 burning hours)</td>
</tr>
<tr>
<td></td>
<td>• constant light output over life</td>
</tr>
<tr>
<td></td>
<td>• no bulb-blackening</td>
</tr>
</tbody>
</table>

Retrofit
• Can fit into most existing luminaires for incandescent reflector lamps |
• mains voltage lamp (does not require transformer) |

Sharp, well-defined beam of high intensity
• Philips patented WISO optical reflector design |

Saves energy
• Can replace incandescent reflector lamps of higher wattage |

Can be used to create different lighting levels
• Dimmable adjustable lighting |

Safety
• Lamps have safety fuses |

Ease of installation

Choice of light beams
• Spot beam of 10° with light stippled lens and flood beam of 30° with lenticuled lens |

A lamp for every application

The range of Philips PAR lamps offers the following benefits to the luminaire manufacturers:
1. Upgrade from GLS reflector lamps. |
2. New business opportunity with distinguishing possibilities. |
3. Possibility of designing new compact, cost-efficient, user-friendly luminaires. |

Applications
The PAR HalogenA range of lamps are ideally suited for:
• Indoor: shops, homes and horeca for accent/display lighting, general lighting and downlighting. |
• Outdoor: accent/display lighting of statues, sculptures, trees etc. (with waterproof connection between reflector and luminaire). |

2.4.2 IEC specifications
IEC-432, IEC-360 and IEC 61-1 |

2.4.3 Position of components (lamp construction)
The typical constructional details of a PAR lamp are given in figure 2.24.

2.4.4 Maximum permissible temperatures
Base temperature: < 130° C
Heat distribution
The typical heat distribution curves for the PAR HalogenA lamps are given below:

![Heat Distribution Curves]  

Note:  
use same x-axis, minimum 60°, maximum 220°

2.4.5 PET values
Refer chapter 1.3 of this brochure.

Spectral distribution
The double-envelope construction of the PAR HalogenA lamps ensures that the lamps have an insignificant UV radiation as shown in the curve below:

![Spectral Distribution Curve]  

2.4.6 Range

- PAR 16 40W (25° beam angle)
- PAR 20 50W (10° and 25° beam angles)
- PAR 30S 75W (10° and 30° beam angles)
- PAR 30S 100W (10° and 30° beam angles)
- PAR 38 75W (10° and 30° beam angles)
- PAR 38 100W (10° and 30° beam angles)

2.4.7 Lamp dimensions and comparison with incandescent reflector lamps
Figure 2.27 gives the dimensions and the comparative dimensions of the PAR HalogenA lamps and the incandescent lamps to be replaced by them.
2.4.8 Electrical and lighting data

<table>
<thead>
<tr>
<th>Lamp type</th>
<th>Wattage (W)</th>
<th>Voltage (V)</th>
<th>Beam angle</th>
<th>Luminous intensity (cd)</th>
<th>Lamp base</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAR 16 SPOT</td>
<td>40</td>
<td>230/240</td>
<td>10</td>
<td>2300</td>
<td>E14</td>
</tr>
<tr>
<td>PAR 16 FLOOD</td>
<td>40</td>
<td>230/240</td>
<td>30</td>
<td>850</td>
<td>E14</td>
</tr>
<tr>
<td>PAR 20 SPOT</td>
<td>50</td>
<td>230/240</td>
<td>10</td>
<td>3500</td>
<td>E27</td>
</tr>
<tr>
<td>PAR 20 FLOOD</td>
<td>50</td>
<td>230/240</td>
<td>30</td>
<td>1000</td>
<td>E27</td>
</tr>
<tr>
<td>PAR 305 SPOT</td>
<td>75</td>
<td>230/240</td>
<td>10</td>
<td>6500</td>
<td>E27</td>
</tr>
<tr>
<td>PAR 305 FLOOD</td>
<td>75</td>
<td>230/240</td>
<td>30</td>
<td>9000</td>
<td>E27</td>
</tr>
<tr>
<td>PAR 38 SPOT</td>
<td>75</td>
<td>230/240</td>
<td>10</td>
<td>9200-9500</td>
<td>E27</td>
</tr>
<tr>
<td>PAR 38 FLOOD</td>
<td>75</td>
<td>230/240</td>
<td>30</td>
<td>2200-2400</td>
<td>E27</td>
</tr>
<tr>
<td>PAR 38 SPOT</td>
<td>100</td>
<td>230/240</td>
<td>10</td>
<td>11600-15000</td>
<td>E27</td>
</tr>
<tr>
<td>PAR 38 FLOOD</td>
<td>100</td>
<td>230/240</td>
<td>30</td>
<td>3000</td>
<td>E27</td>
</tr>
</tbody>
</table>

Note:
The average lifetime for PAR 20, PAR 30L, PAR 30S and PAR 38 lamps is 2500 hours.

2.4.9 Luminous intensity distribution and visual impact diagrams

Figure 2.28A

Figure 2.28B

Figure 2.28C
2.4.10 Lamp disposal
Refer chapter 1.6 in this brochure.

2.4.11 Lifetime performance
Typical life expectancy and lumen maintenance curves for PAR HalogenA lamps are shown in figure 2.29.

2.4.12 Influence of mains voltage on lamp characteristics
See figure 2.30.

2.4.13 Dimming
All Philips PAR HalogenA lamps are dimmable, see also chapter 1.4.

2.4.14 Burning positions
The PAR HalogenA lamps have a universal burning position.
2.5 - Halogen Reflector Lamps

2.5.1 Introduction and description

The Halogen reflector R50 and R63 in standard GLS shaped lamps contain a halogen burner inside. The reflectors offer an improved light quality and output with an extended 2 year lifetime. These lamps can be considered as a consumer alternative to Par 16 and Par 20 lamps.

Features and Benefits

<table>
<thead>
<tr>
<th>Benefits</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>GLS standard lamp with benefits of a Halogen burner.</td>
<td>• Higher Luminous efficacy</td>
</tr>
<tr>
<td>It has a warm ‘wohn’ light. Excellent colour rendering. A longer life compared with GLS equivalent.</td>
<td>• Colour temp 2800º K</td>
</tr>
<tr>
<td>Suitable for various applications</td>
<td>• RF = 100</td>
</tr>
<tr>
<td>No transformer required</td>
<td>• 2000 hours burning</td>
</tr>
</tbody>
</table>

2.5.2 Application IEC standards

IEC 432-1, 2, IEC 630

2.5.3 Position of components (lamp construction)

1. GLS Bulb
2. Satinised coating
3. Mains Voltage Halogen Burner
4. Assembly Clip
5. GLS Stem
6. GLS Cap

2.5.4 PET values

Mains voltage halogen reflector ≥ 100 (at 1000 LUX) in hours
Refer to chapter 1.3 of this brochure

2.5.5 Range with electrical and lighting data

<table>
<thead>
<tr>
<th>Commercial</th>
<th>10 NC</th>
<th>W</th>
<th>V</th>
<th>Luminous Intensity</th>
<th>Cap / Lamp Base</th>
<th>Life 50%</th>
</tr>
</thead>
<tbody>
<tr>
<td>D</td>
<td>Cd</td>
<td>W</td>
<td>V</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NR 50</td>
<td>9248 200 44200</td>
<td>40W</td>
<td>230V</td>
<td>680</td>
<td>E27</td>
<td>2000</td>
</tr>
<tr>
<td>NR 63</td>
<td>9248 201 45500</td>
<td>60W</td>
<td>240V</td>
<td>1160</td>
<td>E27</td>
<td>2000</td>
</tr>
<tr>
<td>NR 63</td>
<td>9248 203 45500</td>
<td>60W</td>
<td>240V</td>
<td>1160</td>
<td>B22</td>
<td>2000</td>
</tr>
<tr>
<td>NR 50</td>
<td>9248 204 44200</td>
<td>40W</td>
<td>230V</td>
<td>1160</td>
<td>E14</td>
<td>2000</td>
</tr>
<tr>
<td>NR 63</td>
<td>9248 205 45500</td>
<td>60W</td>
<td>240V</td>
<td>1160</td>
<td>E14</td>
<td>2000</td>
</tr>
<tr>
<td>NR 50</td>
<td>9248 206 45500</td>
<td>40W</td>
<td>240V</td>
<td>680</td>
<td>E27</td>
<td>2000</td>
</tr>
<tr>
<td>NR 63</td>
<td>9248 207 45500</td>
<td>60W</td>
<td>240V</td>
<td>1160</td>
<td>E27</td>
<td>2000</td>
</tr>
</tbody>
</table>

