Light determines the mood of a room. Lighting applications and the corresponding lighting effects of different luminaires are rehearsed using simulations and architectural examples.
The effect of rooms, areas and objects greatly depends on the type of lighting. This ranges from uniform washlighting through to highlighting and the projection of gobo images.
Guide

Indoor lighting | Types of lighting

General lighting

Ambient lighting produced by wide beam light distribution facilitates perception and orientation in the horizontal plane. As direct or indirect lighting, it produces a directed or diffuse light to illuminate workplaces or traffic zones.
Direct and aimed general lighting produces an even illumination on the horizontal working plane. The architecture is visible and it is possible to orientate oneself and work in the room.

The directed light produces good modelling and brilliance. The uniformity on the working plane increases as the room height increases or as the beam angle widens. Directed light enables good appreciation of form and surface texture. The visual comfort increases as the cut-off angle increases. A feature of direct illumination is its highly efficient use of energy. At the work place, secondary glare must be taken into consideration.

Applications

Projects:
City Hall, Graz
Centre Pompidou, Paris
Congress Palace, Valencia
ERCO, Lüdenscheid
Direct diffuse general lighting designates an even illumination with respect to a horizontal working plane. The architecture is visible and it is possible to orientate oneself and work in the room.

**Observation**

Direct diffuse general lighting designates an even illumination with respect to a horizontal working plane. The architecture is visible and it is possible to orientate oneself and work in the room.

**Light structures**

**Downlights, diffuse**

**Wall-mounted downlights, diffuse**
Direct diffuse light produces a soft illumination with little shadow and reflection. The limited formation of shadow results in weak modelling capabilities. Shapes and surface textures are only slightly emphasised.

Conclusion

Applications

Projects:
Congress Centre, Valencia
Prada, Milan
German Architectural Museum, Frankfurt
Fondation Beyeler, Basel

Direct, diffuse general lighting for
- working areas
- multifunctional rooms
- museums
- exhibitions
- pedestrian traffic areas

Preferred luminaire groups:
- light structures
- downlights
- wall-mounted downlights
- luminous ceilings
Guideline

Indoor lighting | Types of lighting | General lighting

indirect

Observation

Indirect general lighting uses a ceiling, wall or other surface as a secondary reflector. The brightening of these surfaces that delineate the room or area gives an open spatial impression.

Light structures

Uplights

The diffuse light produces limited shadows and a weak modelling. Using indirect illumination alone gives a lower spatial differentiation. Compared to direct illumination, a considerably higher luminous flux is necessary for achieving the same illuminance on the working plane. The secondary reflector should boast a high reflectance. Direct and secondary glare are extensively avoided.

Conclusion
The prerequisite for an even distribution of light is a sufficiently high room. Indirect illumination should be mounted above eye-level. The distance from the ceiling depends on the level of evenness required and should be at least 0.8m.

Indirect general lighting for:
- working areas
- multifunctional rooms
- pedestrian traffic areas

Preferred luminaire groups
- light structures
- uplights
Observation

Direct/indirect general lighting refers to a combination of direct and indirect illumination with respect to the horizontal working plane. The ceiling or walls serve here as reflection surfaces. The brightening of these surfaces that delineate the room or area gives an open spatial impression.

Light structures

Pendant downlights

The uniformity on the working plane increases as the room height increases. Directed light enables a good appreciation of form and surface texture. The secondary reflector should boast a high reflectance. The uniformity on the ceiling increases the further away the luminaire is from the ceiling. A feature of general lighting with fluorescent lamps is its highly efficient use of energy.

Conclusion
Applications

Projects:
Civic Cleaning Adult-Education Centre, Berlin
Reichstag, Berlin
Palacio de la Aljaferia, Zaragoza
Fibanc, Barcelona

Indoor lighting  | Types of lighting  | General lighting
direct and indirect

Direct/indirect general lighting for:
- working areas
- multifunctional rooms
- pedestrian traffic areas

Preferred luminaire groups:
- light structures
- pendant downlights
Indoor lighting | Types of lighting

Accentuation

Observation

Accent light emphasises individual objects or architectural elements using narrow beams of light. Bright points in dark surroundings attract attention. They separate the important from the unimportant, allowing individual objects to come to the fore.

Spotlights

Directional downlights

Conclusion

Accent lighting enables good appreciation of form and surface structure. The focused light produces pronounced shadows and good modelling ability, as well as brilliance. A narrow beam and a high brightness contrast to the surroundings give the object particular emphasis.
Accent lighting creates points of interest and improves the local visual performance, e.g. at the work place. Structures and textures of objects are clearly emphasised by the directed light.

