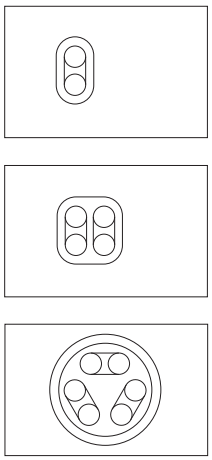
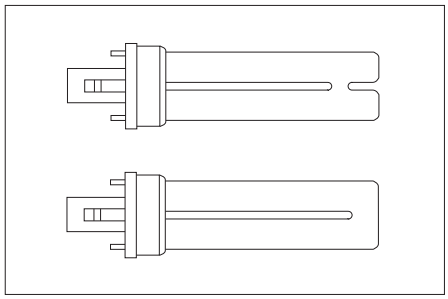
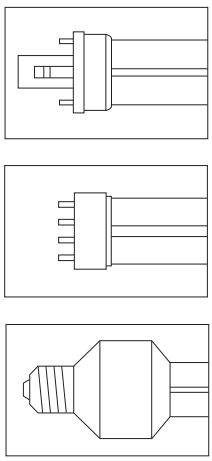


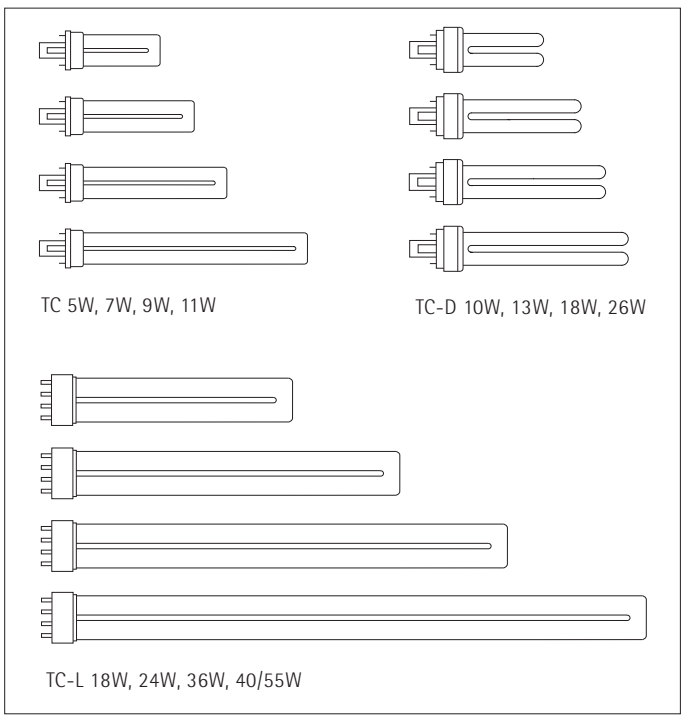
Arrangement of tubes in compact fluorescent lamps: TC/TC-L (above), TC-D (centre), TC-DEL (below).



In contrast to conventional fluorescent lamps, in the case of compact fluorescents both ends of the discharge tube(s) are mounted on a single cap.



Compact fluorescent lamps with two-pin plug-in cap and integral starting device (above), four-pin plug-in cap for operation on electronic control gear (centre), screw cap with integral ballast for mains operation (below).



Comparison of sizes of standard TC, TC-D and TC-L compact fluore-scent lamps.

ted light can be produced to accentuate the qualities of illuminated objects by creating shadows.

Compact fluorescent lamps with an integrated starting device cannot be dimmed, but there are models available with external igniting devices and four-pin bases that can be run on electronic control gear, which allows dimming.

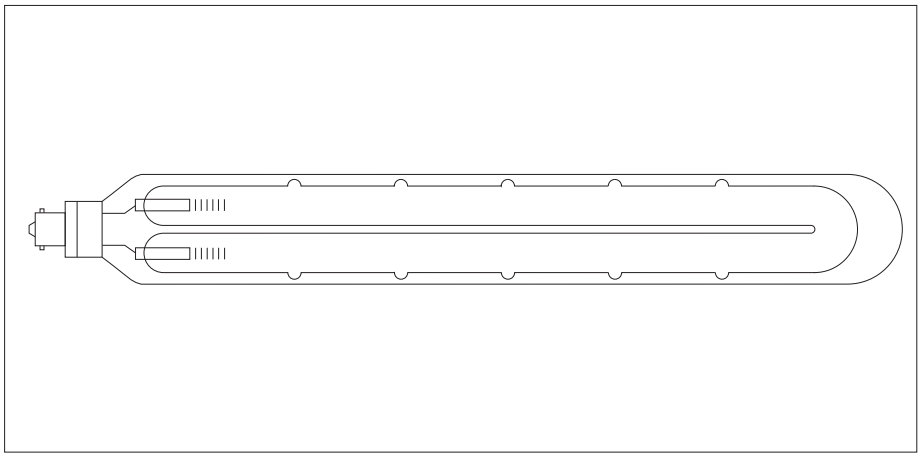
Compact fluorescent lamps are mainly available in the form of tubular lamps, in which each lamp has a combination of two or four discharge tubes. Starting device and ballast are required to operate these lamps; in the case of lamps with two-pin plug-in caps the starting device is integrated into the cap.

Alongside the standard forms equipped with plug-in caps and designed to be run on ballasts, there is a range of compact fluorescent lamps with integrated starting device and ballast; they have a screw cap and can be used like incandescent lamps. Some of these lamps have an additional cylindrical or spherical glass bulb or cover to make them look more like incandescent lamps. If these lamps are used in luminaires designed to take incandescent lamps it should be noted that the luminaire characteristics will be compromised by the greater volume of the lamp.