2.5.6 Lamp dimensions

NR 50

2.5.7 Luminous intensity distribution

Currently being measured

2.5.8 Spectral irradiance, transmitted wavelengths and UV – Block

The graph below shows the spectral irradiance and the transmitted wavelength of UV block. UV Block burners have a PET ≥ 100 hours which is far better than the ACGIH recommendations at 1000 lux (permissible exposure time per 24 hours).

Graph to be created

2.5.9 Lamp disposal

Refer to chapter 1.6 in this brochure

2.5.10 Lifetime performance

under preparation

2.5.11 Influence of mains voltage on lamp characteristics

At end of life the lamp filament can break. Causing an arc. Rising Temperature can cause Pinch to explode.

2.5.12 Dimming

All Philips mains voltage burner products can be dimmed

2.5.13 Fuse

The Philips mains voltage capsules are provided with a patented fuse system in the pinch of the lamp

At end of life the lamp filament can break. Causing an arc. Rising Temperature can cause Pinch to explode.

2.5.14 Burning position

All Philips mains voltage capsules have a universal burning position and are therefore suitable for a variety of applications as previously indicated
2.6.1 Introduction and description

The MasterPAR 20 is a mains-voltage reflector lamp with E27 base, featuring a low-voltage halogen burner. The power conversion from the mains to the 12V light source is achieved by a built-in electronic transformer. The faceted parabolic pressed-glass reflector is aluminium coated and has a clear flat front glass. MasterPAR 20 fits in most luminaires designed for PAR 20 and R83 reflector lamps. The product combines the good efficacy and long lifetime of low-voltage halogen technology with the ease of use of PAR HalogenA and R83 lamps.

2.6.2 Applicable IEC standards

The product complies with following standards. Safety: IEC 968; EMC: EN 55015, EN 61000-3-2 and EN 55022; EMI: EN 61547.

2.6.3 Position of components (lamp construction)

![Diagram of lamp construction]

1. Front Glass
2. Reflector
3. Burner
4. Holding ring
5. Electronics holder
6. Potted Electronics
7. Cap

The lamp is not suitable for dimming or for use on electronic switches.

Applications

The PAR HalogenA range of lamps are ideally suited for:
1. Indoor: shops, homes and horeca for accent/display lighting, general lighting and downlighting.
2. Outdoor: accent/display lighting of statues, sculptures, trees etc. (with waterproof connection between reflector and luminaire).

2.6.4 Maximum permissible temperatures

To prevent overheating of the electronic circuit inside, the case temperature Tc (see drawing) shall not exceed 100 °C. Under normal operating conditions this situation will not occur. Refer figure 4.1 in this chapter.

2.6.5 PET values

Refer to chapter 1.3 of this brochure.

2.6.6 Range with electrical and lighting data

<table>
<thead>
<tr>
<th>Type</th>
<th>Wattage (W)</th>
<th>Beam angle (°)</th>
<th>Luminous intensity (cd)</th>
<th>Average life (h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAR 20-E 240V 20W 10DGR E27</td>
<td>20</td>
<td>10</td>
<td>7000</td>
<td>5000</td>
</tr>
<tr>
<td>PAR 20-E 240V 20W 10DGR E27</td>
<td>20</td>
<td>50</td>
<td>5000</td>
<td>5000</td>
</tr>
<tr>
<td>PAR 20-E 230V 20W 15DGR E27</td>
<td>20</td>
<td>15</td>
<td>1200</td>
<td>5000</td>
</tr>
<tr>
<td>PAR 20-E 240V 20W 15DGR E27</td>
<td>20</td>
<td>15</td>
<td>1200</td>
<td>5000</td>
</tr>
</tbody>
</table>

Note:
1. All lamps have an E27 base.
2. The total lamp power is actually 19.9 W burner power + 1.5W transformer loss = 21.4W

Replacement for Incandescent lamps

<table>
<thead>
<tr>
<th>Type</th>
<th>Incandescent lamp replaced</th>
</tr>
</thead>
<tbody>
<tr>
<td>MasterPAR-E 20W</td>
<td>PAR 20 50W</td>
</tr>
<tr>
<td>R83 60W</td>
<td>MasterPAR-E 20W</td>
</tr>
</tbody>
</table>

Reflector 3. Burner 4.5. PAR HalogenA 20W PAR 20 50W similar (flood) or double (spot) intensity, or 66% more times as high as R63. Compared to R63.

Unprecedented beam contrast and uniformity for a mains-voltage reflector lamp. Highlights goods and exhibit, adds drama and creates ambience.

2.6.7 Lamp dimensions

<table>
<thead>
<tr>
<th>Type</th>
<th>Diameter (mm)</th>
<th>Height (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAR 20-E 240V 20W 10DGR E27</td>
<td>43.5</td>
<td>65.5</td>
</tr>
<tr>
<td>PAR 20-E 230V 20W 10DGR E27</td>
<td>43.5</td>
<td>65.5</td>
</tr>
<tr>
<td>PAR 20-E 240V 20W 10DGR E27</td>
<td>43.5</td>
<td>65.5</td>
</tr>
<tr>
<td>PAR 20-E 230V 20W 10DGR E27</td>
<td>43.5</td>
<td>65.5</td>
</tr>
</tbody>
</table>

2.6.8 Luminous intensity distribution

![Graph of luminous intensity distribution]

MasterPAR 20 Electronic 10D
1 x HAL-P20E-10-20W / N/A

![Diagram of polar intensity diagram]

![Diagram of Cartesian intensity diagram]

![Diagram of isolum diagram]

![Diagram of visual impact diagram]
2.6.9 Lamp disposal

Refer to chapter 1.6 of this brochure

2.6.10 Lifetime performance

An average burner lifetime exceeding 5000h. In combination with electronics failure, the average lamp lifetime is 5000h, i.e. twice the lifetime of PAR Halogen and 3 times the lifetime of incandescent reflector lamps.

Life expectancy

Lumen maintenance
2.7 - Twistline

2.7.1 Introduction and description
Twistline are mains voltage Halogen reflectors with a quartz burner optically positioned with clear front glass with a hard coated dichroic full glass reflector and GZ10 base or an aluminium coated glass reflector with a GU10 base. It is manufactured with UV block quartz glass. The lamp is ideal for small lightweight luminaire applications. Conforming to IEC 357, 432-2 and 598 the Twistline does not require a covered luminaire. The GU10 and GZ10 bases offer an easy insertion and replacement system to the end user.

