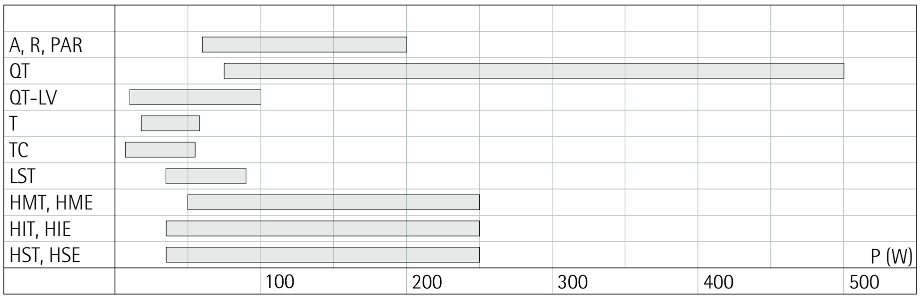
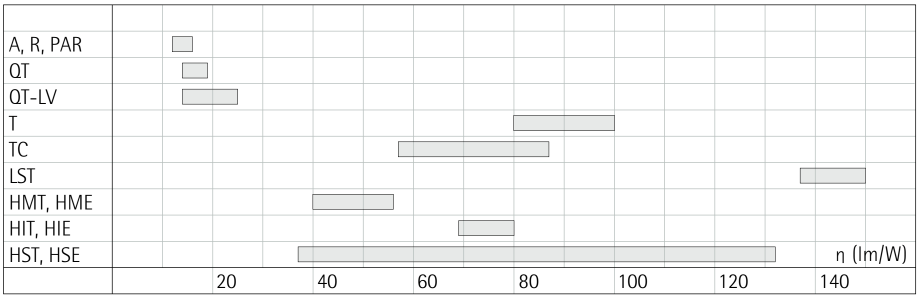
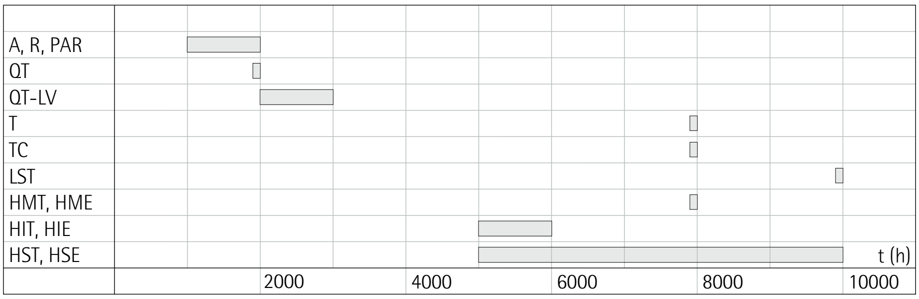


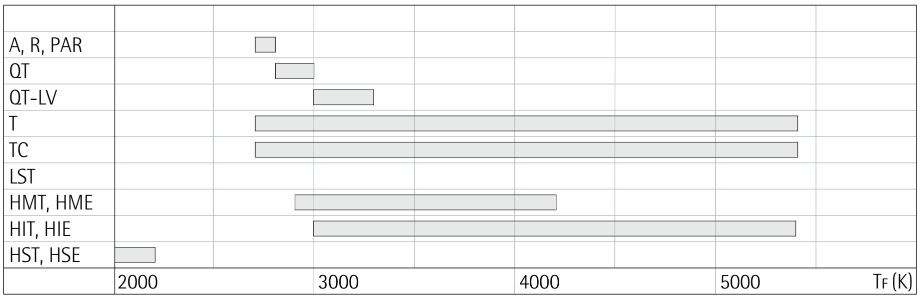
Range of power P for various lamp types.



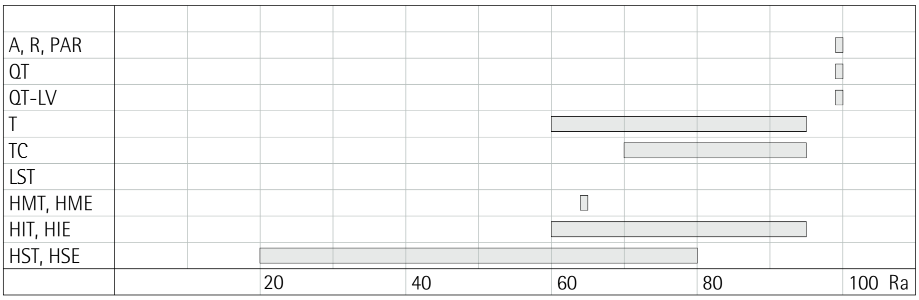
Ranges of luminous efficacy η for various lamp types.



