



Market Overview on Directional Mains-Voltage Lamps

*related to stage 3 of Commission
Regulation (EU) No 1194/2012*

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Summary and conclusions

Commission Regulation (EU) No 1194/2012 ¹ stipulates that:

“Stage 3 for mains-voltage filament lamps shall apply only if no later than 30 September 2015, evidence is produced by the Commission through a detailed market assessment and communicated to the Consultation Forum that there are mains-voltage lamps on the market that are:

- compliant with the maximum EEI requirement in stage 3;*
- affordable in terms of not entailing excessive costs for the majority of end-users;*
- broadly equivalent in terms of consumer-relevant functionality parameters to mains-voltage filament lamps available on the date of entry into force of this Regulation, including in terms of luminous fluxes spanning the full range of reference luminous fluxes listed in Table 6;*
- compatible with equipment designed for installation between the mains and filament lamps available on the date of entry into force of this Regulation according to state-of-the-art requirements for compatibility”.*

This document is the technical market overview to assess the fulfilment of all four above mentioned criteria.

According to Annex III, point 1.1, table 2 of Regulation 1194/2012, starting from stage 3 (1 September 2016), directional mains-voltage filament lamps (including halogen lamps) shall have a maximum Energy Efficiency Index (EEI) of 0.95 ², and a maximum EEI of 0.20 for other lamps (including LED lamps).

The ‘*date of entry into force of this Regulation*’, used as a reference for the availability of lamps and equipment is January 2013 ³.

The ‘*luminous fluxes spanning the full range of reference luminous fluxes listed in Table 6*’ implies a range from 90 to 1000 lm, measured in a 90° cone.

‘*Mains-voltage*’ has been taken as 230V(±10%) (AC, 50 Hz) ⁴.

The study team gathered data from manufacturers’ catalogues and on-line sales’ sites on 625 directional mains-voltage lamps (131 filament lamps and 494 LED lamps).

¹ Commission Regulation (EU) No 1194/2012 of 12 December 2012 implementing Directive 2005/32/EC of the European Parliament and of the Council with regard to ecodesign requirements directional lamps, light emitting diode lamps and related equipment, Official Journal of the European Union, L342/1, 14.12.2012, available as <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2012:342:0001:0022:EN:PDF>

² This corresponds to an energy label class B (or better) according to Regulation (EU) No 874/2012.

³ This date is defined in article 8 of the regulation as: ‘*the twentieth day following that of its publication in the Official Journal of the European Union*’. That publication is dated 14 December 2012.

⁴ According to CENELEC Harmonisation Document HD 472 S1:1988

The 'consumer-relevant functionality parameters' considered for the 'broadly equivalent' check included: cap-type, lamp shape and dimensions, beam angle, luminous flux, voltage, power, correlated colour temperature (CCT), colour rendering index (CRI), colour consistency, lamp weight, dimmability, power factor, starting and warmup times, lifetime, switching withstand, lumen maintenance and equivalent incandescent power. In addition data on luminous efficacy and energy efficiency index (EEI) were gathered or derived, and price information was collected.

The research was performed in the first quarter of 2015. As regards filament lamps, the gathered data can be considered representative also for the availability of these lamps in January 2013.

The data were inserted in an Excel file and then ordered, according to cap type, lamp shape, beam angle, and luminous flux. Extracts from the database are included in this report. Figure 1 provides the distribution of the lamps over cap-types, shapes and beam angles.

The following conclusions can be drawn from the study:

- No MV halogen lamps were found on the market, which fulfil the $EEI < 0.95$ stage 3 criterion of Regulation 1194/2012.
- Seventy percent of the LED lamps on the market already meet the $EEI < 0.2$ stage 3 criterion of Regulation 1194/2012. This situation is expected to further improve towards September 2016.
- For more than 90% of the directional mains-voltage filament lamps with luminous flux in a 90° cone between 90 and 1000 lm, equivalent LED retrofit lamps are available. As regards number of models, lumen levels, beam angles, and colour temperatures, the variety of these LED lamps is larger than the variety for the filament lamps, in particular for lamps with GU10 cap⁵. More than 99% of these LED lamps has a declared $CRI \geq 80$, and models with $CRI > 90$ are also available. In general the declared lamp characteristics meet the functionality requirements of Regulation 1194/2012 table 5⁶.
- For less than 10% of the directional mains-voltage filament lamps in the database, there is matching cap and acceptable form factor but consumers may have to compromise on e.g. the beam angle or use a realistic alternative in the sense of a bigger or smaller form factor or use an adapter for the cap. These lamps, listed hereafter and indicated by a yellow colour in Figure 1, are considered 'broadly equivalent':
 - For E14/R39 filament lamps in the database (4 models, 3.1% of the database) there is a match in cap and shape with compliant LED lamps, but the beam angles of the LED E14/R39 reflector lamps, that are explicitly sold by vendors as substitute to the filament lamps, are wider ($110-120^\circ$). Consumers will have to accept the compromise on the beam angle or, space inside the luminaire permitting, use an LED-lamp with the smaller beam angle but a larger form factor (E14/R50).

⁵ Lamps with GU10 cap account for 56% of the models.

⁶ These requirements regard lamp survival factor, lumen maintenance, switching withstand, starting- and warmup-time, premature failure rate, colour rendering, colour consistency and power factor.

-
- There is one G9/MR16 filament lamp in the database (0.8% of the database) that matches with the G9 cap of LED-lamps, but the beam angle of the LED reflector lamps is wider (>120° instead of 40°) and the form factor of these LED-substitutes is smaller. The latter means that they will fit the luminaire, but the aesthetics will be different from the filament lamp. Consumers can accept the compromise or, alternatively, use an adapter from G9 to GU10.
 - For R63, R80, R90 and PAR25 filament lamps with E27 cap there are Stage 3 compliant LED retrofit lamps available, but the number of substitutes is limited and not necessarily the exactly same beam angle or colour temperature can be found. For uncompromising consumers there are realistic substitution options, e.g. by using adapters or lamps with slightly different form factor.
- As regards the affordability of the directional LED retrofit lamps for the '*majority of the end-users*', a survey of prices of directional LED lamps on on-line sales' sites reveals that LED prices are quickly coming down and that the gap between prices for halogen lamps and comparable LED lamps is narrowing. This situation will further improve up to September 2016. Considering efficacy differences between halogen lamps and LED lamps and current electricity prices, pay-back times for an investment in LED lamps of around 1 year are feasible.
 - Dimmable LED lamps are available, and in principle they will work on the dimmers that are declared as compatible by the lamp manufacturer.

Hence, this technical market overview shows that all four questions related to the market assessment for stage 3 can be answered positive ('yes'). In conclusion, this market overview presents the evidence that there are mains-voltage lamps on the market fulfilling all the necessary conditions laid out in Regulation 1194/2012 for stage 3 to apply to mains-voltage filament lamps.

The results of the study report were presented to the Ecodesign Consultation Forum on 25 June 2015 in Brussels. Technical questions and topics raised by stakeholders, summarised in Annex B, led to some extra clarifications in the report.

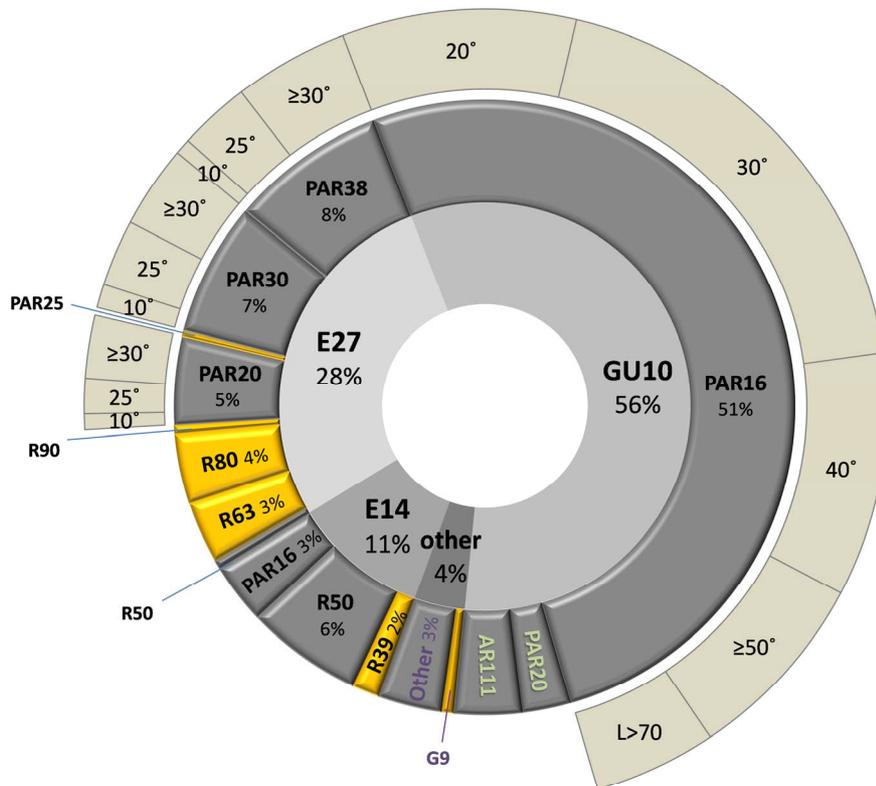


Figure 1. Survey of the models in the database of mains voltage directional lamps. The inner ring gives the % of database-models with the indicated cap type. The middle ring gives the % of models with the indicated lamp shape. The sizes of the segments of the outer ring indicate the portion of models with the indicated beam angle.

The yellow colour indicates availability of LED retrofit lamps with the same cap and fitting shape, but where a minor compromise on beam angle should be accepted and/or where there is a possibility to use alternative LED solutions in the same socket, e.g. using smaller form factors or adapters.

1. Introduction

This note has been prepared in the context of the Lot 8/9/19 ecodesign preparatory study on light sources. According to the assignment, one of the tasks of this study is to perform the formal review of regulation 1194/2012. In particular a detailed market assessment is requested for directional mains voltage filament lamps, in relation to 1194/2012 stage 3.

According to annex III of 1194/2012:

The maximum EEI of directional lamps is indicated in Table 2.

Table 2

Application date	Maximum energy efficiency index (EEI)				
	Mains-voltage filament lamps	Other filament lamps	High-intensity discharge lamps	Other lamps	
Stage 1	If $\Phi_{\text{use}} > 450$ lm: 1,75	If $\Phi_{\text{use}} \leq 450$ lm: 1,20 If $\Phi_{\text{use}} > 450$ lm: 0,95	0,50	0,50	Stage 1: Sept. 2013
Maximum energy efficiency index (EEI)					
Application date	Mains-voltage filament lamps	Other filament lamps	High-intensity discharge lamps	Other lamps	Stage 2: Sept. 2014 Stage 3: Sept. 2016
Stage 2	1,75	0,95	0,50	0,50	
Stage 3	0,95	0,95	0,36	0,20	

"Stage 3 for mains-voltage filament lamps shall apply only if no later than 30 September 2015, evidence is produced by the Commission through a detailed market assessment and communicated to the Consultation Forum that there are mains-voltage lamps on the market that are:

- compliant with the maximum EEI requirement in stage 3;
- affordable in terms of not entailing excessive costs for the majority of end-users;
- broadly equivalent in terms of consumer-relevant functionality parameters to mains-voltage filament lamps available on the date of entry into force of this Regulation, including in terms of luminous fluxes spanning the full range of reference luminous fluxes listed in Table 6;
- compatible with equipment designed for installation between the mains and filament lamps available on the date of entry into force of this Regulation according to state-of-the-art requirements for compatibility".

Stage 3 of 1194/2012 enters into force in September 2016. By that time directional mains voltage filament lamps are required to have an energy efficiency index (EEI) less than 0.95, which corresponds to label class B or better of regulation 874/2012. This requirement will only apply under the conditions described under table 2 in annex III of 1194/2012 (see text above). The following is observed:

- The only conditional value is the stage 3 EEI<0.95 for mains voltage filament lamps. For 'other filament lamps' (low voltage), for 'HID lamps', and for 'other lamps' (including LEDs and fluorescent lamps) the EEI limits are NOT conditional.
- To be suitable, amongst others, the lamps on the market should be 'broadly equivalent' with MV-filament lamps available in January 2013⁷.
- The condition is limited to the luminous fluxes of table 6 of the regulation, which gives a range from 90 to 1000 lm (measured in a 90° cone).

The condition is fulfilled, and the EEI<0.95 can be applied to MV filament lamps from September 2016, if:

- there are (or will be by September 2016) suitable MV filament lamps on the market (mainly halogen lamps, with EEI<0.95),

OR

- there are (or will be by September 2016) suitable MV non-filament lamps on the market (probably LED lamps, with then EEI<0.20).

where suitable means that the conditions listed in 1194/2012 are fulfilled: EEI limit respected, no excessive costs, 'broadly equivalent' with existing MV filament lamps, compatible with existing state-of-the-art control gears and control devices.

2. Methodology for the market study

The market study for mains voltage (MV) directional lamps (DLS) consists in an analysis of the types of DLS MV filament lamps that currently exist on the market and of their 'broadly equivalent' non-filament substitutes. See chapter 0 and introductory remarks below.

Data on DLS MV lamps were gathered from manufacturers' catalogues and from on-line sales' sites. These data were inserted in an Excel file, that is separately available, and then ordered to facilitate equivalence checks. From the experience during this data research, the following points are highlighted:

1. Regulation 1194/2012/EU defines that: "*directional lamp means a lamp having at least 80% light output within a solid angle of n sr (corresponding to a cone with angle of 120°)*". During the data research this definition gave some problems, because the catalogue data do not always allow to easily establish if the light source is directional or non-directional. For light sources with beam angles up to 90°, covering all reference filament lamps in the database, it can safely be assumed that they are 'directional' in the sense of the regulation.

⁷ The date of entry into force is defined in article 8 of the regulation as: '*the twentieth day following that of its publication in the Official Journal of the European Union*'. That publication is dated 14 December 2012.

Light sources with higher beam angles (typically 110° or 120°) have anyway been included in the database, and they are all LED lamps.

2. Regulation 1194/2012/EU prescribes that the luminous flux shall be measured in a 120° cone for light sources with beam angle $\geq 90^\circ$, and in a 90° cone for light sources with beam angle $< 90^\circ$. The luminous flux is important because the calculation of the Energy Efficiency Index (EEI) directly depends on it. The study team assumed that the luminous flux data declared in the lamp documentation are compliant with the definition of the regulation.
3. Regulation 1194/2012/EU, in table 1, foresees a correction factor of 0.8 for the rated power if the light source has an anti-glare shield⁸. Some lamps are declared as 'frosted' or 'coated', but considering that the definition '*does not include surface coating of the light source in the directional lamp*', this has NOT been interpreted as 'anti-glare shield' and consequently the 0.8 factor has NOT been applied⁹.
4. The research entails verifying if there are suitable LED lamps that can replace existing directional mains voltage halogen lamps. This equivalence check involves (more or less in order of importance):
 - Cap type: the first approach is to verify if retrofit lamps with the same cap type exist, so lamps in the database have primarily been ordered per cap type. Where this approach is not successful, the possibility is examined to use retrofit lamps with another cap in combination with a cap-adapter. Where applicable this is discussed for the specific filament lamp type in chapter 0. It has been assumed that a halogen lamp with cap GZ10 can be substituted by a LED lamp with cap GU10.
 - Lamp shape and dimensions: this is the second criterion for ordering of the lamps. Whether or not a lamp with different shape and dimensions can be used as a substitute, essentially depends on the space available in the luminaire, which is unknown in this study. The main approach is that only lamps of the same shape can be certainly equivalent, allowing small variations in dimensions, in particular as regards the length of the lamp. Where this approach is not successful, the possibility is examined to use retrofit lamps with a slightly different shape. Where applicable this is discussed for the specific filament lamp type in chapter 0.
In particular for lamps with GU10/GZ10 cap, there is a lot of confusion on the denomination of the lamp shape. For this cap type, ES50-, MR16- and PAR16-denominations seem to indicate the same lamp shape. Where the lamp shape is not specified in the documentation, lamp dimensions (diameter and length) have been considered.

⁸ 'anti-glare shield' means a mechanical or optical reflective or non-reflective impervious baffle designed to block direct visible radiation emitted from the light source of a directional lamp, in order to avoid temporary partial blindness (disability glare) if viewed directly by an observer. It does not include surface coating of the light source in the directional lamp;

⁹ In addition it is not always clear from the documentation if a lamp is 'frosted' or not, so application of the factor might lead to 'false' differences between the lamps.

Also note that regulation 874/2012 (energy labelling) does NOT foresee a factor for anti-glare shield.

- Beam angle: a candidate substitute should have a beam angle that is similar to the one of the lamp being substituted. This is the third ordering criterion for the lamps in the Excel file.
- Luminous flux: this is used as the fourth ordering criterion for the lamps. As an indicator for the quantity of light emitted, the flux should at least be similar for the original filament lamp and its LED substitute. There is some elasticity in this however, also considering that 'broadly equivalent' retrofit lamps are sought. For LEDs the declared luminous flux is expected to be the initial one. As it will degrade with time, it could be argued that the flux for LEDs should be higher than the flux for the filament lamps that they substitute, but this is disputable ¹⁰.
- Colour of the light: correlated colour temperature (CCT), colour rendering (CRI) and colour consistency. The study is currently limited to white lights. For LED lights a wide range of white tones is available, but the Colour Rendering Index (CRI) is lower (typically 80 is declared; some lamps with CRI≥90 are available) than for halogen lamps (CRI=100). For many applications a CRI=80 is sufficient to be considered 'broadly equivalent' with CRI=100. Colour consistency for LEDs is not always specified in the data sheets.
- Dimmability: all filament lamps are dimmable. A considerable number of LED lamps is declared dimmable.
- Weight: important only for some types of luminaires where equilibrium depends on it. Not all manufacturers report the weight of their lamps. In addition some weights are inclusive packaging, while others are exclusive, or it is not further specified.
- Voltage: only lamps with 'European' mains voltage have been considered, i.e. 220-240 V. For some lamps a specific voltage is declared, e.g. 230V or 240V, and the same lamp may exist in a 230V version and a 240V version. The effect of voltage difference on power or lumen is not always clear. For many lamps a voltage range is declared, e.g. 220-240V or 100-240V, and in those cases it is most often not clear for which voltage the other declared parameters are valid, suggesting that the same lumen and power are obtained for any voltage in the range.
- Power factor: this is 1 for filament lamps. For LEDs a variety of values ranging from 0.4 to 0.9 is declared. The power factor is not always specified. Displacement factor and Distortion factor are never declared separately. The power factor has not been taken into account when judging if lamps are 'broadly equivalent'.
- Start-up and warm-up times. Declared values for LEDs are usually within 1 second, so this is not an issue for the equivalence.

¹⁰ As most LED lamps declare LLMF=0.7 at end of nominal life, it could be argued that the initial flux for LED lamps should be 30% higher than for halogen lamps. However, if the LED lamp is not dimmable, this would mean 30% more light for a considerable period of time, which seems excessive. Another consideration is that for many halogen lamps a degradation with time is also specified (LLMF = 0.75 or 0.8).

- Lifetimes, number of switching cycles and LLMF. A variety of values is reported for LEDs, but lifetimes are anyway much longer than for halogen lamps and the number of switching cycles seems to be sufficient for most applications. It is often not clear exactly what limit is indicated by the declared lifetime. Most LED manufacturers report LLMF=0.7 at end of nominal life. This value has been used as a default in those cases where it was not specified (it is a necessary input for computation of a correction factor, see point 5).
 - Prices: the reported prices are excluding VAT and shipment costs (in case of on-line sales). In principle they are for acquisition of a single lamp, i.e. without discounts for high quantity. Prices for the same lamp vary considerably from shop to shop, from website to website, and from country to country. The difference between the lowest and highest price can also be a factor 4 or 5. See further information in chapter 4.
5. The following variables are calculated in the Excel sheet based on the information provided by the manufacturers:
- Efficacy: computed for information only, as lumen divided by power. It has been assumed that declared lumen values are compliant with the definition in regulation 1194/2012 (see also point 2). Where both nominal and rated values were available for lumen and/or power, rated values have been used for efficacy computations.
 - Energy Efficiency Index: computed as indicated in annex III of regulation 1194/2012, as P_{cor}/P_{ref} , where P_{ref} is a function of the lumen. The correction factor for P_{cor} is currently always 1.0 (no external control gear, no CFL with $CRI \geq 90$, no anti-glare shield (see also earlier remarks)). Most datasheets do NOT report the EEI. The Excel sheet also indicates (yes/no) if the EEI meets the EEI criteria of regulation 1194/2012. For halogen lamps, all lamps meet the stage 2 criterion ($EEI < 1.75$) while no lamps meet the stage 3 criterion ($EEI < 0.95$ ¹¹). For LED lamps, all lamps meet the stage 2 criterion ($EEI < 0.50$) while approximately 70% already meet the stage 3 criterion ($EEI < 0.20$).
 - Energy Label Class: this is the assignment of the class (for directional lamps) according to regulation 874/2012, based on the calculated EEI. This is for information only: there is no requirement for the class in the 1194/2012 conditions. Most manufacturers declare the class for their lamps, so the computed result can be compared with the declaration. In most cases the computed and declared classes correspond¹², or they are very close (EEI near a class limit).
For halogen lamps, the $EEI < 0.95$ criterion of regulation 1194/2012 stage 3 coincides with an energy label class limit from regulation 874/2012:

¹¹ An exception are the Philips MASTER PAR20 E 20W E27 230V 10D/25D 1CT that have an $EEI = 0.78$ and energy label class B. The impression is that these are actually low voltage lamps with a voltage transformer in the foot, such that they work on 230V. Similar to the situation that was encountered during the 244/2009 stage 6 review for NDLS lamps, the production seems to have stopped, because these lamps have disappeared from recent Philips documentation and several on-line sales' sites now state them as being 'no longer available'.

¹² This is not a real check on the correctness of the declared class, because the declared lumen and power were used to compute the EEI, not the tested lumen and power.

directional lamps have to be class B or better to meet the criterion of regulation 1194/2012.

For LED lamps, the $EEI < 0.20$ criterion of regulation 1194/2012 stage 3 does NOT coincide with an energy label class limit from regulation 874/2012. As a consequence, some class A LED lamps meet the 1194-criterion and some do not: A-class lamps with EEI between 0.18 and 0.20 meet the criterion while A-class lamps with $EEI > 0.20$ do not.

- Equivalent incandescent power: for information only. This is computed following the rules of regulation 1194/2012 table 6, that specifies reference powers and fluxes in function of the lamp shape. For LED lamps the correction factor $1 + 0.5 * (1 - LLMF)$ is applied, which most often leads to 1.15 (for $LLMF = 0.7$). In case of beam angles below 20° the additional correction factor (less than 1.0) is also applied (1194/2012, tables 7 and 8). In many cases (but not always) the computed equivalent incandescent power is identical to the one declared by the manufacturer.

According to 1194/2012 an equivalent incandescent power should only be declared for lamp types listed in table 6 of the regulation and only if the lumens are not smaller than the lowest reference lumen in the table. This is not always respected. Table 6 of regulation 1194/2012 does not seem to be complete: some lamp types that exist on the market are not listed in this table, or they are only listed as low voltage lamps while mains voltage variants also exist. Some LED lamp manufacturers indicate the equivalent power of a halogen lamp.

In some cases the flux for LED lamps is far higher than the highest reference flux in table 6. In this case the regulation does not seem to be forbid to declare an equivalence, but it is not clear on which basis this should be done. For example for R50/NR50 lamps the highest reference flux in table 6 is 170 lm, while there are LED lamps of this type that have 350 lm or higher. In these cases the declared equivalent power is often (much) lower than the one computed in the Excel sheet. The reason for this has not been clarified yet.

6. The thermal effects of the substitution of a halogen lamp by a LED lamp have not been evaluated: these depend on the type of luminaire and on the burning position, which in general are unknown in this study.
7. It is not feasible, in this document, to indicate all the data sources and all the doubts or comments regarding the parameter values declared in the lamp documentation. These data can be found as comments in the cells of the Excel file that accompanies this report.

3. MV DLS equivalence data

This chapter reports extracts from the Excel file, subdivided per cap type, lamp type and sometimes per beam angle. For space reasons, not all columns of the Excel file are shown: see that file for a complete survey and for comments on the single cells. For almost all lamps the Excel file also specifies the source of information (in a comment in the first or second column; and/or in the price column)^{13 14 15}.

In all tables, lines containing data on reference filament lamps have a light-yellow background colour. Lines for LED lamps are white.

Blue text is used for lamps with beam angle 110° or 120° (where doubts can exist if these lamps are 'directional'; these are all LED lamps) In some cases red text is used to highlight values that are 'out of the ordinary' for the group of lamps considered.

The meaning of the column headers is as follows:

- Column tech: lamp technology; GLS or HL (halogen) for filament lamps, or LED
- Column L: lamp total length in mm (in principle including the cap)
- Column D: lamp maximum diameter in mm
- Column BA: beam angle in degrees
- Column LM: luminous flux in lm (in principle in 90° or 120° cone)
- Column LI: luminous intensity in cd (typically the centre beam intensity)
- Column CCT: correlated colour temperature in K
- Column DIM: 'yes' if the lamp is declared as dimmable, otherwise 'no'
- Column CRI: colour rendering index (Ra8)
- Column M: mass of the lamp in grams
- Column V: lamp voltage or voltage range in V
- Column P: lamp power in W (in principle rated value)
- Column PF: power factor
- Column LIFE: declared lamp lifetime in hours (typically L70 for LED lamps)
- Column switch: number of switches before failure occurs
- Column LLMF: lamp lumen maintenance factor (at declared lifetime)
- Column EFF: lamp efficacy in lm/W (computed, for information only)
- Column EEI: energy efficiency index (computed)
- Columns EEL: energy label class for regulation 874/2012 (for information only):
comp=computed from EEI; decl=declared by lamp supplier
- Column 1194/2012 Stg3:
for filament lamps: if EEI<0.95 'yes', otherwise 'NO'
for LED lamps: if EEI<0.20 'yes', otherwise 'NO'
- Columns Peq: equivalent incandescent power:
comp=computed; decl=declared by lamp supplier
- Column €: price in euros (excluding VAT)

For copyright reasons, the document cannot display images of the lamp types. Instead, links to websites have been provided where the discussed lamps are displayed¹⁵.

¹³ The data source for Philips lamps is not specified, but is: <http://www.ecat.lighting.philips.com>.

¹⁴ Due to ordering of the lines in the Excel sheet, some comments have moved far away from the cell to which they refer. In addition some comments seem to have disappeared because boxes have collapsed to a line. To view these comments, right-click in the cell, choose 'edit comment', and re-dimension the comment box. The study team apologizes for the inconvenience.

¹⁵ Unfortunately, websites change frequently. Especially for LED lamps, new models come to the market almost each day and information on older models tends to disappear. It can therefore not be guaranteed that all referenced websites are still accessible.

3.1. E14 cap, lamp type R39

See the table below for the list of lamps found. The existing filament lamps have beam angles from 40 to 45°. No LED lamps with E14 cap, R39 shape, and comparable beam angles have been found. The LED lamps found have a beam angle of 110-120°, so consumers would have to compromise on that aspect. Alternatively, in some luminaires it may be possible to use R50 LED lamps with E14 cap (see next paragraph) but they are longer and have a larger diameter. Considering that the filament beam angle of 40-45° is already a wide-beam angle that is typical for general (down) lighting and not for accent lighting, the replacement with a 110-120° lamp, and other features matching, is considered 'broadly equivalent'.

Links to images: [Philips GLS](#) [XavaX LED](#)

Table 1 Directional lamps with E14 cap and R39 shape, all beam angles

manufacture	lamp designation	tech	L	D	BA	LM	LI	CCT	DIM	CRI	M	V	P	PF	LIFE	Switch	LLMF	EFF	EEL	EEL comp	EEL decl	1194/2012	Peq comp	Peq decl	€
			[mm]	[mm]	[deg]	[lm]	[cd]	[K]		[Ra8]	[gr]	[V]	[W]	[-]	[h]	[X]	[-]	lm/W	[-]	[-]	[-]	Stg3	[W]	[W]	Euro
Osram	Osram Concentra R39 30W E14	GLS	68	40	40	140	180	2700	yes	100		230	30.0	1.00	1000	25,000		4.7	1.74	D	E	NO		30	2.22
Sylvania	R39 30W 240V E14	GLS	66	39	40		120	2700	yes	100		240	30.0	1.00	1000	25,000					E	NO		30	1.32
Philips	REF STD 30W E14 230V R39 45D FR (Model : 035059)	GLS	67	39	45		160	2700	yes	100		230	30.0	1.00	1000						E	NO		30	1.59
Philips	EcoClassic 28W E14 230V R39 45D 1CT	HL	76	40	45	150	200	2800	yes	100	16.0	230	28.0	1.00	2000	8000 ?	0.8	5.4	1.54	D	D	NO		30	
LLLC	LLLCR39RB; R39 LED 3W E14	LED	67	39	120	200		3000	no			240	3.0		30,000		0.7	66.7	0.13	A+	A	yes		30	5.41
Lighting EVER	700008-WW-EU-5; LE 3W R39 Reflector LED	LED	66	39	120	200		3000	no	80	44.4	220-240	3.0		50,000		0.7	66.7	0.13	A+	A+	yes		25	3.68
V-tac	VT-1820	LED	75	39	120	200		4500	no	>80	33	200-240	3.0	>0.4	20,000		0.7	66.7	0.13	A+		yes			
Bioledex	RODER LED Spot E14 R39 3W 230Lm Warmweiss	LED	68	39	120	230	70	2700	no	80		230	3.0	>0.4	30,000	100,000	0.8	76.7	0.12	A++	A+	yes	47	23	
Xavax	LED lamp 3W R39 E14 warm wit	LED	68	39	120	245	50	2700	no	80	33	230	3.2	0.4	30,000	15,000	0.85	75.9	0.13	A++	A+	yes		25	8.99

3.2. E14 cap, lamp type R50/NR50

See table below for the list of lamps found. The existing filament lamps have a beam angle of 30° or 40° and a luminous flux ranging from 76 to 290 lm. LED lamps with a similar beam angle (24°-38°) are available from 125 to 500 lm, and some are dimmable. The cheapest dimmable LED lamp is from Philips (36°, 210 lm, 7.41 euros excl. VAT ¹⁶). The overall cheapest LED lamp is the one from IKEA (4.95 euros excl. VAT, compared to 3.60 euros for a halogen lamp), but no beam angle is specified for this lamp and it is not dimmable. Recent (April 2015) price for a similar LED lamp is 3.30 euros excl. VAT ¹⁷. A range of other LED lamps is available with higher beam angles.

Conclusion: LED lamps R50 with E14 cap are available for affordable prices.