Accent lighting for:
- exhibitions
- museums
- sales and presentation areas
- restaurants, cafés, wine bars
- working areas

Preferred luminaire groups:
- spotlights
- contour spotlights
- directional downlights
- directional recessed floor luminaires
- task lights

Projects:
Neue Wache, Berlin
Iglesia del Sagrado Corazón, Bilbao
Issey Miyake, Paris
Pinacoteca Vaticana, Rome
Observation

Washlighting illuminates larger objects or spatial zones using wide beam light distribution. In contrast to accent light, it conveys a wide impression.

Conclusion

The directed light produces good modelling abilities and enables good appreciation of form and surface structure. Washlighting illumination can serve as a background for accent lighting.

Applications

Mounting floodlights on tracks allows a flexible positioning of the luminaires.

Washlighting illumination for:
- exhibitions
- museums
- sales and presentation areas
- multifunctional rooms
Preferred luminaire groups
- floodlights

Projects:
Catedral de Santa Ana, Las Palmas
Passeig de Gràcia, Barcelona
Royal Armouries Museum, Leeds
Museo Fournier del Naipe, Vitoria
Guide

Indoor lighting | Types of lighting

Wallwashing

Vertical illuminance defines and structures spatial situations. It makes a significant contribution to the impression of brightness in a space and to a feeling of security.

Uniform wallwashing
Wallwashing with focal emphasis
Wallwashing for corridors

Wallwashing with ambient lighting
Grazing light wallwashing
Wallwashing

Uniform wallwashing defines the spatial environment. A uniform brightness distribution from ceiling to floor emphasises walls as a whole. Wallwashing with a high degree of uniformity is ideal for museums to illuminate artwork, in salesrooms for shelf lighting or in foyers to create the impression of a wide and representational space.

Wallwashing with focal emphasis complements the uniform wallwashing by adding a highlight in the upper third of the illuminated wall. This type of lighting is suitable, for instance, for the efficient illumination of displays above shelving in salesrooms.

Wallwashing for corridors provides highly uniform illumination for two parallel running walls. The uniform illuminance distribution from ceiling to floor conveys a wide impression. The clear structure of the room facilitates orientation. Wallwashing for corridors is particularly suited for halls and passageways in hotels, administrative buildings or health and care facilities.
**Wallwashing with ambient lighting**

Wallwashing with ambient lighting complements the uniform wallwashing by adding horizontal ambient lighting. This type of lighting forges a link between the vertical illuminance on the surrounding surfaces and the ambient lighting provided by downlights in the centre of the room. In salesrooms, both shelves and tables in front of the wall can be illuminated.

**Grazing light wallwashing**

Grazing light emphasises the material and surface texture of walls. Positioning the luminaire close to the wall produces a graduation of brightness on the vertical axis. Grazing light impressively brings out the texture of natural stone or wood.
Guide

Indoor lighting | Types of lighting

Projection

Observation

Projectors are used for projecting signs, patterns and images using gobos or structured lenses for light effects and to create sharp-edged patterns. This enables an additional level of information and awareness to be built up.

Conclusion

Interesting effects can be created using gobos and filters.
Indoor lighting | Types of lighting

Projection

Applications

- exhibitions
- museums
- sales and presentation areas
- restaurants, cafés, wine bars
- hotels

Projections can be made with
- spotlight projectors

Projects:
- Aragon Pavillon, Sevilla
- Hannover Messe
- Teatri Ravintola, Finland
- ERCO, Lüdenscheid
Orientation lighting improves perception by adding light points and lines, e.g. along pathways and on stairs. The light must function as a signal. Illuminating the room is of secondary importance here.
Low illumination levels are sufficient for orientation purposes. Small luminaires with high luminance clearly set themselves apart from their surroundings. Orientation lighting improves orientation in complex buildings and makes it easier to find fire exits in emergencies.

Applications

Orientation lighting for the identification of
- architectural lines
- steps and exclusion zones
- entrances
- routes
- emergency exit routes

Preferred luminaire group
- floor washlight
- wall-mounted downlights
- recessed floor luminaires
- orientation luminaires

Projects:
- Light and Building, Frankfurt
- Palazzo della Ragione, Bergamo
- Hilton Hotel Dubai
- Hilton Hotel Dubai
Luminaires are available in a wide variety of types, each intended to fulfil different lighting requirements. The same light distributions can be achieved with different luminaires. The choice depends on whether the luminaires are to be a design feature in their own right, or whether an integrative design approach is being followed. Compared to luminaires that are permanently mounted, track-mounted luminaires offer a higher degree of flexibility.
Tracks form the basis for a variable and flexible lighting design that can orientate itself around the changing interior design and usage of a room. Mating adapters on the luminaires perform both the electrical and mechanical connection.