Service life t of various lamp types.



Colour temperature ranges T_F for various lamp types.



Colour rendering index R_a ranges for various lamp types.

$$K = \left(\frac{K_{La}}{\Phi \cdot t} + \frac{P \cdot a}{\Phi \cdot 1000}\right) \cdot 10^6$$

$[K] = \frac{DM}{10^6 lm \cdot h}$

$[K_{LA}] = DM$

$[P] = W$

$[\Phi] = lm$

$[t] = h$

$[a] = \frac{DM}{kW \cdot h}$

Formula for calculating the operating costs of a lighting installation on the basis of specific lamp costs K (DM/10^6 lmh). To calculate the costs the lamp price K_{La}, the wattage P, the luminous flux Φ, the service life t and the cost per unit of electricity a are required. Depending on lamp type and power the specific costs can be between DM 3 and DM 30 per 10^6 lmh.

lamps is given as the average lamp life after the failure of 50 % of the lamps; in the case of discharge lamps the values refer to lamp life in terms of light output, i.e. when there is a reduction in luminous flux of up to 80 %. The actual rated life is, however, also affected by site conditions. In the case of incandescent lamps the operating voltage has a critical influence on the life of the lamp. In the case of discharge lamps it is switching frequency that affects the rated life.

Incandescent lamps and halogen lamps have the shortest rated life at 1000 - 3000 h. The rated life of fluorescent lamps and metal halide lamps is considerably higher at 8000 h and 6000 h, respectively. Sodium lamps have a rated life of 10 000 h, high-pressure mercury lamps over 8000 h.

Lamp costs are another aspect of the efficiency of a lighting installation. They vary between values that can be ignored when compared with costs for power and maintenance, to values that are as high as these costs. The most economical lamps are conventional incandescent lamps, followed by fluorescent lamps and halogen lamps. Prices for high-pressure discharge lamps are substantially higher.

3.3.1.6 Brightness control

The dimming quality of light sources is important for the lighting of spaces with changing activities and for environments where different atmospheres are required. Dimmable lamps can also be used to adjust the lighting to changing environmental conditions, e.g. day and night-time lighting.

Conventional incandescent lamps and halogen lamps for mains voltage can be dimmed easily and economically. Low-voltage halogen lamps and fluorescent lamps are technically more difficult to handle, but are also dimmable. From a technical point of view high-pressure discharge lamps should not be dimmed.

3.3.1.7 Ignition and re-ignition

Lamp behaviour when lamps are switched on and reswitching after power failure may be of significance in the design. For many applications it is essential that the light sources provide sufficient luminous flux immediately after switching (e.g. when a person enters a room). In the majority of cases there is no time to allow a cooling phase before reigniting lamps that have been switched off or are off due to power failure. For the lighting of large meeting spaces and sports facilities there are statutory requirements stipulating that the instant re-ignition of lamps must be ensured.
Incandescent lamps and halogen lamps pose no problems here. They can simply be switched on at any time. The same applies to fluorescent lamps, which can be ignited in a cold or warm state with negligible delay. High-pressure discharge lamps require a substantial run-up period. Re-ignition is only possible without special equipment, after a specific cooling time. If high-pressure lamps are to allow instant re-ignition, double-ended versions equipped with special ignitors must be installed.

3.3.1.8 Radiant and thermal load

When dimensioning air-conditioning plants the lighting load has to be taken into account. This is due to the fact that the power used by the lighting equipment is, in fact, converted into heat, either directly through air convection or when light-absorbing materials heat up. The thermal load of a space increases, the lower the efficacy of the light sources, since in the case of low efficacy for a given lighting level more energy exists in the infrared range.

In the case of some special lighting tasks limiting the radiant load on objects is a prime concern. This applies to accent lighting on heat-sensitive objects. Radiation problems occur most frequently in exhibition lighting, however. In the exhibition environment light, infrared and ultraviolet radiation, can all result in damage due to the acceleration in the ageing of materials and fading of colours.

High proportions of infrared radiation and convection heat are emitted by light sources with predominantly low luminous efficacy, such as incandescent lamps and halogen lamps. In the case of linear and compact fluorescent lamps infrared radiation is considerably lower.

Ultraviolet radiation is theoretically emitted predominantly by high-pressure discharge lamps. As the UV component is always reduced by obligatory front glass covers, the highest ultrviolet load in practice is produced by halogen lamps which