Links to images: [Osram halogen](#) [Philips ledspot](#)

Table 2 Directional lamps with E14 cap and R50/NR50 shape, all beam angles

manufacture	lamp designation	tech	L	D	BA	LM	LI	CCT	DIM	CRI	M	V	P	PF	LIFE	Switch	LLMF	EFF	EEI	EEL cmp	EEL decl	1194/2012	Peq cmp	Peq decl	€
			[mm]	[mm]	[deg]	[lm]	[cd]	[K]		[Ra8]	[gr]	[V]	[W]	[-]	[h]	[X]	[-]	lm/W	[-]	[-]	[-]	Stg3	[W]	[W]	Euro
Paulmann	R50 4,5 Watt E14 WW 282.38	LED	85	50	24	225	800	2700	yes	80-89		230	4.5	0.46	20,000	50,000	0.85	50.0	0.19	A	A	yes	47		10.08
Osram	Osram Concentra R50 25W E14	GLS	85	51	30	90	210	2700	yes	100		230	25.0	1.00	1,000	25,000		3.6	1.96	E	E	NO		25	1.29
Osram	Osram Concentra R50 40W E14	GLS	85	51	30	190	410	2700	yes	100		230	40.0	1.00	1,000	25,000		4.8	1.87	E	E	NO		40	1.29
Philips	NR50 25W 230V 30D E14	GLS	86	50	30		210	2700	yes	100		230	25.0	1.00	1000					E	E	NO		25	1.04
Philips	NR50 40W 230V 30D E14	GLS	86	50	30		400	2700	yes	100		230	40.0	1.00	1000					E	E	NO		40	1.04
Philips	EcoClassic 18W E14 230V NR50 FR 1CT	HL	87	51	30	76	180	2800	yes	100	20.8	230	18.0	1.00	2,000	8,000 ?	0.8	4.2	1.58	D	D	NO	22	none	
Osram	CLASSIC ECO SUPERSTAR; ECO SST R50 20 W 230 V E14	HL	87	51	30	90	210	2700	yes	100	29	230	20.0	1.00	2,000	50,000	0.75	4.5	1.57	D	D	NO	25	25	3.60

¹⁶ http://www.amazon.it/Philips-LED4R50DMB1-Riflettore-Lampadina-230V/dp/B00MB5Y0VC/ref=sr_1_7?s=lighting&ie=UTF8&qid=1422354726&sr=1-7&keywords=e14+led#productDetails

¹⁷ <http://www.ikea.com/nl/nl/catalog/products/80287989/>

Table 2 Directional lamps with E14 cap and R50/NR50 shape, all beam angles

manufacture	lamp designation	tech	L	D	BA	LM	LI	CCT	DIM	CRI	M	V	P	PF	LIFE	Switch	LLMF	EFF	EEI	EEL cmp	EEL decl	1194/2012	Peq cmp	Peq decl	€
			[mm]	[mm]	[deg]	[lm]	[cd]	[K]		[Ra8]	[gr]	[V]	[W]	[-]	[h]	[X]	[-]	lm/W	[-]	[-]	[-]	Stg3	[W]	[W]	Euro
Philips	EcoClassic 28W E14 230V NR50 FR 1CT	HL	87	51	30	136	300	2800	yes	100	20.8	230	28.0	1.00	2,000	8,000 ?	0.8	4.9	1.65	D	D	NO	34	33	2.40
Osram	CLASSIC ECO SUPERSTAR; ECO SST R50 30 W 230 V E14	HL	87	51	30	170	410	2700	yes	100	30	230	30.0	1.00	2,000	50,000	0.75	5.7	1.51	D	D	NO	40	40	3.60
Philips	EcoClassic 42W E14 230V NR50 1CT	HL	87	51	30	250	780	2800	yes	100	20.8	230	42.0	1.00	2000	8000 ?	0.8	6.0	1.61	D	D	NO	55	55	
Osram	CLASSIC ECO SUPERSTAR; ECO SST R50 46 W 230 V E14	HL	87	51	30	290	490	2700	yes	100	30	230	46.0	1.00	2,000	50,000	0.75	6.3	1.58	D	D	NO	63	60	3.60
NCC-licht	LED R50 2W = 25W E14 2700K 30° A++	LED	82	50	30	125		2700	no	80		230	2.0		20,000	15,000	0.7	62.5	0.13	A++	A++	yes	29	25	
Osram	LED STAR R50 40 30 3.9 W/827 E14	LED	85	50	30	196	540	2700	no	80	92.0	220	3.9	>0.4	15,000	100,000	0.7	50.3	0.18	A+	A+	yes	40	40	16.19
Osram	LED STAR R50 40 30 3.9 W/840 E14	LED	85	50	30	200	540	4000	no	80	111.0	220	3.9	>0.4	15,000	100,000	0.7	51.3	0.18	A+	A+	yes	41	40	
Lampenwelt	E14 7W 830 LED R50 WW 30grad	LED	74	50	30	500		3000	no	80		230	7.0	>0.5	30,000	15,000	0.7	71.4	0.16	A+	A+	yes	90	65	8.15
Osram	Parathom R50 25 3 W WW E14	LED	85	50	30		250	3000		80	59.0	220-240	4.0				0.7						25	28.63	
GE	LED5D/R50/827/220-240V/WFL HBX 1/8 discontinued ?	LED	83	50	35	220	500	2700	yes	80	100.0	230	5.0	0.80	25,000		0.7	44.0	0.21	A	A	NO	44		
Philips	CorePro LEDspotMV D 4-40W 827 R50 36D	LED	85	51	36	210	300	2700	yes	80	32.0	220-240	4.0	0.60	20,000	50,000 ?	0.7	52.5	0.17	A+	A+	yes	42	40	13.13
Philips	LED4R50DMB1	LED	85	51	36	180	350	2700	yes	80	32.0	220-240	4.0		20,000		0.7	45.0	0.19	A	A	yes	37	40	7.41
HQ	HQ E14 LED Reflector lamp 5,5W warm wit HQL14REFL001	LED	82	50	36	350		2700	no			220-240	5.5		15,000	20,000		63.6	0.16	A+	A+	yes	65	50	6.20
Bioledex	HEL50 LED Strahler E14 6W 450Lm Warmweiss	LED	75	50	38	450	750	2800	no	82		230	6.0	>0.56	30,000	100,000	0.8	75.0	0.15	A+	A+	yes	85	50	12.60
Paulmann	R50 28W E14 Silber 200.11	HL	85	50	40	160	300	2800	yes	>90		230	28.0	1.00	1,500	6000		5.7	1.48	D	D	NO	38		3.42
Paulmann	R50 42W E14 Silber 200.14	HL	85	50	40	243	400	2800	yes	>90		230	42.0	1.00	1,500	6000		5.8	1.64	D	D	NO	54		3.42
Osram	SUPERSTAR R50 25 3W E14	LED	85	50		100	250	3000	no			220-240	3.0	0.44	25,000	50,000	0.7	33.3	0.22	A		NO	24	25	19.83
IKEA	LEDARE LED1211R4 (art. 402.559.14)	LED	84	50		200		2700	no	80	100.0	230	4.0	0.50	25,000	25,000	0.7	50.0	0.18	A+	A+	yes	41	25	4.95
Eglo	LED lamp Reflector E14/230V 5W Warmwit Eglo 11431	LED	85	50		400		3000				230	5.0		15,000		0.7	80.0	0.13	A+	A+	yes	73		9.68
Havells-Sylvania	RefLED R50 510Lm 6W E14 BL	LED	86	50		510		3000	no	80		220-240	6.0	0.55	30,000	15,000	0.8	85.0	0.13	A+	A+	yes	95	42	

Table 2 Directional lamps with E14 cap and R50/NR50 shape, all beam angles

manufacture	lamp designation	tech	L	D	BA	LM	LI	CCT	DIM	CRI	M	V	P	PF	LIFE	Switch	LLMF	EFF	EEL	EEL cmp	EEL decl	1194/2012	Peq cmp	Peq decl	€
			[mm]	[mm]	[deg]	[lm]	[cd]	[K]		[Ra8]	[gr]	[V]	[W]	[-]	[h]	[X]	[-]	lm/W	[-]	[-]	[-]	Stg3	[W]	[W]	Euro
Megaman	LR2603.5-SWFL-2800K	LED	87	50	90	210	120	2800	no	80	33.0	220-240	3.5	>0.4	15,000	>1E6	0.7	60.0	0.15	A+	A+	yes	42	40	
Megaman	LR2603.5-SWFL-4000K	LED	87	50	90	210	120	4000	no	80	33.0	220-240	3.5	>0.4	15,000	>1E6	0.7	60.0	0.15	A+	A+	yes	42	40	
Megaman	LR2603.5-SWFL-6500K	LED	87	50	90	210	120	6500	no	80	33.0	220-240	3.5	>0.4	15,000	>1E6	0.7	60.0	0.15	A+	A+	yes	42	40	
Megaman	LR2605-SWFL-E14-2800K-230V*	LED	87	50	90	400	190	2800		80	35.0	220-240	5.0		15,000			80.0	0.13	A+	A+	yes	73	> 40	
Megaman	LR2605-SWFL-4000K	LED	87	50	90	400	190	4000	no	80	35.0	220-240	5.0		15,000		0.7	80.0	0.13	A+	A+	yes	73	40	
Avide	LED R50 5W WW E14	LED	85	50	110	400		3000	no	80		220-240	5.0		25,000		0.7	80.0	0.13	A+	A+	yes	73	36	6.36
Avide	LED R50 5W CW E14	LED	85	50	110	420		6500	no	80		220-240	5.0		25,000		0.7	84.0	0.13	A++	A+	yes	77	36	6.36
V-tac	VT-1821	LED	90	50	120	380		4500	no	>80	68	200-240	6.0	>0.5	20,000		0.7	63.3	0.17	A+		yes	70		
Long Life Lamp Company	R50 LED 5W E14 LLLCR50RB	LED	89	50	120	400		3000	?			240	5.0	?	30,000		0.7	80.0	0.13	A+	A+	yes	73	40	5.73
Lighting EVER	LE 6W R50 E14 Reflector LED Bulb (700002-WW-5)	LED	90	50	120	420		2700	?	80	76.2	230	6.0	?	30,000		0.7	70.0	0.16	A+	A	yes	77	45	4.98
Lightwell	R50 - 5 Watt E14 Reflector LED bulb	LED	88	50	120	430		warm white	no			85-265	5.0		45,000			86.0	0.13	A++		yes	78	50-60	6.92

3.3. E14 cap, lamp type PAR16

See table below for the list of lamps found. The existing filament lamps have beam angles of 25° or 35° and luminous flux around 260 lm. The dimmable LED lamps by Zenaro are available with beam angles of 24° and 36° (and 50°) and have a comparable flux¹⁸. A range of other LED lamps is available, also with beam angles of 60°, but none of these is declared as dimmable, which might not be so important for these relatively low lumen lamps. Noteworthy is the LED lamp with 30° beam angle by LEDworld with a price of 3.51 euros excl. VAT, that is lower than the price for a halogen lamp (3.92 euros). In addition the declared data lead to A++ energy label class. However, a low CRI=70 is specified and it is a weak lamp with only 60 lm and 1.0 W.

¹⁸ Recently (April 2015) difficulties have been encountered in accessing the Zenaro website, and some on-line sales' sites state the lamps as non-available.

Conclusion: LED lamps PAR16 with E14 cap are available.

Links to images: [Zenaro LED](#) [Osram halopar](#)

Table 3 Directional lamps with E14 cap and PAR16 shape, all beam angles

manufacture	lamp designation	tech	L	D	BA	LM	LI	CCT	DIM	CRI	M	V	P	PF	LIFE	Switch	LLMF	EFF	EEI	EEL cmp	EEL decl	1194/2012	Peq cmp	Peq decl	€
			[mm]	[mm]	[deg]	[lm]	[cd]	[K]		[Ra8]	[gr]	[V]	[W]	[-]	[h]	[X]	[-]	lm/W	[-]	[-]	[-]	Stg3	[W]	[W]	Euro
Philips	HalogenA PAR16 40W E14 230V 25D 1CT	HL	79	51	25	260	680	2800	yes	100	54.0	230	40.0	1.00	2,000	8,000 ?	0.8	6.5	1.49	D	D	NO	44	none	
Havells-Sylvania	HS50 230V 40W 25° E14 SV1 (or ECO BL1 or ECO SV2)	HL	77	50	25	265	950	2700	yes	100	60.0	230	40.0	1.00	2,000	>8,000	0.8	6.6	1.46	D	D	NO	45	none	
Osram	HALOPAR 16 ST 40 W 230 V 35° E14	HL	75	51	35	250	650	2800	yes	100	51.5	230	40.0	1.00	2,000	50,000	0.75	6.3	1.53	D	D	NO	43	none	3.92
Verbatim	LED PAR16 E14 4W 52139	LED	76	50	20	200	750	3000	no	80	83	220-240	4.0	0.40	30,000	20,000	0.7	50.0	0.18	A+	A+	yes	32	27	10.74
Verbatim	LED PAR16 E14 4W 52122	LED	76	50	20	160	750	3000	no	80	63	220-240	4.0	0.40	30,000	20,000	0.7	40.0	0.21	A		NO	27	35	
Zenaro	PAR16 E14 5W (Z00120001/2/3)	LED	74	50	24	250		3000	yes	>80	65	200-240	5.0		25,000		0.7	50.0	0.19	A	A	yes	37	<25	
Zenaro	PAR16 E14 5W (Z00120004/5/6)	LED	74	50	24	275		5000	yes	>80	65	200-240	5.0		25,000		0.7	55.0	0.18	A+	A+	yes	40	<25	
LEDworld	E14 LED Spot 1-10W Warmwit 3000K 230VAC 30D SP21E14WW	LED	76	50	30	60		3000	no	70		230	1.0		20,000		0.7	60.0	0.10	A++		yes	15	6	3.51
Megaman	LR1204DGv2-WFL-2800K-E14	LED	76	50	35	250	300	2800	no	80	47.0	220-240	4.0	>0.4	25,000	>1E6	0.9	62.5	0.15	A+	A+	yes	41	45	
Megaman	LR1204DGv2-WFL-4000K-E14	LED	76	50	35	250	300	4000	no	80	47.0	220-240	4.0	>0.4	25,000	>1E6	0.9	62.5	0.15	A+	A+	yes	41	45	
Zenaro	PAR16 E14 5W (Z00120001/2/3)	LED	74	50	36	250		3000	yes	>80	65	200-240	5.0		25,000		0.7	50.0	0.19	A	A	yes	37	<25	
Zenaro	PAR16 E14 5W (Z00120004/5/6)	LED	74	50	36	275		5000	yes	>80	65	200-240	5.0		25,000		0.7	55.0	0.18	A+	A+	yes	40	<25	
Havells-Sylvania	RefLED PAR16 5W 345LM 830 36° SL	LED	81	50	36	345	950	3000	no	80	50.0	220-240	5.0	0.80	15,000	>20,000	0.85	69.0	0.15	A+	A+	yes	53	50	
Zenaro	PAR16 E14 5W (Z00120001/2/3)	LED	74	50	50	250		3000	yes	>80	65	200-240	5.0		25,000		0.7	50.0	0.19	A	A	yes	37	<25	
Zenaro	PAR16 E14 5W (Z00120004/5/6)	LED	74	50	50	275		5000	yes	>80	65	200-240	5.0		25,000		0.7	55.0	0.18	A+	A+	yes	40	<25	
LEDworld	E14 LED Spot 3-25W Warmwit 3000K 230VAC 60D SP60E14WW	LED	79	50	60	180		3000	no	70		230	3.0		20,000		0.7	60.0	0.15	A+		yes	29	18	8.22

Table 3 Directional lamps with E14 cap and PAR16 shape, all beam angles

manufacture	lamp designation	tech	L	D	BA	LM	LI	CCT	DIM	CRI	M	V	P	PF	LIFE	Switch	LLMF	EFF	EEI	EEL cmp	EEL decl	1194/2012	Peq cmp	Peq decl	€
			[mm]	[mm]	[deg]	[lm]	[cd]	[K]		[Ra8]	[gr]	[V]	[W]	[-]	[h]	[X]	[-]	lm/W	[-]	[-]	[-]	Stg3	[W]	[W]	Euro
Megaman	LR1204DGv2-VWFL-2800K-E14	LED	76	50	60	250	200	2800	no	80	47.0	220-240	4.0	>0.4	15,000	>1E6	0.9	62.5	0.15	A+	A+	yes	41	50	
Megaman	LR1204DGv2-VWFL-4000K-E14	LED	76	50	60	250	200	4000	no	80	47.0	220-240	4.0	>0.4	15,000	>1E6	0.9	62.5	0.15	A+	A+	yes	41	50	
Megaman	LR1204DGv2-VWFL	LED	76	50	60	250	200	2800	no	80	47.0	220-240	4.0	>0.4	25,000	>1E6	0.9	62.5	0.15	A+	A+	yes	38	50	
LEDworld	E14 LED Spot 3-30W Warmwit 3000K 230VAC 120D SP48SE14WW	LED	74	50	120	250		3000	no	80		230	3.0		20,000		0.7	83.3	0.11	A++		yes	37	25	9.05

3.4. E27 cap, lamp type R50

For this combination of cap and bulb shape, only LED lamps have been found. The Osram lamps are the same lamps that are also available with E14 cap.

Links to images: [Osram LEDstar](#)

Table 4 Directional lamps with E27 cap and R50 shape, all beam angles

anufacture	lamp designation	tech	L	D	BA	LM	LI	CCT	DIM	CRI	M	V	P	PF	LIFE	Switch	LLMF	EFF	EEI	EEL cmp	EEL decl	1194/2012	Peq cmp	Peq decl	€
			[mm]	[mm]	[deg]	[lm]	[cd]	[K]		[Ra8]	[gr]	[V]	[W]	[-]	[h]	[X]	[-]	lm/W	[-]	[-]	[-]	Stg3	[W]	[W]	Euro
Osram	LED STAR R50 40 30 3.9 W/840 E27	LED	85	50	30	200	540	4000	no	80	127.0	220	3.9	>0.4	15000	100000	0.7	51.3	0.18	A+	A+	yes	41	40	
Osram	LED STAR R50 40 30 3.9 W/827 E27	LED	85	50	30	196	540	2700	no	80	127.0	220	3.9	>0.4	15000	100000	0.7	50.3	0.18	A+	A+	yes	40	40	
Segula	LED Lens Reflektor E27	LED	47	50	60	150		2600	yes	80	45.0	230	3.5	0.94	20,000	1E+06	0.7	42.9	0.19	A	A	yes	33	17	7.52

3.5. E27 cap, lamp type R63/NR63

See table below for the list of lamps found. The existing filament lamps have beam angles of 30° or 35° and a luminous flux ranging from 90 to 310 lm. Only two comparable LED lamps have been found. The Paulmann lamp (24°, 345 lm, dimmable) also satisfies the EEI<0.20 criterion of regulation 1194/2012 stage 3. The Verbatim lamp (35°, 370 lm, dimmable) has a different colour (4200 K), slightly smaller dimensions, and it does not (yet) meet the EEI<0.20 criterion. Although named R63 it is suggested as a replacement for PAR20. Other LED lamps are available, but they have higher beam angles and are not dimmable.

Note that in many occasions R63/NR63 lamps can probably be substituted by PAR20 LED lamps, that have the same diameter, are shorter, but have a slightly different shape (widely available, see pars. 3.8-3.10). Substitution by R50 LED lamps (previous paragraph) may also be an option: these lamps have a smaller diameter, but comparable beam angles and luminous fluxes are available. A third option is to use MR16/PAR16 or PAR20 LED lamps with GU10 cap (widely available, see pars. 3.18-3.23) in a GU10-to-E27 adapter. Such adapters are widely available for a price between 1 and 2 euros¹⁹. The combined length of adapter and GU10 lamp could be close to that of the original R63 lamp. When using MR16/PAR16, the lamp diameter will be slightly smaller, but this is not necessarily a problem.

Conclusion: For MV R63 filament lamps with E27 cap, the availability of LED lamps with identical shape is limited, but other realistic substitution options are available.

Links to images: [Osram Halogen](#) [Verbatim LED](#)

Table 5 Directional lamps with E27 cap and R63/NR63 shape, all beam angles

manufacture	lamp designation	tech	L	D	BA	LM	LI	CCT	DIM	CRI	M	V	P	PF	LIFE	Switch	LLMF	EFF	EEI	EEL cmp	EEL decl	1194/2012	Peq cmp	Peq decl	€
			[mm]	[mm]	[deg]	[lm]	[cd]	[K]		[Ra8]	[gr]	[V]	[W]	[-]	[h]	[X]	[-]	lm/W	[-]	[-]	[-]	Stg3	[W]	[W]	Euro
Paulmann	R63 6 Watt E27 WW 282.39	LED	102	63	24	345	1500	2700	yes	80-89		230	6.0	0.53	20,000	50,000	0.85	57.5	0.18	A	A	yes	68	40	16.63

¹⁹ <http://www.kanlux.pl/en/8851>

http://www.squeetty.com/scheda.php?id=1248&qclid=CjwKEAiArqKMBRC0j_qfmuqinnYSJAAkAYwGhdrhdTAt_MrCUjCGNo9cR7BpvDtEaEGFuiTGF0VLpBoCUYLw_wcB

http://www.miniinthebox.com/it/e14-a-gu10-led-lampadine-socket-adapter_p493125.html?currency=EUR&litb_from=paid_adwords_shopping&qclid=CjwKEAiArqKMBRC0j_qfmuqinnYSJAAkAYwGFhZeGC8WrRc4XCcCpZaNMqT17Y0kDtREEjwsP2qj8RoC7qv_wcB

<http://www.amazon.co.uk/GU10-Light-Socket-Converter-Adaptor/dp/B0076MEOEI>

Table 5 Directional lamps with E27 cap and R63/NR63 shape, all beam angles

manufacture	lamp designation	tech	L	D	BA	LM	LI	CCT	DIM	CRI	M	V	P	PF	LIFE	Switch	LLMF	EFF	EEI	EEL cmp	EEL decl	1194/2012	Peq cmp	Peq decl	€
			[mm]	[mm]	[deg]	[lm]	[cd]	[K]		[Ra8]	[gr]	[V]	[W]	[-]	[h]	[X]	[-]	lm/W	[-]	[-]	[-]	Stg3	[W]	[W]	Euro
Philips	Spotone NR63 25W 230V 30D E27	GLS	104	63	30		230	2700	yes	100		230	25.0	1.00	1000						E	NO		25	1.21
Osram	Osram Concentra R63 25W E27	GLS	104	64	30	90	230	2700	yes	100		230	25.0	1.00	1,000	25,000		3.6	1.96	E	E	NO		25	1.29
Philips	Spotone NR63 40W 230V 30D E27	GLS	104	63	30		420	2700	yes	100		230	40.0	1.00	1000						E	NO		40	1.04
Osram	Osram Concentra R63 40W E27	GLS	105	64	30	200	430	2700	yes	100		230	40.0	1.00	1,000	25,000		5.0	1.80	E	E	NO		40	1.29
Osram	Osram Concentra R63 60W E27	GLS	105	64	30	310	960	2700	yes	100		230	60.0	1.00	1,000	25,000		5.2	1.96	E	E	NO		60	1.29
Philips	EcoClassic 28W E27 230V NR63 FR 1CT	HL	104	64	30	145	360	2800	yes	100	28.6	230	28.0	1.00	2000	8000 ?	0.8	5.2	1.58	D	D	NO	34	none	
Osram	CLASSIC ECO SUPERSTAR; ECO SST R63 30 W 230 V E27	HL	105	64	30	180	430	2700	yes	100	43.3	230	30.0	1.00	2000	50,000	0.75	6.0	1.45	D	D	NO	40	40	3.60
Philips	EcoClassic 42W E27 230V NR63 FR 1CT	HL	104	64	30	270	750	2800	yes	100	28.6	230	42.0	1.00	2000	8000 ?	0.8	6.4	1.52	D	D	NO	55	55	
Osram	CLASSIC ECO SUPERSTAR; ECO SST R63 46 W 240 V E27	HL	105	64	30	300	765	2700	yes	100	43.3	240	46.0	1.00	2000	50,000	0.75	6.5	1.54	D	D	NO	60	60	3.60
Paulmann	R63 28W E27 Silber 200.13	HL	105	63	35	158	390	2800	yes	>90		230	28.0	1.00	1,000	4000		5.6	1.49	D	D	NO	36		3.83
Paulmann	R63 42W E27 Silber 200.12	HL	102	63	35	283	500	2800	yes	>90		230	42.0	1.00	1,000	4000		6.7	1.46	D	D	NO	57		3.83
Verbatim	LED R63 52009	LED	94	60	35	370	880	4200	yes	>80	140.0	220-240	8.0	0.85	35,000		0.7	46.3	0.23	A		NO	64	60	
Havells-Sylvania	RefLED R63 850Lm 10W E27 BL	LED	102	63		850		3000	no	80		220-240	10.0	0.55	30,000	15,000	0.8	85.0	0.15	A+	A+	yes	139	63	
Megaman	LR2407.5-SWFL-2800K	LED	103	63	90	520	230	2800	no	80	67.0	220-240	7.5	>0.5	15,000	>1E6	0.7	69.3	0.16	A+	A+	yes	85	60	
Megaman	LR2407.5-SWFL-4000K	LED	103	63	90	520	230	4000	no	80	67.0	220-240	7.5	>0.5	15,000	>1E6	0.7	69.3	0.16	A+	A+	yes	85	60	
Megaman	LR2407.5-SWFL-6500K	LED	103	63	90	520	230	6500	no	80	67.0	220-240	7.5	>0.5	15,000	>1E6	0.7	69.3	0.16	A+	A+	yes	85	60	
V-tac	VT-1822	LED	100	63	120	560		4500	no	>80	122	200-240	8.0	>0.5	20,000		0.7	70.0	0.17	A+		yes	91		
Avide	LED R63 7W CW E27	LED	106	63	110	520		6500	no	80		220-240	7.0		25,000		0.7	74.3	0.15	A+	A+	yes	85	43	8.82
Avide	LED R63 7W WW E27	LED	106	63	110	500		3000	no	80		220-240	7.0		25,000		0.7	71.4	0.16	A+	A+	yes	82	42	8.82

3.6. E27 cap, lamp type R80/NR80

Existing filament lamps with cap E27 and shape R80/NR80 have beam angles ranging from 15° to 55°, and luminous flux from 175 to 580 lm. Some LED lamps have been found with similar characteristics, i.e. 30-36° and luminous flux 250-420 lm. In addition LED lamps with higher beam angles are available (75°, 90°, 120°). For the lower beam angles (15°-25°) no LED substitutes seem to be available.

Note that R80/NR80 lamps could also be substituted by PAR25 lamps, that have the same diameter, are shorter, but have a slightly different shape (see par. 3.11, but no LED lamps have been found not even there). In addition it seems likely that PAR20 or PAR30 LED lamps can be used in most occasions, even if dimensions and shape are slightly different. In case of length problems, E27-to-E27 adapters²⁰ could bring a solution. In the same way as observed for R63 lamps (previous paragraph) it might be an option to use PAR16 or PAR20 lamps with GU10 cap in a GU10-to-E27 adapter, accepting a smaller lamp diameter.

Conclusion: For MV R80 filament lamps with E27 cap, the availability of LED lamps with identical shape is limited, but other realistic substitution options are available.

Links to images: [Havells-Sylvania halogen](#) [Segula LED](#)

Table 6 Directional lamps with E27 cap and R80/NR80 shape, all beam angles

manufacture	lamp designation	tech	L	D	BA	LM	LI	CCT	DIM	CRI	M	V	P	PF	LIFE	Switch	LLMF	EFF	EEI	EEL cmp	EEL decl	1194/2012	Peq cmp	Peq decl	€
			[mm]	[mm]	[deg]	[lm]	[cd]	[K]		[Ra8]	[gr]	[V]	[W]	[-]	[h]	[X]	[-]	lm/W	[-]	[-]	[-]	Stg3	[W]	[W]	Euro
Osram	HALOGEN SPOT R80 ECO; ECO R80 46 W 230 V E27	HL	116	81	15	300	1100	2700	yes	>99	60.0	230	46.0	1.00	2000	50,000	0.75	6.5	1.54	D	D	NO	60	60	
Osram	HALOGEN SPOT R80 ECO; ECO R80 57 W 230 V E27	HL	116	81	20	370	1250	2800	yes	>99	58.0	230	57.0	1.00	2000	50,000	0.75	6.5	1.63	D	D	NO	77	75	
Osram	HALOGEN SPOT R80 ECO; ECO R80 77 W 230 V E27	HL	116	81	20	580	1550	2800	yes	>99	60.0	230	77.0	1.00	2000	50,000	0.75	7.5	1.55	D	D	NO	100	100	
Philips	NR80 60W 230V 25D E27	GLS	116	80	25		1000	2700	yes	100		230	60.0	1.00	1000						E	NO		60	2.07
Philips	EcoClassic 42W E27 230V R80 25D 1CT	HL	112	81	25	255	800	2800	yes	100	39.5	230	42.0	1.00	2000	8000 ?	0.8	6.1	1.58	D	D	NO		none	
Philips	EcoClassic 70W E27 230V R80 25D 1CT	HL	112	81	25	485	1440	2800	yes	100	39.5	230	70.0	1.00	2000	8000 ?	0.8	6.9	1.62	D	D	NO	90	90	
Havells-Sylvania	CLECO R80 240V 28W 30° E27 BL1 (or SV1)	HL	116	80	30	175	335	2800	yes	100	60.0	240	28.0	1.00	2000	>8,000	0.8	6.3	1.39	D	D	NO		none	

²⁰ See for example: http://www.ledstrip-shop.be/index.php?item=e27-naar-e27--fitting-converter_adapter&action=article&aid=1691&lang=NL (price 2.41 euros incl. VAT)

Table 6 Directional lamps with E27 cap and R80/NR80 shape, all beam angles

manufacture	lamp designation	tech	L	D	BA	LM	LI	CCT	DIM	CRI	M	V	P	PF	LIFE	Switch	LLMF	EFF	EEL	EEL cmp	EEL decl	1194/2012	Peq cmp	Peq decl	€
			[mm]	[mm]	[deg]	[lm]	[cd]	[K]		[Ra8]	[gr]	[V]	[W]	[-]	[h]	[X]	[-]	lm/W	[-]	[-]	[-]	Stg3	[W]	[W]	Euro
Havells-Sylvania	CLECO R80 240V 42W 30° E27 BL1 (or SV1)	HL	116	80	30	300	500	2800	yes	100	60.0	240	42.0	1.00	2000	>8,000	0.8	7.1	1.40	D	D	NO	60	60	
Havells-Sylvania	CLECO R80 240V 53W 30° E27 BL1 (or SV1)	HL	116	80	30	375	750	2800	yes	100	60.0	240	53.0	1.00	2000	>8,000	0.8	7.1	1.50	D	D	NO	78	78	
Havells-Sylvania	CLECO R80 240V 70W 30° E27 SV1	HL	116	80	30	538	1080	2800	yes	100	40.0	240	70.0	1.00	2000	>8,000	0.8	7.7	1.50	D	D	NO	95	95	
NCC-licht	LED Filament R80 4W = 40W E27 2700K 30° A+	LED	115	80	30	250		2700	no	>80	40.0	230	4.0		20,000	15,000	0.7	62.5	0.15	A+	A+	yes	35	40	8.39
Segula	E27 6,5W R80 LED-Reflektorlampe	LED	115	80	30	270		2600	yes	80	60.0	220-240	6.5	0.91	20,000	>1E6	0.7	41.5	0.23	A	A	NO	40	30	20.93
Bioledex	E27 6W R80 LED-Reflektorlampe PUNO R70	LED	97	70	36	420	500	2700	no	85	180.0	230	6.0	0.55	30,000	100,000	0.8	70.0	0.16	A+	A+	yes	78	75	19.25
Osram	Osram Concentra R80 40W E27	GLS	115	81	50	180	150	2700	yes	100		230	40.0	1.00	1,000	25,000		4.5	1.94	E	E	NO		40	2.07
Osram	Osram Concentra R80 75W E27	GLS	115	81	50	440	345	2700	yes	100		230	75.0	1.00	1,000	25,000		5.9	1.87	E	E	NO		75	2.67
Osram	Osram Concentra R80 100W E27	GLS	115	81	50		500	2700	yes	100		230	100.0	1.00	1,000	25,000					E	NO		100	5.23
Philips	EcoClassic 42W E27 230V E80 55D 1CT	HL	112	81	55	265	307	2800	yes	100	46.0	230	42.0	1.00	2000	8000 ?	0.85	6.3	1.54	D	D	NO		none	
Kosnic	LED Half Life ReonLED Reflector E27 8 Watt Warm White	LED	115	80	75	350		3000	no	80		220-240	8.0		20,000		0.7	43.8	0.24	A	A+	NO	70	40	12.96
Megaman	LR4307-SWFL-2800K	LED	112	78	90	420	230	2800	no	80	90.0	220-240	7.0	>0.5	15,000	>1E6	0.7	60.0	0.18	A	A+	yes	77	74	
Megaman	LR4307-SWFL-4000K	LED	112	78	90	420	230	4000	no	80	90.0	220-240	7.0	>0.5	15,000	>1E6	0.7	60.0	0.18	A	A+	yes	77	74	
Megaman	LR4307-SWFL-6500K	LED	112	78	90	420	230	6500	no	80	90.0	220-240	7.0	>0.5	15,000	>1E6	0.7	60.0	0.18	A	A+	yes	77	74	
Beneito	R-80 LED 10W 120° 220-240V E27 3.000K	LED	117	80	120	891	283	3000	no			220-240	10.0		50,000		0.7	89.1	0.14	A+	A++	yes	121	74	31.85
Bioledex	RODER R80 LED Spot E27 10W 900Lm Warmweiss	LED	117	80	120	900	250	2700	no	80		230	10.0	>0.5	30,000	100,000	0.8	90.0	0.14	A+	A+	yes	126	100	

3.7. E27 cap, lamp type R90/NR90

A limited number of existing filament lamps has been found with cap E27 and shape R90/NR90. Beam angles for these lamps are 30° and luminous flux ranges from 242 to 500 lm. One LED R90 lamp was found, but it has a beam angle of 120° and twice the lumens of the halogen

lamps. Note that it might be possible to use PAR30 lamps as substitutes. These lamps have similar dimensions but a different shape (see pars. 3.12-3.14; LED lamps are available there).

Conclusion: There are few MV R90 filament lamps with E27 cap. No LED substitutes with identical shape are available, but PAR30 can be used.

Links to images: [Havells-sylvania halogen](#) [bioledex LED](#)

Table 7 Directional lamps with E27 cap and R90/NR90 shape, all beam angles

manufacture	lamp designation	tech	L	D	BA	LM	LI	CCT	DIM	CRI	M	V	P	PF	LIFE	Switch	LLMF	EFF	EEI	EEL cmp	EEL decl	1194/2012	Peq cmp	Peq decl	€
			[mm]	[mm]	[deg]	[lm]	[cd]	[K]		[Ra8]	[gr]	[V]	[W]	[-]	[h]	[X]	[-]	lm/W	[-]	[-]	[-]	Stg3	[W]	[W]	Euro
Havells-Sylvania	CLECO R90 240V 42W 30° E27 SV1	HL	120	91	30	242	473	2800	yes	100	50.0	240	42.0	1.00	2000	>8,000	0.8	5.8	1.64	D	D	NO		none	
Havells-Sylvania	CLECO R90 240V 70W 30° E27 SV1	HL	120	91	30	500	1673	2800	yes	100	50.0	240	70.0	1.00	2000	>8,000	0.8	7.1	1.58	D	D	NO		none	
Bioledex	RODER R90 LED Spot E27 13W 1000Lm Warmweiss	LED	118	90	120	1000	300	2700	no	80		230	13.0	>0.5	30,000	100,000	0.8	76.9	0.17	A+	A+	yes		100	

3.8. E27 cap, lamp type PAR20, beam angle 10°

Two existing filament lamps have been found with cap E27, shape PAR20 and a 10° beam angle. These lamps have 245 and 350 lm respectively. There are LED lamps by Zenaro that have comparable characteristics and are dimmable²¹. Lumen output for these lamps is higher: 470-510 lm. Although all lamps are named PAR20, the photos in the references below show that shapes are different and there might be some lock-in problems. The Zenaro lamps should NOT be used in totally enclosed fixtures.

The Philips MASTER PAR20 E 20W E27 230V 10D 1CT, and its variant with beam angle of 25° (see next paragraph), are the only halogen lamps found that fulfil the 1194/2012 stage 3 criterion of EEI<0.95. The impression is that these are actually low voltage lamps with a voltage transformer in the foot, such that they work on 230V. Similar to the situation that was encountered during the 244/2009 stage 6 review for

²¹ In April 2015 the Zenaro website could no longer be accessed.

NDLS lamps, the production of these lamps seems to have stopped, because these lamps have disappeared from recent Philips documentation²² and several on-line sales' sites now state them as being 'no longer available'.

Conclusion: LED substitutes for MV PAR20 with E27 cap and 10° beam angle are available.