Features and benefits

<table>
<thead>
<tr>
<th>Benefits</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Best of both worlds of GLS and Halogen</td>
<td>• Higher luminous efficacy</td>
</tr>
<tr>
<td>It has a warm 'wohn' light</td>
<td>• Colour temp. 2800° K</td>
</tr>
<tr>
<td>Excellent colour rendering</td>
<td>• Ra=100</td>
</tr>
<tr>
<td>A longer life</td>
<td>• 2000 burning hours</td>
</tr>
<tr>
<td>Suitable for various applications</td>
<td>• Compact</td>
</tr>
<tr>
<td></td>
<td>• Universal burning position</td>
</tr>
<tr>
<td></td>
<td>• Dimmable</td>
</tr>
<tr>
<td></td>
<td>• Standardised GZ10 &amp; GU10 base</td>
</tr>
<tr>
<td></td>
<td>• With front glass</td>
</tr>
<tr>
<td></td>
<td>• Patented fuse effect.</td>
</tr>
<tr>
<td></td>
<td>• UV block quartz glass</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>No transformer required</td>
<td></td>
</tr>
<tr>
<td>Easy Insertion and removal at end of life</td>
<td></td>
</tr>
</tbody>
</table>

The mains voltage capsules offer benefits to luminaire Manufacturers:

1. Design freedom for more compact luminaires in a variety of applications
2. No transformer is required so system costs are less
3. The reflectors conform to IEC norms allowing use in an open luminaire

Applications
The twistlines are mainly suited for lighting in homes in suspended, ceiling, spots, tracks and floor consumer luminaires.

2.7.2 Application IEC standards
IEC 357, IEC 432, IEC 598

2.7.3 Position of components
(lamp construction)

2.7.4 Maximum permissible temperatures
The maximum permissible temperatures for different parts of the lamp are:
- Pinch : 350° C
- Reflector : 250° C
- Contacts : 250° C
- Front Glass : 240° C

2.7.5 PET values
Mains voltage capsule ≥ 100 (at 1000 LUX) in hours
Refer to chapter 1.3 of this brochure

2.6.11 Influence of voltage on lamp characteristics
The electronic driver does not contain power stabilization.

2.6.12 Dimming
The lamp is not suitable for use on dimmers or electronic switches. Electronic switches – as used in dusk to dawn sensors and timers – are basically dimmers with only 2 states: 0% dimmed (closed switch) and 100% dimmed (open switch). Dimmers generate a distorted current through the lamp, causing an audible hum and unstable operation in case the lamp is also an electronic device. To a smaller extent, this is also true for closed 2-terminal electronic switch because some distortion is needed to power the device itself. The problem is known from CFL.

In case of accidental use on such a device the product will not be damaged and no hazardous situation will occur.

2.6.13 Fuse
Built-in safety fuse

2.6.14 Burning positions
The MasterPAR Electronic has an universal burning position.

2.6.15 Safety
- The lamp is not suitable for use on dimmers or electronic switches. In case of accidental use on such a device the product will not be damaged and no hazardous situation will occur.
- Built-in safety fuse
- Quartz burner
- Protective front glass reduces UV-output and prevents finger burn and damage by non-passive failure
- Flame retardant plastic lamp base

2.6.16 Influence of voltage on lamp characteristics
The electronic driver does not contain power stabilization.
2.7.7 Lamp dimensions

Figure 2.39

Figure 2.40

2.7.8 Luminous intensity distribution

Twist Line 230V/50W/25D Aluminium 25 DGR

Figure 2.41A

Figure 2.41B

Twist Line 230V/50W/50D Aluminium 25 DGR

Twist Line 230V/50W/50D Dichroic 25 DGR

Figure 2.41C

Figure 2.41D

Figure 2.41E

2.7.9 Spectral irradiance, transmitted wavelengths and UV – Block

UV Block capsules have a PET ≥ 100 hours which is far better than the ACGIH recommendations at 1000 lux (permissible exposure time per 24 hours).

Refer to chapter 1.3 Fig. 1.3.

2.7.10 Lamp disposal

Refer to chapter 1.6 in this brochure.

2.7.11 Lifetime performance

2.7.12 Influence of mains voltage on lamp characteristics

Refer to chapter 1.6 in this brochure.
2.8 - Clickline

2.8.1 Introduction and description

This single-ended mains-voltage capsule is the most compact capsule in its range. It is manufactured with UV block quartz glass. The capsule is ideal for small lightweight luminaire applications. Conforming to IEC 357, 432-2 and 598 the capsule does not require a covered luminaire. The frosted versions give softer light effects. The G9 base offers an easy insertion and replacement system to the end user.

Features and benefits

<table>
<thead>
<tr>
<th>Benefits</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Best of both worlds of GLS and Halogen</td>
<td>Higher luminous efficacy</td>
</tr>
<tr>
<td>It has a warm 'wohn' light</td>
<td>Halogen temp. 2800° K</td>
</tr>
<tr>
<td>Excellent colour rendering</td>
<td>Ra=100</td>
</tr>
<tr>
<td>A longer life</td>
<td>2000 burning hours</td>
</tr>
<tr>
<td>Suitable for various applications</td>
<td>Ultra compact</td>
</tr>
<tr>
<td></td>
<td>Universal burning position</td>
</tr>
<tr>
<td></td>
<td>Dimmable</td>
</tr>
<tr>
<td></td>
<td>Standardised G9 base</td>
</tr>
<tr>
<td></td>
<td>Clear and Frosted versions</td>
</tr>
<tr>
<td></td>
<td>Patented fuse effect.</td>
</tr>
<tr>
<td></td>
<td>UV block quartz glass</td>
</tr>
</tbody>
</table>

No transformer required
Easy Insertion and removal at end of life

The mains voltage capsules offer benefits to luminaire Manufacturers:
1. Design freedom for more compact luminaires in a variety of applications
2. No transformer is required so system costs are less
3. The capsule conforms to IEC norms allowing use in an open luminaire

Applications:
The capsule will be mainly suited for lighting in homes in wall, ceiling and table consumer luminaires.

2.8.2 Application IEC standards

IEC 357, IEC 432, IEC 598

2.8.3 Position of components (lamp construction)

![Diagram of Clickline components]

- 1 Bulb
- 2 Coil
- 3 Gas filling
- 4 Coil support
- 5 Pinch foil
- 6 Lead in wire

2.8.4 Maximum permissible temperatures

The maximum permissible temperatures for different parts of the lamp are:
- Pinch : 350° C
- Bulb : 900° C
- Contacts : 250° C

2.8.5 PET values

Mains voltage capsule ≥ 100
(at 1000 LUX) in hours
Refer to chapter 1.3 of this brochure

2.8.6 Range with electrical and lighting data

<table>
<thead>
<tr>
<th>Type</th>
<th>Wattage (W)</th>
<th>Voltage (V)</th>
<th>Luminous Flux (lm)</th>
<th>Base</th>
<th>Finish</th>
<th>Average life (hrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>14683</td>
<td>40W</td>
<td>230V</td>
<td>490</td>
<td>G9</td>
<td>CLEAR</td>
<td>2000</td>
</tr>
<tr>
<td>14684</td>
<td>40W</td>
<td>230V</td>
<td>460</td>
<td>G9</td>
<td>FROSTED</td>
<td>2000</td>
</tr>
<tr>
<td>14689</td>
<td>60W</td>
<td>230V</td>
<td>820</td>
<td>G9</td>
<td>CLEAR</td>
<td>2000</td>
</tr>
<tr>
<td>14690</td>
<td>60W</td>
<td>230V</td>
<td>790</td>
<td>G9</td>
<td>CLEAR</td>
<td>2000</td>
</tr>
<tr>
<td>14694</td>
<td>40W</td>
<td>240V</td>
<td>490</td>
<td>G9</td>
<td>CLEAR</td>
<td>2000</td>
</tr>
<tr>
<td>14695</td>
<td>40W</td>
<td>240V</td>
<td>460</td>
<td>G9</td>
<td>FROSTED</td>
<td>2000</td>
</tr>
<tr>
<td>14700</td>
<td>60W</td>
<td>240V</td>
<td>820</td>
<td>G9</td>
<td>CLEAR</td>
<td>2000</td>
</tr>
<tr>
<td>14701</td>
<td>60W</td>
<td>240V</td>
<td>790</td>
<td>G9</td>
<td>FROSTED</td>
<td>2000</td>
</tr>
</tbody>
</table>
2.8.7 Lamp dimensions

2.8.8 Spectral irradiance, transmitted wavelengths and UV – Block

UV Block capsules have a PET ≥ 100 hours which is far better than the ACGIH recommendations at 1000 lux (permissible exposure time per 24 hours).