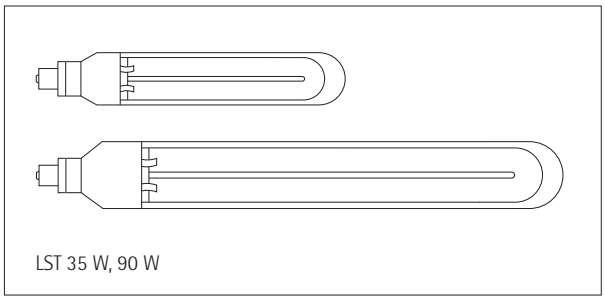
2.3.2.3 High-voltage fluorescent tubes

High-voltage fluorescent tubes work on the principle of low-pressure gas discharge, the gas being either an inert or rare gas or a mixture of inert gas and mercury vapour. In contrast to fluorescent lamps, the electrodes contained in these lamps are not heated, which means they have to be ignited and run on high voltage. As there are special regulations concerning installations run at 1000 V and more, high-voltage tubular lamps are usually operated at less than 1000 V. There are, however, high-voltage discharge lamps available that run at over 1000 V.

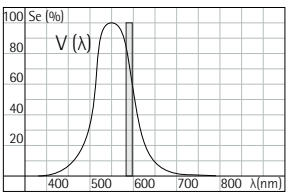
High-voltage fluorescent tubes have a considerably lower luminous efficacy than conventional fluorescent lamps, but they have a long lamp life. Rare-gas discharge does not allow much scope when it comes to producing different colours; red can be produced using neon gas or blue using argon. To extend the spectrum of colours available it is possible to use coloured discharge tubes. However, mercury is usually added to the inert gas and the resulting ultraviolet radiation transformed into the desired luminous colours using fluorescent material. High-voltage fluorescent tubes require a ballast; they are operated on leakage transformers, which manage the high voltages required for ignition and operation. High-voltage



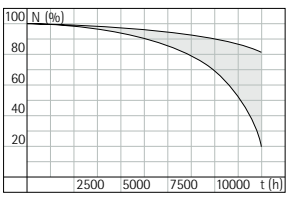
Low-pressure sodium lamp with U-shaped discharge tube in a dichroic glass bulb. The infrared radiation produced by the lamp is reflected back into the discharge tube via the dichroic coating on the glass, thereby cutting down the time required to reach operating temperature.



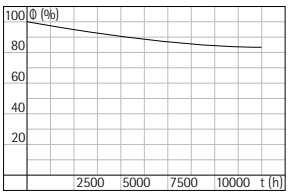
Comparison of sizes of low-pressure sodium lamps (LST).



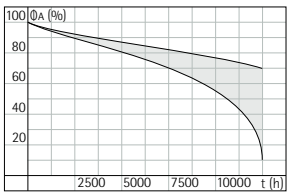
Relative spectral distribution S_e (λ) of low-pressure sodium vapour discharge. The line spectrum produced is close to the maximum spectral sensitivity of the eye, but limits colour rendering through its monochromatic character.

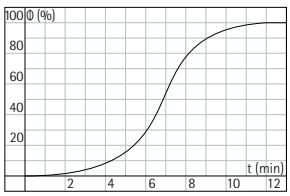


Proportion of operating lamps N, lamp lumens Φ and luminous flux of total installation $Φ_A$ (as the product of both values) as a function of the operating time t.



Run-up characteristic: lamp lumens Φ in relation to time t.





fluorescent tubes ignite instantly and they can be restarted when hot. There are no restrictions with regard to burning position.

High-voltage fluorescent tubes come in various diameters and lengths. Different tubular shapes can be manufactured to meet the requirements of specific applications, e.g. for written signs and company logos. They are available in a variety of colours.

2.3.2.4 Low-pressure sodium lamps

Low-pressure sodium lamps are comparable to fluorescent lamps in the way they are constructed and how they operate. In this case sodium vapour is excited instead of mercury vapour. This leads to a number of essential differences to fluorescent lamps. In the first place, sodium lamps are more difficult to ignite than mercury lamps, because solid sodium – as opposed to liquid mercury – does not produce metal vapour at room temperature. In the case of sodium lamps, ignition can only be effected with the aid of additional inert gas; only when the rare-gas discharge produces sufficient heat does the sodium begin to evaporate, thereby enabling the actual metal vapour discharge to take place. Low-pressure sodium lamps require high ignition voltage and a relatively long run-up time before they reach maximum efficacy. To guarantee a sufficiently high operating temperature, the discharge tube is usually encased in a separate glass envelope that is often designed to reflect infrared radiation.

Another difference is the kind of light the lamp produces. Whereas mercury vapour excited at low pressure produces mainly ultraviolet radiation, which is transformed into light with the aid of fluorescent substances, sodium vapour produces light directly. Low-pressure sodium lamps therefore require no luminous substances to be added. Moreover, the luminous efficacy of these lamps is so high that the lamp volume required is considerably smaller than is the case for fluorescent lamps.

The most striking feature of low-pressure sodium lamps is their extraordinarily high luminous efficacy. As the low-pressure sodium lamp has a very long lamp life, it is the most economically efficient light source available.

Low-pressure sodium vapour only produces light in two spectral lines which are very close together; the light radiated by the lamp is monochrome yellow. Due to its monochromatic character it does not produce any chromatic aberration in the eye and therefore guarantees visual acuity. The obvious disadvantage of these lamps with regard to the advantages mentioned above is their exceptionally poor colour rendering quality. Colour ren-