Links to images: [Philips halogen](#) [Zenaro LED](#)

Table 8 Directional lamps with E27 cap, PAR20 shape and beam angle 10°

manufacture	lamp designation	tech	L	D	BA	LM	LI	CCT	DIM	CRI	M	V	P	PF	LIFE	Switch	LLMF	EFF	EEI	EEL cmp	EEL decl	1194/2012	Peq cmp	Peq decl	€
			[mm]	[mm]	[deg]	[lm]	[cd]	[K]		[Ra8]	[gr]	[V]	[W]	[-]	[h]	[X]	[-]	lm/W	[-]	[-]	[-]	Stg3	[W]	[W]	Euro
Philips	MASTER PAR20 E 20W E27 230V 10D 1CT	HL	86	64	10	245	7000	3000	yes	100	101.0	230	20.0	1.00	5000	20000 ?	0.8	12.3	0.78	B	B	yes	42	50	
Osram	HALOPAR 20 50 W 230 V 10° E27	HL	91	65	10	350	3000	2800	yes	100	139.0	230	50.0	1.00	2000	50,000	0.75	7.0	1.49	D	D	NO	56	none	5.77
Zenaro	SL-PAR20B/H/P08/10 /E30/TD/27/HAC/EU/ZN	LED	80	65	10	470	4200	3000	yes	>80	170.0	200-240	8.0	>0.9	40,000	>20,000	0.7	58.8	0.19	A	A/A+	yes	73	<60	
Zenaro	SL-PAR20B/H/P08/10 /E50/TD/27/HAC/EU/ZN	LED	80	65	10	510	5000	5000	yes	>80	170.0	200-240	8.0	>0.9	40,000	>20,000	0.7	63.8	0.18	A+	A/A+	yes	78	<60	

3.9. E27 cap, lamp type PAR20, beam angle 25°

Three existing filament lamps have been found with cap E27, shape PAR20 and a 25° beam angle. These lamps have fluxes ranging from 245 to 360 lm. Six LED spots have been found that could be suitable replacements. They are all dimmable, have fluxes from 410 to 540 lm and weigh slightly more than the halogen lamps. The Zenaro lamps should NOT be used in totally enclosed fixtures. As regards the Philips MASTER PAR20, see comments in the previous paragraph. Although they are all named PAR20, the images on the referenced websites reveal considerable differences in shape. For the Philips LED lamps note that efficacy slightly increases with the colour temperature.

Conclusion: LED substitutes for MV PAR20 with E27 cap and 25° beam angle are available.

²² In the 'Philips Licht Pocket 2014' these lamps are still proposed (http://www.lighting.philips.com/pwc_li/nl_nl/connect/Licht_pocket_bladerversie/index.html#132), but they could no longer be found in the 'Philips Licht Pocket 2015', although there are notes near other lamps that recommend to use the MASTER PAR20 instead (http://www.lighting.philips.nl/connect/licht_pocket_bladerversie/p.1-67).

Links to images: [Philips halogen](#) [Zenaro LED](#) [PhilipsLED](#)

Table 9 Directional lamps with E27 cap, PAR20 shape and beam angle 25°

manufacture	lamp designation	tech	L	D	BA	LM	LI	CCT	DIM	CRI	M	V	P	PF	LIFE	Switch	LLMF	EFF	EEI	EEL cmp	EEL decl	1194/2012	Peq cmp	Peq decl	€
			[mm]	[mm]	[deg]	[lm]	[cd]	[K]		[Ra8]	[gr]	[V]	[W]	[-]	[h]	[X]	[-]	lm/W	[-]	[-]	[-]	Stg3	[W]	[W]	Euro
Philips	MASTER PAR20 E 20W E27 230V 25D 1CT	HL	86	64	25	245	1100	3000	yes	100	101.0	230	20.0	1.00	5000	20000 ?	0.8	12.3	0.78	B	B	yes	42	50	
Philips	HalogenA PAR20 50W E27 230V 25D 1CT	HL	105	65	25	305	850	2800	yes	100	108.0	230	50.0	1.00	2000	8000 ?	0.8	6.1	1.65	D	D	NO	51	none	
Havells-Sylvania	HS63 SU 230V 50W 25° E27 BL1	HL	88	63	25	360	1000	2900	yes	100	110.0	230	50.0	1.00	3,000	>12,000	0.8	7.2	1.46	D	D	NO	58	58	
Philips	MASTER LEDspot D 6.5-50W 2700K PAR20 25D	LED	90	64	25	410	1400	2700	yes	80	156.0	220-240	6.5	0.65	40000	50000 ?	0.7	63.1	0.17	A+	A+	yes	57	50	21.55
Philips	MASTER LEDspot D 6.5-50W 3000K PAR20 25D	LED	90	64	25	430	1450	3000	yes	80	156.0	220-240	6.5	0.65	40000	50000 ?	0.7	66.2	0.17	A+	A+	yes	59	50	21.55
Philips	MASTER LEDspot D 6.5-50W 4000K PAR20 25D	LED	90	64	25	440	1500	4000	yes	80	156.0	220-240	6.5	0.65	40000	50000 ?	0.7	67.7	0.16	A+	A+	yes	60	50	21.55
Havells-Sylvania	REFLED PAR20 DIM 500LM 7.5W 830 25° SL	LED	91	62	25	500	2500	3000	yes	80		220-240	7.5	0.80	40,000	25,000	0.7	66.7	0.17	A+	A+	yes	67	67	
Zenaro	SL-PAR20B/H/P08/25 /E30/TD/27/HAC/EU/ZN	LED	80	65	25	505	1800	3000	yes	>80	170.0	220-240	8.0	>0.9	40,000	>20,000	0.7	63.1	0.18	A+	A/A+	yes	67	<60	
Zenaro	SL-PAR20B/H/P08/25 /E50/TD/27/HAC/EU/ZN	LED	80	65	25	540	2500	5000	yes	>80	170.0	220-240	8.0	>0.9	40,000	>20,000	0.7	67.5	0.17	A+	A/A+	yes	71	<60	

3.10. E27 cap, lamp type PAR20, beam angle 30° and higher

Only one existing filament lamp has been found with cap E27, shape PAR20 and a 30° beam angle. This lamp has a flux of 350 lm. A dimmable LED lamp with the same beam angle and flux is available from the same manufacturer (Osram). Other LED lamps are available with beam angles of 30°, 35°, 40° and 50°, but there are several that do not (yet) meet the EEI<0.2 criterion.

Conclusion: LED substitutes for MV PAR20 with E27 cap and 30° beam angle or higher are available.

Links to images: [Osram halopar](#) [Osram LED](#)

Table 10 Directional lamps with E27 cap, PAR20 shape and beam angle 30° or higher

manufacture	lamp designation	tech	L	D	BA	LM	LI	CCT	DIM	CRI	M	V	P	PF	LIFE	Switch	LLMF	EFF	EEI	EEL cmp	EEL decl	1194/2012	Peq cmp	Peq decl	€
			[mm]	[mm]	[deg]	[lm]	[cd]	[K]		[Ra8]	[gr]	[V]	[W]	[-]	[h]	[X]	[-]	lm/W	[-]	[-]	[-]	Stg3	[W]	[W]	Euro
Osram	HALOPAR 20 50 W 230 V 30° E27	HL	91	65	30	350	1000	2800	yes	100	126.0	230	50.0	1.00	2000	50,000	0.75	7.0	1.49	D	D	NO	56	none	5.44
Havells-Sylvania	RefLED PAR20 5.5W 300LM 830 30° SL	LED	93	62	30	270	900	3000	no	80	110.0	220-240	5.5	0.70	30,000	100,000	0.85	49.1	0.20	A	A	yes	43	40	
Osram	PARATHOM PAR20 50 30° 6 W/827 E27	LED	87	65	30	350	980	2700	yes	80	158.0	220	6.0	>0.5	40,000	100,000	0.7	58.3	0.18	A+	A+	yes	51	50	
Megaman	LR0308-50H30D-2800K	LED	95	65	30	405	1,600	2800	no	82	140.0	220-240	8.0	>0.5	25,000	>1E6	0.9	50.6	0.21	A	A	NO	61	63	
Megaman	LR0308-50H30D-4000K	LED	95	65	30	405	1,600	4000	no	85	140.0	220-240	8.0	>0.5	25,000	>1E6	0.9	50.6	0.21	A	A	NO	61	63	
Megaman	LR0308d-50H30D-2800K	LED	95	65	30	405	1,600	2800	yes	82	140.0	220-240	8.0	>0.5	25,000	>1E6	0.9	50.6	0.21	A	A	NO	61	63	
Megaman	LR0308d-50H30D-4000K	LED	95	65	30	405	1,600	4000	yes	85	140.0	220-240	8.0	>0.5	25,000	>1E6	0.9	50.6	0.21	A	A	NO	61	63	
Megaman	LR2906-WFL-2800K	LED	90	63	35	250	450	2800	no	82	60.0	220-240	6.0	>0.5	15,000	>1E6	0.7	41.7	0.23	A	A	NO	40	50	
Megaman	LR2906-WFL-4000K	LED	90	63	35	250	450	4000	no	85	60.0	220-240	6.0	>0.5	15,000	>1E6	0.7	41.7	0.23	A	A	NO	40	50	
Verbatim	LED PAR20 E27 8W 52232	LED	94	60	35	344	900	3000	yes	>80	140.0	220-240	8.0	0.86	30,000	60,000	0.7	43.0	0.24	A		NO	50	49	
V-tac	VT-1208	LED	83	64	40	360		3000	no	>80		220-240	8.0	>0.5			0.7	45.0	0.23	A		NO	52	40	
Philips	MASTER LEDspot D 6.5-50W 2700K PAR20 40D	LED	90	64	40	400	750	2700	yes	80	156.0	220-240	6.5	0.65	40000	50000 ?	0.7	61.5	0.17	A+	A+	yes	56	50	21.55
Philips	MASTER LEDspot D 6.5-50W 3000K PAR20 40D	LED	90	64	40	420	780	3000	yes	80	156.0	220-240	6.5	0.65	40000	50000 ?	0.7	64.6	0.17	A+	A+	yes	58	50	21.55
Philips	MASTER LEDspot D 6.5-50W 4000K PAR20 40D	LED	90	64	40	430	810	4000	yes	80	156.0	220-240	6.5	0.65	40000	50000 ?	0.7	66.2	0.17	A+	A+	yes	59	50	21.55
Zenaro	SL-PAR20B/H/P08/50/E30/TD/27/HAC/EU/ZN	LED	80	65	50	510	550	3000	yes	>80	170.0	220-240	8.0	>0.9	40,000	>20,000	0.7	63.8	0.18	A+	A/A+	yes	68	<60	
Zenaro	SL-PAR20B/H/P08/50/E50/TD/27/HAC/EU/ZN	LED	80	65	50	550	700	5000	yes	>80	170.0	220-240	8.0	>0.9	40,000	>20,000	0.7	68.8	0.17	A+	A/A+	yes	72	<60	

3.11. E27 cap, lamp type PAR25, all beam angles

Only filament lamps have been found with cap E27 and shape PAR25. These lamps have beam angles of 10° and 25° respectively and a luminous flux of 670 lm. Note that they are for 240 V. No comparable LED lamps have been found, but it is likely that in most cases PAR20 or PAR30 substitutes can be used.

Conclusion: There are few MV PAR25 filament lamps with E27 cap. No LED substitutes with identical shape are available, but PAR20 and PAR30 can be used.

Links to images: [Havells-sylvania halogen](#)

Table 11 Directional lamps with E27 cap, PAR25 shape, all beam angles

manufacture	lamp designation	tech	L	D	BA	LM	LI	CCT	DIM	CRI	M	V	P	PF	LIFE	Switch	LLMF	EFF	EEI	EEL cmp	EEL decl	1194/2012	Peq cmp	Peq decl	€
			[mm]	[mm]	[deg]	[lm]	[cd]	[K]		[Ra8]	[gr]	[V]	[W]	[-]	[h]	[X]	[-]	lm/W	[-]	[-]	[-]	Stg3	[W]	[W]	Euro
Havells-Sylvania	HS80 SU 240V 75W 10° E27 SV1	HL	108	80	10	670	5500	2900	yes	100	140.0	240	75.0	1.00	3,000	>12,000	0.8	8.9	1.35	D	D	NO	90	90	
Havells-Sylvania	HS80 SU 240V 75W 25° E27 SV1	HL	108	80	25	670	1300	2900	yes	100	140.0	240	75.0	1.00	3,000	>12,000	0.8	8.9	1.35	D	D	NO	90	90	

3.12. E27 cap, lamp type PAR30, beam angle 10°

Four filament lamps have been found with cap E27, shape PAR30 and beam angle 10°. These lamps have fluxes ranging from 640 to 980 lm. Comparable (dimmable) LED lamps are available from Zenaro, but they are considerably longer (even if all are classified as PAR30). These lamps have 600 and 650 lm respectively, but the latter has a different colour temperature (5000 K).

Conclusion: LED substitutes for MV PAR30 with E27 cap and 10° beam angle are available.

Links to images: [Havells-sylvania halogen](#) [Zenaro LED](#)

Table 12 Directional lamps with E27 cap, PAR30 shape, beam angle 10°

manufacture	lamp designation	tech	L	D	BA	LM	LI	CCT	DIM	CRI	M	V	P	PF	LIFE	Switch	LLMF	EFF	EEI	EEL cmp	EEL decl	1194/2012	Peq cmp	Peq decl	€
			[mm]	[mm]	[deg]	[lm]	[cd]	[K]		[Ra8]	[gr]	[V]	[W]	[-]	[h]	[X]	[-]	lm/W	[-]	[-]	[-]	Stg3	[W]	[W]	Euro
Havells-Sylvania	HS95 SU 230V 75W 10° E27 SV1	HL	88	95	10	640	6900	2900	yes	100	180.0	230	75.0	1.00	3,000	>12,000	0.8	8.5	1.40	D	D	NO	86	86	6.55
Osram	HALOPAR 30 75 W 230 V 10° E27	HL	91	97	10	650	6900	2900	yes	100	202.0	230	75.0	1.00	2000	50,000	0.75	8.7	1.38	D	D	NO	88	none	6.94
Philips	HalogenA PAR30S 75W E27 230V 10D 1CT	HL	99	96	10	725	5525	3200	yes	100	176.0	230	75.0	1.00	2500	8000 ?	0.8	9.7	1.27	D	D	NO	97	none	
Havells-Sylvania	HS95 SU 230V 100W 10° E27 SV1	HL	88	95	10	980	10000	2900	yes	100	180.0	230	100.0	1.00	3,000	>12,000	0.8	9.8	1.32	D	D	NO	129	129	6.55

Table 12 Directional lamps with E27 cap, PAR30 shape, beam angle 10°

manufacture	lamp designation	tech	L	D	BA	LM	LI	CCT	DIM	CRI	M	V	P	PF	LIFE	Switch	LLMF	EFF	EEI	EEL cmp	EEL decl	1194/2012	Peq cmp	Peq decl	€
			[mm]	[mm]	[deg]	[lm]	[cd]	[K]		[Ra8]	[gr]	[V]	[W]	[-]	[h]	[X]	[-]	lm/W	[-]	[-]	[-]	Stg3	[W]	[W]	Euro
Zenaro	SL-PAR30C-L/H/P10/10/E30/TD/27/HAC/EU/ZN	LED	117	100	10	600	9000	3000	yes	>80	225.0	200-240	10.0		40,000		0.7	60.0	0.20	A	A/A+	yes	83	<75	
Zenaro	SL-PAR30C-L/H/P10/10/E50/TD/27/HAC/EU/ZN	LED	117	100	10	650	10000	5000	yes	>80	225.0	200-240	10.0		40,000		0.7	65.0	0.18	A	A/A+	yes	89	<75	

3.13. E27 cap, lamp type PAR30, beam angle 20-25°

Only LED lamps have been found with cap E27, shape PAR30 and beam angle 20-25°. These lamps have fluxes ranging from 580 to 1100 lm. Note that several lamps do not meet the EEI<0.2 criterion. The others are all dimmable and range from 2700 K to 5000 K. Note that there are considerable differences in length and diameter, although all are named PAR30.

Links to images: [Philips LED](#) [Zenaro LED](#)

Table 13 Directional lamps with E27 cap, PAR30 shape, beam angle 20-25°

manufacture	lamp designation	tech	L	D	BA	LM	LI	CCT	DIM	CRI	M	V	P	PF	LIFE	Switch	LLMF	EFF	EEI	EEL cmp	EEL decl	1194/2012	Peq cmp	Peq decl	€
			[mm]	[mm]	[deg]	[lm]	[cd]	[K]		[Ra8]	[gr]	[V]	[W]	[-]	[h]	[X]	[-]	lm/W	[-]	[-]	[-]	Stg3	[W]	[W]	Euro
Verbatim	LED PAR30 E27 52034	LED	129	120	22	1100	6500	3000	yes	>80	390.0	220-240	20.0	0.90	35,000	60,000	0.7	55.0	0.24	A		NO	126	128	
Megaman	LR0215-100H24D-2800K	LED	102	96	24	500	3,200	2800	no	85	239.0	220-240	15.0	>0.5	30,000	>1E6	0.9	33.3	0.34	A	A	NO	66	100	
Megaman	LR0215-100H24D-4000K	LED	102	96	24	500	3,200	4000	no	92	239.0	220-240	15.0	>0.5	30,000	>1E6	0.9	33.3	0.34	A	A	NO	66	100	
Megaman	LR0215d-100H24D-2800K	LED	102	96	24	500	3,200	2800	yes	85	230.0	220-240	15.0	>0.5	30,000	>1E6	0.9	33.3	0.34	A	A	NO	66	100	
Megaman	LR0215d-100H24D-4000K	LED	102	96	24	500	3,200	4000	yes	92	230.0	220-240	15.0	>0.5	30,000	>1E6	0.9	33.3	0.34	A	A	NO	66	100	
Verbatim	LED PAR30 E27 52016	LED	118	91	25	580	1300	2700	yes	>80	330.0	220-240	11.3	0.75	25,000	60,000	0.7	51.3	0.23	A	A	NO	69	69	

Table 13 Directional lamps with E27 cap, PAR30 shape, beam angle 20-25°

Verbatim	LED PAR30 E27 52016	LED	118	91	25	580	1300	2700	yes	>80	330.0	220-240	11.3	0.75	25,000	60,000	0.7	51.3	0.23	A	A	NO	69	69	
Havells-Sylvania	RefLED PAR30 11W 680LM 830 25° SL	LED	98	95	25	610	2300	3000	no	80	290.0	220-240	11.0	0.75	30,000	100,000	0.85	55.5	0.21	A	A	NO	77	73	
Philips	MASTER LEDspot D 12-75W 2700K PAR30S	LED	91	92	25	630	2250	2700	yes	80	321.0	230	12.0	0.80	45000	50000 ?	0.7	52.5	0.23	A	A	NO	75	75	
Philips	MASTER LED 12-75W 2700K PAR30S 25D Dim	LED	91	92	25	630	2250	2700	yes	80	321.0	230	12.0	0.80	45000	50000 ?	0.7	52.5	0.23	A	A	NO	75	75	
Zenaro	SL-PAR30C-L/H/P10/25 /E30/TD/27/HAC/EU/ZN	LED	117	100	25	640	2500	3000	yes	>80	225.0	200-240	10.0		40,000		0.7	64.0	0.19	A	A/A+	yes	76	<75	
Philips	MASTER LEDspot D 9.5-75W 827 PAR30S 25D	LED	94	92	25	650	3500	2700	yes	80	321.0	220-240	9.5	0.90	40000	50000 ?	0.7	68.4	0.18	A+	A+	yes	77	75	
Zenaro	SL-PAR30C-L/H/P10/25 /E30/TD/27/HAC/EU/ZN	LED	117	100	25	700	3000	5000	yes	>80	225.0	200-240	10.0		40,000		0.7	70.0	0.17	A+	A/A+	yes	82	<75	
Philips	MASTER LEDspot D 9.5-75W 840 PAR30S 25D	LED	94	92	25	750	3850	4000	yes	80	321.0	220-240	9.5	0.90	40000	50000 ?	0.7	78.9	0.16	A+	A+	yes	88	75	
Havells-Sylvania	REFLED PAR30 DIM 900LM 12.5W 830 25° SL	LED	98	95	25	900	4600	3000	yes	80		220-240	12.5	0.80	40,000	25,000	0.7	72.0	0.18	A+	A+	yes	104	104	
Aurora	220-240V AC PAR38 Dimmable 20W AOne AU-DP30S152/30	LED	97	95	25	1040		3000	yes	80		200-264	15.0	0.90	25,000		0.7	69.3	0.19	A		yes	121		
Aurora	220-240V AC PAR38 Dimmable 20W AOne AU-DP30S152/40	LED	97	95	25	1140		4000	yes	80		200-264	15.0	0.90	25,000		0.7	76.0	0.18	A+		yes	133		

3.14. E27 cap, lamp type PAR30, beam angle 30° and higher

Six filament lamps have been found with cap E27, shape PAR30 and beam angle 30°. Luminous fluxes for these lamps range from 640 to 980 lm. The LED lamp that most closely resembles is the one by Osram which is dimmable and has 870 lm. Two Megaman lamps and the Verbatim lamp have a very high CRI>0.94 but they do not (yet) meet the EEI<0.2 criterion of regulation 1194/2012 stage 3. LED lamps with higher beam angles are also available. Note that some of the lamps differ in length and in diameter.

Conclusion: LED substitutes for MV PAR30 with E27 cap and 30° beam angle or higher are available.

Links to images: [Havells-sylvania halogen](#) [Aurora LED](#)

Table 14 Directional lamps with E27 cap, PAR30 shape, beam angle 30° and higher

manufacture	lamp designation	tech	L	D	BA	LM	LI	CCT	DIM	CRI	M	V	P	PF	LIFE	Switch	LLMF	EFF	EEI	EEL cmp	EEL decl	1194/2012	Peq cmp	Peq decl	€
			[mm]	[mm]	[deg]	[lm]	[cd]	[K]		[Ra8]	[gr]	[V]	[W]	[-]	[h]	[X]	[-]	lm/W	[-]	[-]	[-]	Stg3	[W]	[W]	Euro
Havells-Sylvania	HS95 SU 230V 75W 30° E27 SV1	HL	88	95	30	640	2200	2900	yes	100	180.0	230	75.0	1.00	3,000	>12,000	0.8	8.5	1.40	D	D	NO	86	86	6.55
Osram	HALOPAR 30 75 W 230 V 30° E27	HL	91	97	30	650	2200	2900	yes	100	206.0	230	75.0	1.00	2000	50,000	0.75	8.7	1.38	D	D	NO	88	none	6.83
Havells-Sylvania	HS95D SU 230V 75W 30° E27 SV1 (dichroic)	HL	88	95	30	700	2400	2900	yes	100	180.0	230	75.0	1.00	3,000	>12,000	0.8	9.3	1.30	D	D	NO	94	94	
Philips	HalogenA PAR30S 75W E27 230V 30D 1CT	HL	99	96	30	725	1700	2800	yes	100	176.0	230	75.0	1.00	2000	8000 ?	0.8	9.7	1.27	D	D	NO	97	none	
Philips	HalogenA PAR30S 100W E27 230V 30D 1CT	HL	99	96	30	950	3000	2900	yes	100	146.0	230	100.0	1.00	2500	8000 ?	0.8	9.5	1.36	D	D	NO	125	none	
Havells-Sylvania	HS95 SU 230V 100W 30° E27 SV1	HL	88	95	30	980	3500	2900	yes	100	180.0	230	100.0	1.00	3,000	>12,000	0.8	9.8	1.32	D	D	NO	129	129	6.55
Megaman	LR1412dR9-75H30D-2800K	LED	88	95	30	470	2300	2800	yes	94	263.0	220-240	12.0		30,000		0.7	39.2	0.28	A	A	NO	57	none	
Megaman	LR1412dR9-75H30D-4000K	LED	88	95	30	470	2300	4000	yes	94	263.0	220-240	12.0		30,000		0.7	39.2	0.28	A	A	NO	57	none	
Megaman	LR1412d-75H30D-2800K	LED	88	95	30	580	2,300	2800	yes	82	260.0	220-240	12.0	>0.5	30,000	>1E6	0.9	48.3	0.24	A	A	NO	75	77	
Megaman	LR1412d-75H30D-4000K	LED	88	95	30	580	2,300	4000	yes	85	260.0	220-240	12.0	>0.5	30,000	>1E6	0.9	48.3	0.24	A	A	NO	75	77	
Verbatim	LED PAR30 E27 52042	LED	90	91	30	595	1300	4000	yes	>95	300.0	220-240	14.5	0.80	25,000	60,000	0.7	41.0	0.29	A	A	NO	71	71	
Svetila	LED Par 7W 30deg 6000K	LED	100	95	30	600		6500	no	80		85-265	7.0				0.7	85.7	0.14	A+	A	yes	70	none	36.72
Osram	PARATHOM PAR30 100 30° ADV 13 W/827	LED	90	95	30	870	2100	2700	yes	80	244.0	220	13.0	>0.5	40,000	100,000	0.7	66.9	0.19	A	A+	yes	101	75	
Megaman	LR3010.5-WFL-2800K	LED	88	95	35	635	850	2800	no	80	103.0	220-240	10.5	>0.5	15,000	>1E6	0.7	60.5	0.20	A	A	yes	75	82	
Megaman	LR3010.5-WFL-4000K	LED	88	95	35	635	850	4000	no	80	103.0	220-240	10.5	>0.5	15,000	>1E6	0.7	60.5	0.20	A	A	yes	75	82	
V-tac	VT-1212	LED	114	95	40	600		3000	no	>80		220-240	12.0	>0.5			0.7	50.0	0.24	A		NO	71	60	
Aurora	220-240V AC PAR38 Dimmable 20W AOne AU-DP30S154/27	LED	97	95	40	950		2700	yes	80		200-264	15.0	0.90	25,000		0.7	63.3	0.20	A		NO	109		
Aurora	220-240V AC PAR38 Dimmable 20W AOne AU-DP30S154/30	LED	97	95	40	1040		3000	yes	80		200-264	15.0	0.90	25,000		0.7	69.3	0.19	A		yes	121		
Aurora	220-240V AC PAR38 Dimmable 20W AOne AU-DP30S154/40	LED	97	95	40	1140		4000	yes	80		200-264	15.0	0.90	25,000		0.7	76.0	0.18	A+		yes	133		
Zenaro	SL-PAR30C-L/H/P10/50 /E30/TD/27/HAC/EU/ZN	LED	117	100	50	640	900	3000	yes	>80	225.0	200-240	10.0		40,000		0.7	64.0	0.19	A	A/A+	yes	76	<75	
Zenaro	SL-PAR30C-L/H/P10/50 /E50/TD/27/HAC/EU/ZN	LED	117	100	50	700	1000	5000	yes	>80	225.0	200-240	10.0		40,000		0.7	70.0	0.17	A+	A/A+	yes	82	<75	

3.15. E27 cap, lamp type PAR38, beam angle 10-12°

Two filament lamps have been found with cap E27, shape PAR38 and beam angle 12°. Luminous fluxes for these lamps are 620 and 1100 lm. There are two potential LED substitutes with a beam angle of 10° and fluxes of 845 and 900 lm. They are both declared as dimmable, but neither meets the EEI<0.20 criterion (yet).

Conclusion: There are few filament lamps PAR38 with cap E27 and beam angle 10-12°, and LED substitutes are available.

Links to images: [Osram halogen](#) [Zenaro LED](#)

Table 15 Directional lamps with E27 cap, PAR38 shape, beam angle 10°-12°

manufacture	lamp designation	tech	L	D	BA	LM	LI	CCT	DIM	CRI	M	V	P	PF	LIFE	Switch	LLMF	EFF	EEI	EEL cmp	EEL decl	1194/2012	Peq cmp	Peq decl	€
			[mm]	[mm]	[deg]	[lm]	[cd]	[K]		[Ra8]	[gr]	[V]	[W]	[-]	[h]	[X]	[-]	lm/W	[-]	[-]	[-]	Stg3	[W]	[W]	Euro
Zenaro	SL-PAR38C/H/P16/10/E30/TD/27/HAC/EU/ZN	LED	128	120	10	845	10000	3000	yes	>80	300.0	200-240	16.0		40,000		0.7	52.8	0.24	A	A	NO	115	<100	
Zenaro	SL-PAR38C/H/P16/10/E50/TD/27/HAC/EU/ZN	LED	128	120	10	900	12000	5000	yes	>80	300.0	200-240	16.0		40,000		0.7	56.3	0.23	A	A	NO	123	<100	
Osram	HALOPAR 38 75 W 240 V 12° E27	HL	139	123	12	620	7200	2800	yes	100	396.0	240	75.0	1.00	2000	50,000	0.75	8.3	1.43	D	D	NO	83	none	7.65
Philips	PAR38 120W 230V SP E27	HL	137	123	12	1100	8200	2700	yes	100		230	120.0	1.00	2000			9.2	1.44	D	D	NO	149	none	6.16

3.16. E27 cap, lamp type PAR38, beam angle 22-25°

Only LED lamps have been found with cap E27, shape PAR38 and beam angle 22°-25°. Two LED lamps by Verbatim that are declared as PAR30 have been inserted here as PAR38, considering their dimensions. Only four of the listed LED lamps meet the EEI<0.20 criterion. Luminous fluxes for these lamps are from 1065 to 1615 lm, and all are dimmable. Note that the Zenaro lamps have half the mass of the Philips lamps.

Conclusion: There are no filament lamps PAR38 with cap E27 and beam angle 22-25°, while LED lamps are available.

Links to images: [Havells-sylvania LED](#) [Aurora LED](#)

Table 16 Directional lamps with E27 cap, PAR38 shape, beam angle 22°-25°

manufacture	lamp designation	tech	L	D	BA	LM	LI	CCT	DIM	CRI	M	V	P	PF	LIFE	Switch	LLMF	EFF	EEI	EEL cmp	EEL decl	1194/2012	Peq cmp	Peq decl	€
			[mm]	[mm]	[deg]	[lm]	[cd]	[K]		[Ra8]	[gr]	[V]	[W]	[-]	[h]	[X]	[-]	lm/W	[-]	[-]	[-]	Stg3	[W]	[W]	Euro
Verbatim	LED PAR30 E27 52034	LED	129	120	22	1100	6500	3000	yes	>80	390.0	220-240	20.0	0.90	35,000	60,000	0.7	55.0	0.24	A		NO	126	128	
Philips	MASTER LEDspot 17-90W 827 PAR38 OD	LED	133	122	25	780	3500	2700	no	80	609.0	230	17.0	0.70	25000	50000 ?	0.7	45.9	0.27	A	A	NO	90	90	
Havells-Sylvania	RefLED PAR38 15W 900LM 25° SL	LED	130	121	25	780	2500	3000	no	80	630.0	220-240	15.0	0.70	30,000	100,000	0.85	52.0	0.24	A	A	NO	95	90	
Megaman	LR1916-FL-2800K	LED	133	121	25	800	6,000	2800	no	80	485.0	220-240	16.0	>0.5	25,000	>1E6	0.9	50.0	0.25	A	A	NO	100	120	
Megaman	LR1916-FL-4000K	LED	133	121	25	800	6,000	4000	no	80	485.0	220-240	16.0	>0.5	25,000	>1E6	0.9	50.0	0.25	A	A	NO	100	120	
Verbatim	LED PAR30 E27 52017	LED	131	109	25	800	2400	2700	yes	>80	465.0	220-240	17.5	0.75	25,000	60,000	0.7	45.7	0.27	A	A	NO	93	92	
Philips	MASTER LED 18-100W 2700K PAR38 25D Dim	LED	133	122	25	810	3400	2700	yes	80	609.0	230	18.0	0.80	45000	50000 ?	0.7	45.0	0.28	A	A	NO	93	100	
Philips	MASTER LEDspot D 18-100W 2700K PAR38	LED	133	122	25	810	3400	2700	yes	80	609.0	230	18.0	0.80	45000	50000 ?	0.7	45.0	0.28	A	A	NO	93	100	
Philips	MASTER LEDspot D 14.5-100W 827 PAR38 25D	LED	136	121	25	900	4700	2700	yes	80	609.0	220-240	14.5	0.92	40000	50000 ?	0.7	62.1	0.21	A	A	NO	103	100	
Megaman	LR0920R9-25M25D-2800K	LED	133	121	25	900	5000	2800	yes	94	485.0	220-240	20.0		30,000		0.7	45.0	0.28	A	A	NO	104	113	
Megaman	LR0920R9-25M25D-4000K	LED	133	121	25	900	5000	4000	yes	94	485.0	220-240	20.0		30,000		0.7	45.0	0.28	A	A	NO	103	113	
Zenaro	SL-PAR38C/H/P16/25/E30/TD/27/HAC/EU/ZN	LED	128	120	25	960	3000	3000	yes	>80	300.0	200-240	16.0		40,000		0.7	60.0	0.22	A	A	NO	111	<100	
Megaman	LR0920-25M25D-2800K	LED	133	121	25	1000	6,800	2800	no	82	485.0	220-240	20.0	>0.5	30,000	>1E6	0.9	50.0	0.26	A	A	NO	127	120	
Megaman	LR0920d-25M25D-2800K	LED	133	121	25	1000	6,800	2800	yes	82	490.0	220-240	20.0	>0.5	30,000	>1E6	0.9	50.0	0.26	A	A	NO	127	120	
Megaman	LR0920-25M25D-4000K	LED	133	121	25	1000	6,800	4000	no	85	485.0	220-240	20.0	>0.5	30,000	>1E6	0.9	50.0	0.26	A	A	NO	127	120	
Megaman	LR0920d-25M25D-4000K	LED	133	121	25	1000	6,800	4000	yes	85	490.0	220-240	20.0	>0.5	30,000	>1E6	0.9	50.0	0.26	A	A	NO	127	120	
Zenaro	SL-PAR38C/H/P16/25/E50/TD/27/HAC/EU/ZN	LED	128	120	25	1065	3300	5000	yes	>80	300.0	200-240	16.0		40,000		0.7	66.6	0.20	A	A	yes	124	<100	
Havells-Sylvania	REFLED PAR38 DIM 1300LM 18.5W 830 25° SL	LED	128	120	25	1300	7000	3000	yes	80		220-240	18.5	0.80	40,000	25,000	0.7	70.3	0.19	A	A	yes	153	153	
Aurora	220-240V AC PAR38 Dimmable 20W AOne AU-DP38202/30	LED	130	120	25	1520		3000	yes	80		200-264	20.0	0.90	25,000		0.7	76.0	0.18	A+		yes	180		
Aurora	220-240V AC PAR38 Dimmable 20W AOne AU-DP38202/40	LED	130	120	25	1615		4000	yes	80		200-264	20.0	0.90	25,000		0.7	80.8	0.17	A+		yes	192		

3.17. E27 cap, lamp type PAR38, beam angle 30° and higher

Seven existing filament lamps have been found with cap E27, shape PAR38 and beam angle 30°. The luminous flux ranges from 400 to 1110 lm and power from 50 W to 120 W. All have a CCT around 2800 K. Seven LED lamps with beam angle 30° have been found, but the three by Svetila have a CCT of 6500 K. The Osram lamp has 1035 lm, 2700 K and is dimmable, but does not meet the EEI<0.20 criterion yet. The Megaman lamps also do not meet this criterion yet. Other LED lamps with higher beam angle are available.