Refer to chapter 1.3 Fig. 1.3.

2.8.9 Lamp disposal

Refer to chapter 1.6 in this brochure.

2.8.10 Lifetime performance

2.8.11 Influence of mains voltage on lamp characteristics

2.8.12 Dimming

All Philips mains voltage capsules can be dimmed.

2.8.13 Fuse

The Philips mains voltage capsules are provided with a patented fuse system in the pinch of the lamp.

Figure 2.47

2.8.14 Burning position

All Philips mains voltage capsules have a universal burning position and are therefore suitable for a variety of applications as previously indicated.
3.1 - Low voltage Halogen Capsule Lamps

3.1.1 Introduction and description

Capsuline
Capsules are the most compact Halogen lamps and can be used for a wide range of applications. The Philips range of low voltage capsules consists of the following lamp groups:
- LOW PRESSURE (incl. UV-Block glass) lamps according IEC 357 with special operating filling gas pressure ≤ 2.5 bar to be used in luminaires without front glass and are available in Clear or Frosted execution for a more uniform light distribution.
- UV BLOCK: with special UV-Block Quartz glass to considerably reduce the UV output and with axial filament.
- STANDARD LOW PRESSURE 5W lamp with clear bulb and a transversal (bow) filament.

Capsule Limited range of low pressure lamps (incl. UV-block). Only available in a clear version with lower lifetime and less light output.

Features and benefits

<table>
<thead>
<tr>
<th>Benefits</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>All benefits of Halogen lamps</td>
<td>• Higher luminous efficacy</td>
</tr>
<tr>
<td>More light</td>
<td>• Colour temp. 3000°K</td>
</tr>
<tr>
<td>Pure, bright light</td>
<td>• Ra &gt; 90</td>
</tr>
<tr>
<td>Excellent colour rendering</td>
<td>• 2000 burning hours</td>
</tr>
<tr>
<td>Longer lamp life</td>
<td>• No bulb blackening</td>
</tr>
<tr>
<td>Constant light output over life</td>
<td>• Sturdy and very compact</td>
</tr>
<tr>
<td>Suitable for various applications</td>
<td>• Extremely shock resistant</td>
</tr>
<tr>
<td>High light intensities</td>
<td>• Universal burning position</td>
</tr>
<tr>
<td>Easy insertion and removal at end of life</td>
<td>• Dimmable</td>
</tr>
<tr>
<td>Uniform light distribution in SILVER capsules</td>
<td>• Standardised pin-bases</td>
</tr>
<tr>
<td>Almost no UV radiation and its unwanted effects in Low Pressure and UV BLOCK capsules</td>
<td>• Wide range</td>
</tr>
<tr>
<td></td>
<td>• Free burning operation</td>
</tr>
<tr>
<td></td>
<td>• Axial filament</td>
</tr>
<tr>
<td></td>
<td>• Special shaped corrosion resistant pins</td>
</tr>
<tr>
<td></td>
<td>• Frosted bulb</td>
</tr>
<tr>
<td></td>
<td>• Unique UV block quartz glass</td>
</tr>
</tbody>
</table>

The Halogen low voltage capsules also offer the following benefits to luminaire manufacturers:
1. Opportunity to design compact luminaires for a variety of applications
2. Value-addition possibilities with total lighting system (lamp and reflector).
3. Low pressure technology to design luminaires without front glass.
4. Significantly by reduced pinch temperature.

3.1.2 Applicable IEC standards

IEC 61, IEC 357

3.1.3 Position of components (lamp construction)

![Diagram of lamp components]

1. Bulb
2. Col
3. Gas filling
4. Pinch foil
5. Lead-in wire

3.1.4 Maximum permissible temperatures

The maximum permissible temperatures for different parts of the lamps are:
- Pinch: 350° C
- Bulb: 900° C (minimum 250° C)*
- Contacts: 300° C

* 600° C (minimum 250° C) for lamp type 13283.

3.1.5 PET values

Refer chapter 1.3 of this brochure.

3.1.6 Electrical and lighting data

SILVER (LOW PRESSURE/UV-BLOCK)

<table>
<thead>
<tr>
<th>Commercial name</th>
<th>Type</th>
<th>V</th>
<th>W</th>
<th>Cap/finish</th>
<th>Finish</th>
<th>Lumen output</th>
<th>Correlated colour temperature</th>
<th>Lamp life 50% h</th>
<th>EOC</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAPSUline PRO</td>
<td>13691</td>
<td>12V</td>
<td>20W</td>
<td>G4</td>
<td>Frosted</td>
<td>315</td>
<td>3000</td>
<td>3000</td>
<td>404966</td>
</tr>
<tr>
<td>CAPSUline PRO</td>
<td>13755</td>
<td>12V</td>
<td>35W</td>
<td>GY6.35</td>
<td>Frosted</td>
<td>600</td>
<td>3000</td>
<td>3000</td>
<td>402488</td>
</tr>
<tr>
<td>CAPSUline PRO</td>
<td>13091</td>
<td>24V</td>
<td>20W</td>
<td>G4</td>
<td>Clear</td>
<td>300</td>
<td>3000</td>
<td>2000</td>
<td>409621</td>
</tr>
<tr>
<td>CAPSUline PRO</td>
<td>13090</td>
<td>24V</td>
<td>50W</td>
<td>GY6.35</td>
<td>Clear</td>
<td>850</td>
<td>3000</td>
<td>2000</td>
<td>409638</td>
</tr>
<tr>
<td>CAPSUline PRO</td>
<td>13089</td>
<td>24V</td>
<td>100W</td>
<td>GY6.35</td>
<td>Clear</td>
<td>2200</td>
<td>3000</td>
<td>2000</td>
<td>409645</td>
</tr>
</tbody>
</table>

SUPER (REF: 24 V) (UV-BLOCK)

<table>
<thead>
<tr>
<th>Commercial name</th>
<th>Type</th>
<th>V</th>
<th>W</th>
<th>Cap/finish</th>
<th>Finish</th>
<th>Lumen output</th>
<th>Correlated colour temperature</th>
<th>Lamp life 50% h</th>
<th>EOC</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAPSUline PRO</td>
<td>13078</td>
<td>12V</td>
<td>20W</td>
<td>G4</td>
<td>Clear</td>
<td>320</td>
<td>3000</td>
<td>3000</td>
<td>402103</td>
</tr>
<tr>
<td>CAPSUline PRO</td>
<td>13104</td>
<td>12V</td>
<td>20W</td>
<td>GY6.35</td>
<td>Clear</td>
<td>300</td>
<td>3000</td>
<td>3000</td>
<td>402196</td>
</tr>
<tr>
<td>CAPSUline PRO</td>
<td>13103</td>
<td>12V</td>
<td>35W</td>
<td>GY6.35</td>
<td>Clear</td>
<td>600</td>
<td>3000</td>
<td>3000</td>
<td>402189</td>
</tr>
<tr>
<td>CAPSUline PRO</td>
<td>13102</td>
<td>12V</td>
<td>50W</td>
<td>GY6.35</td>
<td>Clear</td>
<td>935</td>
<td>3000</td>
<td>3000</td>
<td>402172</td>
</tr>
<tr>
<td>CAPSUline PRO</td>
<td>13101</td>
<td>12V</td>
<td>75W</td>
<td>GY6.35</td>
<td>Clear</td>
<td>1575</td>
<td>3000</td>
<td>3000</td>
<td>402165</td>
</tr>
<tr>
<td>CAPSUline PRO</td>
<td>13100</td>
<td>12V</td>
<td>100W</td>
<td>GY6.35</td>
<td>Clear</td>
<td>2200</td>
<td>3000</td>
<td>3000</td>
<td>402158</td>
</tr>
</tbody>
</table>