Tracks provide a flexible form of voltage supply for spotlights, floodlights and wallwashers, for accent lighting and washlighting of all professional lighting situations. Using multiphase tracks makes it possible to operate different circuits simultaneously. Recessed tracks are inconspicuous architectural details. The tracks can also be suspended via pendant tubes or wire rope. They should correspond to the architecture in their arrangement and form.

Projects:
Teatrit Ravintola, Helsinki
Christie’s Showroom, New York
Caras Gourmet Coffee Kranzler-eck, Berlin
Kayser private home, Neuenrade
Light structures are luminaires that additionally allow the possibility for attaching mobile luminaires, often using integrated tracks or singlets. Light structures consist of a tubular or panel elements and are usually suspended from the ceiling. First and foremost, light structures use elements with integrated luminaires for linear light sources that can be used both for direct general lighting and for indirect lighting with light reflected by the ceiling. Elements with integrated downlights or directional luminaires provide accent lighting.

**Luminares**

**Direct**
Light structures with direct light have an axially symmetric light distribution emitted downwards for illuminating the usable surfaces.

**Indirect**
Light structures with indirect light distribution have an axially symmetric light distribution emitted upwards for illuminating the ceiling.

**Direct/Indirect**
Light structures with direct/indirect light distribution have an axially symmetric light distribution emitted upwards and downwards for illuminating the usable surfaces and the ceiling.
The offset from the wall (a) is recommended as being half the luminaire spacing (d). The luminaire spacing (d) between two neighbouring structures should correspond to the height (h) above the floor or work surface. The distance to the ceiling depends on the level of evenness required on the ceiling. The distance to the ceiling should measure at least 0.8 m for indirect lighting so that an even illumination is ensured.

General lighting in:
- offices, medical practices
- pedestrian traffic areas
- additional accent lighting and washlighting with the help of spotlights, floodlights and wallwashers

Projects:
Reichstag, Berlin
Xaverian Brothers High School, Westwood MA
Regional Govt., Berlin
Shanghai Museum
Light

Spotlights
Spotlights have a narrow-beam (spot approx. 10°) to wide-beam (flood approx. 30°) light distribution with a rotationally symmetrical beam.

The use of accessories is also typical for spotlights:
- lenses: spread or sculpture lenses
- filters: colour filters, ultraviolet or infrared filters
- barn doors, dazzle cylinders, multigroove baffles or honeycomb anti-dazzle screens

Contour spotlights
Contour spotlights with lenses for projection for various beam emission angles.
Some types of spotlight are equipped with convex lenses or Fresnel lenses for a variable beam angle. In addition, spotlights with image contouring or projecting systems (contour spotlights) enable different beam contours or projected images by projecting through apertures or stencils (gobos).

The mounting location and the orientation are variable. Spotlights are offered with different beam emission angles and light distributions.

Criteria for spotlights
- choice of lamp determines light colour, brilliance, functional life, light intensity
- emission angle determines the beam of light and is defined by the reflector
- cut-off angle limits glare and increases visual comfort
- rotatable and tiltable
- accessories: lenses, filters, glare control
Guide

Indoor lighting | Luminaire groups

Spotlights

Arrangement

On pictures on walls or objects in a room, the light should be incident at an angle of less than 30°.

Applications

For highlighting or projection in:
- museums
- exhibitions, art galleries
- sales rooms
- presentation and display areas

Since they enable variable mounting locations and orientation, spotlights can be adapted to suit changing tasks. A narrow light distribution enables smaller areas to be illuminated, even from a larger distance. Conversely, the wide light distribution of projector floodlights enables a larger area to be illuminated with a single luminaire. Gobos and structured lenses are used to project lighting effects. In addition, filter foils can also be used.

Projects:
Christie’s Auctioneers, New York
Gmurzynska Gallery, Cologne
Bunkamura Museum of Art, Tokyo
Expo Seville, Spain
Light
Floodlights feature a wide-beam characteristic. They are offered with a predominantly symmetrical light distribution.