Conclusion: LED substitutes for MV PAR38 with E27 cap and 30° beam angle or higher are available.

Links to images: [Osram halogen](#) [Lampenwelt LED](#)

Table 17 Directional lamps with E27 cap, PAR38 shape, beam angle 30° and higher

manufacture	lamp designation	tech	L	D	BA	LM	LI	CCT	DIM	CRI	M	V	P	PF	LIFE	Switch	LLMF	EFF	EEI	EEL cmp	EEL decl	1194/2012	Peq cmp	Peq decl	€	
			[mm]	[mm]	[deg]	[lm]	[cd]	[K]		[Ra8]	[gr]	[V]	[W]	[-]	[h]	[X]	[-]	lm/W	[-]	[-]	[-]	Stg3	[W]	[W]	Euro	
Osram	HALOPAR 38 50 W 240 V 30° E27	HL	139	123	30	400	1200	2700	yes	100	396.0	240	50.0	1.00	2000	50,000	0.75	8.0	1.34	D	D	NO	60	none	7.65	
Philips	PAR38 60W 230V FL E27	HL	137	123	30	445	1200	2700	yes	100		230	60.0	1.00	2000			7.4	1.49	D	D	NO	55	none	6.16	
Osram	HALOPAR 38 75 W 240 V 30° E27	HL	139	123	30	580	2400	2800	yes	100	396.0	240	75.0	1.00	2000	50,000	0.75	7.7	1.51	D	D	NO	78	none	7.65	
Osram	HALOPAR 38 100 W 240 V 30° E27	HL	134	123	30	900	3100	2900	yes	100	396.0	240	100.0	1.00	2000	50,000	0.75	9.0	1.42	D	D	NO	120	none	7.88	
Philips	HalogenA PAR38 100W E27 230V 30D 1CT	HL	139	123	30	950	3100	2800	yes	100	299.0	230	100.0	1.00	2500	8000 ?	0.8	9.5	1.36	D	D	NO	127	none		
Philips	PAR38 120W 230V FL E27	HL	137	123	30	1040	3100	2700	yes	100		230	120.0	1.00	2000			8.7	1.51	D	D	NO	140	none	5.99	
Havells-Sylvania	HS120 SU 230V 100W 30° E27 BL1	HL	136	122	30	1110	3500	2900	yes	100	310.0	230	100.0	1.00	3,000	>12,000	0.8	11.1	1.19	C	D	NO	150	150		
Megaman	LR0915-75H30D-2800K	LED	133	121	30	520	2,200	2800	no	82	458.0	220-240	15.0	>0.5	30,000	>1E6	0.9	34.7	0.33	A	A	NO	69	75		
Megaman	LR0915-75H30D-4000K	LED	133	121	30	520	2,200	4000	no	85	458.0	220-240	15.0	>0.5	30,000	>1E6	0.9	34.7	0.33	A	A	NO	69	75		
Svetila	LED Par 9W 30deg 6000K	LED	128	122	30	700		6500	no	80		85-265	9.0					0.7	77.8	0.16	A+	A	yes	81	none	45.07
Svetila	LED Par 12W 30deg 6000K	LED	128	122	30	900		6500	no	80		85-265	12.0					0.7	75.0	0.17	A+	A	yes	103	none	51.41
Osram	PARATHOM PAR38 120 30° ADV 17 W/827	LED	133	123	30	1035	3000	2700	yes	80	519.0	220	17.0	0.90	40,000	100,000	0.7	60.9	0.22	A	A	NO	120	120		
Svetila	LED Par 15W 30deg 6000K	LED	128	122	30	1300		6500	no	80		85-265	15.0					0.7	86.7	0.16	A+	A	yes	146	none	55.08
Bioledex	RODER PAR38 LED Strahler Wasserdicht E27 15W 30° NW	LED	139	123	30	1300	2,350	4000	no	80		230	15.0	0.92	30,000	100,000	0.8	86.7	0.16	A+	A+	yes	160	120		
Megaman	LR3215.5-WFL-2800K	LED	132	121	35	760	1,500	2800	no	80	204.0	220-240	15.5	>0.5	15,000	>1E6	0.7	49.0	0.25	A	A	NO	86	109		
Megaman	LR3215.5-WFL-4000K	LED	132	121	35	760	1,500	4000	no	80	204.0	220-240	15.5	>0.5	15,000	>1E6	0.7	49.0	0.25	A	A	NO	86	109		

Table 17 Directional lamps with E27 cap, PAR38 shape, beam angle 30° and higher

Lampenwelt	E27 15W LED-Reflektorlampe Roder PAR38	LED	135	120	36	1150		3000	no	90	180.0	230	15.0		30,000	100,000	0.7	76.7	0.17	A+	A+	yes	134	120	43.61
V-tac	VT-1216	LED	132	120	40	800		3000	no	>80		220-240	15.0	>0.5			0.7	53.3	0.23	A		NO	91	75	
Aurora	220-240V AC PAR38 Dimmable 20W AOne AU-DP38204/27	LED	130	120	40	1400		2700	yes	80		200-264	20.0	0.90	25,000		0.7	70.0	0.19	A		yes	165		
Aurora	220-240V AC PAR38 Dimmable 20W AOne AU-DP38204/30	LED	130	120	40	1520		3000	yes	80		200-264	20.0	0.90	25,000		0.7	76.0	0.18	A+		yes	180		
Aurora	220-240V AC PAR38 Dimmable 20W AOne AU-DP38204/40	LED	130	120	40	1615		4000	yes	80		200-264	20.0	0.90	25,000		0.7	80.8	0.17	A+		yes	192		
Megaman	LR0920-25M45D-2800K	LED	133	121	45	1000	2,200	2800	no	82	485.0	220-240	20.0	>0.5	30,000	>1E6	0.9	50.0	0.26	A	A	NO	127	120	
Megaman	LR0920d-25M45D-2800K	LED	133	121	45	1000	2,200	2800	yes	82	490.0	220-240	20.0	>0.5	30,000	>1E6	0.9	50.0	0.26	A	A	NO	127	120	
Megaman	LR0920-25M45D-4000K	LED	133	121	45	1000	2,200	4000	no	85	485.0	220-240	20.0	>0.5	30,000	>1E6	0.9	50.0	0.26	A	A	NO	127	120	
Megaman	LR0920d-25M45D-4000K	LED	133	121	45	1000	2,200	4000	yes	85	490.0	220-240	20.0	>0.5	30,000	>1E6	0.9	50.0	0.26	A	A	NO	127	120	
Zenaro	SL-PAR38C/H/P16/50 /E30/TD/27/HAC/EU/ZN	LED	128	120	50	960	1000	3000	yes	>80	300.0	200-240	16.0		40,000		0.7	60.0	0.22	A	A	NO	111	<100	
Zenaro	SL-PAR38C/H/P16/50 /E50/TD/27/HAC/EU/ZN	LED	128	120	50	1065	1200	5000	yes	>80	300.0	200-240	16.0		40,000		0.7	66.6	0.20	A	A	yes	124	<100	

3.18. GU10/GZ10 cap, lamp type PAR16/MR16/ES50, beam angle 20-25°

Some halogen lamps have GZ10 instead of GU10 caps, but it is assumed that they can be replaced by LEDs with GU10 caps. The lamp shape indications MR16, PAR16 and ES50 are practically equivalent (as long as they all have the GU10 base): all have a 50-51 mm diameter and 51-58 mm length. See also remarks in the chapter on methodology.

There are two filament lamps with beam angle 20° and 185 and 330 lm. Several 'broadly equivalent' LED lamps are available, with a beam angle of 24° and 150 to 350 lm. Dimmable versions and high CRI=0.9 versions also exist. Several LED lamps already meet the EEI<0.20 criterion, or the difference is small.

There is a large number of filament lamps with beam angle 25° and flux ranging from 95 to 385 lm. All these lamps have a CCT around 2700 K. There is also a large number of LED lamps with the same beam angle and flux ranging from 150 to 460 lm. Many of these lamps are available in 2700 K, 3000 K and 4000 K versions. Many are declared as dimmable and most meet the EEI<0.20 limit of regulation 1194/2012 stage 3.

Conclusion: LED substitutes for MV PAR16/MR16/ES50 with GU10 cap and 20-25° beam angle are available.

Links to images: [Philips halogen](#) [Philips LED](#) [Havells-sylvania halogen](#) [Osram LED](#)

Table 18 Directional lamps with GU10/GZ10 cap, MR16/PAR16/ES50 shape, beam angle 20°-25°

manufacture	lamp designation	tech	L	D	BA	LM	LI	CCT	DIM	CRI	M	V	P	PF	LIFE	Switch	LLMF	EFF	EEI	EEL cmp	EEL decl	1194/2012	Peq cmp	Peq decl	€
			[mm]	[mm]	[deg]	[lm]	[cd]	[K]		[Ra8]	[gr]	[V]	[W]	[-]	[h]	[X]	[-]	lm/W	[-]	[-]	[-]	Stg3	[W]	[W]	Euro
Philips	Twistline Alu 2000h 35W GU10 230V 20D 1CT	HL	51	51	20	185	500	2800	yes	100	38.8	230	35.0	1.00	2000	8000 ?	0.8	5.3	1.66	D	D	NO		none	
Philips	Twistline Alu 2000h 50W GU10 230V 20D 1CT	HL	51	51	20	330	1000	2800	yes	100	38.9	230	50.0	1.00	2000	8000 ?	0.8	6.6	1.55	D	D	NO		none	
Megaman	LR1204DG-FL-2800K	LED	57	50	24	150	800	2800	no	80	40.0	220-240	4.0	>0.4	20,000	>1E6	0.7	37.5	0.22	A	A	NO	26	31	
Megaman	LR1204DG-FL-4000K	LED	57	50	24	150	800	4000	no	80	40.0	220-240	4.0	>0.4	20,000	>1E6	0.7	37.5	0.22	A	A	NO	26	31	
Megaman	LR1506-35H24D-2800K TCH	LED	64	50	24	220	1,300	2800	no	82	70.0	220-240	6.0	>0.5	25,000	>1E6	0.9	36.7	0.25	A	A	NO	36	47	
Megaman	LR1204dLNv2-FL-2800K	LED	61	50	24	220	800	2800	yes	80	49.0	220-240	4.0	>0.4	25,000	>1E6	0.9	55.0	0.17	A+	A+	yes	36	40	
Megaman	LR1506-35H24D-4000K TCH	LED	64	50	24	220	1,300	4000	no	85	70.0	220-240	6.0	>0.5	25,000	>1E6	0.9	36.7	0.25	A	A	NO	36	47	
Megaman	LR1204dLNv2-FL-4000K	LED	61	50	24	220	800	4000	yes	80	49.0	220-240	4.0	>0.4	25,000	>1E6	0.9	55.0	0.17	A+	A+	yes	36	40	
Osram	PARATHOM PRO PAR16 35 24° ADV 5.2 W/927 GU10	LED	58	50	24	230	900	2700	yes	90	88.0	230	5.2	>0.75	50,000	100,000	0.7	44.2	0.21	A	A	NO	35	35	27.50
Osram	PARATHOM PRO PAR16 35 24° ADV 5.2 W/940 GU10	LED	58	50	24			4000		90		230	5.2												
Megaman	LR1206dLNv2-FL-2800K	LED	61	50	24	300	1,100	2800	yes	80	70.0	220-240	6.0	>0.5	25,000	>1E6	0.9	50.0	0.20	A	A	NO	48	47	
Megaman	LR1206dLNv2-FL-4000K	LED	61	50	24	300	1,100	4000	yes	80	70.0	220-240	6.0	>0.5	25,000	>1E6	0.9	50.0	0.20	A	A	NO	48	47	
Zenaro	SL-10B/T/P05/24 /E30/HAC/EU/ZN	LED	56	50	24	320		3000	yes	>80	65.0	200-240	5.0		25,000		0.7	64.0	0.16	A+	A+	yes	47	<25	
Zenaro	SL-10B/T/P05/24 /E50/HAC/EU/ZN	LED	56	50	24	320		5000	yes	>80	65.0	200-240	5.0		25,000		0.7	64.0	0.16	A+	A+	yes	47	<25	
Megaman	LR4407-50H24D-2800K	LED	64	50	24	345	2,200	2800	no	82		220-240	7.0		25,000		0.7	49.3	0.21	A	A	NO	50	50	
Megaman	LR4407d-50H24D-2800K	LED	64	50	24	345	2,200	2800	yes	82		220-240	7.0		25,000		0.7	49.3	0.21	A	A	NO	50	50	

Table 18 Directional lamps with GU10/GZ10 cap, MR16/PAR16/ES50 shape, beam angle 20°-25°

manufacture	lamp designation	tech	L	D	BA	LM	LI	CCT	DIM	CRI	M	V	P	PF	LIFE	Switch	LLMF	EFF	EEI	EEL cmp	EEL decl	1194/2012	Peq cmp	Peq decl	€
			[mm]	[mm]	[deg]	[lm]	[cd]	[K]		[Ra8]	[gr]	[V]	[W]	[-]	[h]	[X]	[-]	lm/W	[-]	[-]	[-]	Stg3	[W]	[W]	Euro
Megaman	LR4407-50H24D-4000K	LED	64	50	24	345	2,200	4000	no	85		220-240	7.0		25,000		0.7	49.3	0.21	A	A	NO	50	50	
Megaman	LR4407d-50H24D-4000K	LED	64	50	24	345	2,200	4000	yes	85		220-240	7.0		25,000		0.7	49.3	0.21	A	A	NO	50	50	
Osram	PARATHOM PRO PAR16 50 24° ADV 6.8 W/927 GU10	LED	58	50	24	350	1700	2700	yes	90	88.0	230	6.8	>0.75	30,000	1E+06	0.7	51.5	0.20	A	A	NO	51	50	
Havells-Sylvania	HS ES50 ECO 230V 18W 25° GU10 SV1	HL	55	50	25	95	350	2700	yes	100	50.0	230	18.0	1.00	2,000	>8,000	0.8	5.3	1.36	D	D	NO	21	21	
Philips	EcoHalo Twist 18W GU10 230V 25D 1CT	HL	51	51	25	105	280	2800	yes	100	38.4	230	18.0	1.00	2000	8000 ?	0.8	5.8	1.27	D	D	NO		22	
Philips	Twistline Alu 2000h 25W GU10 230V 25D 1CT	HL	51	51	25	130	280	2800	yes	100	45.0	230	25.0	1.00	2000	8000 ?	0.8	5.2	1.52	D	D	NO		none	
Havells-Sylvania	HS SUPERIA ES50 SU 230V 35W 25° GU10 SV1	HL	55	50	25	180	800	2600	yes	100	50.0	230	35.0	1.00	3,000	>12,000	0.8	5.1	1.70	D	D	NO	32	none	
Havells-Sylvania	HS HOME ES50 HM 230V 35W 25° GU10 SV1	HL	55	50	25	180	500	2700	yes	100	50.0	230	35.0	1.00	3,000	>12,000	0.8	5.1	1.70	D	D	NO	32	none	
Havells-Sylvania	HS ES50 ECO 230V 28W 25° GU10 SV1	HL	55	50	25	195	600	2800	yes	100	50.0	230	28.0	1.00	2,000	>8,000	0.8	7.0	1.28	D	D	NO	34	34	
Havells-Sylvania	Hi-Spot ES 50 50W 240V 25D GU10	HL	57	51	25	300	800	2750	yes	100		240	50.0	1.00	3,000			6.0	1.67	D	D	NO		none	1.79
Havells-Sylvania	HS HOME ES50 HM 230V 50W 25° GU10 SV1	HL	55	50	25	300	1100	2700	yes	100	50.0	230	50.0	1.00	3,000	>12,000	0.8	6.0	1.67	D	D	NO	50	none	
Havells-Sylvania	HS SUPERIA ES50 SU 230V 50W 25° GU10 SV1	HL	55	50	25	300	1150	2650	yes	100	50.0	230	50.0	1.00	3,000	>12,000	0.8	6.0	1.67	D	D	NO	50	none	
Havells-Sylvania	HS SUPERIA ESD50 SU 240V 50W 25° GZ10 SV1 (dichroic)	HL	55	50	25	300	1150	2650	yes	100	50.0	240	50.0	1.00	3,000	>12,000	0.8	6.0	1.67	D	D	NO	50	none	
Havells-Sylvania	HS ESD50 SU 230V 50W 25° GZ10 SV1 (dichroic)	HL	55	50	25	300	1150	2650	yes	100	50.0	230	50.0	1.00	3,000	>12,000	0.8	6.0	1.67	D	D	NO	50	none	
Havells-Sylvania	HS ES50 ECO 230V 40W 25° GU10 SV1	HL	55	50	25	325	1000	2800	yes	100	50.0	230	40.0	1.00	2,000	>8,000	0.8	8.1	1.26	D	D	NO	54	54	
Philips	Twistline Alu 3000h 50W GU10 230V 25D 1CT	HL	51	51	25	385	700	2800	yes	100	38.4	230	50.0	1.00	3000	12000 ?	0.8	7.7	1.38	D	D	NO		none	
Philips	MASTER LEDspotMV D 4-35W GU10 WW 25D	LED	55	50	25	180	700	2700	yes	80	35.0	230	4.0	0.60	25000	50000 ?	0.7	45.0	0.19	A	A	yes	29	35	
Philips	MASTER LEDspotMV D 4-35W GU10 WH 25D	LED	55	50	25	180	700	3000	yes	80	35.0	230	4.0	0.60	25000	50000 ?	0.7	45.0	0.19	A	A	yes	29	35	
Philips	MASTER LEDspotMV D 4-35W GU10 CW 25D	LED	55	50	25	200	760	4000	yes	80	35.0	230	4.0	0.60	25000	50000 ?	0.7	50.0	0.18	A+	A	yes	32	35	18.27
Havells-Sylvania	RefLED Superia ES50 230LM 830 25° SL	LED	55	50	25	230	900	3000	no	80	50.0	220-240	4.5	0.70	25,000	100,000	0.85	51.1	0.18	A	A+	yes	37	35	

Table 18 Directional lamps with GU10/GZ10 cap, MR16/PAR16/ES50 shape, beam angle 20°-25°

manufacture	lamp designation	tech	L	D	BA	LM	LI	CCT	DIM	CRI	M	V	P	PF	LIFE	Switch	LLMF	EFF	EEI	EEL cmp	EEL decl	1194/2012	Peq cmp	Peq decl	€
			[mm]	[mm]	[deg]	[lm]	[cd]	[K]		[Ra8]	[gr]	[V]	[W]	[-]	[h]	[X]	[-]	lm/W	[-]	[-]	[-]	Stg3	[W]	[W]	Euro
Havells-Sylvania	RefLED Superia ES50 230LM 840 25° SL	LED	55	50	25	230	400	4000	no	80	50.0	220-240	4.5	0.70	25,000	100,000	0.85	51.1	0.18	A	A+	yes	37	35	
Philips	MASTER LEDspotMV D 4-35W GU10 827 25D	LED	55	50	25	255	900	2700	yes	80	38.0	220-240	4.0	0.60	40000	50000 ?	0.7	63.8	0.15	A+	A+	yes	38	35	
Philips	MASTER LEDspotMV 5.5-50W GU10 2700K 25D	LED	55	50	25	270	1100	2700	no	80	50.0	230	5.5	0.50	40000	50000 ?	0.7	49.1	0.20	A	A	yes	40	50	34.07
Philips	MASTER LEDspotMV D 4-35W GU10 830 25D	LED	55	50	25	275	1100	3000	yes	80	38.0	220-240	4.0	0.60	40000	50000 ?	0.7	68.8	0.14	A+	A+	yes	41	35	
Philips	MASTER LEDspotMV D 4-35W GU10 840 25D	LED	55	50	25	280	1100	4000	yes	80	38.0	220-240	4.0	0.60	40000	50000 ?	0.7	70.0	0.14	A+	A+	yes	42	35	
Philips	MASTER LEDspotMV D 6-50W GU10 WW 25D	LED	55	50	25	300	1000	2700	yes	80	50.0	230	6.0	0.60	40000	50000 ?	0.7	50.0	0.20	A	A	NO	44	50	24.63
Philips	MASTER LEDspotMV D 6-50W GU10 WH 25D	LED	55	50	25	320	1100	3000	yes	80	50.0	230	6.0	0.60	40000	50000 ?	0.7	53.3	0.19	A	A	yes	47	50	
Philips	MASTER LEDspotMV D 6-50W GU10 CW 25D	LED	55	50	25	320	1100	4000	yes	80	50.0	230	6.0	0.60	40000	50000 ?	0.7	53.3	0.19	A	A	yes	47	50	24.63
Havells-Sylvania	RefLED Coolfit ES50 Dim 345LM 827 25° SL	LED	55	50	25	345	1200	2700	yes	80	50.0	220-240	5.5	0.80	50,000	100,000	0.85	62.7	0.17	A+	A+	yes	53	50	
Havells-Sylvania	RefLED Coolfit ES50 345LM 830 25° SL	LED	55	50	25	345	1200	3000	no	80	50.0	220-240	5.5	0.80	50,000	100,000	0.85	62.7	0.17	A+	A+	yes	53	50	
Havells-Sylvania	RefLED Coolfit ES50 Dim 345LM 830 25° SL	LED	55	50	25	345	1200	3000	yes	80	50.0	220-240	5.5	0.80	50,000	100,000	0.85	62.7	0.17	A+	A+	yes	53	50	
Havells-Sylvania	RefLED Superia ES50 345LM 827 25° SL	LED	55	50	25	350	1200	2700	no	80	50.0	220-240	7.5	0.80	25,000	100,000	0.85	46.7	0.22	A	A	NO	54	50	
Havells-Sylvania	RefLED Superia ES50 345LM 830 25° SL	LED	55	50	25	350	1200	3000	no	80	50.0	220-240	7.5	0.80	25,000	100,000	0.85	46.7	0.22	A	A	NO	54	50	
Havells-Sylvania	RefLED Superia ES50 345LM 840 25° SL	LED	55	50	25	350	1200	4000	no	80	50.0	220-240	7.5	0.80	25,000	100,000	0.85	46.7	0.22	A	A	NO	54	50	
Philips	MASTER LEDspotMV D 5.5-50W GU10 827 25D	LED	55	50	25	370	1100	2700	yes	80	38.0	220-240	5.5	0.60	40000	50000 ?	0.5	67.3	0.16	A+	A+	yes	49	50	
Havells-Sylvania	RefLED Superia ES50 375Lm 2700K 25° SL	LED	56	50	25	375	1700	2700	no	80		100-240	5.5	0.90	50,000	100,000	0.7	68.2	0.16	A+	A+	yes	54	54	
Havells-Sylvania	RefLED Superia ES50 375Lm 3000K 25° SL	LED	56	50	25	375	1700	3000	no	80		100-240	5.5	0.90	50,000	100,000	0.7	68.2	0.16	A+	A+	yes	54	54	
Havells-Sylvania	RefLED Superia ES50 375Lm 4000K 25° SL	LED	56	50	25	375	1700	4000	no	80		100-240	5.5	0.90	50,000	100,000	0.7	68.2	0.16	A+	A+	yes	54	54	
Philips	MASTER LEDspotMV D 5.5-50W GU10 830 25D	LED	55	50	25	400	1200	3000	yes	80	38.0	220-240	5.5	0.60	40000	50000 ?	0.7	72.7	0.15	A+	A+	yes	57	50	
Philips	MASTER LEDspotMV D 5.5-50W GU10 840 25D	LED	55	50	25	415	1200	4000	yes	80	38.0	220-240	5.5	0.60	40000	50000 ?	0.7	75.5	0.14	A+	A+	yes	59	50	

Table 18 Directional lamps with GU10/GZ10 cap, MR16/PAR16/ES50 shape, beam angle 20°-25°

manufacture	lamp designation	tech	L	D	BA	LM	LI	CCT	DIM	CRI	M	V	P	PF	LIFE	Switch	LLMF	EFF	EEI	EEL cmp	EEL decl	1194/2012	Peq cmp	Peq decl	€
			[mm]	[mm]	[deg]	[lm]	[cd]	[K]		[Ra8]	[gr]	[V]	[W]	[-]	[h]	[X]	[-]	lm/W	[-]	[-]	[-]	Stg3	[W]	[W]	Euro
Havells-Sylvania	RefLED Superia ES50 460LM 827 25° SL	LED	55	50	25	450	1800	2700	no	80	50.0	220-240	7.0	0.80	25,000	100,000	0.85	64.3	0.17	A+	A+	yes	68	60	
Havells-Sylvania	RefLED Superia ES50 460LM 830 25° SL	LED	55	50	25	460	1800	3000	no	80	50.0	220-240	7.0	0.80	25,000	100,000	0.85	65.7	0.17	A+	A+	yes	69	60	
Havells-Sylvania	RefLED Superia ES50 460LM 840 25° SL	LED	55	50	25	460	1800	4000	no	80	50.0	220-240	7.0	0.80	25,000	100,000	0.85	65.7	0.17	A+	A+	yes	69	60	

3.19. GU10/GZ10 cap, lamp type PAR16/MR16/ES50, beam angle 30-38°

Some halogen lamps have GZ10 instead of GU10 caps, but it is assumed that they can be replaced by LEDs with GU10 caps. The lamp shape indications MR16, PAR16 and ES50 are practically equivalent (as long as they all have the GU10 base): all have a 50-51 mm diameter and 51-58 mm length. See also remarks in the chapter on methodology.

There are nine filament lamps with beam angle 30° and 111 to 300 lm. No LED lamps have been found with this beam angle, but there are many available with angles of 25° or 35°.

There are seven filament lamps with beam angle 35° and flux ranging from 100 to 300 lm. Versions are available with 2700, 2800 or 3000 K. In addition there are two filament lamps with a beam angle of 36° and flux of 180 or 300 lm. There is a large number of LED lamps with a beam angle of 35°, 36° or 38°, with fluxes ranging from 120 to 690 lm. Many of these lamps are available in 2700 K, 3000 K and 4000 K versions. Many are declared as dimmable, and most meet the EEI<0.20 limit of regulation 1194/2012 stage 3 or are close to it.

Conclusion: LED substitutes for MV PAR16/MR16/ES50 with GU10 cap and 30-38° beam angle are available.

Links to images: [Osram halogen](#) [Verbatim LED](#) [IKEA LED](#) [Avide LED](#)

Table 19 Directional lamps with GU10/GZ10 cap, MR16/PAR16/ES50 shape, beam angle 30°-38°

manufacture	lamp designation	tech	L	D	BA	LM	LI	CCT	DIM	CRI	M	V	P	PF	LIFE	Switch	LLMF	EFF	EEI	EEL cmp	EEL decl	1194/2012	Peq cmp	Peq decl	€
			[mm]	[mm]	[deg]	[lm]	[cd]	[K]		[Ra8]	[gr]	[V]	[W]	[-]	[h]	[X]	[-]	lm/W	[-]	[-]	[-]	Stg3	[W]	[W]	Euro
Paulmann	Reflektor 25 Watt GU10 Silber 836.33	HL	53	51	30	111	550	2900	yes	100	80-89	230	25.0	1.00	4,000	16,000		4.4	1.70	D	D	NO	22		5.08
Paulmann	Reflektor 35 Watt GU10 Silber 836.34	HL	53	51	30	173	700	2900	yes	100	80-89	230	35.0	1.00	4,000	16,000		4.9	1.75	D	D	NO	31		5.08
Paulmann	Reflektor 28 Watt GU10 Silber 800.35	HL	53	51	30	190	650	2900	yes	100		230	28.0	1.00	1,500	6,000		6.8	1.31	D	D	NO	34		5.08
Paulmann	Reflektor 50 Watt GU10 Silber 836.35	HL	53	51	30	292	800	2900	yes	100		230	50.0	1.00	4,000	16,000		5.8	1.70	D	D	NO	49		5.08
Paulmann	Reflektor 40 Watt GU10 Silber 800.36	HL	53	51	30	300	900	2900	yes	100		230	40.0	1.00	1,500	6,000		7.5	1.34	D	D	NO	50		5.08
Osram	Halopar eco fl 64819 230V 28W GU10	HL	55	51	30	200	570	2700	yes	100		230	30.0	1.00	2,000	50,000	0.75	6.7	1.35	D	D	NO	35	35	3.28
Osram	HALOPAR 16 ST 50 W 240 V 30° GU10	HL	58	51	30	300	900	2800	yes	100	42.7	240	50.0	1.00	1,000	25,000	0.75	6.0	1.67	D	D	NO	50	none	1.38
Osram	Halopar eco fl 64823 230V 40W GU10	HL	55	51	30	300	900	2700	yes	100		230	42.0	1.00	2,000	50,000	0.75	7.1	1.40	D	D	NO	50	50	3.28
Osram	HALOPAR 16 50 W 240 V 30° GU10	HL	55	51	30	300	900	2800	yes	100	58.3	240	50.0	1.00	2,000	25,000	0.75	6.0	1.67	D	D	NO	50	none	
Osram	HALOPAR 16 20 W 230 V 35° GU10; 64831 ST FL 20 W	HL	55	51	35	100	230	2700	yes	100	46.3	230	20.0	1.00	2,000	25,000	0.75	5.0	1.46	D	D	NO	21	none	1.56
Osram	HALOPAR 16 35 W 230 V 35° GU10; 64820 ST FL 35 W	HL	55	51	35	200	570	2700	yes	100	48.0	230	35.0	1.00	2,000	25,000	0.75	5.7	1.57	D	D	NO	35	none	
Osram	HALOPAR 16 ST 35 W 230 V 35° GU10	HL	55	51	35	230	570	2700	yes	100	45.5	230	35.0	1.00	1,000	25,000	0.75	6.6	1.42	D	D	NO	40	none	1.70
Osram	HALOPAR 16 ST 50 W 230 V 35° GU10	HL	58	51	35	300	650	2800	yes	100	44.5	230	50.0	1.00	1,500	25,000	0.75	6.0	1.67	D	D	NO	50	none	
Osram	HALOPAR 16 50 W 230 V 35° GU10	HL	55	51	35	300	900	2800	yes	100	47.5	230	50.0	1.00	2,000	25,000	0.75	6.0	1.67	D	D	NO	50	none	
Osram	HALOPAR 16 50 W 230 V 35° GZ10	HL	55	51	35	300	900	3000	yes	100	47.3	230	50.0	1.00	2,000	25,000	0.75	6.0	1.67	D	D	NO	50	none	1.79
Osram	HALOPAR 16 50 W 240 V 35° GZ10	HL	55	51	35	300	900	3000	yes	100	47.3	240	50.0	1.00	2,000	25,000	0.75	6.0	1.67	D	D	NO	50	none	
Megaman	LR2104DG-WFL-2800K	LED	57	50	35	220	560	2800	no	80	32.0	220-240	4.0	>0.4	15,000	>1E6	0.7	55.0	0.17	A+	A+	yes	34	37	
Megaman	LR1204dLNv2-WFL-2800K	LED	61	50	35	220	600	2800	yes	80	49.0	220-240	4.0	>0.4	25,000	>1E6	0.9	55.0	0.17	A+	A+	yes	36	40	
Megaman	LR2104DG-WFL-4000K	LED	57	50	35	220	560	4000	no	80	32.0	220-240	4.0	>0.4	15,000	>1E6	0.7	55.0	0.17	A+	A+	yes	34	37	
Megaman	LR1204dLNv2-WFL-4000K	LED	61	50	35	220	600	4000	yes	80	49.0	220-240	4.0	>0.4	25,000	>1E6	0.9	55.0	0.17	A+	A+	yes	36	40	
Megaman	LR2104DG-WFL-6500K	LED	57	50	35	220	560	6500	no	80	32.0	220-240	4.0	>0.4	15,000	>1E6	0.7	55.0	0.17	A+	A+	yes	34	37	