STANDARD (LOW PRESSURE/UV-BLOCK)

<table>
<thead>
<tr>
<th>Commercial name</th>
<th>Type</th>
<th>V</th>
<th>W</th>
<th>Cap/finish</th>
<th>Finish</th>
<th>Lumen output</th>
<th>Correlated colour temperature</th>
<th>Lamp life 50% h</th>
<th>EOC</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAPSUline PRO</td>
<td>13283</td>
<td>12V</td>
<td>5W</td>
<td>G4</td>
<td>Clear</td>
<td>60</td>
<td>2800</td>
<td>2000</td>
<td>409690</td>
</tr>
<tr>
<td>CAPSUline PRO</td>
<td>13284</td>
<td>12V</td>
<td>10W</td>
<td>G4</td>
<td>Clear</td>
<td>140</td>
<td>2850</td>
<td>3000</td>
<td>409706</td>
</tr>
<tr>
<td>CAPSUline PRO</td>
<td>13079</td>
<td>12V</td>
<td>20W</td>
<td>GY6.35</td>
<td>Clear</td>
<td>320</td>
<td>3000</td>
<td>3000</td>
<td>402103</td>
</tr>
<tr>
<td>CAPSUline PRO</td>
<td>13104</td>
<td>12V</td>
<td>20W</td>
<td>GY6.35</td>
<td>Clear</td>
<td>300</td>
<td>3000</td>
<td>3000</td>
<td>402196</td>
</tr>
<tr>
<td>CAPSUline PRO</td>
<td>13103</td>
<td>12V</td>
<td>35W</td>
<td>GY6.35</td>
<td>Clear</td>
<td>600</td>
<td>3000</td>
<td>3000</td>
<td>402189</td>
</tr>
<tr>
<td>CAPSUline PRO</td>
<td>13102</td>
<td>12V</td>
<td>50W</td>
<td>GY6.35</td>
<td>Clear</td>
<td>935</td>
<td>3000</td>
<td>3000</td>
<td>402172</td>
</tr>
<tr>
<td>CAPSUline PRO</td>
<td>13101</td>
<td>12V</td>
<td>75W</td>
<td>GY6.35</td>
<td>Clear</td>
<td>1575</td>
<td>3000</td>
<td>3000</td>
<td>402165</td>
</tr>
<tr>
<td>CAPSUline PRO</td>
<td>13100</td>
<td>12V</td>
<td>100W</td>
<td>GY6.35</td>
<td>Clear</td>
<td>2200</td>
<td>3000</td>
<td>3000</td>
<td>402158</td>
</tr>
</tbody>
</table>
3.1.9 Spectral distribution

The graphs below show the spectral irradiance and the transmitted wavelengths in the case of UV Block capsules as compared to the normal capsules. UV Block capsules have a PET value ≥ 100 hours which is far better than the ACGIH recommendations at 1000 lux (permissible exposure time per 24 hours).

The typical spectral Irradiance for 12 V 50 W SUPER (normal glass) capsule is given in figure 3.4 and that for 12 V 50 W UV-BLOCK capsule is given in figure 3.5 below.

3.1.10 Lamp disposal

Refer chapter 1.6 in this brochure.

3.1.11 Lifetime performance

Typical lifetime and lamp lumen depreciation curves for low voltage Halogen capsules are given in figure 3.6 and 3.6A.
3.12 Influence of lamp voltage on lamp characteristics

The effect of lamp voltage on the lamp characteristics such as lamp power, colour temperature, luminous flux and average lamp life are given in the graphs in figure 3.7 to 3.10. It must be noted that these graphs give typical relationships applicable for low voltage Halogen lamps.

3.13 Dimming

All Philips low voltage Halogen capsules can be dimmed using appropriate dimming devices, see also chapter 1.4.

3.14 Burning positions

All Philips low-voltage Halogen capsules have universal burning positions which makes them suitable for a variety of applications.

3.2.1 Introduction and description

The new Masterline ES is an advanced MR16 with infrared technology introduced by Philips. Like its predecessor, the Masterline PLUS, the Masterline ES sets a new standard in performance in display lighting dichroics. The technology used by Philips is based on the application of a heat-reflecting coating on the inner lamp burner. Normally only 10-15% of the energy consumed by a halogen lamp produces visible light; the rest is lost as heat. The infrared burner coating reflects an important part of the waste heat back to the filament, so less energy is needed to operate the lamp. Moreover the lamp has a revolutionary compact and precision-shaped double-ended burner which enables the infrared reflecting coating to perform to fullest potential.

The MASTERline ES is the best long life low-voltage product in the world with a burner efficacy (lm/W) improvement of up to 30%! The increased efficacy serves to lower the energy consumption while maintaining light output. Only the MASTERline ES aimed at replacing Masterline Plus and all conventional MR16's (35/50/75W) offering energy savings of 30% and more.

MASTERline ES

The light output dichroic lamp with 50mm, diameter and having:
- a high-pressure Xenon gas filled burner
- axial filament optimally aligned in a 'hard coated' reflector
- ES burner

BRILLIANTLINE PRO:
Closed reflector lamp with an extra low voltage Halogen burner optically positioned in a dichroic reflector to give a high-intensity beam with a clearly defined beam spread without a front glass.

Features and Benefits

Benefits
- All benefits of Halogen lamps
- More light
- Pure, bright light
- Excellent colour rendering
- Longer lamp life
- Constant light output over life
- No adverse heating of object

Features
- • higher luminous efficacy
- • colour temp. +/-300°K
- • Run 100
- • 4000/5000 burning hours
- • no bulb blackening
- • Almost no UV output
- • cool beam to be fit

Additional benefits of all closed dichroic lamps:
- • flat, clear, optical neutral front glass

Additional benefits of MASTERLINE ES range:
- • double-sided interference coated flat, clear front glass
- • Colour temp. approx. 3100°K
- • No deterioration of reflector coating (hard Dichroic coating)
- • Almost no UV output
- • Almost no UV output
- • Almost no UV output

Specific benefits ES:
- • Energy saving in both initial installations and replacement situations
- • High light output and intensities
- • Almost no UV output
- • Whiter light to accentuate beauty of highlighted objects
- • Excellent lamp lumen maintenance over lamp life
- • No colour shift/consistent colour appearance
- • Beautiful see-through effect of the reflector without distracting patterns
- • Very low lamp replacement costs
- • long lamp life of 5000 burning hours
- • Wide choice of beam angles
- • 10°, 24°, 38°, 60°
- • Excellent lamp retention in luminaire
- • special metallic GU5.3 lamp base

3.13 Applications

Masterline ES

The wide range of Philips dichroic lamps can be used for accent lighting, general lighting (downlights) and task lighting in:
- shops, stores
- hotels, restaurants, bars
- museums and exhibitions
- homes

Features and Benefits

Benefits
- All benefits of Halogen lamps
- More light
- Pure, bright light
- Excellent colour rendering
- Longer lamp life
- Constant light output over life
- No adverse heating of object

Features
- • higher luminous efficacy
- • colour temp. +/-300°K
- • Run 100
- • 4000/5000 burning hours
- • no bulb blackening
- • Almost no UV output
- • cool beam to be fit

Applications Brillantline

Dichroic reflector lamps are ideally suitable for accent, task and decorative lighting in homes, shops, and hotels/restaurants.

