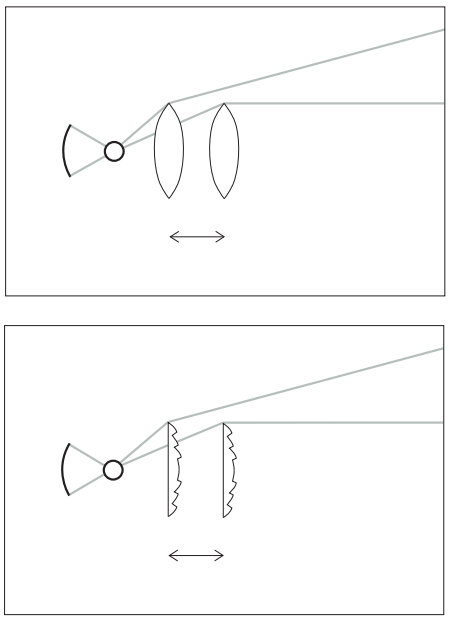
2.6.3 Lens systems

In contrast to prismatic louvres, lenses are used practically exclusively for luminaires for point light sources. As a rule the optical system comprises a combination of one reflector with one or more lenses.

2.6.3.1 Collecting lenses

Collecting lenses direct the light emitted by a light source located in its focal point to a parallel beam of light. Collecting lenses are usually used in luminaire constructions together with a reflector. The reflector directs the overall luminous flux in beam direction, the lens is there to concentrate the light. The distance be-tween the collecting lens and the light source is usually variable, so that the beam angles can be adjusted as required.

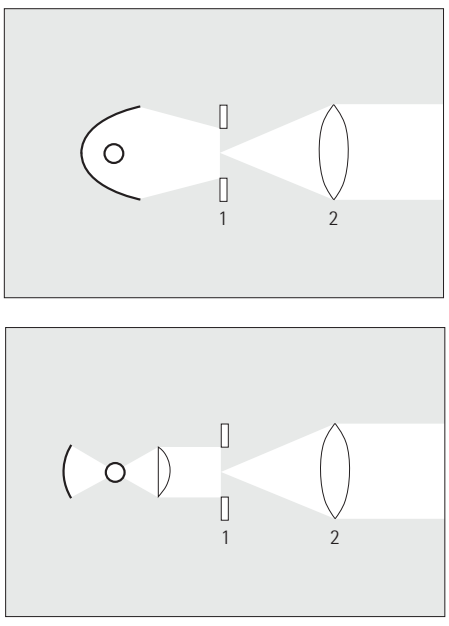


Collecting lens (above) and Fresnel lens (below). The beam angle can be varied by changing the distance between lens and light source.

2.6.3.2 Fresnel lenses

Fresnel lenses consist of concentrically aligned ring-shaped lens segments. The optical effect of these lenses is comparable to the effect produced by conventional lenses of corresponding shape or curvature. Fresnel lenses are, however, considerably flatter, lighter and less expensive, which is why they are frequently used in luminaire construction in place of converging lenses.

The optical performance of Fresnel lenses is confined by aberration in the regions between the segments; as a rule the rear side of the lenses is structured to mask visible irregularities in the light distribution and to ensure that the beam contours are soft. Luminaires equipped with Fresnel lenses were originally mainly used for stage lighting; in the meantime they are also used in architectural lighting schemes to allow individual adjustment of beam angles when the distance between luminaires and objects varies.



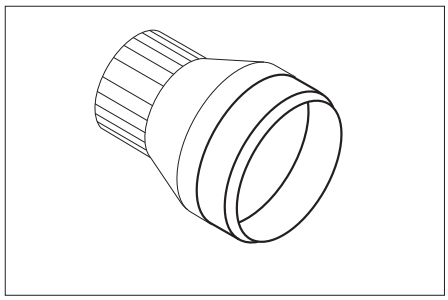
Projector with projecting system: a uniformly illuminated carrier (1) is focussed via a lens system (2). The ellipsoidal projector (above) with high light output, and the condenser projector (below) for high quality definition.