Table 19 Directional lamps with GU10/GZ10 cap, MR16/PAR16/ES50 shape, beam angle 30°-38°

manufacture	lamp designation	tech	L	D	BA	LM	LI	CCT	DIM	CRI	M	V	P	PF	LIFE	Switch	LLMF	EFF	EEI	EEL cmp	EEL decl	1194/2012	Peq cmp	Peq decl	€
			[mm]	[mm]	[deg]	[lm]	[cd]	[K]		[Ra8]	[gr]	[V]	[W]	[-]	[h]	[X]	[-]	lm/W	[-]	[-]	[-]	Stg3	[W]	[W]	Euro
Megaman	LR1506-35H35D-2800K TCH	LED	64	50	35	220	600	2800	no	82	70.0	220-240	6.0	>0.5	25,000	>1E6	0.9	36.7	0.25	A	A	NO	36	47	
Megaman	LR1506-35H35D-4000K TCH	LED	64	50	35	220	600	4000	no	85	70.0	220-240	6.0	>0.5	25,000	>1E6	0.9	36.7	0.25	A	A	NO	36	47	
Osram	SPAR163535 4W/8 (ST PAR16)	LED	58	50	35	230		2700	no	80	75.5	220	4.0	0.41	15,000	100,000	0.7	57.5	0.16	A+	A+	yes	35	35	
Megaman	LR4204.5-35H35D-2800K	LED	55	50	35	240	600	2800	no	82		220-240	4.5		25,000		0.7	53.3	0.18	A+	A	yes	36	35	
Megaman	LR4204.5-35H35D-4000K	LED	55	50	35	240	600	4000	no	85		220-240	4.5		25,000		0.7	53.3	0.18	A+	A	yes	36	35	
Megaman	LR1204DGv2-WFL-2800K-GU10	LED	57	50	35	250	300	2800	no	80	38.0	220-240	4.0	>0.4	25,000	>1E6	0.9	62.5	0.15	A+	A+	yes	41	45	
Megaman	LR1204dDGv2-WFL-2800K-GU10	LED	57	50	35	250	300	2800	yes	80	47.0	220-240	4.0	>0.4	25,000	>1E6	0.9	62.5	0.15	A+	A+	yes	41	45	
Megaman	LR1204DGv2-WFL-4000K-GU10	LED	57	50	35	250	300	4000	no	80	38.0	220-240	4.0	>0.4	25,000	>1E6	0.9	62.5	0.15	A+	A+	yes	41	45	
Megaman	LR1204dDGv2-WFL-4000K-GU10	LED	57	50	35	250	300	4000	yes	80	47.0	220-240	4.0	>0.4	25,000	>1E6	0.9	62.5	0.15	A+	A+	yes	41	45	
Megaman	LR1204DGv2-WFL-6500K-GU10	LED	57	50	35	250	300	6500	no	80	38.0	220-240	4.0	>0.4	25,000	>1E6	0.9	62.5	0.15	A+	A+	yes	41	45	
Verbatim	LED PAR16 GU10 4W 52607	LED	55	50	35	250	650	2700	no	80	56.0	220-240	4.0	0.40	20,000	100,000	0.7	62.5	0.15	A+	A+	yes	38	38	8.26
Megaman	LR1206dLNv2-WFL-2800K	LED	61	50	35	280	750	2800	yes	80	70.0	220-240	6.0	>0.5	25,000	>1E6	0.9	46.7	0.21	A	A	NO	45	37	
Megaman	LR1206dLNv2-WFL-4000K	LED	61	50	35	280	750	4000	yes	80	70.0	220-240	6.0	>0.5	25,000	>1E6	0.9	46.7	0.21	A	A	NO	45	37	
Megaman	LR1206dDGv2-WFL-2800K	LED	57	50	35	315	500	2800	yes	80	71.0	220-240	6.0	>0.5	25,000	>1E6	0.9	52.5	0.19	A	A	yes	50	50	
Megaman	LR1206dDGv2-WFL-4000K	LED	57	50	35	315	500	4000	yes	80	71.0	220-240	6.0	>0.5	25,000	>1E6	0.9	52.5	0.19	A	A	yes	50	50	
Megaman	LR1206dDGv2-WFL-6500K	LED	57	50	35	315	500	6500	yes	80	71.0	220-240	6.0	>0.5	25,000	>1E6	0.9	52.5	0.19	A	A	yes	50	50	
Megaman	LR2307DG-WFL-2800K	LED	57	50	35	330	650	2800	no	82	65.0	220-240	7.0	>0.5	25,000	>1E6	0.9	47.1	0.22	A	A	NO	52	50	
Megaman	LR2307dDG-WFL-2800K	LED	57	50	35	330	650	2800	yes	82	67.0	220-240	7.0	>0.5	25,000	>1E6	0.9	47.1	0.22	A	A	NO	52	50	
Megaman	LR2307DG-WFL-4000K	LED	57	50	35	330	650	4000	no	85	65.0	220-240	7.0	>0.5	25,000	>1E6	0.9	47.1	0.22	A	A	NO	52	50	
Megaman	LR2307dDG-WFL-4000K	LED	57	50	35	330	650	4000	yes	85	67.0	220-240	7.0	>0.5	25,000	>1E6	0.9	47.1	0.22	A	A	NO	52	50	

Table 19 Directional lamps with GU10/GZ10 cap, MR16/PAR16/ES50 shape, beam angle 30°-38°

manufacture	lamp designation	tech	L	D	BA	LM	LI	CCT	DIM	CRI	M	V	P	PF	LIFE	Switch	LLMF	EFF	EEI	EEL cmp	EEL decl	1194/2012	Peq cmp	Peq decl	€
			[mm]	[mm]	[deg]	[lm]	[cd]	[K]		[Ra8]	[gr]	[V]	[W]	[-]	[h]	[X]	[-]	lm/W	[-]	[-]	[-]	Stg3	[W]	[W]	Euro
Megaman	LR2307DG-WFL-6500K	LED	57	50	35	330	650	6500	no	85	65.0	220-240	7.0	>0.5	25,000	>1E6	0.9	47.1	0.22	A	A	NO	52	50	
Megaman	LR2307dDG-WFL-6500K	LED	57	50	35	330	650	6500	yes	85	67.0	220-240	7.0	>0.5	25,000	>1E6	0.9	47.1	0.22	A	A	NO	52	50	
Megaman	LR4407-50H35D-2800K	LED	64	50	35	345	1,200	2800	no	82		220-240	7.0		25,000		0.7	49.3	0.21	A	A	NO	50	50	
Megaman	LR4407d-50H35D-2800K	LED	64	50	35	345	1,200	2800	yes	82		220-240	7.0		25,000		0.7	49.3	0.21	A	A	NO	50	50	
Megaman	LR4407-50H35D-4000K	LED	64	50	35	345	1,200	4000	no	85		220-240	7.0		25,000		0.7	49.3	0.21	A	A	NO	50	50	
Megaman	LR4407d-50H35D-4000K	LED	64	50	35	345	1,200	4000	yes	85		220-240	7.0		25,000		0.7	49.3	0.21	A	A	NO	50	50	
Verbatim	LED PAR16 GU10 5W 52608	LED	55	50	35	350	750	2700	no	80	57.0	220-240	5.0	0.40	20,000	100,000	0.7	70.0	0.15	A+	A+	yes	51	51	9.83
Osram	SPAR165035 5W/8 (ST PAR16)	LED	58	50	35	350	750	2700	no	80	75.5	220	5.0	0.56	15,000	100,000	0.7	70.0	0.15	A+	A+	yes	51	50	
Verbatim	LED GU10 6W 2700K 400lm 52312	LED	56	50	35	420	1000	2700	yes	80	55.0	220-240	6.0	>0.7	40,000	100,000	0.7	70.0	0.16	A+	A+	yes	60	57	
Verbatim	LED GU10 6W 3000K 430lm 52307	LED	56	50	35	450	1100	3000	yes	80	55.0	220-240	6.0	>0.7	40,000	100,000	0.7	75.0	0.15	A+	A+	yes	64	61	
Verbatim	LED GU10 6W 3000K 430lm 52306	LED	56	50	35	450	1100	3000	no	80	55.0	220-240	6.0	>0.8	40,000	100,000	0.7	75.0	0.15	A+	A+	yes	64	61	
Verbatim	LED GU10 6W 4000K 450lm 52308	LED	56	50	35	470	1170	4000	yes	80	55.0	220-240	6.0	>0.7	40,000	100,000	0.7	78.3	0.14	A+	A+	yes	66	64	
Verbatim	LED GU10 8.5W 2700K 590lm 52313	LED	56	50	35	620	1180	2700	yes	80	55.0	220-240	8.5	>0.7	30,000	100,000	0.7	72.9	0.16	A+	A+	yes	86	82	
Verbatim	LED GU10 8.5W 3000K 620lm 52310	LED	56	50	35	650	1250	3000	yes	80	55.0	220-240	8.5	>0.7	30,000	100,000	0.7	76.5	0.16	A+	A+	yes	90	86	
Verbatim	LED GU10 8.5W 3000K 620lm 52309	LED	56	50	35	650	1250	3000	no	80	55.0	220-240	8.5	>0.8	30,000	100,000	0.7	76.5	0.16	A+	A+	yes	90	86	
Verbatim	LED GU10 8.5W 4000K 660lm 52311	LED	56	50	35	690	1340	4000	yes	80	55.0	220-240	8.5	>0.7	30,000	100,000	0.7	81.2	0.15	A+	A+	yes	95	91	
Havells-Sylvania	HS HOME ES50 BSC 240V 35W 36° GU10 SV1	HL	55	50	36	180	450	2700	yes	100	50.0	240	35.0	1.00	2,000	>8,000	0.8	5.1	1.70	D	D	NO	32	none	
Havells-Sylvania	HS HOME ES50 BSC 240V 50W 36° GU10 SV1	HL	55	50	36	300	800	2700	yes	100	50.0	240	50.0	1.00	2,000	>8,000	0.8	6.0	1.67	D	D	NO	50	none	
Osram	LED STAR PAR16 20 36° 1.6 W/827 GU10	LED	58	50	36	120	350	2700	no	80	51.0	220	1.6	>0.8	15,000	100,000	0.7	75.0	0.10	A++	A+	yes	21	20	
Osram	Parathom PRO ADV Par16 20 3W-827 WW 230V GU10 36D Dimmerable	LED	58	50	36	130	330	2700	yes	80		230	3.0	0.75	25,000		0.7	43.3	0.18	A	A	yes	22	20	10.06

Table 19 Directional lamps with GU10/GZ10 cap, MR16/PAR16/ES50 shape, beam angle 30°-38°

manufacture	lamp designation	tech	L	D	BA	LM	LI	CCT	DIM	CRI	M	V	P	PF	LIFE	Switch	LLMF	EFF	EEI	EEL cmp	EEL decl	1194/2012	Peq cmp	Peq decl	€
			[mm]	[mm]	[deg]	[lm]	[cd]	[K]		[Ra8]	[gr]	[V]	[W]	[-]	[h]	[X]	[-]	lm/W	[-]	[-]	[-]	Stg3	[W]	[W]	Euro
Philips	CorePro LEDspotMV 4-35W GU10 WH 36D	LED	55	50	36	165	300	3000	no	80	35.0	230	4.0	0.50	10000	50000 ?	0.7	41.3	0.21	A	A	NO	27	35	
IKEA	LEDARE LED GU10 1210R4 (art.no.802.559.07)	LED	54	50	36	200	400	2700	no	80		220-240	4.0	0.5	25,000	25,000	0.7	50.0	0.18	A+	A+	yes	31	none	3.30
Philips	LEDspot 4-35W W 230V GU10 36D	LED	54	50	36	230	560	3000	no	80		220-240	3.0	0.60	15,000	50,000	0.7	76.7	0.12	A++	A+	yes	35	35	14.78
Philips	LEDspot 4-35W WW 230V GU10 36D	LED	54	50	36	230	580	2700	no	80		220-240	3.0	0.60	15,000	50,000	0.7	76.7	0.12	A++	A+	yes	35	35	14.78
Osram	LED SUPERSTAR PAR16 35 36° ADV 3.6 W/827 GU10	LED	58	50	36	230	700	2700	yes	80	112.0	220-240	3.6	>0.8	25,000	100,000	0.7	63.9	0.15	A+	A+	yes	35	35	
Osram	LED SUPERSTAR PAR16 35 36° ADV 3.6 W/840 GU10	LED	58	50	36	230	750	4000	yes	80	112.0	220-240	3.6	<0.8	25,000	100,000	0.7	63.9	0.15	A+	A+	yes	35	35	
Osram	LED STAR PAR16 35 36° 3.9 W/840 GU10	LED	58	50	36	230		4000	no	80	82.0	230	3.9	0.85	15,000	100,000	0.7	59.0	0.16	A+	A	yes	35	35	
Osram	LED STAR PAR16 35 36° 3.9 W/827 GU10	LED	58	50	36	230	600	2700	no	80	81.0	220	4.0	>0.8	15,000	100,000	0.7	57.5	0.16	A+	A+	yes	35	35	
Osram	PARATHOM PAR16 35 36° 4.4 W/827	LED	58	50	36	230	600	2700	no	80	70.0	220	4.0	>0.8	15,000	100,000	0.7	57.5	0.16	A+	A+	yes	35	35	
Osram	PARATHOM PAR16 35 36° ADV 3.6 W/827 GU10	LED	58	50	36	230	700	2700	yes	80	76.0	220-240	3.6	>0.8	25,000	100,000	0.7	63.9	0.15	A+	A+	yes	35	35	
Osram	PARATHOM PAR16 35 36° ADV 3.6 W/830 GU10	LED	58	50	36	230	700	3000	yes	80	76.0	220-240	3.6	>0.8	25,000	100,000	0.7	63.9	0.15	A+	A+	yes	35	35	
Osram	PARATHOM PAR16 35 36° ADV 3.6 W/840 GU10	LED	58	50	36	230	750	4000	yes	80	76.0	220-240	3.6	<0.8	25,000	100,000	0.7	63.9	0.15	A+	A+	yes	35	35	
Osram	PARATHOM PRO PAR16 35 36° ADV 5.2 W/927 GU10	LED	58	50	36	230	600	2700	yes	90	81.0	230	5.2	>0.75	50,000	1E+06	0.7	44.2	0.21	A	A	NO	35	35	
Osram	PARATHOM PRO PAR16 35 36° ADV 5.2 W/930 GU10	LED	58	50	36	230	600	3000	yes	90	80.0	230	5.2	>0.75	50,000	1E+06	0.7	44.2	0.21	A	A	NO	35	35	27.50
Osram	PARATHOM PRO PAR16 35 36° ADV 5.2 W/940 GU10	LED	58	50	36	230	600	4000	yes	90	81.0	230	5.2	>0.75	50,000	100,000	0.7	44.2	0.21	A	A	NO	35	35	
Philips	CorePro LEDspotMV 4-35W GU10 827 36D	LED	55	50	36	235	560	2700	no	80	38.0	220-240	4.0	0.40	25000	50000 ?	0.7	58.8	0.16	A+	A+	yes	36	35	
Philips	CorePro LEDspotMV 3.5-35W GU10 827 36D	LED	54	50	36	235	330	2700	no	80	38.0	220-240	3.5	0.50	15000	50000 ?	0.7	67.1	0.14	A+	A+	yes	36	35	7.18
Havells-Sylvania	RefLED ES50 V2 3.5W 250LM 830 36° BL3/BL/SL	LED	54	50	36	250	650	3000	no	80		220-240	3.5	0.70	15,000	>20,000	0.85	71.4	0.13	A+	A++	yes	40	38	
Havells-Sylvania	RefLED ES50 V2 3.5W 250LM 840 36° BL3/BL/SL	LED	54	50	36	250	700	4000	no	80		220-240	3.5	0.70	15,000	>20,000	0.85	71.4	0.13	A+	A++	yes	40	38	
Bioledex	PERO LED Spot GU10 4.2W 280Lm Warmweiss	LED	58	50	36	280	550	3000	no	82		230	4.2	>0.5	30,000	100,000	0.8	66.7	0.15	A+	A+	yes	43	35	6.71

Table 19 Directional lamps with GU10/GZ10 cap, MR16/PAR16/ES50 shape, beam angle 30°-38°

manufacture	lamp designation	tech	L	D	BA	LM	LI	CCT	DIM	CRI	M	V	P	PF	LIFE	Switch	LLMF	EFF	EEI	EEL cmp	EEL decl	1194/2012	Peq cmp	Peq decl	€
			[mm]	[mm]	[deg]	[lm]	[cd]	[K]		[Ra8]	[gr]	[V]	[W]	[-]	[h]	[X]	[-]	lm/W	[-]	[-]	[-]	Stg3	[W]	[W]	Euro
Philips	MASTER LEDspotMV VLE D 4.5-35W GU10 827 36D	LED	55	50	36	305	780	2700	yes	80	38.0	220-240	4.5	0.50	25000	50000 ?	0.7	67.8	0.15	A+	A+	yes	45	35	11.90
Philips	MASTER LEDspotMV VLE D 4.5-35W GU10 830 36D	LED	55	50	36	305	780	3000	yes	80	44.0	220-240	4.5	0.50	25000	50000 ?	0.7	67.8	0.15	A+	A+	yes	45	35	11.90
Zenaro	SL-10B/T/P05/36/E30/HAC/EU/ZN	LED	56	50	36	320		3000	yes	>80	65.0	200-240	5.0		25,000		0.7	64.0	0.16	A+	A+	yes	47	<25	
Zenaro	SL-10B/T/P05/36/E50/HAC/EU/ZN	LED	56	50	36	320		5000	yes	>80	65.0	200-240	5.0		25,000		0.7	64.0	0.16	A+	A+	yes	47	<25	
Philips	MASTER LEDspotMV VLE D 4.5-35W GU10 840 36D	LED	55	50	36	335	850	4000	yes	80	44.0	220-240	4.5	0.50	25000	50000 ?	0.7	74.4	0.14	A+	A+	yes	49	35	12.72
Bioledex	PERO LED Strahler GU10 5.2W 340Lm 36° Warmweiss	LED	58	50	36	340	660	3000	no	80		230	5.2	>0.5	30,000	100,000	0.7	65.4	0.16	A+	A+	yes	49	50	7.55
Philips	CorePro LEDspotMV 4.5-50W GU10 827 36D	LED	54	50	36	345	560	2700	no	80	38.0	220-240	4.5	0.50	15000	50000 ?	0.7	76.7	0.14	A+	A+	yes	50	50	11.70
Havells-Sylvania	RefLED ES50 V2 5W 345LM 827 36° SL	LED	54	50	36	345	950	2700	no	80		220-240	5.0	0.80	15,000	>20,000	0.85	69.0	0.15	A+	A+	yes	53	50	
Havells-Sylvania	RefLED ES50 V2 DIM 345LM 830 36° SL	LED	54	50	36	345	900	3000	yes	80		220-240	6.0	0.90	15,000	20,000	0.85	57.5	0.18	A	A+	yes	53	50	
Havells-Sylvania	RefLED ES50 V2 DIM 345LM 840 36° SL	LED	54	50	36	345	900	4000	yes	80		220-240	6.0	0.90	15,000	20,000	0.85	57.5	0.18	A	A+	yes	53	50	
Havells-Sylvania	RefLED ES50 V2 5W 345LM 830 36° SL	LED	54	50	36	345	950	3000	no	80		220-240	5.0	0.80	15,000	>20,000	0.85	69.0	0.15	A+	A+	yes	53	50	
Havells-Sylvania	RefLED ES50 V2 5W 345LM 840 36° SL	LED	54	50	36	345	1000	4000	no	80	40.0	220-240	5.0	0.80	15,000	>20,000	0.85	69.0	0.15	A+	A+	yes	53	50	
Osram	LED SUPERSTAR PAR16 50 36° ADV 5.3 W/827 GU10	LED	58	50	36	350	950	2700	yes	80	119.0	220-240	5.3	>0.8	25,000	100,000	0.7	66.0	0.16	A+	A+	yes	51	50	
Osram	LED SUPERSTAR PAR16 50 36° ADV 5.3 W/840 GU10	LED	58	50	36	350	1000	4000	yes	80	119.0	220-240	5.3	>0.8	25,000	100,000	0.7	66.0	0.16	A+	A+	yes	51	50	
Osram	LED STAR PAR16 50 36° 5.5 W/840 GU10	LED	58	50	36	350	850	4000	no		82.0	220	5.5	0.61	15,000	100,000	0.7	63.6	0.16	A+	A+	yes	51	50	
Osram	LED STAR PAR16 50 36° 5.5 W/827	LED	58	50	36	350	1000	2700	no	80	91.0	220	5.5	>0.8	15,000	100,000	0.7	63.6	0.16	A+	A+	yes	51	50	
Osram	PARATHOM PAR16 50 36° 5.5 W/827	LED	58	50	36	350		2700	no	80	77.0	220	5.5	>0.8	15,000	100,000	0.7	63.6	0.16	A+	A+	yes	51	50	
Osram	PARATHOM PAR16 50 36° 5.5 W/840	LED	58	50	36	350	850	4000	no		72.0	220	5.5	0.61	15,000	100,000	0.7	63.6	0.16	A+	A+	yes	51	50	
Osram	PARATHOM PAR16 50 36° ADV 5.3 W/827 GU10	LED	58	50	36	350	850	2700	yes	80	83.0	220-240	5.3	>0.8	25,000	100,000	0.7	66.0	0.16	A+	A+	yes	51	50	
Osram	PARATHOM PAR16 50 36° ADV 5.3 W/830 GU10	LED	58	50	36	350	850	3000	yes		83.0	220-240	5.3	>0.8	25,000	100,000	0.7	66.0	0.16	A+	A+	yes	51	50	

Table 19 Directional lamps with GU10/GZ10 cap, MR16/PAR16/ES50 shape, beam angle 30°-38°

manufacture	lamp designation	tech	L	D	BA	LM	LI	CCT	DIM	CRI	M	V	P	PF	LIFE	Switch	LLMF	EFF	EEI	EEL cmp	EEL decl	1194/2012	Peq cmp	Peq decl	€
			[mm]	[mm]	[deg]	[lm]	[cd]	[K]		[Ra8]	[gr]	[V]	[W]	[-]	[h]	[X]	[-]	lm/W	[-]	[-]	[-]	Stg3	[W]	[W]	Euro
Osram	PARATHOM PAR16 50 36° ADV 5.3 W/840 GU10	LED	58	50	36	350	850	4000	yes		83.0	220-240	5.3	>0.8	25,000	100,000	0.7	66.0	0.16	A+	A+	yes	51	50	
Osram	PARATHOM PRO PAR16 50 36° ADV 6.8 W/927 GU10	LED	58	50	36	350	900	2700	yes	90	78.0	230	6.8	>0.75	30,000	1E+06	0.7	51.5	0.20	A	A	NO	51	50	
Osram	PARATHOM PRO PAR16 50 36° ADV 6.8 W/930 GU10	LED	58	50	36	350	900	3000	yes	90	76.0	230	6.8	>0.75	30,000	1E+06	0.7	51.5	0.20	A	A	NO	51	50	30.17
Osram	PARATHOM PRO PAR16 50 36° ADV 6.8 W/940 GU10	LED	58	50	36	350	900	4000	yes	90	88.0	230	6.8	>0.75	30,000	1E+06	0.7	51.5	0.20	A	A	NO	51	50	
Philips	CorePro LEDspotMV 4.5-50W GU10 830 36D	LED	54	50	36	355	580	3000	no	80	38.0	220-240	4.5	0.50	15000	50000 ?	0.7	78.9	0.13	A+	A+	yes	51	50	
Philips	Master LEDspotMV VLE 5.3-50W WH 230V GU10 36D Dim	LED	55	50	36	385	950	3000	yes	80		220-240	5.3	0.50	25,000	50,000	0.7	72.6	0.15	A+	A+	yes	55	50	15.39
Philips	Master LEDspotMV VLE 5.3-50W WW 230V GU10 36D Dim	LED	55	50	36	385	950	2700	yes	80		220-240	5.3	0.50	25,000	50,000	0.7	72.6	0.15	A+	A+	yes	55	50	15.39
IKEA	LEDARE LED GU10 1334R7 (art.no.402.880.52)	LED	60	50	36	400		2700	yes	80		220-240	6.3	0.7	25,000	25,000	0.7	63.5	0.17	A+	A+	yes	57	none	4.99
Philips	Master LEDspotMV VLE 5.3-50W CW 230V GU10 36D Dim	LED	55	50	36	420	1000	4000	yes	80		220-240	5.3	0.50	25,000	50,000	0.7	79.2	0.14	A+	A+	yes	60	50	15.39
Osram	PARATHOM PAR16 65 36° ADV 8 W/830 GU10	LED	58	50	36	460		3000	yes		83.0	220-240	7.8	0.75	25,000	100,000	0.7	59.0	0.19	A	A	yes	65	65	
Osram	PARATHOM PAR16 83 36° 9 W/827 GU10	LED	58	50	36	570	900	2700	no	80	94.0	230	8.0	0.9		100,000	0.7	71.3	0.16	A+	A+	yes	79	83	
Osram	PARATHOM PRO PAR16 83 36° ADV 9 W/827 GU10	LED	58	50	36	600		2700		80	95.0	230	8.0				0.7	75.0	0.16	A+		yes	83	83	
V-tac	VT-1833	LED	56	50	38	250		3000	no	>80	42	200-240	4.0	>0.4	20,000		0.7	62.5	0.15	A+		yes	38	>35	
V-tac	VT-1816	LED	56	50	38	300		3000	no	>80	48	200-240	5.0	>0.5	20,000		0.7	60.0	0.17	A+		yes	44	50	
V-tac	VT-2882	LED	54	50	38	345		3000	no	>80		220-240	6.0	>0.5			0.7	57.5	0.18	A		yes	50	50	
V-tac	VT-1878	LED	55	50	38	345		3000	no	>80		170-240	6.0	>0.4			0.7	57.5	0.18	A		yes	50	50	
Avide	LED Spot COB 5W WW GU10	LED	58	50	38	350		3000	no	80		220-240	5.0		25,000		0.7	70.0	0.15	A+	A+	yes	51	50	5.84
Avide	LED Spot COB 5W CW GU10	LED	58	50	38	360		6500	no	80		220-240	5.0		25,000		0.7	72.0	0.15	A+	A+	yes	52	50	5.84
V-tac	VT-1971	LED	55	50	38	425		3000	no	>80		100-240	7.0	>0.5			0.7	60.7	0.18	A+		yes	60	60	

3.20. GU10/GZ10 cap, lamp type PAR16/MR16/ES50, beam angle 40°

Some halogen lamps have GZ10 instead of GU10 caps, but it is assumed that they can be replaced by LEDs with GU10 caps. The lamp shape indications MR16, PAR16 and ES50 are practically equivalent (as long as they all have the GU10 base): all have a 50-51 mm diameter and 51-58 mm length. See also remarks in the chapter on methodology.

There are six filament lamps with beam angle 40° and flux ranging from 165 to 330 lm. All these lamps have a CCT of 2800 K. There is a large number of LED lamps with a beam angle of 40°, with fluxes ranging from 180 to 460 lm. Many of these lamps are available in 2700 K, 3000 K and 4000 K versions. Many are declared as dimmable, and most meet the EEI<0.20 limit of regulation 1194/2012 stage 3 or are close to it.

Conclusion: LED substitutes for MV PAR16/MR16/ES50 with GU10 cap and 40° beam angle are available.

Links to images: [Philips halogen](#) [Philips halogen2](#) [V-tac LED](#) [Havells-sylvania LED](#)

Table 20 Directional lamps with GU10/GZ10 cap, MR16/PAR16/ES50 shape, beam angle 40°

manufacture	lamp designation	tech	L	D	BA	LM	LI	CCT	DIM	CRI	M	V	P	PF	LIFE	Switch	LLMF	EFF	EEI	EEL cmp	EEL decl	1194/2012	Peq cmp	Peq decl	€
			[mm]	[mm]	[deg]	[lm]	[cd]	[K]		[Ra8]	[gr]	[V]	[W]	[-]	[h]	[X]	[-]	lm/W	[-]	[-]	[-]	Stg3	[W]	[W]	Euro
Philips	EcoHalo Twist 25W GU10 230V 40D 1CT	HL	51	51	40	165	400	2800	yes	100	38.4	230	25.0	1.00	2000	8000 ?	0.8	6.6	1.29	D	D	NO		30	
Philips	Twistline Alu 2000h 35W GU10 230V 40D 1CT	HL	51	51	40	185	300	2800	yes	100	32.0	230	35.0	1.00	2000	8000 ?	0.8	5.3	1.66	D	D	NO		none	
Philips	ESSENTIAL TWISTLine Alu 35W GU10 230V 40D 1CT	HL	51	51	40	185	300	2800	yes	100	46.0	230	35.0	1.00	2500	8000 ?	0.8	5.3	1.66	D	D	NO		none	
Philips	EcoHalo Twist 35W GU10 230V 40D 1CT	HL	51	51	40	270	600	2800	yes	100	38.4	230	35.0	1.00	2000	8000 ?	0.8	7.7	1.26	D	D	NO		45	
Philips	Twistline Alu 2000h 50W GU10 230V 40D 1CT	HL	51	51	40	330	600	2800	yes	100	45.3	230	50.0	1.00	2000	8000 ?	0.8	6.6	1.55	D	D	NO		none	
Philips	Twistline Alu 2000h 50W GZ10 230V 40D 1CT	HL	51	51	40	330	400	2800	yes	100	36.0	230	50.0	1.00	2000	8000 ?	0.8	6.6	1.55	D	D	NO		none	
Philips	MASTER LEDspotMV D 4-35W GU10 WW 40D	LED	55	50	40	180	350	2700	yes	80	35.0	230	4.0	0.60	25000	50000 ?	0.7	45.0	0.19	A	A	yes	29	35	
Philips	MASTER LEDspotMV D 4-35W GU10 WH 40D	LED	55	50	40	180	350	3000	yes	80	35.0	230	4.0	0.60	25000	50000 ?	0.7	45.0	0.19	A	A	yes	29	35	
Philips	MASTER LEDspotMV D 4-35W GU10 CW 40D	LED	55	50	40	200	380	4000	yes	80	35.0	230	4.0	0.60	25000	50000 ?	0.7	50.0	0.18	A+	A	yes	32	35	

Table 20 Directional lamps with GU10/GZ10 cap, MR16/PAR16/ES50 shape, beam angle 40°

manufacture	lamp designation	tech	L	D	BA	LM	LI	CCT	DIM	CRI	M	V	P	PF	LIFE	Switch	LLMF	EFF	EEI	EEL cmp	EEL decl	1194/2012	Peq cmp	Peq decl	€
			[mm]	[mm]	[deg]	[lm]	[cd]	[K]		[Ra8]	[gr]	[V]	[W]	[-]	[h]	[X]	[-]	lm/W	[-]	[-]	[-]	Stg3	[W]	[W]	Euro
Havells-Sylvania	RefLED Superia ES50 230LM 827 40° SL	LED	55	50	40	230	400	2700	no	80	50.0	220-240	4.5	0.70	25,000	100,000	0.85	51.1	0.18	A	A+	yes	37	35	
Havells-Sylvania	RefLED Superia ES50 230LM 830 40° SL	LED	55	50	40	230	400	3000	no	80	50.0	220-240	4.5	0.70	25,000	100,000	0.85	51.1	0.18	A	A+	yes	37	35	
Havells-Sylvania	RefLED+ ES50 4.5W 230LM 827 40° SL	LED	55	50	40	230	400	2700	no	80	50.0	220-240	4.5	0.50	15,000	100,000	0.85	51.1	0.18	A	A+	yes	37	35	
Havells-Sylvania	RefLED+ ES50 4.5W 230LM 830 40° SL	LED	55	50	40	230	400	3000	no	80	50.0	220-240	4.5	0.50	15,000	100,000	0.85	51.1	0.18	A	A+	yes	37	35	
Havells-Sylvania	RefLED+ ES50 4.5W 230LM 840 40° SL	LED	55	50	40	230	400	4000	no	80	50.0	220-240	4.5	0.50	15,000	100,000	0.85	51.1	0.18	A	A+	yes	37	35	
V-tac	VT-1806	LED	56	50	40	230		3000	no	>80	45	200-240	5.0	>0.5	20,000		0.7	46.0	0.20	A		NO	35	35	
V-tac	VT-1777D	LED	60	50	40	230		3000	yes	>80	45	100-240	4.0	>0.4	20,000		0.7	57.5	0.16	A+		yes	35	35	
Philips	MASTER LEDspotMV D 4-35W GU10 827 40D	LED	55	50	40	255	500	2700	yes	80	38.0	220-240	4.0	0.60	40000	50000 ?	0.7	63.8	0.15	A+	A+	yes	38	35	
Megaman	LR2105DG-WFL-2800K	LED	57	50	40	265	480	2800	no	80	33.0	220-240	5.0	>0.5	15,000	>1E6	0.7	53.0	0.18	A	A+	yes	40	50	
Megaman	LR2105DG-WFL-4000K	LED	57	50	40	265	480	4000	no	80	33.0	220-240	5.0	>0.5	15,000	>1E6	0.7	53.0	0.18	A	A+	yes	40	50	
Megaman	LR2105DG-WFL-6500K	LED	57	50	40	265	480	6500	no	80	33.0	220-240	5.0	>0.5	15,000	>1E6	0.7	53.0	0.18	A	A+	yes	40	50	
Philips	MASTER LEDspotMV 5.5-50W GU10 2700K 40D	LED	55	50	40	270	550	2700	no	80	50.0	230	5.5	0.50	40000	50000 ?	0.7	49.1	0.20	A	A	yes	40	50	
Philips	MASTER LEDspotMV D 4-35W GU10 830 40D	LED	55	50	40	275	600	3000	yes	80	38.0	220-240	4.0	0.60	40000	50000 ?	0.7	68.8	0.14	A+	A+	yes	41	35	
Philips	MASTER LEDspotMV D 4-35W GU10 840 40D	LED	55	50	40	280	600	4000	yes	80	38.0	220-240	4.0	0.60	40000	50000 ?	0.7	70.0	0.14	A+	A+	yes	42	35	
V-tac	VT-1888D	LED	60	50	40	280		3000	yes	>80	45	100-240	5.0	>0.5	20,000		0.7	56.0	0.18	A+		yes	42	42	
Philips	MASTER LEDspotMV D 6-50W GU10 WW 40D	LED	55	50	40	300	600	2700	yes	80	50.0	230	6.0	0.60	40000	50000 ?	0.7	50.0	0.20	A	A	yes	44	50	
Philips	MASTER LEDspotMV D 6-50W GU10 WH 40D	LED	55	50	40	320	600	3000	yes	80	50.0	230	6.0	0.60	40000	50000 ?	0.7	53.3	0.19	A	A	yes	47	50	
Philips	MASTER LEDspotMV D 6-50W GU10 CW 40D	LED	55	50	40	320	600	4000	yes	80	50.0	230	6.0	0.60	40000	50000 ?	0.7	53.3	0.19	A	A	yes	47	50	24.63
Havells-Sylvania	RefLED Coolfit ES50 345LM 827 40° SL	LED	55	50	40	345	600	2700	no	80	50.0	220-240	5.5	0.80	50,000	100,000	0.85	62.7	0.17	A+	A+	yes	53	50	
Havells-Sylvania	RefLED Coolfit ES50 Dim 345LM 827 40° BL/SL	LED	55	50	40	345	600	2700	yes	80	60.0	220-240	5.5	0.80	50,000	100,000	0.85	62.7	0.17	A+	A+	yes	53	50	

