

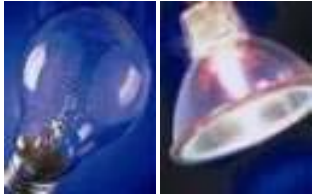
Further light sources

Most commonly used types of lamps



Further light sources

Characteristics and applications



Thermal Radiators

- Light bulbs
- Halogen lamps

- + simple & compact
- + best possible light quality
- + switch resistant & dimmable
- inefficient
- hot
- short lamp life

private houses
museums
shops & retail
niche applications



Low pressure discharge lamps

- Fluorescent lamps
- Compact fluorescent lamps

- + very efficient
- + very good light quality
- + long lamp life
- rather large
- temperature dependency
- gear needed

offices
industry
schools
super markets
private houses

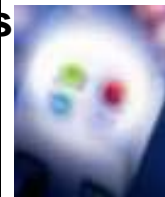


High intensity discharge lamps

- Mercury vapour lamps
- Metal-halide lamps
- Sodium vapour lamps

- + some are very efficient
- + large variety
- + powerful
- run-up delayed
- not dimmable
- strong requirements for luminaires

industry
shops & retails
street lighting



Semi conductor light sources

- Light emitting diodes (LED, OLED)
- LED-Lamps

- + efficient & compact
- + very long lamp life
- + very good colour generation
- critical to temperatures
- yet quite expensive
- standards in preparation

decorative applications
functional illumination

Further light sources

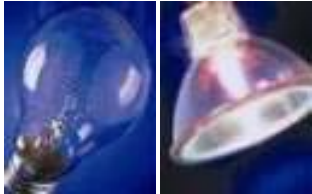
Lamp specifications – overview

	Therm. radiators	Discharge lamps		Semiconductor l. s.
	Light bulbs Halogen lamps	Low pressure	High intensity	Light emitting diodes: LED-chips LED-modules LED-lamps
		Fluorescent lamps Compact fluorescent lamps	Mercury vapour lamps Metal-halide lamps Sodium vapour lamps	
Applications	private and semi-professional applications	private and professional applications	professional applications	private and professional applications
Light generation	filament is heated up until it glows	electrical current runs through ionised gas (mercury is essential)	light arc within an ionised gas (plasma - mercury is needed)	photons are generated in semiconductor material
Power range	low and middle: 15 up to 400 W	low: 5 up to 80 W	low up to very high: 20 up to >1,000 W	very low up to low: 0.5 up to 10 W (modules up to 50 W)
Lamp voltage	230 V, 12 V	230 V, >110 V	>80 V	230 V, 12/24 V
Sockets	E27, E14, GY6,35, GU5.3, G9, R7s	E27, E14, G13, G5, G24/GX24-d/-q, 2G11 a.o.	E27, E40, G12, G8,5, GU6,5 a.o.	E27, GU6.53, G13 a.o. or boards and modules without socket
Light output	100 up to 9,000 lm	250 up to 6,150 lm	1,600 up to >110,000 lm	up to 3,000 lm (LED-modules)
Efficiency	10 up to 25 lm/W	50 up to 100 lm/W	40 up to 100 lm/W (some >120 lm/W)	up to 60 lm/W (LED-lamps), up to 90 lm/W (LED-modules)
EEI	C, D, E, F	A, B	not applicable	A (LED-lamps)
Life time values	1,000 up to 5,000 hrs	10,000 up to 24,000 hrs	8,000 up to 15,000 hrs	25,000 up to 50,000 hrs
Colour	warm: ca. 2,500 up to 3,000 K	warm, cool, daylight: ca. 2,500 up to 8,000 K	warm, cool, daylight: ca. 2,500 up to 8,000 K	warm, cool, daylight: 2,700 up to >6,500 K
Colour rendering	very good: CRI = 100	good up to very good: CRI = 80- 98	poor up to very good: CRI = <40 up to 95	good up to very good: CRI = 70 up to >90
Remarks	low voltage operation requires transformer	ballasts needed	gear essential	modules need converter

green = best-in-class – red = worst-in-class

Further light sources

The four lamp groups – trends



Thermal Radiators

- Light bulbs
- Halogen lamps

- phase-out of inefficient lamps
- introduction of more efficient lamps
- replacement by different technologies



Low pressure discharge lamps

- Fluorescent lamps
- Compact FL

- most important artificial light source worldwide
- not only for professional use
- large variety of „energy saving lamps“
- critical waste management of mercury



High intensity discharge lamps

- Mercury vapour
- Metal halide
- Sodium vapour

- phase-out of inefficient lamps
- switch to white light in outdoor applications
- large variety of special lamps



Semi conductor light sources

- Light emitting diodes (LED, OLED)
- LED-Lamps

- rising demand to replace light bulbs
- expansion of applications
- more and more professional use