Criteria for floodlights
- choice of lamp determines light colour, brilliance, functional life, efficiency, light intensity
- uniformity: optimised reflector for even illumination of areas
- gradient: soft edge to the beam of light
- light output ratio is increased by optimised reflector technology

Applications

Projects:
Catedral de Santa Ana, Las Palmas
Passeig de Gràcia, Barcelona
Royal Armouries Museum, Leeds
Museo ‘Fournier’ del Naipe, Vitoria

Floodlights provide even illumination of areas or objects for:
- museums
- exhibitions
- trade-fair stands
- sales areas
- presentational areas

The luminaires should correspond to the architecture in their arrangement and form.
Wallwashers have a wide-beam characteristic. They are offered with an asymmetric light distribution.

Criteria for wallwashers:
- choice of lamp determines light colour, brilliance, functional life, light intensity
- uniformity: optimised reflector for even illumination of areas
- gradient: soft edges to the beam
- light output ratio is increased by optimised reflector technology

Wallwashers (spotlights)
Wallwashers have an asymmetric light distribution for evenly illuminating wall faces. Track-mounted wallwashers allow the luminaire spacing to be flexibly adjusted as required.

Wallwashers, tiltable (spotlight)
Spotlights with wallwasher attachment feature a asymmetric light distribution for evenly illuminating wall surfaces. Track-mounted wallwashers allow the luminaire spacing to be flexibly adjusted as required. Wallwashers with kick-reflector have an asymmetric light distribution for evenly illuminating wall faces.

Washlights
Wallwashers have an asymmetric light distribution for evenly illuminating wall faces. In addition, they also feature a downlight component for evenly illuminating the floor.
Double-focus wallwashers
Double-focus wallwashers have an asymmetric light distribution for evenly illuminating wall faces. The shielding of the lamp provides high visual comfort and prevents the emission of spill light. The homogeneity of the wallwashing is particularly high.

Lens wallwashers
Lens wallwashers have an asymmetric light distribution for evenly illuminating wall faces. The lens serves to spread out the beam.
Wallwashing is an important component of architectural lighting for adding emphasis to room areas and for illuminating higher, vertical faces or wall areas for:

- museums
- exhibitions
- trade-fair stands
- auditoriums
- halls in public buildings and shopping malls
- sales areas
- presentational areas

Surface-mounted luminaires act as a feature in the room. They should correspond to the architecture in their arrangement and form.

The offset from the wall for wallwashers should not be less than one third of the wall height. This corresponds to an angle of at least 20°. The optimal ratio of wall offset to luminaire spacing for avoiding evenly illumination is 1:1. Independent of the actual room height and offset from the wall, tiltable luminaires must be aligned on the lower part of the wall.
Recessed spotlights, recessed floodlights and recessed wallwashers

Recessed spotlights, floodlights and wallwashers emit a beam that is directed downwards or to the side. They are offered with narrow-beam, wide-beam, symmetrical or asymmetrical light distribution. This type of lighting combines the flexibility of spotlights with the discreet appearance of recessed luminaires.

Recessed spotlights
Recessed directional luminaires provide highlighting for individual areas or objects with a narrow to medium light distribution.

Recessed floodlights
Recessed floodlights produce a wide-beam light distribution for washlight illumination of objects in the room or on the wall.

Recessed wallwashers
Recessed wallwashers have an asymmetrical beam that is directed onto vertical surfaces. They provide an even illumination for wall surfaces.
Light

Downlights emit a beam that is directed downwards at either a perfectly vertical or an adjustable angle. They are offered with narrow-beam, wide-beam, symmetrical or asymmetric light distribution.

Criteria for downlights
- choice of lamp determines light colour, functional life, efficiency, light intensity
- emission angle determines the beam of light and is defined by the reflector
- cut-off angle limits glare and increases visual comfort
- light output ratio is increased by optimised reflector technology

Double-focus downlights
Double-focus downlights have a rotationally symmetric beam that is directed vertically downwards. On double-focus downlights, a special reflector shape enables a high luminous flux even for smaller ceiling apertures.

Downlights
Downlights have a rotationally symmetric beam that is directed vertically downwards.

Washlights
Washlights have an asymmetric beam that is directed vertically downwards and onto vertical surfaces. They provide an even illumination for wall and floor surfaces. Special forms are double washlights for illuminating two opposite wall sections and corner washlights for illuminating corners of rooms.

The cut-off angle of narrow-beam downlights makes them a highly glare-free. On downlights with Darklight reflector, the lamp’s cut-off angle is identical to that of the luminaire. This gives a luminaire with the widest beam possible while simultaneously having an optimised light output ratio. The use of a diffuser reduces the luminance in the luminaire and thereby improves the visual comfort.
Double-focus wallwashers

Double-focus washlights have an asymmetric light distribution that is directed at vertical surfaces. They are used for illuminating wall surfaces evenly. Double-focus wallwashers are fitted with special, internal wallwasher segments. With this special kind of reflector technology the lamp is hidden from the direct view of the observer at all times.
**Directional luminaires**

Directional downlights are used for highlighting individual areas or objects with a medium to narrow light distribution.