2.6.3.3 Projecting systems

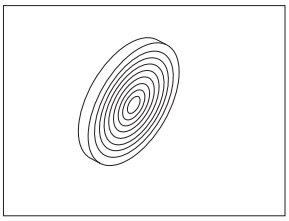
Projecting systems comprise an elliptical reflector or a combination of spherical reflector and condenser to direct light at a carrier, which can be fitted with optical accessories. The light is then projected on the surface to be illuminated by the main lens in the luminaire.

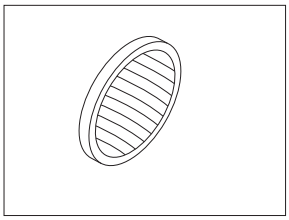
Image size and beam angle can be defined at carrier plane. Simple aperture plates or iris diaphragms can produce variously sized light beams, and contour masks can be used to create different contours on the light beam. With the aid of templates (gobos) it is possible to project logos or images.

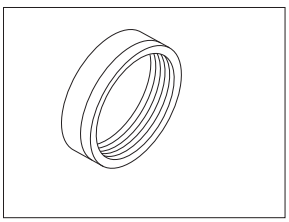
In addition, different beam angles or image dimensions can be selected depen-

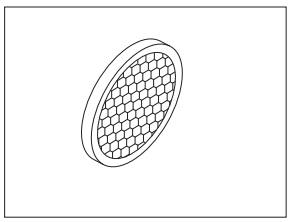


Light head of a spotlight to which various accessories can be fitted.



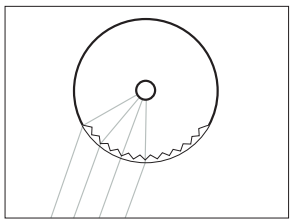


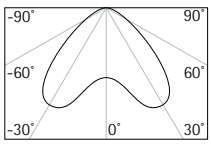




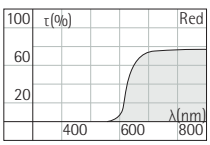
Accessories (from the top down): flood lenses to widen the light beam. Sculpture lens to produce an oval light beam. Multigroove baffle and honeycomb anti-dazzle screen to control the light beam and reduce glare.

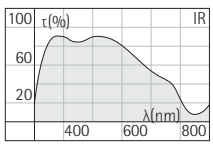
Typical light distribution of a fluorescent lamp equipped with prismatic optics.

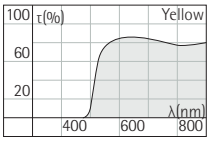


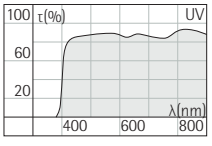


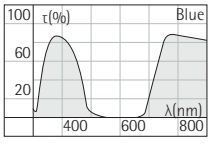
Spectral transmission τ (λ) for conventional filters.











ding on the focal length of the lenses. In contrast to luminaires for Fresnel lenses it is possible to produce light beams with sharp contours; soft contours can be obtained by setting the projector out of focus.

2.6.4 Prismatic systems

Another optical means of controlling light is deflection using prisms. It is known that the deflection of a ray of light when it penetrates a prism is dependent on the angle of the prism. The deflection angle of the light can therefore be determined by the shape of the prism.

If the light falls onto the side of the prism above a specific angle, it is not longer refracted but reflected. This principle is also frequently applied in prismatic systems to deflect light in angles beyond the widest angle of refraction.

Prismatic systems are primarily used in luminaires that take fluorescent lamps to control the beam angle and to ensure adequate glare limitation. This means that the prisms have to be calculated for the respective angle of incidence and combined to form a lengthwise oriented louvre or shield which in turn forms the outer cover of the luminaire.

2.6.5 Accessories

Many luminaires can be equipped with accessories to change or modify their photometric qualities. The most important are supplementary filters, which provide coloured light, or reduce the UV or IR component. Filters may be made of plastic foil, although glass filters are more durable. Apart from conventional absorption filters there are also interference filters (dichroic filters) available, which have high transmission and produce exact separation of transmitted and reflected spectral components.

Wider and softer light distribution can be achieved using flood lenses, whereas sculpture lenses produce an elliptical light cone. Additional glare shields or honeycomb anti-dazzle screens can be used to improve glare limitation. In the case of increased risk of mechanical damage, above all in sports facilities and in areas prone to vandalism, additional protective shields can be fitted.