Applications Accentline

Dichroic reflector lamps are ideally suitable for accent, task and decorative lighting in homes, shops, and hotels/restaurants.

3.13 Specific benefits ES:

Even less UV-output because of ES burner

No metallic base only glass in GU5.3 => better fit in luminaire

Applications Masterline ES

The wide range of Philips dichroic lamps can be used for accent lighting, general lighting (downlights) and task lighting in:
- shops, stores
- hotels, restaurants, bars
- museums and exhibitions
- homes

Applications Brillantline

Dichroic reflector lamps are ideally suitable for accent, task and decorative lighting in homes, shops, and hotels/restaurants.

Applications Accentline

Dichroic reflector lamps are ideally suitable for accent, task and decorative lighting in homes, shops, and hotels/restaurants.
### 3.2.2 Applicable IEC standards

IEC 61, IEC 357

### 3.2.3 Position of components

(lamp construction)

Figure 3.12 illustrates the typical lamp construction of the MASTERLINE ES Dichroic lamp.

### 3.2.4 Maximum permissible temperatures

The maximum permissible temperatures for the different lamp parts are as follows:

- Reflector: 250°C
- Pinch: 350°C
- Reflector rim: 240°C
- Contacts: 300°C

### 3.2.5 PET values

Refer chapter 1.3 in this brochure.

### 3.2.6 Electrical and lighting data

#### MASTERLINE ES

<table>
<thead>
<tr>
<th>Type</th>
<th>Voltage (V)</th>
<th>Wattage (W)</th>
<th>Beam angle degs</th>
<th>Cap/base</th>
<th>Luminous intensity (cd)</th>
<th>Average life (h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>14578</td>
<td>12</td>
<td>20</td>
<td>8</td>
<td>GU5.3</td>
<td>6500</td>
<td>5000</td>
</tr>
<tr>
<td>14579</td>
<td>12</td>
<td>20</td>
<td>36</td>
<td>GU5.3</td>
<td>1000</td>
<td>5000</td>
</tr>
<tr>
<td>14580</td>
<td>12</td>
<td>30</td>
<td>8</td>
<td>GU5.3</td>
<td>11000</td>
<td>5000</td>
</tr>
<tr>
<td>14581</td>
<td>12</td>
<td>30</td>
<td>24</td>
<td>GU5.3</td>
<td>3350</td>
<td>5000</td>
</tr>
<tr>
<td>14582</td>
<td>12</td>
<td>30</td>
<td>36</td>
<td>GU5.3</td>
<td>1600</td>
<td>5000</td>
</tr>
<tr>
<td>14583</td>
<td>12</td>
<td>30</td>
<td>60</td>
<td>GU5.3</td>
<td>750</td>
<td>5000</td>
</tr>
<tr>
<td>14584</td>
<td>12</td>
<td>35</td>
<td>8</td>
<td>GU5.3</td>
<td>14000</td>
<td>5000</td>
</tr>
<tr>
<td>14585</td>
<td>12</td>
<td>35</td>
<td>24</td>
<td>GU5.3</td>
<td>4400</td>
<td>5000</td>
</tr>
<tr>
<td>14586</td>
<td>12</td>
<td>35</td>
<td>36</td>
<td>GU5.3</td>
<td>2200</td>
<td>5000</td>
</tr>
<tr>
<td>14587</td>
<td>12</td>
<td>35</td>
<td>60</td>
<td>GU5.3</td>
<td>1050</td>
<td>5000</td>
</tr>
<tr>
<td>14588</td>
<td>12</td>
<td>45</td>
<td>8</td>
<td>GU5.3</td>
<td>16000</td>
<td>5000</td>
</tr>
<tr>
<td>14589</td>
<td>12</td>
<td>45</td>
<td>24</td>
<td>GU5.3</td>
<td>5450</td>
<td>5000</td>
</tr>
<tr>
<td>14590</td>
<td>12</td>
<td>45</td>
<td>36</td>
<td>GU5.3</td>
<td>2850</td>
<td>5000</td>
</tr>
<tr>
<td>14591</td>
<td>12</td>
<td>45</td>
<td>60</td>
<td>GU5.3</td>
<td>1300</td>
<td>5000</td>
</tr>
</tbody>
</table>

Notes:
1. All types designed for 12 V power supply.
2. All lamp types have GU/GZ4 caps standardised in accordance with IEC 61-1.
3. Numerical technical data are average values and do not refer to single lamps.
4. Manufacturer reserves the right to change specifications without prior notice.
5. 30W version will be available per 01-01-2000

#### Dichroic standard (50 mms. diameter)

<table>
<thead>
<tr>
<th>Type</th>
<th>Voltage (V)</th>
<th>Wattage (W)</th>
<th>Half-intensity Beam angle degs</th>
<th>Base</th>
<th>Luminous intensity (cd)</th>
<th>Average life (h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>14592</td>
<td>12</td>
<td>20</td>
<td>10</td>
<td>GU5.3</td>
<td>1300</td>
<td>4000</td>
</tr>
<tr>
<td>14593</td>
<td>12</td>
<td>20</td>
<td>24</td>
<td>GU5.3</td>
<td>1700</td>
<td>4000</td>
</tr>
<tr>
<td>14594</td>
<td>12</td>
<td>20</td>
<td>36</td>
<td>GU5.3</td>
<td>750</td>
<td>4000</td>
</tr>
<tr>
<td>14595</td>
<td>12</td>
<td>35</td>
<td>10</td>
<td>GU5.3</td>
<td>11000</td>
<td>4000</td>
</tr>
<tr>
<td>14596</td>
<td>12</td>
<td>35</td>
<td>24</td>
<td>GU5.3</td>
<td>3100</td>
<td>4000</td>
</tr>
<tr>
<td>14597</td>
<td>12</td>
<td>35</td>
<td>36</td>
<td>GU5.3</td>
<td>1300</td>
<td>4000</td>
</tr>
<tr>
<td>14598</td>
<td>12</td>
<td>35</td>
<td>60</td>
<td>GU5.3</td>
<td>700</td>
<td>4000</td>
</tr>
<tr>
<td>14599</td>
<td>12</td>
<td>50</td>
<td>10</td>
<td>GU5.3</td>
<td>15000</td>
<td>4000</td>
</tr>
<tr>
<td>14600</td>
<td>12</td>
<td>50</td>
<td>24</td>
<td>GU5.3</td>
<td>4400</td>
<td>4000</td>
</tr>
<tr>
<td>14601</td>
<td>12</td>
<td>50</td>
<td>36</td>
<td>GU5.3</td>
<td>2200</td>
<td>4000</td>
</tr>
<tr>
<td>14602</td>
<td>12</td>
<td>50</td>
<td>60</td>
<td>GU5.3</td>
<td>1100</td>
<td>4000</td>
</tr>
</tbody>
</table>

Notes:
1. All lamp types are designed for 12 V power supply.
2. All lamp types have GU5.3 caps standardised in accordance with IEC 61-1.