Table 20 Directional lamps with GU10/GZ10 cap, MR16/PAR16/ES50 shape, beam angle 40°

manufacture	lamp designation	tech	L	D	BA	LM	LI	CCT	DIM	CRI	M	V	P	PF	LIFE	Switch	LLMF	EFF	EEI	EEL cmp	EEL decl	1194/2012	Peq cmp	Peq decl	€
			[mm]	[mm]	[deg]	[lm]	[cd]	[K]		[Ra8]	[gr]	[V]	[W]	[-]	[h]	[X]	[-]	lm/W	[-]	[-]	[-]	Stg3	[W]	[W]	Euro
Havells-Sylvania	RefLED Coolfit ES50 345LM 830 40° SL	LED	55	50	40	345	600	3000	no	80	50.0	220-240	5.5	0.80	50,000	100,000	0.85	62.7	0.17	A+	A+	yes	53	50	
Havells-Sylvania	RefLED Coolfit ES50 Dim 345LM 830 40° SL	LED	55	50	40	345	600	3000	yes	80	50.0	220-240	5.5	0.80	50,000	100,000	0.85	62.7	0.17	A+	A+	yes	53	50	
Havells-Sylvania	RefLED Coolfit ES50 345LM 840 40° SL	LED	55	50	40	345	600	4000	no	80	50.0	220-240	5.5	0.80	50,000	100,000	0.85	62.7	0.17	A+	A+	yes	53	50	
Havells-Sylvania	RefLED Coolfit ES50 Dim 345LM 840 40° SL	LED	55	50	40	345	600	4000	yes	80	50.0	220-240	5.5	0.80	50,000	100,000	0.85	62.7	0.17	A+	A+	yes	53	50	
Havells-Sylvania	RefLED+ ES50 7.5W 345LM 827 40° SL	LED	55	50	40	345	600	2700	no	80	50.0	220-240	7.5	0.50	15,000	100,000	0.85	46.0	0.23	A	A	NO	53	50	
Havells-Sylvania	RefLED+ ES50 7.5W 345LM 830 40° SL	LED	55	50	40	345	600	3000	no	80	50.0	220-240	7.5	0.50	15,000	100,000	0.85	46.0	0.23	A	A	NO	53	50	
Havells-Sylvania	RefLED+ ES50 7.5W 345LM 840 40° SL	LED	55	50	40	345	600	4000	no	80	50.0	220-240	7.5	0.50	15,000	100,000	0.85	46.0	0.23	A	A	NO	53	50	
Havells-Sylvania	RefLED+ ES50 Dim 6.5W 345LM 827 40° SL	LED	57	50	40	345	750	2700	yes	80	50.0	220-240	6.5	0.75	15,000	>12,500	0.85	53.1	0.20	A	A	yes	53	50	
V-tac	VT-1999D	LED	60	50	40	345		3000	yes	>80	45	100-240	6.0	>0.5	20,000		0.7	57.5	0.18	A		yes	50	50	
Havells-Sylvania	RefLED Superia ES50 345LM 824 40° SL	LED	55	50	40	350	600	2400	no	80	50.0	220-240	7.5	0.80	25,000	100,000	0.85	46.7	0.22	A	A	NO	54	50	
Havells-Sylvania	RefLED Superia ES50 345LM 827 40° SL	LED	55	50	40	350	600	2700	no	80	50.0	220-240	7.5	0.80	25,000	100,000	0.85	46.7	0.22	A	A	NO	54	50	
Havells-Sylvania	RefLED Superia ES50 345LM 830 40° SL	LED	55	50	40	350	600	3000	no	80	50.0	220-240	7.5	0.80	25,000	100,000	0.85	46.7	0.22	A	A	NO	54	50	
Havells-Sylvania	RefLED Superia ES50 345LM 840 40° SL	LED	55	50	40	350	600	4000	no	80	50.0	220-240	7.5	0.80	25,000	100,000	0.85	46.7	0.22	A	A	NO	54	50	
V-tac	VT-2999D	LED	60	50	40	350		3000	yes	>80	45	100-240	7.0	>0.5	20,000		0.7	50.0	0.21	A		NO	51	52	
Megaman	LR2106dDG-WFL-2800K	LED	57	50	40	360	480	2800	yes	80	33.0	220-240	6.0		25,000		0.7	60.0	0.17	A+	A+	yes	52	50	
Megaman	LR2106dDG-WFL-4000K	LED	57	50	40	360	480	4000	yes	80	33.0	220-240	6.0		25,000		0.7	60.0	0.17	A+	A+	yes	52	50	
Havells-Sylvania	RefLED+ ES50 V2 360Lm 2700K 40d	LED	56	50	40	360	670	2700	no	80		220-240	5.0	0.50	25,000	100,000	0.7	72.0	0.15	A+	A+	yes	52	52	
Havells-Sylvania	RefLED+ ES50 V2 360Lm DIM 2700K 40d	LED	56	50	40	360	670	2700	yes	80		220-240	5.5	0.80	25,000	100,000	0.7	65.5	0.16	A+	A+	yes	52	52	
Havells-Sylvania	RefLED+ ES50 Dim 6.5W 360LM 830 40° SL	LED	57	50	40	360	800	3000	yes	80	50.0	220-240	6.5	0.75	15,000	>12,500	0.85	55.4	0.19	A	A	yes	55	52	
Havells-Sylvania	RefLED+ ES50 V2 370Lm DIM 3000K 40d	LED	56	50	40	370	700	3000	yes	80		220-240	5.5	0.80	25,000	100,000	0.7	67.3	0.16	A+	A+	yes	53	53	

Table 20 Directional lamps with GU10/GZ10 cap, MR16/PAR16/ES50 shape, beam angle 40°

manufacture	lamp designation	tech	L	D	BA	LM	LI	CCT	DIM	CRI	M	V	P	PF	LIFE	Switch	LLMF	EFF	EEI	EEL cmp	EEL decl	1194/2012	Peq cmp	Peq decl	€
			[mm]	[mm]	[deg]	[lm]	[cd]	[K]		[Ra8]	[gr]	[V]	[W]	[-]	[h]	[X]	[-]	lm/W	[-]	[-]	[-]	Stg3	[W]	[W]	Euro
Havells-Sylvania	RefLED+ ES50 V2 370Lm 3000K 40d	LED	56	50	40	370	700	3000	no	80		220-240	5.0	0.50	25,000	100,000	0.7	74.0	0.14	A+	A+	yes	53	53	
Philips	MASTER LEDspotMV D 5.5-50W GU10 827 40D	LED	55	50	40	370	800	2700	yes	80	38.0	220-240	5.5	0.60	40000	50000 ?	0.5	67.3	0.16	A+	A+	yes	49	50	
Havells-Sylvania	RefLED Superia ES50 375Lm 2700K 40° SL	LED	56	50	40	375	850	2700	no	80		100-240	5.5	0.90	50,000	100,000	0.7	68.2	0.16	A+	A+	yes	54	54	
Havells-Sylvania	RefLED Superia ES50 375Lm 3000K 40° SL	LED	56	50	40	375	850	3000	no	80		100-240	5.5	0.90	50,000	100,000	0.7	68.2	0.16	A+	A+	yes	54	54	
Havells-Sylvania	RefLED Superia ES50 375Lm 4000K 40° SL	LED	56	50	40	375	850	4000	no	80		100-240	5.5	0.90	50,000	100,000	0.7	68.2	0.16	A+	A+	yes	54	54	
Havells-Sylvania	RefLED+ ES50 V2 380Lm 4000K 40d	LED	56	50	40	380	745	4000	no	80		220-240	5.0	0.50	25,000	100,000	0.7	76.0	0.14	A+	A+	yes	55	55	
Havells-Sylvania	RefLED+ ES50 V2 380Lm DIM 4000K 40d	LED	56	50	40	380	745	4000	yes	80		220-240	5.5	0.80	25,000	100,000	0.7	69.1	0.15	A+	A+	yes	55	55	
Havells-Sylvania	RefLED+ ES50 Dim 6.5W 380LM 840 40° SL	LED	57	50	40	380	850	4000	yes	80	50.0	220-240	6.5	0.75	15,000	>12,500	0.85	58.5	0.18	A	A+	yes	58	55	
Philips	MASTER LEDspotMV D 5.5-50W GU10 830 40D	LED	55	50	40	400	850	3000	yes	80	38.0	220-240	5.5	0.60	40000	50000 ?	0.7	72.7	0.15	A+	A+	yes	57	50	
Philips	MASTER LEDspotMV D 5.5-50W GU10 840 40D	LED	55	50	40	415	850	4000	yes	80	38.0	220-240	5.5	0.60	40000	50000 ?	0.7	75.5	0.14	A+	A+	yes	59	50	
Havells-Sylvania	RefLED Superia ES50 425LM 830 40° SL	LED	55	50	40	450	900	3000	no	80	50.0	220-240	7.0	0.80	25,000	100,000	0.85	64.3	0.17	A+	A+	yes	68	60	
Havells-Sylvania	RefLED Superia ES50 425LM 840 40° SL	LED	55	50	40	450	900	4000	no	80	50.0	220-240	7.0	0.80	25,000	100,000	0.85	64.3	0.17	A+	A+	yes	68	60	
Havells-Sylvania	RefLED Superia ES50 460LM 827 40° SL	LED	55	50	40	460	900	2700	no	80	50.0	220-240	7.0	0.80	25,000	100,000	0.85	65.7	0.17	A+	A+	yes	69	60	

3.21. GU10/GZ10 cap, lamp type PAR16/MR16/ES50, beam angle 50° or higher

Some halogen lamps have GZ10 instead of GU10 caps, but it is assumed that they can be replaced by LEDs with GU10 caps. The lamp shape indications MR16, PAR16 and ES50 are practically equivalent (as long as they all have the GU10 base): all have a 50-51 mm diameter and 51-58 mm length. See also remarks in the chapter on methodology.

There are six filament lamps with beam angle 50° and flux ranging from 300 to 385 lm. These lamps have a CCT between 2650 and 2800 K. There are many LED lamps with a beam angle of 50° or 60°, with fluxes ranging from 220 to 415 lm. These lamps have CCT's ranging from

2700 to 4000 K. Many of these are declared as dimmable, and many already meet the EEI<0.20 limit of regulation 1194/2012 stage 3. In addition there is a large number of LED lamps with beam angles of 90°, 110° or 120°.

The Osram Lightify (last in the table below) has the same cap, shape and dimensions as the other lamps. No beam angle is specified, but it is a smart lamp, remotely controllable from smart phone or tablet, it has a tuneable CCT and is dimmable. It offers 350 lm (at full power) and has A+ energy label class..

Conclusion: LED substitutes for MV PAR16/MR16/ES50 with GU10 cap and 50° beam angle or higher are available.

Links to images: [Megaman LED](#) [Havells-sylvania halogen](#) [Philips halogen](#) [Osram LEDsmart](#)

Table 21 Directional lamps with GU10/GZ10 cap, MR16/PAR16/ES50 shape, beam angle 50° or higher

manufacture	lamp designation	tech	L	D	BA	LM	LI	CCT	DIM	CRI	M	V	P	PF	LIFE	Switch	LLMF	EFF	EEI	EEL cmp	EEL decl	1194/2012	Peq cmp	Peq decl	€
			[mm]	[mm]	[deg]	[lm]	[cd]	[K]		[Ra8]	[gr]	[V]	[W]	[-]	[h]	[X]	[-]	lm/W	[-]	[-]	[-]	Stg3	[W]	[W]	Euro
Havells-Sylvania	HS SUPERIA ES50 SU 230V 50W 50° GU10 SV1	HL	55	50	50	300	475	2650	yes	100	50.0	230	50.0	1.00	3,000	>12,000	0.8	6.0	1.67	D	D	NO	50	none	
Havells-Sylvania	HS ESD50 SU 230V 50W 50° GZ10 SV1 (dichroic)	HL	55	50	50	300	475	2650	yes	100	50.0	230	50.0	1.00	3,000	>12,000	0.8	6.0	1.67	D	D	NO	50	none	
Havells-Sylvania	HS HOME ES50 HM 230V 50W 50° GU10 SV1	HL	55	50	50	300	500	2700	yes	100	50.0	230	50.0	1.00	3,000	>12,000	0.8	6.0	1.67	D	D	NO	50	none	
Havells-Sylvania	HS ES50 ECO 230V 40W 50° GU10 SV1	HL	55	50	50	325	500	2800	yes	100	50.0	230	40.0	1.00	2,000	>8,000	0.8	8.1	1.26	D	D	NO	54	54	
Philips	Twistline Alu 3000h 50W GU10 230V 50D 1CT	HL	51	51	50	385	400	2800	yes	100	38.4	230	50.0	1.00	3000	12000 ?	0.8	7.7	1.38	D	D	NO		none	
Philips	Twistline Dichroic 3000h 50W GZ10 230V 50D 1CT	HL	51	51	50	385	400	2800	yes	100	38.4	230	50.0	1.00	3000	12000 ?	0.8	7.7	1.38	D	D	NO		none	
Havells-Sylvania	RefLED Superia ES50 425LM 830 50° SL	LED	55	50	50	425	600	3000	no	80	50.0	220-240	7.0	0.80	25,000	100,000	0.85	60.7	0.18	A+	A+	yes	64	60	
Havells-Sylvania	RefLED Superia ES50 425LM 840 50° SL	LED	55	50	50	425	600	4000	no	80	50.0	220-240	7.0	0.80	25,000	100,000	0.85	60.7	0.18	A+	A+	yes	64	60	
Megaman	LR2104DG-VWFL-2800K	LED	57	50	60	220	300	2800	no	80	32.0	220-240	4.0	>0.4	15,000	>1E6	0.7	55.0	0.17	A+	A+	yes	34	37	
Megaman	LR2104DG-VWFL-4000K	LED	57	50	60	220	300	4000	no	80	32.0	220-240	4.0	>0.4	15,000	>1E6	0.7	55.0	0.17	A+	A+	yes	34	37	
Megaman	LR1204DGv2-VWFL-2800K-GU10	LED	57	50	60	250	200	2800	no	80	38.0	220-240	4.0	>0.4	15,000	>1E6	0.9	62.5	0.15	A+	A+	yes	41	50	
Megaman	LR1204dDGv2-VWFL-2800K	LED	57	50	60	250	200	2800	yes	80	34.0	220-240	4.0	>0.4	25,000	>1E6	0.9	62.5	0.15	A+	A+	yes	41	45	

Table 21 Directional lamps with GU10/GZ10 cap, MR16/PAR16/ES50 shape, beam angle 50° or higher

manufacture	lamp designation	tech	L	D	BA	LM	LI	CCT	DIM	CRI	M	V	P	PF	LIFE	Switch	LLMF	EFF	EEI	EEL cmp	EEL decl	1194/2012	Peq cmp	Peq decl	€
			[mm]	[mm]	[deg]	[lm]	[cd]	[K]		[Ra8]	[gr]	[V]	[W]	[-]	[h]	[X]	[-]	lm/W	[-]	[-]	[-]	Stg3	[W]	[W]	Euro
Megaman	LR1204DGv2-VWFL-4000K-GU10	LED	57	50	60	250	200	4000	no	80	38.0	220-240	4.0	>0.4	15,000	>1E6	0.9	62.5	0.15	A+	A+	yes	41	50	
Megaman	LR1204dDGv2-VWFL-4000K	LED	57	50	60	250	200	4000	yes	80	34.0	220-240	4.0	>0.4	25,000	>1E6	0.9	62.5	0.15	A+	A+	yes	41	45	
Megaman	LR1206dDGv2-VWFL-2800K	LED	57	50	60	315	240	2800	yes	80	66.0	220-240	6.0	>0.5	25,000	>1E6	0.9	52.5	0.19	A	A	yes	50	50	
Megaman	LR1206dDGv2-VWFL-4000K	LED	57	50	60	315	240	4000	yes	80	66.0	220-240	6.0	>0.5	25,000	>1E6	0.9	52.5	0.19	A	A	yes	50	50	
Megaman	LR2307dDG-VWFL-2800K	LED	57	50	60	330	300	2800	yes	82	67.0	220-240	7.0	>0.5	25,000	>1E6	0.9	47.1	0.22	A	A	NO	52	50	
Megaman	LR2307dDG-VWFL-4000K	LED	57	50	60	330	300	4000	yes	85	67.0	220-240	7.0	>0.5	25,000	>1E6	0.9	47.1	0.22	A	A	NO	52	50	
Philips	MASTER LEDspotMV D 5.5-50W GU10 827 60D	LED	55	50	60	370	400	2700	yes	80	38.0	220-240	5.5	0.60	40000	50000 ?	0.7	67.3	0.16	A+	A+	yes	53	50	
Philips	MASTER LEDspotMV D 5.5-50W GU10 830 60D	LED	55	50	60	400	450	3000	yes	80	38.0	220-240	5.5	0.60	40000	50000 ?	0.7	72.7	0.15	A+	A+	yes	57	50	
Philips	MASTER LEDspotMV D 5.5-50W GU10 840 60D	LED	55	50	60	415	450	4000	yes	80	38.0	220-240	5.5	0.60	40000	50000 ?	0.7	75.5	0.14	A+	A+	yes	59	50	
Megaman	LR2104DG-SWFL-2800K	LED	57	50	90	250	160	2800	no	80		220-240	4.0		15,000		0.7	62.5	0.15	A+	A+	yes	38		
Megaman	LR2104DG-SWFL-4000K	LED	57	50	90	250	160	4000	no	80		220-240	4.0		15,000		0.7	62.5	0.15	A+	A+	yes	38		
V-tac	VT-1890	LED	58	50	110	150		3000	no	>80		220-240	3.0	>0.5			0.7	50.0	0.17	A+		yes	25	25	
V-tac	VT-1859	LED	57	50	110	150		3000	no	>80		170-240	3.0	>0.4			0.7	50.0	0.17	A+		yes	25	25	
Avide	LED Spot Alu 3W WW GU10	LED	58	50	110	200		3000	no	80		220-240	3.0		25,000		0.7	66.7	0.13	A+	A+	yes	31	27	4.93
Avide	LED Spot Alu 3W CW GU10	LED	58	50	110	210		6500	no	80		220-240	3.0		25,000		0.7	70.0	0.13	A+	A+	yes	32	27	4.93
Avide	LED Spot Alu 4W WW GU10	LED	58	50	110	240		3000	no	80		220-240	4.0		25,000		0.7	60.0	0.16	A+	A+	yes	36	30	5.34
Avide	LED Spot Alu 4W CW GU10	LED	58	50	110	260		6500	no	80		220-240	4.0		25,000		0.7	65.0	0.15	A+	A+	yes	39	32	5.34
Havells-Sylvania	RefLED ES50 265LM 830 110° SL	LED	54	50	110	265	130	3000	no	80		220-240	5.0	0.80	15,000	20,000	0.85	53.0	0.18	A	A+	yes	42	40	
V-tac	VT-1871	LED	57	50	110	280		3000	no	>80		170-240	5.0	>0.5			0.7	56.0	0.18	A+		yes	42	40	

Table 21 Directional lamps with GU10/GZ10 cap, MR16/PAR16/ES50 shape, beam angle 50° or higher

manufacture	lamp designation	tech	L	D	BA	LM	LI	CCT	DIM	CRI	M	V	P	PF	LIFE	Switch	LLMF	EFF	EEI	EEL cmp	EEL decl	1194/2012	Peq cmp	Peq decl	€
			[mm]	[mm]	[deg]	[lm]	[cd]	[K]		[Ra8]	[gr]	[V]	[W]	[-]	[h]	[X]	[-]	lm/W	[-]	[-]	[-]	Stg3	[W]	[W]	Euro
Avide	LED Spot Alu 5W WW GU10	LED	58	50	110	330		3000	no	80		220-240	5.0		25,000		0.7	66.0	0.16	A+	A+	yes	48	35	5.75
V-tac	VT-1860D	LED	55	50	110	345		3000	yes	>80		170-240	6.0	>0.5			0.7	57.5	0.18	A		yes	50	50	
V-tac	VT-2888	LED	54	50	110	345		3000	no	>80		220-240	6.0	>0.5			0.7	57.5	0.18	A		yes	50	50	
Avide	LED Spot Alu 5W CW GU10	LED	58	50	110	350		6500	no	80		220-240	5.0		25,000		0.7	70.0	0.15	A+	A+	yes	51	37	5.75
V-tac	VT-1838	LED	57	50	120	150		3000	no	>80		220-240	3.0	>0.4			0.7	50.0	0.17	A+		yes	25	25	
Avide	LED Spot Glass 2.4W WW GU10	LED	58	50	120	190		3000	no	80		220-240	2.4		25,000		0.7	79.2	0.11	A++	A+	yes	30	24	4.10
Avide	LED Spot Glass 2.4W CW GU10	LED	58	50	120	200		6500	no	80		220-240	2.4		25,000		0.7	83.3	0.11	A++	A+	yes	31	24	4.10
Avide	LED Spot Glass 3W WW GU10	LED	58	50	120	210		3000	no	80		220-240	3.0		25,000		0.7	70.0	0.13	A+	A+	yes	32	30	4.51
V-tac	VT-1826	LED	54	50	120	210		3000	no	>80	40	200-240	4.0	>0.4	20,000		0.7	52.5	0.17	A+		yes	32	35	
Avide	LED Spot Glass 3W CW GU10	LED	58	50	120	230		6500	no	80		220-240	3.0		25,000		0.7	76.7	0.12	A++	A+	yes	35	30	4.51
V-tac	VT-1843	LED	57	50	120	230		3000	no	>80		220-240	4.0	>0.5			0.7	57.5	0.16	A+		yes	35	35	
Osram	LED STAR PAR16 120° 4 W/827 GU10	LED	58	50	120	270	100	2700	no		71.0	220	4.0	0.4	25,000	100,000	0.7	67.5	0.14	A+	A+	yes	40	35	
Avide	LED Spot Glass 3.5W WW GU10	LED	58	50	120	270		3000	no	80		220-240	3.5		25,000		0.7	77.1	0.13	A++	A+	yes	40	35	4.93
Avide	LED Spot Glass 3.5W CW GU10	LED	58	50	120	290		6500	no	80		220-240	3.5		25,000		0.7	82.9	0.12	A++	A+	yes	43	35	4.93
V-tac	VT-1870	LED	55	50	120	400		3000	no	>80		170-240	6.0	>0.5			0.7	66.7	0.16	A+		yes	57	40	
Osram	LED STAR PAR16 120° 6.5 W/827 GU10	LED	58	50	120	450		2700	no		71.0	220	6.5	0.5	25,000	100,000	0.7	69.2	0.16	A+	A	yes	64	35	
Osram	LIGHTIFY PAR16 50 TW (Smart lamp, CCT tunable)	LED	58	50		350		2700-6500	yes	80-89	113.0	220-240	6.0		20,000	100,000	0.7	58.3	0.18	A+	A	yes	51		

3.22. GU10 cap, lamp type PAR16 or reflector, all beam angles

The LED lamps presented in this paragraph have the same diameter as those presented in the preceding paragraphs, but they are considerably longer. Beam angles include 15°, 24°, 25°, 35°, 38° and 40°, with luminous flux ranging from 300 to 490 lm, and CCT from 2700 K to 5600 K. They are all in energy label class A, but several anyway meet the EEI<0.20 criterion.

Links to images: [V-tac LED](#) [Philips LED](#)

Table 22 Directional lamps with GU10 cap, PAR16 or Reflector, all beam angles

manufacture	lamp designation	tech	L	D	BA	LM	LI	CCT	DIM	CRI	M	V	P	PF	LIFE	Switch	LLMF	EFF	EEI	EEL cmp	EEL decl	1194/2012	Peq cmp	Peq decl	€
			[mm]	[mm]	[deg]	[lm]	[cd]	[K]		[Ra8]	[gr]	[V]	[W]	[-]	[h]	[X]	[-]	lm/W	[-]	[-]	[-]	Stg3	[W]	[W]	Euro
Megaman	LR0707-SP-2800K	LED	74	50	15	330	3,000	2800	no	80	83.0	220-240	7.0	>0.5	20,000	>1E6	0.7	47.1	0.22	A	A	NO	48	50	
Megaman	LR0707-SP-4000K	LED	74	50	15	330	3,000	4000	no	80	83.0	220-240	7.0	>0.5	20,000	>1E6	0.7	47.1	0.22	A	A	NO	48	50	
Megaman	LR2008d-50H24D-2800K	LED	70	50	24	380	2,200	2800	yes	82	98.0	220-240	8.0	>0.5	25,000	>1E6	0.9	47.5	0.22	A	A	NO	59	50	
Megaman	LR2008d-50H24D-4000K	LED	70	50	24	380	2,200	4000	yes	85	98.0	220-240	8.0	>0.5	25,000	>1E6	0.9	47.5	0.22	A	A	NO	59	50	
Philips	MASTER LED IND 7-50W GU10 2700K 25D	LED	80	50	25	300	1300	2700	no	80	116.0	230	7.0	0.70	40000	50000 ?	0.7	42.9	0.23	A	A	NO		50	
Philips	MASTER LED IND 7-50W GU10 4000K 25D	LED	80	50	25	300	1300	4000	no	80	116.0	230	7.0	0.70	40000	50000 ?	0.7	42.9	0.23	A	A	NO		50	
Philips	MASTER LED IND 7-50W GU10 5600K 25D	LED	80	50	25	300	1300	5600	no	65	116.0	230	7.0	0.70	40000	50000 ?	0.7	42.9	0.23	A	A	NO		50	
Philips	MASTER LEDspotMV D 8-50W GU10 WW 25D Ra90	LED	80	50	25	340	1200	2700	yes	90	116.0	220-240	8.0	0.90	40000	50000 ?	0.7	42.5	0.24	A	A	NO	49	50	
Philips	MASTER LEDspotMV DimTone 8-50W+ GU10 25D	LED	80	50	25	410	1800	2700	yes	80	130.0	230	8.0	0.90	40000	50000 ?	0.7	51.3	0.21	A	A	NO	58	50	
Philips	MASTER LED 8-50W+ GU10 2700K 25D KoD	LED	80	50	25	410	1800	2700	yes	80	116.0	220-240	8.0	0.90	40000	50000 ?	0.7	51.3	0.21	A	A	NO	58	50	
Philips	MASTER LEDspotMV D 8-50W+ GU10 WW 25D	LED	80	50	25	430	1800	2700	yes	80	116.0	220-240	8.0	0.90	40000	50000 ?	0.7	53.8	0.20	A	A	yes	61	50	34.48
Philips	MASTER LED 8-50W+ GU10 3000K 25D KoD	LED	80	50	25	450	1900	3000	yes	80	116.0	220-240	8.0	0.90	40000	50000 ?	0.7	56.3	0.20	A	A	yes	64	50	
Philips	MASTER LED 8-50W+ GU10 4000K 25D KoD	LED	80	50	25	460	1900	4000	yes	80	116.0	220-240	8.0	0.90	40000	50000 ?	0.7	57.5	0.19	A	A	yes	65	50	
Philips	MASTER LEDspotMV D 8-50W+ GU10 WH 25D	LED	80	50	25	470	1900	3000	yes	80	116.0	220-240	8.0	0.90	40000	50000 ?	0.7	58.8	0.19	A	A	yes	66	50	

Table 22 Directional lamps with GU10 cap, PAR16 or Reflector, all beam angles

manufacture	lamp designation	tech	L	D	BA	LM	LI	CCT	DIM	CRI	M	V	P	PF	LIFE	Switch	LLMF	EFF	EEI	EEL cmp	EEL decl	1194/2012	Peq cmp	Peq decl	€
			[mm]	[mm]	[deg]	[lm]	[cd]	[K]		[Ra8]	[gr]	[V]	[W]	[-]	[h]	[X]	[-]	lm/W	[-]	[-]	[-]	Stg3	[W]	[W]	Euro
Philips	MASTER LEDspotMV D 8-50W+ GU10 CW 25D	LED	80	50	25	490	1900	4000	yes	80	116.0	220-240	8.0	0.90	40000	50000 ?	0.7	61.3	0.18	A	A	yes	69	50	36.94
Megaman	LR2008d-50H35D-2800K	LED	70	50	35	410	1,200	2800	yes	82	98.0	220-240	8.0	>0.5	25,000	>1E6	0.9	51.3	0.21	A	A	NO	64	50	
Megaman	LR2008d-50H35D-4000K	LED	70	50	35	410	1,200	4000	yes	85	98.0	220-240	8.0	>0.5	25,000	>1E6	0.9	51.3	0.21	A	A	NO	64	50	
V-tac	VT-2828	LED	74	50	38	390		3000	no	>80		220-240	7.0	>0.5			0.7	55.7	0.19	A		yes	56	56	
V-tac	VT-1809	LED	74	50	38	345		3000	no	>80		180-250	7.0	>0.5			0.7	49.3	0.21	A		NO	50	50	
Philips	MASTER LED IND 7-50W GU10 2700K 40D	LED	80	50	40	300	600	2700	no	80	116.0	230	7.0	0.70	40000	50000 ?	0.7	42.9	0.23	A	A	NO		50	
Philips	MASTER LED IND 7-50W GU10 4000K 40D	LED	80	50	40	300	600	4000	no	80	116.0	230	7.0	0.70	40000	50000 ?	0.7	42.9	0.23	A	A	NO		50	
Philips	MASTER LED IND 7-50W GU10 5600K 40D	LED	80	50	40	300	600	5600	no	65	116.0	230	7.0	0.70	40000	50000 ?	0.7	42.9	0.23	A	A	NO		50	
Philips	Master LEDspotMV 7-50W CW 230V GU10 40D DIM	LED	80	50	40	310	650	4000	no	80		240	7.0	0.60	40000		0.7	44.3	0.23	A	A	NO		50	31.81
Philips	MASTER LEDspotMV D 8-50W GU10 WW 40D Ra90	LED	80	50	40	340	600	2700	yes	90	116.0	220-240	8.0	0.90	40000	50000 ?	0.7	42.5	0.24	A	A	NO	49	50	
Philips	MASTER LEDspotMV DimTone 8-50W+ GU10 40D	LED	80	50	40	410	900	2700	yes	80	130.0	230	8.0	0.90	40000	50000 ?	0.7	51.3	0.21	A	A	NO	58	50	
Philips	MASTER LED 8-50W+ GU10 2700K 40D KoD	LED	80	50	40	410	900	2700	yes	80	116.0	220-240	8.0	0.90	40000	50000 ?	0.7	51.3	0.21	A	A	NO	58	50	
Philips	MASTER LEDspotMV D 8-50W+ GU10 WW 40D	LED	80	50	40	430	900	2700	yes	80	116.0	220-240	8.0	0.90	40000	50000 ?	0.7	53.8	0.20	A	A	yes	61	50	36.94
Philips	MASTER LED 8-50W+ GU10 3000K 40D KoD	LED	80	50	40	450	950	3000	yes	80	116.0	220-240	8.0	0.90	40000	50000 ?	0.7	56.3	0.20	A	A	yes	64	50	
Philips	MASTER LED 8-50W+ GU10 4000K 40D KoD	LED	80	50	40	460	950	4000	yes	80	116.0	220-240	8.0	0.90	40000	50000 ?	0.7	57.5	0.19	A	A	yes	65	50	
Philips	MASTER LEDspotMV D 8-50W+ GU10 WH 40D	LED	80	50	40	470	950	3000	yes	80	116.0	220-240	8.0	0.90	40000	50000 ?	0.7	58.8	0.19	A	A	yes	66	50	34.48
Philips	MASTER LEDspotMV D 8-50W+ GU10 CW 40D	LED	80	50	40	490	950	4000	yes	80	116.0	220-240	8.0	0.90	40000	50000 ?	0.7	61.3	0.18	A	A	yes	69	50	36.94

3.23. GU10/GZ10 cap, lamp type ES63/PAR20, all beam angles

Filament lamps with GU10 caps and PAR20/ES63 lamp shape exist with beam angles of 25°, 30° or 50°, and flux ranges from 380 to 700 lm. LED lamps are available with beam angles of 25° or 40° and fluxes ranging from 350 to 530 lm. Most of these lamps are dimmable and meet the EEI<0.2 criterion.

Conclusion: LED substitutes for MV PAR20 with GU10 cap are available.

Links to images: [Havells-sylvania halogen](#) [Aurora LED](#)

Table 23 Directional lamps with GU10/GZ10 cap, ES63 or PAR20, all beam angles

manufacture	lamp designation	tech	L	D	BA	LM	LI	CCT	DIM	CRI	M	V	P	PF	LIFE	Switch	LLMF	EFF	EEI	EEL cmp	EEL decl	1194/2012	Peq cmp	Peq decl	€
			[mm]	[mm]	[deg]	[lm]	[cd]	[K]		[Ra8]	[gr]	[V]	[W]	[-]	[h]	[X]	[-]	lm/W	[-]	[-]	[-]	Stg3	[W]	[W]	Euro
Havells-Sylvania	HS ES63 230V 50W 25° GU10 SV1 (or BL1)	HL	62	64	25	380	1500	2750	yes	100	80.0	230	50.0	1.00	2,500	>10,000	0.8	7.6	1.40	D	D	NO		none	5.60
Havells-Sylvania	HS ES63 230V 75W 25° GU10 SV1 (or BL1)	HL	62	64	25	700	2500	2800	yes	100	80.0	230	75.0	1.00	2,500	>10,000	0.8	9.3	1.30	D	D	NO		none	5.60
Havells-Sylvania	HS ESD63 230V 75W 25° GZ10 SV1 (dichroic)	HL	62	64	25	700	2500	2850	yes	100	80.0	230	75.0	1.00	2,500	>10,000	0.8	9.3	1.30	D	D	NO		none	
Aurora	220-240V PAR20 7W Dimmable LED AU-DP2GU7/30	LED	90	63	25	350	1,200	3000	yes	80		220-240	7.0		25,000		0.7	50.0	0.21	A		NO	51		22.70
Aurora	220-240V PAR20 7W Dimmable LED AU-DP2GU7/40	LED	90	63	25	400	1,300	4000	yes	80		220-240	7.0		25,000		0.7	57.1	0.19	A		yes	56		22.70
Aurora	220-240V AC PAR20 Dimmable 8W AOne AU-DP20082/30	LED	82	63	25	460		3000	yes	80		200-264	8.0	0.85	25,000		0.7	57.5	0.19	A		yes	63		
Aurora	220-240V AC PAR20 8W Aone AU-P20082/30	LED	82	63	25	485		3000	no	80		200-264	8.0	0.90	25,000		0.7	60.6	0.19	A		yes	65		
Aurora	220-240V AC PAR20 Dimmable 8W AOne AU-DP20082/40	LED	82	63	25	505		4000	yes	80		200-264	8.0	0.85	25,000		0.7	63.1	0.18	A+		yes	67		
Aurora	220-240V AC PAR20 8W Aone AU-P20082/40	LED	82	63	25	530		4000	no	80		200-264	8.0	0.90	25,000		0.7	66.3	0.17	A+		yes	70		
Osram	HALOPAR 20 75 W 230 V 30° GU10	HL	66	64	30	520	1900	2800	yes	100	65.1	230	75.0	1.00	2,000	25,000	0.75	6.9	1.65	D	D	NO	78	none	5.07
Aurora	220-240V AC PAR20 Dimmable 8W AOne AU-DP20084/27	LED	82	63	40	420		2700	yes	80		200-264	8.0	0.85	25,000		0.7	52.5	0.21	A		NO	58		
Aurora	220-240V AC PAR20 Dimmable 8W AOne AU-DP20084/30	LED	82	63	40	460		3000	yes	80		200-264	8.0	0.85	25,000		0.7	57.5	0.19	A		yes	63		
Aurora	220-240V AC PAR20 8W Aone AU-P20084/30	LED	82	63	40	485		3000	no	80		200-264	8.0	0.90	25,000		0.7	60.6	0.19	A		yes	65		

Table 23 Directional lamps with GU10/GZ10 cap, ES63 or PAR20, all beam angles

manufacture	lamp designation	tech	L	D	BA	LM	LI	CCT	DIM	CRI	M	V	P	PF	LIFE	Switch	LLMF	EFF	EEI	EEL cmp	EEL decl	1194/2012	Peq cmp	Peq decl	€
			[mm]	[mm]	[deg]	[lm]	[cd]	[K]		[Ra8]	[gr]	[V]	[W]	[-]	[h]	[X]	[-]	lm/W	[-]	[-]	[-]	Stg3	[W]	[W]	Euro
Aurora	220-240V AC PAR20 Dimmable 8W AOne AU-DP20084/40	LED	82	63	40	505		4000	yes	80		200-264	8.0	0.85	25,000		0.7	63.1	0.18	A+		yes	67		
Havells-Sylvania	HS ES63 230V 75W 50° GU10 SV1	HL	62	64	50	700	1000	2800	yes	100	80.0	230	75.0	1.00	2,500	>10,000	0.8	9.3	1.30	D	D	NO		none	7.06
Havells-Sylvania	HS ESD63 230V 75W 50° GZ10 SV1 (dichroic)	HL	62	64	50	700	2500	2850	yes	100	80.0	230	75.0	1.00	2,500	>10,000	0.8	9.3	1.30	D	D	NO		none	

3.24. GU10/GZ10 cap, lamp with 111 mm diameter, all beam angles

Five filament lamps have been found with GU10 caps and a lamp diameter of 111 mm. The beam angle is 24°, and flux ranges from 208 to 855 lm. LED lamps with the same diameter and cap are available with beam angles of 8°, 24°, 40° and 45° and fluxes from 460 to 1200 lm. Some of these lamps already meet the EEI<0.20 criterion.

Conclusion: LED substitutes for MV 111 mm diameter lamps with GU10 cap are available.

Links to images: [Havells-sylvania halogen](#) [Paulmann halogen](#) [Megaman LED](#) [Beneito-faure LED](#)

Table 24 Directional lamps with GU10/GZ10 cap, diameter 111 mm, all beam angles

manufacture	lamp designation	tech	L	D	BA	LM	LI	CCT	DIM	CRI	M	V	P	PF	LIFE	Switch	LLMF	EFF	EEI	EEL cmp	EEL decl	1194/2012	Peq cmp	Peq decl	€
			[mm]	[mm]	[deg]	[lm]	[cd]	[K]		[Ra8]	[gr]	[V]	[W]	[-]	[h]	[X]	[-]	lm/W	[-]	[-]	[-]	Stg3	[W]	[W]	Euro
Paulmann	HRL QPar 111 50W GU10 230V 111mm Argento	HL	73	111	24	208	1300	2900	yes	100		230	50.0	1.00	2,000			4.2	2.18	E	D	NO		none	12.29
Paulmann	HRL QPar 111 50W GU10 230V 111mm silber 229.54	HL	73	111	24	360	2000	2900	yes	>90		230	75.0	1.00	2,000	8,000	0.85	4.8	2.18	E	E	NO		none	10.79
Havells-Sylvania	HS ES111AG 230V 75W 24° GU10 SV1	HL	70	110	24	520	3500	2800	yes	100	180.0	230	75.0	1.00	2,000	>8,000	0.8	6.9	1.65	D	D	NO		none	10.20
Havells-Sylvania	HS ES111 230V 75W 24° GU10 SV1	HL	70	110	24	650	3000	2800	yes	100	180.0	230	75.0	1.00	2,000	>8,000	0.8	8.7	1.38	D	D	NO		none	
Havells-Sylvania	HS ESD111 230V 100W 24° GU10 SV1 (dichroic)	HL	70	110	24	855	5000	2900	yes	100	180.0	230	100.0	1.00	2,000	>8,000	0.8	8.6	1.48	D	D	NO		none	

Table 24 Directional lamps with GU10/GZ10 cap, diameter 111 mm, all beam angles

Megaman	LR1712d-50H08D-2800K	LED	89	111	8	460	16,000	2800	yes	80	276.0	220-240	12.0	>0.5	30,000	>1E6	0.9	38.3	0.29	A	A	NO	66	50	
Megaman	LR1712d-50H08D-4000K	LED	89	111	8	460	16,000	4000	yes	80	276.0	220-240	12.0	>0.5	30,000	>1E6	0.9	38.3	0.29	A	A	NO	66	50	
Megaman	LR1715d-75H08D-2800K	LED	89	111	8	700	20,000	2800	yes	82	276.0	220-240	15.0	>0.5	40,000	>1E6	0.85	46.7	0.26	A	A	NO	105	75	
Megaman	LR1715d-75H08D-4000K	LED	89	111	8	700	20,000	4000	yes	85	276.0	220-240	15.0	>0.5	40,000	>1E6	0.85	46.7	0.26	A	A	NO	105	75	
Megaman	LR1612d-50H24D-2800K	LED	89	111	24	500	3,600	2800	yes	80	276.0	220-240	12.0	>0.5	30,000	>1E6	0.9	41.7	0.27	A	A	NO	59	50	
Megaman	LR1612d-50H24D-4000K	LED	89	111	24	500	3,600	4000	yes	80	276.0	220-240	12.0	>0.5	30,000	>1E6	0.9	41.7	0.27	A	A	NO	59	50	
Megaman	LR1615d-75H24D-2800K	LED	89	111	24	800	5,000	2800	yes	82	276.0	220-240	15.0	>0.5	40,000	>1E6	0.85	53.3	0.23	A	A	NO	93	75	
Megaman	LR1615d-75H24D-4000K	LED	89	111	24	800	5,000	4000	yes	85	276.0	220-240	15.0	>0.5	40,000	>1E6	0.85	53.3	0.23	A	A	NO	93	75	
V-tac	VT-1112	LED	91	111	40	500		3000	no	>80		220-240	12.0	>0.9			0.7	41.7	0.27	A		NO		60	
Megaman	LR1812d-50H45D-2800K	LED	89	111	45	550	1400	2800	yes	80	276.0	220-240	12.0	>0.5	30,000	>1E6	0.9	45.8	0.25	A	A	NO	63	50	
Megaman	LR1812d-50H45D-4000K	LED	89	111	45	550	1400	4000	yes	80	276.0	220-240	12.0	>0.5	30,000	>1E6	0.9	45.8	0.25	A	A	NO	63	50	
Megaman	LR1815d-75H45D-2800K	LED	89	111	45	750	2000	2800	yes	82	276.0	220-240	15.0	>0.5	40,000	>1E6	0.85	50.0	0.25	A	A	NO	85	75	
Megaman	LR1815d-75H45D-4000K	LED	89	111	45	750	2000	4000	yes	85	276.0	220-240	15.0	>0.5	40,000	>1E6	0.85	50.0	0.25	A	A	NO	85	75	
Beneito Faure	AR111 BLACK LINE LED 12W GU10 220V 45° 827	LED	70	111	45	880	995	2700	no	80		220-240	12.0	>0.8	50,000	100,000	0.7	73.3	0.17	A+	A++	yes	97		
Beneito Faure	AR111 BLACK LINE LED 12W GU10 220V 45° 830	LED	70	111	45	924	1005	3000	no	80		220-240	12.0	>0.8	50,000	100,000	0.7	77.0	0.17	A+	A++	yes	103		
Beneito Faure	AR111 BLACK LINE LED 12W GU10 220V 45° 840	LED	70	111	45	968	1050	4000	no	80		220-240	12.0	>0.8	50,000	100,000	0.7	80.7	0.16	A+	A++	yes	110		
Bioledex	ES111 LED Strahler GU10 15W 1200Lm 230V Neutralweiss	LED	69	111	45	1200	2000	4000	no	80		230	15.0	>0.5	30,000	100,000	0.8	80.0	0.17	A+	A+	yes	153	100	

3.25. G9 cap, all lamps

This group now contains 1 filament lamp with beam angle 40°, and 3 considerably different LED lamps with matching cap, smaller shape (meaning they fit the luminaire, but look different) but beam angle 120°. Consumers will thus either have to accept the larger beam angle and different look or will have to use e.g. a G9 to GU10 adapter. Considering same arguments as for the E14/R39 lamp and taking into account the specialty character of this lamp, it is considered that 'broadly equivalent' alternatives exist.

Links to images: [Osram halogen](#) [Avida LED](#) [V-tac LED](#)

Table 25 Directional lamps with G9 cap

manufacture	lamp designation	tech	L	D	BA	LM	LI	CCT	DIM	CRI	M	V	P	PF	LIFE	Switch	LLMF	EFF	EEI	EEL cmp	EEL decl	1194/2012	Peq cmp	Peq decl	€
			[mm]	[mm]	[deg]	[lm]	[cd]	[K]		[Ra8]	[gr]	[V]	[W]	[-]	[h]	[X]	[-]	lm/W	[-]	[-]	[-]	Stg3	[W]	[W]	Euro
Osram	DECOPIN 40 W 220...240 V 40° G9	HL	43	42	40	310	550	2700	yes	100	8.5	230	40.0	1.00	2,000	50,000	0.75	7.8	1.30	D	D	NO			2.05
V-tac	VT-1846	LED	60	18	120	160		2700	no	>80	<12	200-240	1.9		20,000		0.7	84.2	0.10	A++		yes			
V-tac	VT-1849	LED	74	50 ?	120	280		3000	no	>80		170-240	4.0	>0.5			0.7	70.0	0.14	A+		yes		40	
Avida	LED 2W WW G9	LED	47	14	120	110		3000	no	80		220-240	2.0		25,000		0.7	55.0	0.14	A+	A+	yes			5.75

3.26. GX16d cap, PAR56 and PAR64 lamps

These are high power lamps that most likely should be considered as 'special purpose products', and as such they would be exempted from regulation 1194/2012. In addition they have more than 1000 lm (even if often not specified), which is out of the scope of table 6 of the regulation. Note anyway that some of these halogen lamps are declared as energy label class B and thus would meet the stage 3 criterion of 1194/2012.

Links to images: [Philips PAR56](#) [Osram PAR64](#)

Table 26 Directional lamps with GX16d cap, PAR56 or PAR64

manufacture	lamp designation	tech	L	D	BA	LM	LI	CCT	DIM	CRI	M	V	P	PF	LIFE	Switch	LLMF	EFF	EEI	EEL cmp	EEL decl	1194/2012	Peq cmp	Peq decl	€
			[mm]	[mm]	[deg]	[lm]	[cd]	[K]		[Ra8]	[gr]	[V]	[W]	[-]	[h]	[X]	[-]	lm/W	[-]	[-]	[-]	Stg3	[W]	[W]	Euro
Philips	PAR56 300W 230V GX16d	HL	127	179	40	2380	9000	2700	yes	100		230	300.0	1.00	2,000			7.9	1.72	D	D	NO		none	15.80
Osram	aluPAR 56 300 W 230 V NSP	HL	113	177	8/9		70000	2950	yes	100	456.0	230	300.0	1.00	2,000						D			none	19.90
Osram	aluPAR 56 300 W 230 V MFL	HL	113	177	15/17		30000	2950	yes	100	475.0	230	300.0	1.00	2,000						D			none	19.90
Osram	aluPAR 56 300 W 230 V WFL	HL	113	177	26/27		10000	2950	yes	100	475.0	230	300.0	1.00	2,000						D			none	19.90
Osram	aluPAR 64 500 W 230 V VNSP	HL	203	204	10/7		240000	3100	yes	100	654.0	230	500.0	1.00	300						C			none	32.72
Osram	aluPAR 64 500 W 230 V NSP	HL	203	204	11/9		140000	2900	yes	100	654.0	230	500.0	1.00	300						B			none	32.72
Osram	aluPAR 64 500 W 230 V MFL	HL	152	204	21/10		65000	2900	yes	100	654.0	230	500.0	1.00	300						B			none	32.72
Osram	aluPAR 64 1000 W 230 V VNSP	HL	152	204	12/9		352000	2900	yes	100	612.0	230	1000.0	1.00	300						B			none	24.04
Osram	aluPAR 64 1000 W 230 V NSP	HL	152	204	14/10		297000	3200	yes	100	612.0	230	1000.0	1.00	300						B			none	24.04
Osram	aluPAR 64 1000 W 230 V MFL	HL	152	204	24/11		138000	3200	yes	100	612.0	230	1000.0	1.00	300						B			none	24.04
Osram	aluPAR 64 1000 W 230 V WFL	HL	152	204	57/21		38000	3200	yes	100	654.0	230	1000.0	1.00	300						B			none	24.04

3.27. Other cap types: JCDR, GU5.3 and GX53

The GX53 cap is similar to the GU10 cap, using a twist-and-lock attachment, but with contacts at a distance of 53 mm instead of 10 mm.

There is some confusion regarding the GU5.3 / MR16 / JCDR.220V cap types. The GU5.3 cap is normally used for low voltage applications, but some lamps have been found where this cap type is used with mains voltage. In these cases it is often referred to as JCDR.220V, but in other occasions it is suggested that there is a difference between GU5.3 and JCDR.220V. The confusion increases because MR16 and JCDR seem to be used both to indicate a cap type and to indicate a lamp shape type, e.g. there are also MR16 and JCDR lamp types with a GU10 cap.

This group contains only LED lamps.

Links to images: [V-tac JCDR LED](#) [Megaman GX53 LED](#)

Table 27 Directional lamps with other cap types: JCDR, GU5.3 and GX53

manufacture	lamp designation	tech	cap	bulb	L	D	BA	LM	LI	CCT	DIM	CRI	M	V	P	PF	LIFE	Switch	LLMF	EFF	EEL	EEL cmp	EEL decl	1194/2012	Peq cmp	Peq decl	€
					[mm]	[mm]	[deg]	[lm]	[cd]	[K]		[Ra8]	[gr]	[V]	[W]	[-]	[h]	[X]	[-]	lm/W	[-]	[-]	[-]	Stg3	[W]	[W]	Euro
V-tac	VT-2992	LED	JCDR	MR16?	53	50	32	345		3000	no	>80		100-240	7.0	>0.5			0.7	49.3	0.21	A		NO	50	50	
V-tac	VT-1835	LED	JCDR	MR16?	49	50	38	250		3000	no	>80	36	220	4.0	>0.4	20,000		0.7	62.5	0.15	A+		yes	38	>35	
V-tac	VT-1889	LED	JCDR	MR16?	53	50	40	310		3000	no	>80		100-240	5.0	>0.4			0.7	62.0	0.16	A+		yes	45	45	
V-tac	VT-1898	LED	JCDR	MR16?	53	50	50	325		3000	no	>80		100-240	6.5	>0.4			0.7	50.0	0.20	A		yes	47	45	
V-tac	VT-1869	LED	JCDR	MR16?	55	50	110	345		3000	no	>80		170-240	6.0	>0.5			0.7	57.5	0.18	A		yes	50	50	
V-tac	VT-1882	LED	JCDR	MR16?	50	48	110	150		3000	no	>80		220-240	3.0	>0.4			0.7	50.0	0.17	A+		yes	25	25	
V-tac	VT-1825	LED	JCDR	MR16?	46	50	120	310		3000	no	>80	45	220	5.0	>0.5	20,000		0.7	62.0	0.16	A+		yes	45	50	
V-tac	VT-1972	LED	GU5.3	MR16?	50	50	38	425		3000	no	>80		100-240	7.0	>0.5			0.7	60.7	0.18	A+		yes	60	60	
V-tac	VT-1960	LED	GU5.3	MR16?	55	50	110	345		3000	no	>80		220-240	6.0	>0.5			0.7	57.5	0.18	A		yes	50	50	
V-tac	VT-1891	LED	GU5.3	MR16?	55	50	110	150		3000	no	>80		220-240	3.0	>0.5			0.7	50.0	0.17	A+		yes	25	25	
V-tac	VT-1868	LED	GX53	GX53	24	75	20	500		3000	no	>80		220-240	7.0	>0.4			0.7	71.4	0.16	A+		yes		35	
Megaman	LR1305-30D-2800K	LED	GX53	GX53	25	75	30	350	350	2800	no	82	82.0	220-240	5.0	>0.4	30,000	>1E6	0.9	70.0	0.15	A+	A+	yes			
Megaman	LR1305-30D-4000K	LED	GX53	GX53	25	75	30	350	350	4000	no	85	82.0	220-240	5.0	>0.4	30,000	>1E6	0.9	70.0	0.15	A+	A+	yes			
Megaman	LR1303DGv2-VWFL-2800K TCH	LED	GX53	GX53	27	75	60	120	135	2800	no	80	75.0	220-240	3.0		25,000			40.0	0.19	A	A	yes			
Megaman	LR1303DGv2-VWFL-4000K TCH	LED	GX53	GX53	27	75	60	120	135	4000	no	80	75.0	220-240	3.0		25,000			40.0	0.19	A	A	yes			
Megaman	LR1305DGv2-VWFL-2800K	LED	GX53	GX53	27	75	60	280	200	2800	no	82	76.0	220-240	5.0	>0.4	30,000	>1E6	0.9	56.0	0.18	A+	A+	yes			
Megaman	LR1305DGv2-VWFL-4000K	LED	GX53	GX53	27	75	60	280	200	4000	no	85	76.0	220-240	5.0	>0.4	30,000	>1E6	0.9	56.0	0.18	A+	A+	yes			
Megaman	LR1305-60D-2800K (TCH)	LED	GX53	GX53	25	75	60	300	350	2800	no	82	82.0	220-240	5.0	>0.5	30,000	>1E6	0.9	60.0	0.17	A+	A+	yes			
Megaman	LR1305-60D-4000K (TCH)	LED	GX53	GX53	25	75	60	300	350	4000	no	85	82.0	220-240	5.0	>0.5	30,000	>1E6	0.9	60.0	0.17	A+	A+	yes			

3.28. Summary of equivalence data

Table 28 and Figure 2 provide an overview of the database for mains voltage directional lamps. The following points can be highlighted:

- The total number of models is 625, of which 131 reference filament lamps (GLS or halogen lamps) and 494 LED lamps.
- The majority of the models has a GU10 cap (57%), with E27 cap accounting for 28% and E14 cap for 11% and others 4%.
- Seventy percent of the LED lamps already meets the $EEI < 0.2$ criterion of regulation 1194/2012 stage 3.
- For more than 90% of the directional mains-voltage filament lamps with luminous flux in a 90° cone between 90 and 1000 lm, 'equivalent' LED retrofit lamps are available. As regards number of models, lumen levels, beam angles, and colour temperatures, the variety of these LED lamps is larger than the variety for the filament lamps, in particular for lamps with GU10 cap. More than 99% of these LED lamps has a declared CRI ≥ 80 , and models with CRI > 90 are also available. In general the declared lamp characteristics meet the functionality requirements of regulation 1194/2012 table 5 ²³.
- For less than 10% of the directional mains-voltage filament lamps in the database, there is matching cap and acceptable form factor but consumers may have to compromise on e.g. the beam angle or use a realistic alternative in the sense of a bigger or smaller form factor or use an adapter for the cap. These lamps, listed hereafter and indicated by a yellow colour in Figure 1, are considered 'broadly equivalent':
 - For E14/R39 filament lamps in the database (4 models, 3.1% of the database) there is a match in cap and shape with compliant LED lamps, but the beam angles of the LED E14/R39 reflector lamps, that are explicitly sold by vendors as substitute to the filament lamps, are wider ($110-120^\circ$). Consumers will have to accept the compromise on the beam angle or, space inside the luminaire permitting, use an LED-lamp with the smaller beam angle but a larger form factor (E14/R50).
 - There is one G9/MR16 filament lamp in the database (0.8% of the database) that match with the G9 cap of LED-lamps, but the beam angle of the LED reflector lamps is wider ($>120^\circ$ instead of 40°) and the form factor of these LED-substitutes is smaller. The latter means that they will fit the luminaire, but the aesthetics will be different from the filament lamp. Consumers can accept the compromise or, alternatively, use an adapter from G9 to GU10.

²³ These requirements regard lamp survival factor, lumen maintenance, switching withstand, starting- and warmup-time, premature failure rate, colour rendering, colour consistency and power factor.

- For R63, R80, R90 and PAR25 filament lamps with E27 cap there are Stage 3 compliant LED retrofit lamps available, but the number of substitutes is limited and not necessarily the exactly same beam angle or colour temperature can be found. For uncompromising consumers there are realistic substitution options, e.g. by using adapters or lamps with slightly different form factor.

The overall conclusion is that there are Stage 3 compliant alternatives which are 'broadly equivalent' to all directional MV filament lamps.

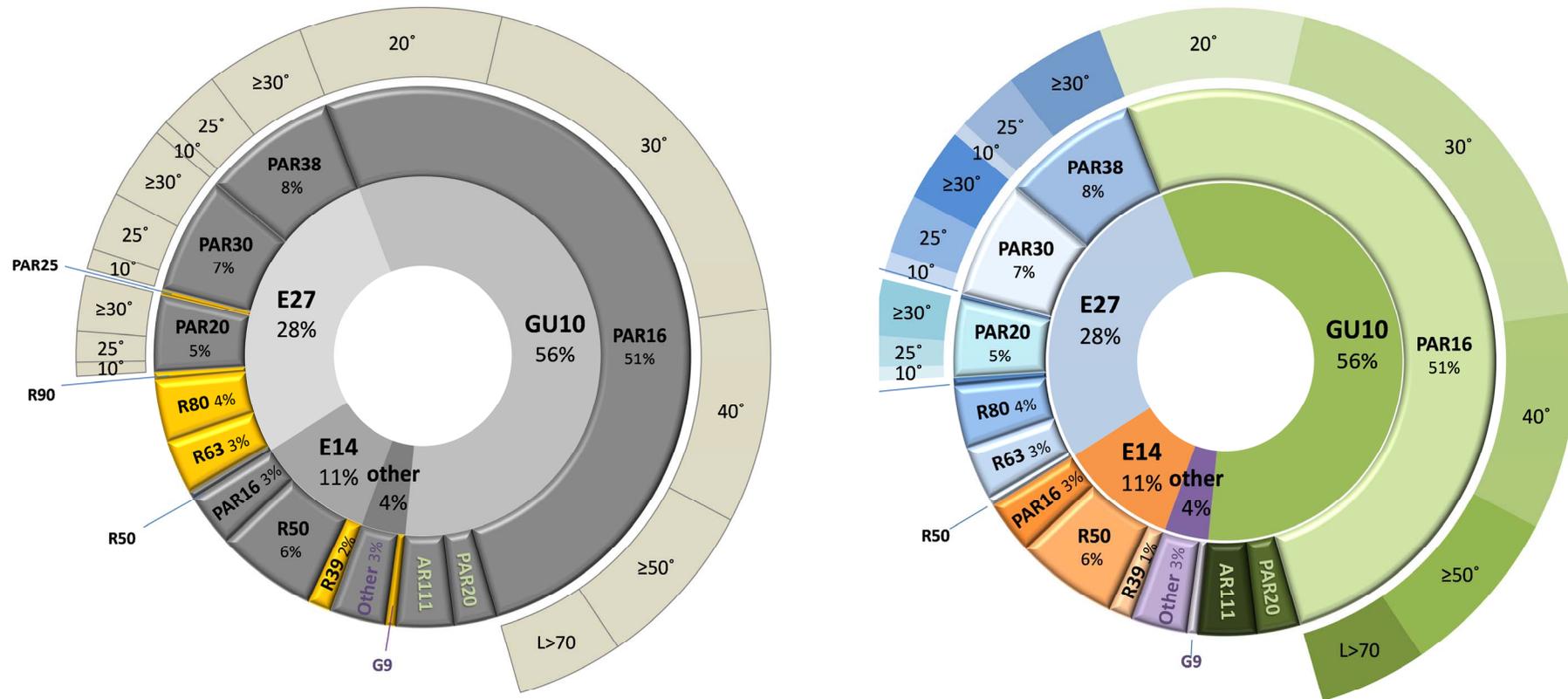


Figure 2. Survey of models in the database of mains voltage directional lamps. In both figures, the inner ring gives the % of database-models with the indicated cap type. The middle ring gives the % of models with the indicated lamp shape. The sizes of the segments of the outer ring indicate the portion of models with the indicated beam angle. In the right hand side figure, colour coding is per cap type. In the left hand side figure the yellow colour indicates a limited availability of LED lamps with the same shape and cap, but with the possibility to use alternative LED solutions in the same socket (PAR20 or PAR30 lamps with E27 cap, or GU10 lamps and GU10-to-E27 adapter).

Table 28 Survey of the number of models in the database for mains voltage directional lamps

Lamp type	All models		Reference models (GLS, HL)				LED models				equivalence	
	number of models	% of total models	number of GLS	number of HL	number of reference models	% of total reference models	number of LEDs	% of LEDs	number with EEI<0.2	% with EEI<0.2	broadly equivalent LEDs in database ?	Need to adapt
E14, R39	9	1%	3	1	4	3%	5	1%	5	1%	adapt	3.1%
E14, R50/NR50	38	6%	4	8	12	9%	26	5%	23	7%	yes	
E14, PAR16	20	3%	0	3	3	2%	17	3%	16	5%	yes	
subtotal E14	67	11%	7	12	19	15%	48	10%	44	13%		3.1%
E27, R50	3	0%	0	0	0	0%	3	1%	3	1%	only LED	
E27, R63/NR63	20	3%	5	6	11	8%	9	2%	8	2%	adapt	0.8%
E27, R80/NR80	23	4%	4	10	14	11%	9	2%	7	2%	adapt	2.1%
E27, R90/NR90	3	0%	0	2	2	2%	1	0%	1	0%	adapt	0.8%
E27, PAR20, 10°	4	1%	0	2	2	2%	2	0%	2	1%	yes	
E27, PAR20, 25°	9	1%	0	3	3	2%	6	1%	6	2%	yes	
E27, PAR20, 30° and higher	16	3%	0	1	1	1%	15	3%	7	2%	yes	
E27, PAR25, all beam angles	2	0%	0	2	2	2%	0	0%	0	0%	adapt	0.8%
E27, PAR30, 10°	6	1%	0	4	4	3%	2	0%	2	1%	yes	
E27, PAR30, 25°	17	3%	0	0	0	0%	17	3%	7	2%	only LED	
E27, PAR30, 30° and higher	21	3%	0	6	6	5%	15	3%	8	2%	yes	
E27, PAR38, 10°-12°	4	1%	0	2	2	2%	2	0%	0	0%	yes	
E27, PAR38, 22°-25°	18	3%	0	0	0	0%	18	4%	4	1%	only LED	
E27, PAR38, 30° and higher	29	5%	0	7	7	5%	20	4%	9	3%	yes	
subtotal E27	175	28%	9	45	54	41%	119	24%	64	18%		4.5%
GU10/GZ10, D < 50	1	0%	0	1	1	1%	0	0%	0	0%	adapt	0.8%
GU10/GZ10, D=50, L< 70, 20°-25°	59	9%	0	15	15	11%	44	9%	27	8%	yes	
GU10/GZ10, D=50, L< 70, 30°-38°	120	19%	0	18	18	14%	102	21%	81	23%	yes	
GU10/GZ10, D=50, L< 70, 40°	62	10%	0	6	6	5%	56	11%	46	13%	yes	
GU10/GZ10, D=50, L< 70, ≥50°	49	8%	0	6	6	5%	43	9%	41	12%	yes	
GU10/GZ10, D=50, L ≥ 70, all beam angles	31	5%	0	0	0	0%	31	6%	9	3%	only LED	
GU10/GZ10, D=64, all beam angles	16	3%	0	6	6	5%	10	2%	8	2%	yes	
GU10/GZ10, D=111, all beam angles	22	4%	0	5	5	4%	17	3%	4	1%	yes	

Table 28 Survey of the number of models in the database for mains voltage directional lamps

Lamp type	All models		Reference models (GLS, HL)				LED models				equivalence	
	number of models	% of total models	number of GLS	number of HL	number of reference models	% of total reference models	number of LEDs	% of LEDs	number with EEI<0.2	% with EEI<0.2	broadly equivalent LEDs in database ?	Need to adapt
subtotal GU10	360	57%	0	57	57	44%	303	61%	216	62%		0.8%
G9, all lamps	4	1%	0	1	1	1%	3	1%	3	1%	adapt	0.8%
Other types: JCDR, GU5.3 and GX53	21	3%	0	0	0	0%	21	4%	19	5%	only LED	
subtotal other caps	25	4%	0	1	1	1%	24	5%	22	6%		0.8%
TOTAL	625	100%	16	115	131	100%	494	100%	346	100%		9.1%

4. MV DLS prices and LED affordability

Prices for the same lamp vary considerably from shop to shop, from website to website, and from country to country. The difference between the lowest and highest price can also be a factor 4 or 5.

A survey of prices of directional LED lamps on on-line sales' sites reveals that LED prices are quickly coming down and that the gap between prices for halogen lamps and comparable LED lamps is narrowing. For some LED lamps, the study team even noticed price reductions of more than 25% between January 2015 (start of work on the database) and April 2015 (final version of database).

This downward price trend is expected to continue, further improving the situation up to September 2016. In the Ecodesign preparatory study on light sources (Lot 8/9/19) the following price trend for LED lamps was identified:

2014/2015:	23 euros/klm
2016:	15 euros/klm
2020:	7.5 euros/klm

Figure 3 shows an estimate by the study team of the price ranges for mains voltage directional halogen lamps and their potential LED retrofits. Considering these price differences, depending on the intensity of use of the lamps, payback times of around one year are possible.

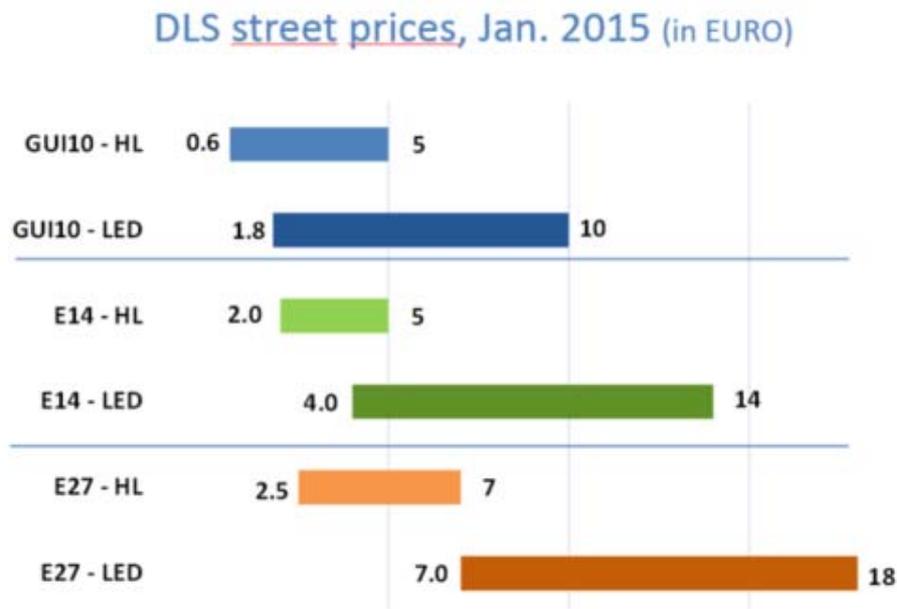


Figure 3 Prices for mains voltage directional filament lamps and their potential LED retrofit lamps.

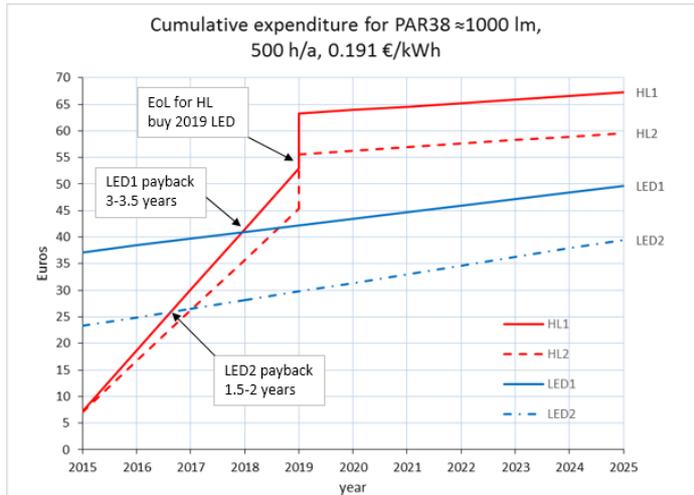
In reaction to comments from stakeholders (see Annex B), VHK presented additional information on the affordability of LED lamps during the Consultation Forum of 25 June 2015. These data have been inserted on the following pages.

This affordability analysis regards a larger and more expensive PAR38 lamp with E27 cap and a smaller and cheaper PAR16 lamp with GU10 cap. The lamps are good quality lamps from major lamp manufacturers. The payback times for an investment in LED are calculated for a use of 1000 h/a in the non-residential sector (lower electricity

rate, no VAT) and for a use of 500 or 1000 h/a in the residential sector (higher electricity rate, 20% VAT).