#### MASTERline Plus/STANDARDline and equivalents from competition

<table>
<thead>
<tr>
<th>Type</th>
<th>Voltage (V)</th>
<th>Wattage (W)</th>
<th>Beam angle degs</th>
<th>Base</th>
<th>Luminous intensity (cd)</th>
<th>Average life (h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>14611</td>
<td>12</td>
<td>20</td>
<td>10</td>
<td>GU5.3</td>
<td>1100</td>
<td>4000</td>
</tr>
<tr>
<td>14612</td>
<td>12</td>
<td>20</td>
<td>24</td>
<td>GU5.3</td>
<td>1700</td>
<td>4000</td>
</tr>
<tr>
<td>14613</td>
<td>12</td>
<td>20</td>
<td>36</td>
<td>GU5.3</td>
<td>750</td>
<td>4000</td>
</tr>
<tr>
<td>14614</td>
<td>12</td>
<td>35</td>
<td>10</td>
<td>GU5.3</td>
<td>11000</td>
<td>4000</td>
</tr>
<tr>
<td>14615</td>
<td>12</td>
<td>35</td>
<td>24</td>
<td>GU5.3</td>
<td>3100</td>
<td>4000</td>
</tr>
<tr>
<td>14616</td>
<td>12</td>
<td>35</td>
<td>36</td>
<td>GU5.3</td>
<td>1300</td>
<td>4000</td>
</tr>
<tr>
<td>14617</td>
<td>12</td>
<td>35</td>
<td>60</td>
<td>GU5.3</td>
<td>700</td>
<td>4000</td>
</tr>
<tr>
<td>14618</td>
<td>12</td>
<td>50</td>
<td>10</td>
<td>GU5.3</td>
<td>15000</td>
<td>4000</td>
</tr>
<tr>
<td>14619</td>
<td>12</td>
<td>50</td>
<td>24</td>
<td>GU5.3</td>
<td>4400</td>
<td>4000</td>
</tr>
<tr>
<td>14620</td>
<td>12</td>
<td>50</td>
<td>36</td>
<td>GU5.3</td>
<td>2200</td>
<td>4000</td>
</tr>
<tr>
<td>14621</td>
<td>12</td>
<td>50</td>
<td>60</td>
<td>GU5.3</td>
<td>1100</td>
<td>4000</td>
</tr>
</tbody>
</table>

Notes:
1. MASTERline Plus/STANDARDline and equivalents from competition. STANDARDline as per today.
3.2.7 Lamp dimensions

Figure 3.13

3.2.8 Photometric data

See figures 3.19 to 3.20 on the next pages.

3.2.9 Spectral distribution

The comparison of the spectral distribution of the STANDARDline PLUS and ES are given in the diagram in figure 3.17

Figure 3.17

The typical absolute Irradiance measurements of Masterline ES lamp of 12 V 45 W is shown in the curve in figure 3.18

Figure 3.18

3.2.10 Lamp disposal

Refer chapter 1.6 in this brochure.

3.2.11 Lifetime performance

The typical life expectancy curves for Philips Dichroic lamps are given in figure 3.21.
3.2.12 Influence of lamp voltage on lamp characteristics

The effect of lamp voltage on the lamp characteristics such as lamp power, colour temperature, luminous flux and average lamp life are given in the graph below. It must be noted that these graphs give typical relationships applicable for low voltage Halogen lamps and are not for any specific lamp type.

3.2.13 Dimming

All Philips Halogen dichroic lamps can be dimmed by using appropriate dimming devices, see also chapter 1.4.

3.2.14 Burning position

All Philips low voltage Dichroic lamps have a universal burning position.
3.3 - Low-voltage dichroic reflector Diamondline Pro

3.3.1 Introduction and description

Halogen reflector lamps with a special "cool daylight" colour impression. This lamp further consists of an extra-low-voltage halogen burner optically positioned in a glass reflector which has a special heat-transmitting and light-reflecting dichroic coating. This combination of the burner and the reflector results in a high-intensity beam with a clearly defined beam spread. The dichroic cool-beam reflector coating transmits the infrared radiation (heat) backwards through the glass and reflects the visible radiation (light) forward, thus resulting in a cool daylight beam impression.

Features:
The most important features of the Diamondline Pro lamp range are:
- a high-pressure Xenon gas filled burner
- axial filament optimally aligned in a reflector with hard dichroic coating providing constant high quality, durability, maintenance over lifetime and aesthetics.
- with front glass
- average lifetime of 4000 hrs.
- range of 35 W and 50 W 50 mm types.
- colour temperature of 4100 K
- excellent colour rendering (Ra = 100)
- GU3 3 base: extra retention in luminaire
- universal burning position
- dimmable

Applications:
Diamondline Pro lamps are ideally suitable for accent, task and decorative lighting in jewelry shops (diamonds, silver, gold, crystal).

3.3.2 Applicable IEC standards

Diamondline Pro is produced according to IEC 357.

3.3.3 Maximum permissible temperatures

- Reflector : 250°C
- Pinch : 250°C
- Reflector mm : 240°C
- Contacts : 300°C

3.3.4 PET values

Refer to chapter 1.3

3.3.5 Lamp dimensions

![Lamp dimensions diagram](image)

3.3.6 Electrical and lighting data

<table>
<thead>
<tr>
<th>Type</th>
<th>W</th>
<th>Beam angle</th>
<th>Cap/base code</th>
<th>ANSI code</th>
<th>Max. luminous intensity</th>
<th>Lamp life</th>
</tr>
</thead>
<tbody>
<tr>
<td>1656</td>
<td>12V 35W</td>
<td>10°</td>
<td>GUS.3</td>
<td>FRB</td>
<td>5400</td>
<td>4000</td>
</tr>
<tr>
<td>1658</td>
<td>12V 35W</td>
<td>24°</td>
<td>GUS.3</td>
<td>FRA</td>
<td>1700</td>
<td>4000</td>
</tr>
<tr>
<td>1659</td>
<td>12V 35W</td>
<td>36°</td>
<td>GUS.3</td>
<td>FMB</td>
<td>1000</td>
<td>4000</td>
</tr>
<tr>
<td>1668</td>
<td>12V 50W</td>
<td>10°</td>
<td>GUS.3</td>
<td>EXT</td>
<td>6400</td>
<td>4000</td>
</tr>
<tr>
<td>1670</td>
<td>12V 50W</td>
<td>24°</td>
<td>GUS.3</td>
<td>EXZ</td>
<td>2700</td>
<td>4000</td>
</tr>
<tr>
<td>1671</td>
<td>12V 50W</td>
<td>36°</td>
<td>GUS.3</td>
<td>EXN</td>
<td>1200</td>
<td>4000</td>
</tr>
</tbody>
</table>

3.3.7 Photometric data

Refer to page 59.

3.3.8 Lamp disposal

Refer to chapter 1.6 in this brochure.

3.3.9 Lifetime performance

Typical life expectancy curves for Diamondline Pro are given below.
### 3.4 - Aluminium reflector lamps

#### 3.4.1 Introduction and description

Closed reflector lamps consisting of a Halogen extra low voltage capsule precisely positioned (photo-electrically) in a parabolic aluminium reflector. The lamps have an integrated front glass cover which is flat and may be clear or frosted.

#### Features and Benefits

<table>
<thead>
<tr>
<th>Benefits</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>All benefits of Halogen lamps</td>
<td>• higher luminous efficacy</td>
</tr>
<tr>
<td>Pure, bright light</td>
<td>• colour temp. 3000° K</td>
</tr>
<tr>
<td>Excellent colour rendering</td>
<td>• Ran100</td>
</tr>
<tr>
<td>Longer lamp life</td>
<td>• 2000+4000 burning hours</td>
</tr>
<tr>
<td>Constant light output</td>
<td>• no bulb blackening</td>
</tr>
<tr>
<td>over life</td>
<td>• high intensities</td>
</tr>
<tr>
<td>High accent factors</td>
<td>• flat, clear/frosted</td>
</tr>
<tr>
<td>No soiling of reflector</td>
<td>• front glass</td>
</tr>
<tr>
<td>No damage/touching of the burner</td>
<td>• almost no UV output</td>
</tr>
<tr>
<td>No colour-fading</td>
<td>• almost no colour-fading</td>
</tr>
<tr>
<td>Quick, simple, secure installation</td>
<td>• B15d bayonet lamp cap</td>
</tr>
<tr>
<td>Longer luminaire/holder life</td>
<td>• less heat at the back of lamp</td>
</tr>
<tr>
<td>No undesirable light patches on ceiling</td>
<td>• no light at the back of the lamp</td>
</tr>
<tr>
<td>No undue heating of ceiling</td>
<td>• very low heat emitted at the back of the lamp</td>
</tr>
</tbody>
</table>

#### 3.4.2 Applicable IEC standards

The applicable IEC standards for Aluminium reflector lamps are:

IEC 61, IEC 357

#### 3.4.3 Maximum permissible temperatures

The maximum permissible temperatures for different parts of the lamp are as given below:

- **Reflector**: 450° C
- **Front glass**: 250° C
- **Pinch**: 350° C
- **Contacts**: 220° C

#### 3.4.4 PET values

Refer chapter 1.3 in this brochure.

#### Spectral distribution

The typical spectral distribution of an Aluminium reflector lamp is given in figure 3.22 along with that of a typical Dichroic reflector lamp for comparison purposes.

The spectral irradiance distribution for a 6 V 35 W lamp with 14 beam spread is given in figure 3.25 below.

#### 3.4.5 Electrical and lighting data

### Aluminium reflector lamps with clear front glass

<table>
<thead>
<tr>
<th>Type</th>
<th>Voltage (V)</th>
<th>Wattage (W)</th>
<th>Beam angle (°)</th>
<th>Lamp diameter (mm)</th>
<th>Luminous intensity (cd)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6423</td>
<td>6</td>
<td>15</td>
<td>4</td>
<td>56</td>
<td>12000</td>
</tr>
<tr>
<td>6424</td>
<td>6</td>
<td>15</td>
<td>6</td>
<td>37</td>
<td>6200</td>
</tr>
<tr>
<td>6425</td>
<td>6</td>
<td>15</td>
<td>14</td>
<td>37</td>
<td>1400</td>
</tr>
<tr>
<td>6433</td>
<td>12</td>
<td>20</td>
<td>6</td>
<td>37</td>
<td>7000</td>
</tr>
<tr>
<td>6434</td>
<td>12</td>
<td>20</td>
<td>18</td>
<td>37</td>
<td>1300</td>
</tr>
<tr>
<td>6435</td>
<td>12</td>
<td>20</td>
<td>32</td>
<td>37</td>
<td>7000</td>
</tr>
<tr>
<td>6439</td>
<td>12</td>
<td>35</td>
<td>6</td>
<td>37</td>
<td>18000</td>
</tr>
<tr>
<td>6438</td>
<td>12</td>
<td>35</td>
<td>10</td>
<td>37</td>
<td>21000</td>
</tr>
<tr>
<td>6437</td>
<td>12</td>
<td>35</td>
<td>25</td>
<td>37</td>
<td>13000</td>
</tr>
</tbody>
</table>

### Aluminium reflector lamps with frosted front glass

<table>
<thead>
<tr>
<th>Type</th>
<th>Voltage (V)</th>
<th>Wattage (W)</th>
<th>Beam angle (°)</th>
<th>Lamp diameter (mm)</th>
<th>Luminous intensity (cd)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6434/FR</td>
<td>12</td>
<td>20</td>
<td>18</td>
<td>37</td>
<td>1000</td>
</tr>
<tr>
<td>6435/FR</td>
<td>12</td>
<td>20</td>
<td>32</td>
<td>37</td>
<td>400</td>
</tr>
<tr>
<td>6439/FR</td>
<td>12</td>
<td>35</td>
<td>25</td>
<td>37</td>
<td>1900</td>
</tr>
</tbody>
</table>

#### Note for lamps with clear or frosted front glass:

All lamps have B15d caps in accordance with IEC 357.

### 3.4.6 Lamp dimensions

- **6423**: Ø 37 ± 1
- **6424**: Ø 54 ± 2

### 3.4.7 Photometric data

See figure 3.27 and 3.28.
3.4.11 Dimming
All Philips Halogen Aluminium reflector lamps can be dimmed by using the appropriate dimming devices, see also chapter 1.4.

3.4.12 Burning position
All Philips low voltage Aluminium reflector lamps have a universal burning position.

3.4.13 Minimum required lamp space
The minimum required lamp space in accordance with IEC 612-2 standard for B15d holder is shown in figure 3.35.
3.5 - Aluminium reflector lamps – ALR 111

3.5.1 Introduction and description

This low voltage halogen reflector lamp has a high purity Aluminium reflector. A metal cap shields the filament to reduce glare, when looking in the direction of the light source. The cap also prevents direct light from mixing with reflected light, resulting in a smooth beam with very sharp contrast.

**Features and Benefits**

<table>
<thead>
<tr>
<th>Benefits</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>Highly attractive design</td>
<td>Metal Cap on burner</td>
</tr>
<tr>
<td>Homogenous beam</td>
<td>G53 socket with screw or tab terminals</td>
</tr>
<tr>
<td>Fast and easy installation</td>
<td>UV block</td>
</tr>
<tr>
<td>Comfortable glare free light</td>
<td>average lamp life of 3000 hours</td>
</tr>
<tr>
<td></td>
<td>low pressure technology</td>
</tr>
<tr>
<td></td>
<td>dimmable</td>
</tr>
<tr>
<td></td>
<td>color temp. 3000 K</td>
</tr>
<tr>
<td></td>
<td>excellent colour rendering (Ra = 100)</td>
</tr>
</tbody>
</table>

**Applications**

ALUline lamps are often applied in technically styled fixtures for accent lighting. Typical applications include:
- shop lighting
- exhibitions and art galleries
- museum lighting

3.5.2 Applicable IEC standards

Data to be confirmed.

3.5.3 Maximum permissible temperatures

Max. pinch temperatures for the ALR 111 is 350 °C.

3.5.4 PET values

Refer chapter 1.3 of this brochure.

3.5.5 Lamp dimensions

Refer chapter 1.3 of this brochure.

3.5.6 Electrical and lighting data

<table>
<thead>
<tr>
<th>Type</th>
<th>Average lamp life (h)</th>
<th>Maximum luminous intensity (cd)</th>
<th>Lamp power (W)</th>
<th>Colour temperature (K)</th>
<th>Beam angle deg</th>
<th>EAN code</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPOT</td>
<td>1000</td>
<td>10000</td>
<td>75</td>
<td>3000</td>
<td>25</td>
<td>426529</td>
</tr>
<tr>
<td>ALU111MM</td>
<td>1000</td>
<td>10000</td>
<td>75</td>
<td>3000</td>
<td>25</td>
<td>426529</td>
</tr>
<tr>
<td>FLOOD</td>
<td>1000</td>
<td>10000</td>
<td>75</td>
<td>3000</td>
<td>25</td>
<td>426987</td>
</tr>
<tr>
<td>ALU111MM</td>
<td>1000</td>
<td>10000</td>
<td>75</td>
<td>3000</td>
<td>25</td>
<td>427045</td>
</tr>
<tr>
<td>ALU111MM</td>
<td>1000</td>
<td>10000</td>
<td>75</td>
<td>3000</td>
<td>25</td>
<td>427045</td>
</tr>
</tbody>
</table>

Notes: The lamp can be electrically connected through:
- a dedicated lamp socket (known as “G53”)
- eyelet wire terminals matching the M4 screw terminals on the lamp
- receptacle wire terminals (e.g. AMP “Fast-on”) matching the 6.3 x 0.8 mm tabs on the lamp

3.5.7 Photometric data

Refer chapter 1.3 of this brochure.
3.5.8 Lamp disposal

Refer to chapter 1.6 in this brochure.

3.5.9 Lifetime performance

Typical life expectancy curves for Aluminium reflector lamps are given below:

![Lamp disposal diagram](image)

![Lifetime performance curve](image)