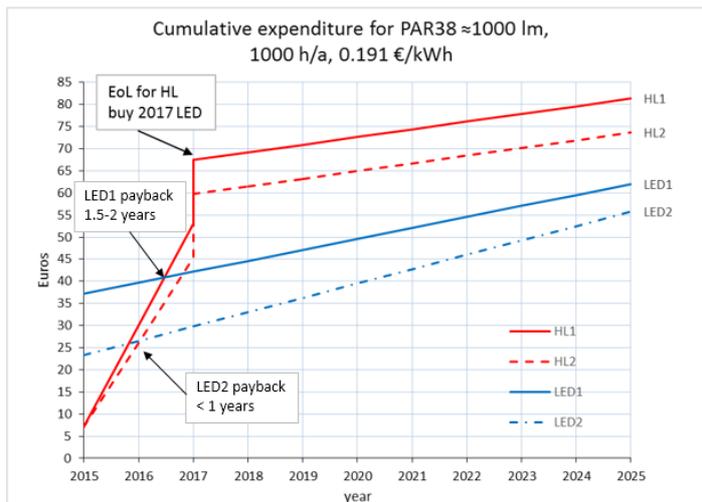
Using life-cycle costs and payback times as a criterion, LED lamps are more affordable than Halogen lamps. For the E27-PAR38 lamps payback times vary from slightly less than 1 year up to 3.5 years. For the GU10-PAR16 lamps payback times are between half a year and 2 years.

Affordability of E27 - PAR38 (1)



(Residential, moderate use)

Affordability of E27 - PAR38 (2)



(Residential, high use)

E27, PAR38	HL1	HL2	LED1	LED2
Beam angle	30°	30°	25°	30°
Flux (lm)	1040	900	1000	1035
Power (W)	120	100	13	17
Life (h)	2000	2000	40000	40000
CRI	100	100	80	80
Dimmable	yes	yes	yes	yes
Efficacy (lm/W)	8.7	9.0	76.9	60.9
EEL	1.51	1.42	0.17	0.22
Price excl. VAT*	5.99	5.95	30.99	19.40
Elec. €/year	11.46	9.55	1.24	1.62
Elec. €/kWh	0.191 (4% escalation, 4% discount)			
VAT	20%			
Hours / year	500			

HL1: Philips PAR38 120W 230V FL E27
 HL2: Osram HALOPAR 38 100 W 240 V 30° E27
 LED1: Philips LEDspot D 13-100W 827 PAR38 25D E27 (MASTER)
 LED2: Osram PARATHOM PAR38 120 30° ADV 17 W/827

2019 LED: 1000 lm, 140 lm/W, 8.5 euros excl. VAT, elec. 0.68 €/yr

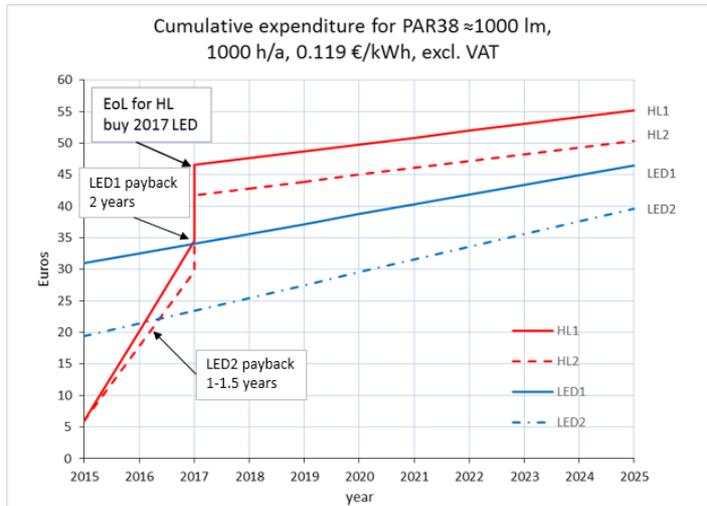
* (Prices updated, June 2015, best on-line)

E27, PAR38	HL1	HL2	LED1	LED2
Beam angle	30°	30°	25°	30°
Flux (lm)	1040	900	1000	1035
Power (W)	120	100	13	17
Life (h)	2000	2000	40000	40000
CRI	100	100	80	80
Dimmable	yes	yes	yes	yes
Efficacy (lm/W)	8.7	9.0	76.9	60.9
EEL	1.51	1.42	0.17	0.22
Price excl. VAT	5.99	5.95	30.99	19.40
Elec. €/year	22.92	19.10	2.48	3.25
Elec. €/kWh	0.191 (4% escalation, 4% discount)			
VAT	20%			
Hours / year	1000			

HL1: Philips PAR38 120W 230V FL E27
 HL2: Osram HALOPAR 38 100 W 240 V 30° E27
 LED1: Philips LEDspot D 13-100W 827 PAR38 25D E27 (MASTER)
 LED2: Osram PARATHOM PAR38 120 30° ADV 17 W/827

2017 LED: 1000 lm, 110 lm/W, 12.0 euros excl. VAT, elec. 1.74 €/yr

Affordability of E27 - PAR38 (3)

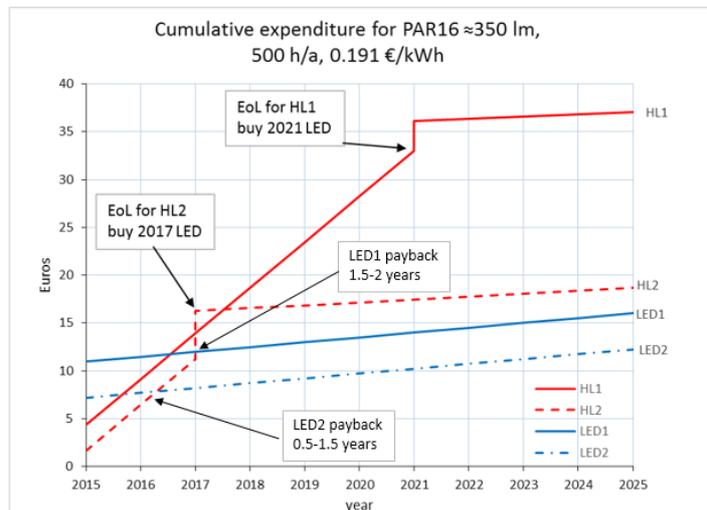


(Non-Residential, high use)

E27, PAR38	HL1	HL2	LED1	LED2
Beam angle	30°	30°	25°	30°
Flux (lm)	1040	900	1000	1035
Power (W)	120	100	13	17
Life (h)	2000	2000	40000	40000
CRI	100	100	80	80
Dimmable	yes	yes	yes	yes
Efficacy (lm/W)	8.7	9.0	76.9	60.9
EEL	1.51	1.42	0.17	0.22
Price excl. VAT	5.99	5.95	30.99	19.40
Elec. €/year	14.28	11.90	1.55	2.02
Elec. €/kWh	0.119 (4% escalation, 4% discount)			
VAT	0%			
Hours / year	1000			

HL1: Philips PAR38 120W 230V FL E27
 HL2: Osram HALOPAR 38 100 W 240 V 30° E27
 LED1: Philips LEDspot D 13-100W 827 PAR38 25D E27 (MASTER)
 LED2: Osram PARATHOM PAR38 120 30° ADV 17 W/827
 2017 LED: 1000 lm, 110 lm/W, 12.0 euros excl. VAT, elec. 1.08 €/yr

Affordability of GU10 – PAR16 (1)



(Residential, moderate use)

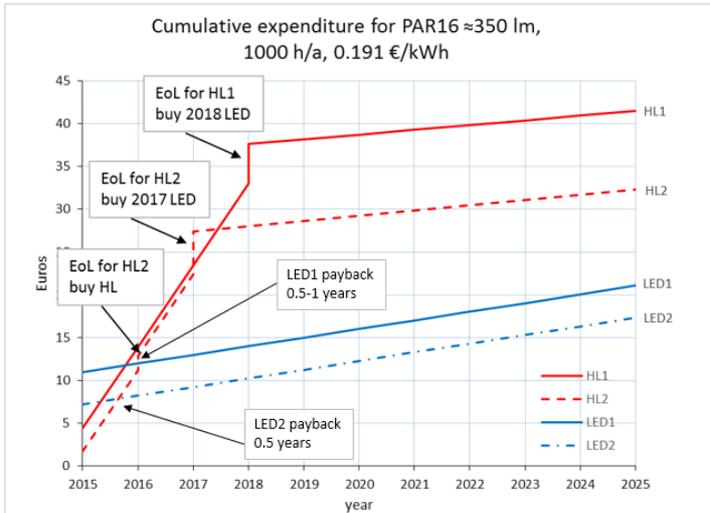
GU10, PAR16	HL1	HL2	LED1	LED2
Beam angle	25°	30°	36°	36°
Flux (lm)	385	300	385	350
Power (W)	50	50	5.3	5.3
Life (h)	3000	1000	25000	25000
CRI	100	100	80	80
Dimmable	yes	yes	yes	yes
Efficacy (lm/W)	7.7	6.0	72.6	66.0
EEL	1.38	1.67	0.15	0.16
Price excl. VAT*	3.63	1.38	9.13	6.00
Elec. €/year	4.78	4.78	0.51	0.51
Elec. €/kWh	0.191 (4% escalation, 4% discount)			
VAT	20%			
Hours / year	500			

HL1: Philips Twistline Alu 3000h 50W GU10 230V 25D 1CT
 HL2: Osram HALOPAR 16 ST 50 W 240 V 30° GU10
 LED1: Philips Master LEDspotMV VLE 5.3-50W WW 230V GU10 36D Dim
 LED2: Osram LED SUPERSTAR PAR16 50 36° ADV 5.3 W/827 GU10

2017 LED: 350 lm, 110 lm/W, 4.20 euros excl. VAT, elec. 0.30 €/yr
 2021 LED: 350 lm, 150 lm/W, 2.63 euros excl. VAT, elec. 0.22 €/yr

* (Prices updated, June 2015, best on-line)

Affordability of GU10 – PAR16 (2)



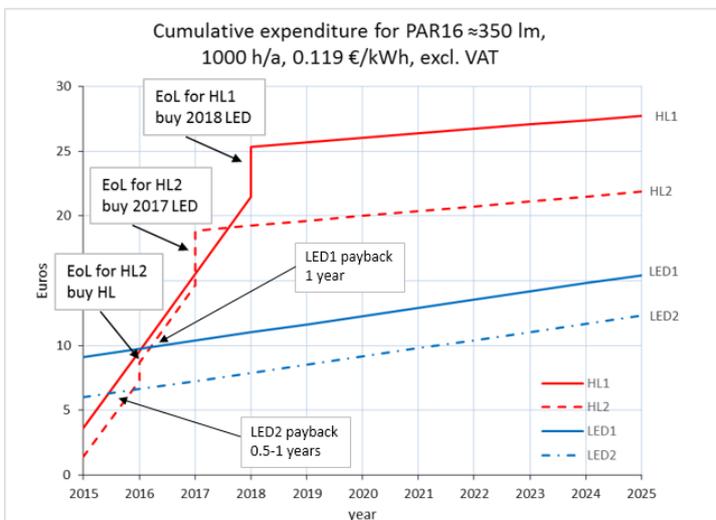
(Residential, high use)

GU10, PAR16	HL1	HL2	LED1	LED2
Beam angle	25°	30°	36°	36°
Flux (lm)	385	300	385	350
Power (W)	50	50	5.3	5.3
Life (h)	3000	1000	25000	25000
CRI	100	100	80	80
Dimmable	yes	yes	yes	yes
Efficacy (lm/W)	7.7	6.0	72.6	66.0
EEL	1.38	1.67	0.15	0.16
Price excl. VAT*	3.63	1.38	9.13	6.00
Elec. €/year	9.55	9.55	1.01	1.01
Elec. €/kWh	0.191 (4% escalation, 4% discount)			
VAT	20%			
Hours / year	1000			

HL1: Philips Twistline Alu 3000h 50W GU10 230V 25D 1CT
 HL2: Osram HALOPAR 16 ST 50 W 240 V 30° GU10
 LED1: Philips Master LEDspotMV VLE 5.3-50W WW 230V GU10 36D Dim
 LED2: Osram LED SUPERSTAR PAR16 50 36° ADV 5.3 W/827 GU10

2017 LED: 350 lm, 110 lm/W, 4.20 euros excl. VAT, elec. 0.61 €/yr
 2018 LED: 350 lm, 120 lm/W, 3.85 euros excl. VAT, elec. 0.56 €/yr

Affordability of GU10 – PAR16 (3)



(Non-Residential, high use)

GU10, PAR16	HL1	HL2	LED1	LED2
Beam angle	25°	30°	36°	36°
Flux (lm)	385	300	385	350
Power (W)	50	50	5.3	5.3
Life (h)	3000	1000	25000	25000
CRI	100	100	80	80
Dimmable	yes	yes	yes	yes
Efficacy (lm/W)	7.7	6.0	72.6	66.0
EEL	1.38	1.67	0.15	0.16
Price excl. VAT*	3.63	1.38	9.13	6.00
Elec. €/year	5.95	5.95	0.63	0.63
Elec. €/kWh	0.119 (4% escalation, 4% discount)			
VAT	0%			
Hours / year	1000			

HL1: Philips Twistline Alu 3000h 50W GU10 230V 25D 1CT
 HL2: Osram HALOPAR 16 ST 50 W 240 V 30° GU10
 LED1: Philips Master LEDspotMV VLE 5.3-50W WW 230V GU10 36D Dim
 LED2: Osram LED SUPERSTAR PAR16 50 36° ADV 5.3 W/827 GU10

2017 LED: 350 lm, 110 lm/W, 4.20 euros excl. VAT, elec. 0.38 €/yr
 2018 LED: 350 lm, 120 lm/W, 3.85 euros excl. VAT, elec. 0.35 €/yr

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See footnotes in text

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Acronyms

CCT	Correlated Colour Temperature
CFL	Compact fluorescent lamps
CFLi	CFL with integrated ballast
CFLni	CFL without integrated ballast
CRI	Colour Rendering Index
DLS	Directional light sources
E14, E27	Screw-type lamp caps for general purpose lamp
EC	European Commission
EEI	Energy Efficiency Index
EU	European Union
G4, GY6.35	Low-voltage halogen lamp types, 2 pin cap, single ended
G9	Mains-voltage halogen lamp, 2-pin cap, single ended
GLS	General Lighting Service (a.k.a. incandescent lamp)
HID	High-Intensity Discharge
HL	Halogen
HPM	High-Pressure Mercury
HPS	High-Pressure Sodium
LED	Light Emitting Diode
LFL	Linear Fluorescent Lamp
LLCC	Least Life Cycle Cost
lm, Φ	Lumen, unit of luminous flux Φ
LV	Low Voltage (typical 12V)
MH	Metal Halide
mn / mln	Million (10^6)
MV	Mains Voltage (typical 230V)
NDLS	Non-directional light sources
P	Rated power
par	paragraph
R7s	Mains voltage linear halogen lamp, double ended
SPL	Special Purpose Lamp
sr	steradian
V	Volt
VHK	Van Holsteijn en Kemna
VITO	Vlaamse Instelling voor Technologisch Onderzoek
W	Watt

Annex A. Statement of contractor on right to delivered result

I, Dirk Fransaer, representing the "Consortium of VITO NV, VHK BV, Viegand & Maagøe ApS, Wuppertal Institute for Climate, Environment and Energy GmbH, and ARMINES", party to the contract 'Preparatory Study on Lighting Systems for Ecodesign and/or Energy Labelling Requirements ('Lot 8/9/19'), specific contract No. ENER/C3/2012-418 LOT1/07/SI2.668526 implementing framework contract No. ENER/C3/2012-418-Lot 1', warrant that the Contractor holds full right to the delivered 'MV DLS market study report' of the 'Preparatory Study on Lighting Systems for Ecodesign and/or Energy Labelling Requirements ('Lot 8/9/19')', which is free of any claims, including claim of the creators who transferred all their rights and will be paid as agreed within 30 days from the receipt of confirmation of acceptance of work.

Mol, Belgium,

Date:

Signature:

Dirk Fransaer
Managing Director VITO NV

Annex B. Summary of stakeholder comments

B.1 Introduction

The Draft Final Market Overview on Directional Mains-Voltage Lamps, dated 24 April 2015, was delivered to stakeholders on 22 May 2015 and presented and discussed in the Consultation Forum of 25 June 2015. Stakeholders were invited to present their written comments before 25 July 2015.

Comments were received from 17 Member States, environmental NGOs, two European industry associations, a national industry association and an independent individual manufacturer.

Stakeholders are divided as regards their general opinion on the implications of the market overview, especially on a desirable implementation date for stage 3 of Regulation 1194/2012 to mains-voltage (MV) filament lamps. Some Member States plus two European industry associations are in favour of a postponement to September 2018. Some Member States, the NGOs and some other industry stakeholders are in favour of September 2016.

In principle, this is not the subject matter of this market overview. The study is merely to address the four criteria in the Regulation, and from the answers the implementation date follows automatically as previously decided by a qualified majority of Member States. But the opinion on a desirable implementation date may influence the opinion of the respective stakeholders on the quality of the study.

Those that agree with the conclusions of this study that the conditions of the Regulation are met, are in favour of applying the stage 3 requirements to MV filament lamps in September 2016 as foreseen. These stakeholders argue that a sufficient variety of compliant, affordable, broadly equivalent and compatible LED lamps is already available to replace the MV filament lamps currently on the market, and that this situation will further improve towards September 2016. They also recall that MV filament lamps from existing stock will anyway be sold for some time after September 2016.

Although these stakeholders are aware of some potential problems related to the compatibility between LED lamps and dimmers, they see this as a minor problem, and/or they do not believe that this situation will change significantly between 2016 and 2018. They also underline that the conditions in the Regulation refer to the '*majority of the users*' and to '*broadly equivalent*'. These stakeholders stress the importance of reaping as soon as possible the economic and environmental benefits of the substitution of MV filament lamps by LED lamps.

Other stakeholders stated that this study does not provide sufficient evidence to conclude that the four criteria are met. In general they propose to amend the Regulation, postponing the application of stage 3 for MV filament lamps by two years (to September 2018), and to have a vote on this in the Regulatory Committee. Such a postponement would give manufacturers more time to provide the consumers with compliant and affordable LED lamps for all directional lighting functionalities now covered by MV filament lamps, and also align the phase-out date for directional MV filament lamps with that for non-directional lamps (the entry into force of stage 6 of Regulation 244/2009 was postponed to September 2018 by an amending Regulation).

These stakeholders generally question the quality of the data used in this study. They draw attention to MV filament lamps market niches where the substitution by LED may require compromises or cap-adapters, and they argue that for users in East-European countries the higher purchase price of LEDs will be an obstacle. These stakeholders also emphasize the problems related to dimmer compatibility, and the need to wait with the phase-out of halogen lamps until the new dimmer compatibility standard is in place (expected by 2018).

These stakeholders stress the importance of providing industry with more time and of avoiding consumer dissatisfaction due to high purchase prices or non-availability of lamps with a specific functionality.

The following sections summarize the main arguments used in favour of or opposing the conclusions of this market overview.

B.2 Database quality

Some stakeholders criticize the fact that the market overview is based only on manufacturer claims (catalogue data), and doesn't provide factual data from accredited and certified laboratories on performance in general, and on safety in particular. Market surveillance studies often show that products that claim to be compliant are in fact not compliant, i.e. catalogue data cannot be trusted. The market overview should have performed at least some practical measurements to prove the availability of genuinely compliant products.

Other comments note that lamps from some manufacturers are missing in the database (and added these lamps on their copy), that some lamps referred to in the database could no longer be found through the reported website-links, that price information was missing for lamps in the database, and that the models in the database are not linked to sales quantities.

Other stakeholders replied that the majority of the lamp models in the database are from major, renowned lamp manufacturers, that these test their products seriously, and that their catalogue data are believed to be trustworthy. Further, laboratory testing of these products would clearly be too long and too costly to be performed in the context of the MV DLS Market Assessment, and is also not required by the criteria stipulated in the Regulation 1194/2012. Some stakeholders presented their own test data for some directional LED lamps, showing compliance.

As an integration to the database used for the market overview, another stakeholder supplied data from the North American Energy Star database for 120V lamps: 2258 stage 3 compliant models were found, of which nearly 94% marked as dimmable according to Energy Star Lamps V1.1. The average CRI of the lamps was 83.8 with some values as high as 98. Additionally, 359 stage 3 compliant models (120V) were found in the LightingFacts database. This stakeholder believes there would be no technical problems in having these lamps with a 230V driver for the European market. These data reinforce the conclusions of the market overview.

The fact that some lamps in the database can no longer be traced was also noted by VHK. This is unavoidable considering the highly dynamic LED market: every day older models disappear from the market while new models, typically with improved or new

characteristics, appear. On average, it is clear that the variety of directional LED models is rapidly increasing, further improving the situation.

The number of models in the database is closely related to the sales quantities. This could be checked for the share of lamps with GU10 caps (57% of the models in the database), which corresponds well with the share of sales found in the Ecodesign preparatory study on light sources (Lot 8/9/19). However, detailed sales data, e.g. the quantity of lamps with E27 cap, R63 shape, 500 lm and 40° beam angle, are not available.

B.3 Compliance condition

Most stakeholders agree that the compliance condition is met, i.e. that there are many LED lamps that already meet the $EEI < 0.20$ condition of Regulation 1194/2012 stage 3 and that this situation will further improve towards September 2016.

One stakeholder analysed in detail the efficacy of LEDs, using the VHK database extended with 256 additional models, and found that LED-lamps with wide beam angle can easily comply with stage 3. LED-lamps with middle beam angle can partly, and LED-lamps with a beam angle $< 9^\circ$ can currently not comply with stage 3. In addition, and even though the criteria are met, the stakeholder showed that a negative correlation exists between the colour rendering and the proportion of LED-lamps complying with stage 3. This stakeholder proposed to amend the EEI criterion in the Regulation, allowing a higher EEI for lamps with low beam angles and lamps with high colour rendering index.

Another stakeholder checked this finding and showed that broadly equivalent LED lamps with small beam angles are available in the database (using a beam angle of 9° instead of 8°). The same is true for high-CRI lamps: there are some lamps in the database that have $CRI \geq 90$ and $EEI \leq 0.2$. In addition the stakeholder presented a list of 40 additional lamps that have a high CRI and meet the stage 3 EEI. This stakeholder also underlined that it is perfectly reasonable to use LED light sources with slightly lower numerical values of CRI and still achieve very pleasant colour rendition: a high CRI value does not always correspond with a user perception of good colour rendering.

The same stakeholder also provided examples of LED lamps with R95/NR95, R125 and PAR25 shapes, that are mentioned in Table 6 of Annex III in EU No 1194/2012, but that are reported missing in the VHK database.

Evidence of the existence of LED lamps with high CRI that meet the $EEI < 0.2$ criterion is also provided by a third stakeholder; for some lamps this is based on test data.

B.4 Affordability condition

The main point of discussion regarding affordability is which criterion should be used to measure it.

Some stakeholders state that, for lamps, affordability is measured by the consumer on the purchase price, and not on the total cost of ownership (life-cycle costs) as

considered in this study. An affordable retail price must be ensured also in EU Member States with less purchase power.

In addition to the above, some stakeholders observed that prices are missing for many lamps in the database and that this mainly seems to regard the better and hence more expensive products, thus falsifying the affordability analysis. Discrepancies between the study and data in the reports of the Lot 8/9/19 study have also been found. In particular the larger and more expensive PAR38 LED lamps are stated to be too expensive for consumers. Another critic is that the additional costs for new dimmers and for the use of adapters has not been taken into account.

Overall many stakeholders agreed with the opinion of the Commission that life-cycle costs should be used, because the Ecodesign Directive specifically refers to the use of the LLCC criterion in its Annex II. Retail costs should only be taken into account if they are of a prohibiting high level, therefore creating an actual market barrier. This prohibiting high level is usually not reached with even the more expensive lamps.

In addition, VHK presented additional affordability analyses for PAR38 with E27 cap and for PAR16 with GU10 cap, for different usage conditions and using updated (June 2015) price information, during the Consultation Forum. These data have now also been included in the final version of the study, see chapter 4 of this document. These data demonstrate that, using life-cycle costs as a criterion, LED lamps are more affordable than Halogen lamps. For the E27-PAR38 lamps payback times vary from less than 1 year to 3.5 years. For the GU10-PAR16 lamps payback times are between half a year and 2 years.

In addition to these data a stakeholder presented affordability analyses for four A-brand lamps representing higher-quality models in the market ²⁴. Life-cycle cost savings (net present value) of 130-140 euros are found for small LED lamps (PAR16). For medium and large diameter lamps (PAR30, PAR38) these savings increase to 470 euros or more. Payback-times between 0.3 and 1.4 years are reported in the case of 2 hours use per day.

The majority industry opinion that PAR38 would be too expensive for consumers (cost increase of 41 euros) is not shared by all industry stakeholders. One of them reports life-cycle cost savings of 384 euros for a PAR38 LED lamp.

Short payback times and the affordability of LEDs on a life-cycle cost basis are also confirmed by data from other stakeholders. LED prices are quickly coming down and these economic advantages will further increase towards September 2016.

As regards additional costs for dimmers and adapters, see dedicated paragraphs below.

²⁴ <http://clasp.ngo/Resources/Resources/PublicationLibrary/2015/European-Market-Assessment-of-Directional-Lamps>

B.5 Functionality condition

Stakeholders that do not agree with the Commission that the (broadly equivalent) functionality condition is met typically doubt the availability of suitable LED substitutes for:

- Lamps with beam angles below 9° ,
- Lamps with high colour rendering index (CRI≥90),
- Lamps with E-cap and R39, R63 or R80 shape, where the study states that in some cases consumers may have to compromise or use cap-adapters,
- Lamps used on dimmers.

The first two aspects are related to the compliance criterion and have been discussed in par. B.3. The use of cap-adapters and dimming-related problems is discussed further below.

The opinion regarding the functionality criterion also depends on the interpretation of what is 'broadly equivalent'. Some stakeholders practically interpret this term as identical LED availability for all types of existing MV filament lamps, while others acknowledge that this term includes compromise solutions.

One stakeholder also pointed out that for some products fully identical replacement products may never be available because the market segment is too small. It is evident that the suppliers sometimes remove non-profitable products from the market. However these products normally are the products with the most limited consumer interest.

B.6 Compatibility condition, dimmers

In their comments, stakeholders have raised three topics regarding the compatibility condition:

- Dimmability of LED lamps
- Thermal aspects of using LED lamps in luminaires designed for MV filament lamps
- Geometric or photometric mismatches when using LED lamps in luminaires designed for MV filament lamps, in particular when using cap-adapters.

Thermal aspects are discussed in par. B.7; geometric and photometric mismatches in par. B.8. Dimmability is discussed here.

Stakeholders that do not agree with the conclusion that the compatibility criterion is met typically presented the following arguments:

- All MV filament lamps are dimmable, but not all LED lamps are dimmable. The availability of dimmable LED lamps is limited for some lamp types and dimmable lamps have higher purchase prices.
- Even LED lamps that are declared dimmable may not work or have problems on existing dimmers so that consumers have to buy new dimmers, leading to additional costs.
- It may not always be possible to install the dimmers that are declared to be compatible with the LED lamps, due to local unavailability or due to geometric constraints in the lighting installation.
- A standard defining the state of the art requirements for compatibility (between LED lamps and dimmers/control devices) is currently under development. This

standard will not be available on the foreseen date of entry into force of Stage 3 of Regulation 1194/2012 (September 2016), while it is expected to be available in September 2018. It is therefore recommendable to postpone stage 3 by two years.

- The problems related to dimmability of LEDs are identical for directional lamps and non-directional lamps. For the latter, Stage 6 of Regulation 244/2009 was postponed to September 2018 by a vote in the Consultation Forum of 17 April 2015. It would be logic to do the same for directional lamps.
- Dimmability is a very important feature for consumers.

Stakeholders that agree that the compatibility criterion is met presented the following arguments:

- Dimmable LED lamps are widely available and they are affordable. Existing regulations require LED lamp manufacturers to publish a list of dimmers that are compatible, and all major manufacturers do this (examples of such lists were presented by VHK during the Consultation Forum and one stakeholder showed additional examples). If these lists are absent in some cases, this is a matter for Market Surveillance.
- Regulation 1194/2012 does not require LED lamps to be compatible with all currently installed dimmers (which would be impossible), only with those that were for sale in January 2013. Requiring more stringent compatibilities is not covered for in the evaluation criteria, and a market assessment following additional criteria would be not compliant to the Regulation.
- The new standard on compatibility between LED lamps and dimmers will ensure that future LED lamps meeting the standard will work on future dimmers meeting the standard. It will not resolve the problem that LED lamps may have on legacy dimmers. Consequently, the problems related to dimming will be the same in September 2018 as in September 2016. Hence, the publication of the standard will not alter the assessment.
- LED lamp dimmer technology has advanced significantly in the last few years, with intelligent dimmers becoming part of the lamp circuits, and offering end-users great compatibility. These intelligent dimmers offer an 'adaptive circuit' detection system that enables LED lamps to determine what type of dimming circuit is installed, and to operate correctly in that application.
- Dimming is only a potential problem for the minority of the consumers and its extent is often exaggerated. One stakeholder stated that the IEE PremiumLight project conducted a comprehensive market survey in 2012, which included detailed mapping of use of dimmers in the home. Twelve EU countries participated, representative of 80 % of the households across the EU. The survey found 55 % of the households have no dimmers, 30 % have 1-2 dimmers, 15 % have more than 2 dimmers. In total, 45% of the household have dimmers and are on average using 2 dimmers.

Another stakeholder provided 2014 country data showing that only 6% of the LED lamps sold were dimmable. The small interest in this product type shows the small size of a potential dimming problem.

- It will be possible for practically all consumers to find dimmable LED lamps that are compatible, thus avoiding the need to replace an existing dimmer in a circuit. Only a "very, very small percentage" of the consumers would be faced with additional costs. In addition, EU Consumer Law allows consumers to return a product (e.g. a lamp) if it doesn't work as was expected, advertised or if it is non-functioning. This means that consumers could buy a dimmable lamp, try it out at home, and take it back if they are not satisfied.

B.7 Compatibility condition, thermal

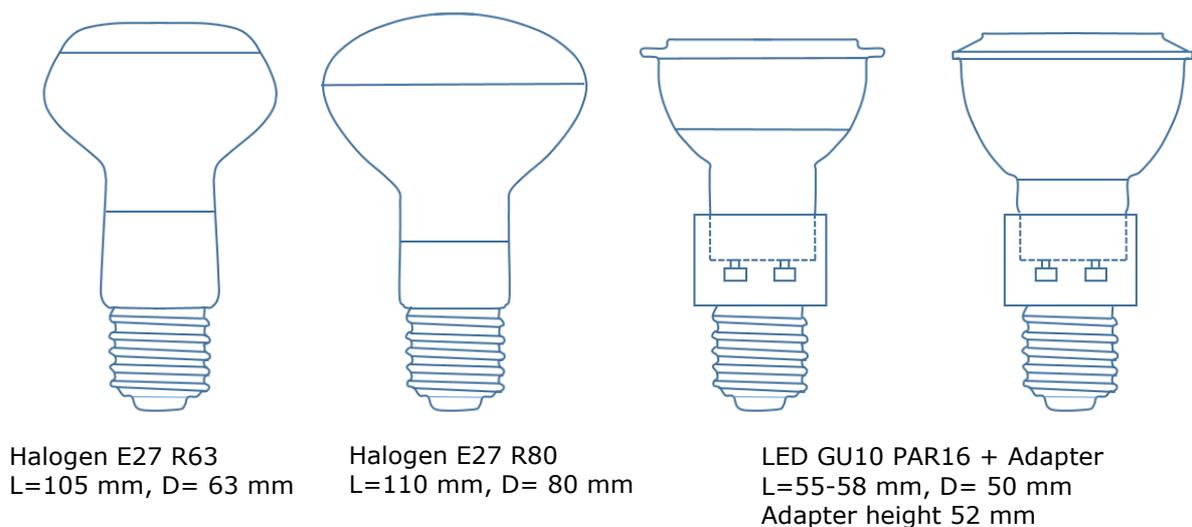
Some stakeholders noted that the study makes no reference to burning position restrictions (base up/down, etc.) and to thermal problems that can be associated with the use of LED lamps inside luminaires designed for MV filament lamps. Some LED lamps in the database are “Not suitable for use in enclosed luminaires” and therefore not a valid substitute.

Other stakeholders point out that in their experience these thermal problems do not exist and that no evidence has been provided that they do. In addition, fixtures developed for halogen lamps are in general designed for heat management, e.g. by ventilation holes, metal construction, ceramic socket. LED replacement lamps operate at around one tenth of the wattage of the halogen lamps they replace and the waste heat generated in the fixture is thus many times lower for LED lamps. This will further improve in future as the efficacy of LED lamps increases.

B.8 Use of cap-adapters

Some stakeholders have criticized the proposal of the study that consumers can use cap-adapters when they encounter difficulties in finding a suitable LED replacement lamp with the same cap. These adapters are stated to present a safety hazard for consumers, to lead to lamp-adapter combinations that are too long to fit in the luminaire, to lead to a different light centre that will alter the photometric characteristics, and to present additional costs for consumers. As evidence for the safety risks, two links to YouTube videos are presented.

During the Consultation Forum, VHK presented an example of the use of E27-to-GU10 cap-adapters (see figure below ²⁵), showing that at least in some cases this can be a valid solution. The costs of cap-adapters are 1-2 euros and thus negligible considering the large life-cycle cost advantages of LED lamps. As also pointed out by some stakeholders in their comments, if the adapters are CE-marked, consumers should be able to rely on their safety. The YouTube videos mentioned above show that consumers have to take care in choosing the correct, CE-marked and safe adapter for their application, but they do not demonstrate that adapters should in general not be used.



²⁵ The figure has been adapted compared to the one presented during the CF
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