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**Arrangement Downlights**

The offset from the wall should measure approximately half of the luminaire spacing in order to achieve sufficient brightness on the wall and well proportioned scallops of light. To attain an even illumination on a reference plane, the luminaire spacing should not exceed the mounting height $h$ by more than 1.5:1. An optimal evenness is achieved when $d = h$. To obtain symmetrical scallops in a corner, one downlight must be positioned on the 45° diagonal.

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**Arrangement Wallwashers**

The offset from the wall should measure at least one third of the room height. Alternatively, the offset from the wall is where a 20 degree line projected upwards from the base of the wall intersects the ceiling. An optimum evenness is obtained when the luminaire spacing is the same as the offset from the wall, or at least does not exceed it by more than 1.5 times. Wallwashers only develop their optimal evenness as of a minimum number of three luminaires. The position of a wallwasher in a corner of a room should lie on the 45° line.
Downlights are a universal instrument for functional, architectonic and accentuating lighting.

Recessed downlights are inconspicuous architectural details, whereas surface-mounted downlights and pendant downlights act as features in the room. They should correspond to the architecture in their arrangement and form.

Projects:
Pleats Please Issey Miyake Store, Bangkok
British Museum, London
Centre Pompidou, Paris
Armand Basi Shop, Barcelona
Surface-mounted luminaires emit a beam that is directed downwards or to the side. They are offered with narrow-beam, wide-beam, symmetrical or asymmetrical light distribution. Surface-mounted luminaires are used where there is not enough room to install conventional recessed luminaires or for subsequent mounting in existing buildings to reduce the level of installation work.

Criteria for surface-mounted luminaires
- choice of lamp determines light colour, functional life, efficiency, light intensity
- emission angle determines the beam of light and is defined by the reflector
- cut-off angle limits glare and increases visual comfort
- light output ratio is increased by optimised reflector technology
Pendant luminaires emit a beam that is directed downwards. The pendant suspension system allows adjustment of the height of the light source for optimum glare control for tables or in rooms with high ceilings.

Criteria for pendant luminaires
- choice of lamp determines light colour, functional life, efficiency, light intensity
- emission angle determines the beam of light and is defined by the lighting technology
- cut-off angle limits glare and increases visual comfort
- light output ratio is increased by optimised reflector technology
Wall-mounted downlights are defined first and foremost by their type of mounting and not by their light characteristics. Different light distributions are possible such as narrow-beamed, wide-beamed, symmetrical or asymmetrical in various directions.

Criteria for wall-mounted downlights:
- choice of lamp determines light colour, functional life, efficiency, light intensity
- emission angle determines the beam of light and is defined by the reflector
- cut-off angle limits glare and increases visual comfort
- light output ratio is increased by optimised reflector technology

Ceiling washlights
Ceiling washlights have an asymmetric light distribution and emit light upwards onto horizontal surfaces. The ceiling surface is illuminated evenly and over a large area. On ceiling washlights, the section of the ceiling to be illuminated can be partly clipped along the luminaire’s main axis with the help of infinitely adjustable cut-off shields. Uplights differentiate themselves from ceiling washlights by their different reflector geometry, altered light distribution, and higher light output ratio.

Floor washlights
Floor washlights have an asymmetric light distribution and emit light downwards onto horizontal surfaces.
**Arrangement**

**Ceiling washlights**

Ceiling washlights should be mounted above eye-level. The distance to the ceiling depends on the level of evenness required on the ceiling. The distance to the ceiling should measure at least 0.8 m for indirect lighting so that an even illumination is ensured.

**Floor washlights**

The mounting height (h) of floor washlights near to seats or seating should be less than eye-level (1.2 m), normally 0.8 m above the floor level.

**Applications**

For illumination of ceilings or floors in:
- churches
- theatres
- museums
- pedestrian traffic areas

Recessed wall-mounted downlights are inconspicuous architectural details, whereas surface-mounted downlights act as a feature in the room. They should correspond to the architecture in their arrangement and form.

**Projects:**
- Citibank, Paris
- Museo de Historia, Barcelona
- Hilton Hotel Dubai Creek
- Light and Building, Frankfurt
Recessed floor luminaires emit their beam upwards. They are offered with narrow-beamed, wide-beamed, symmetrical or asymmetrical light distribution.

Criteria for recessed floor luminaires:
- choice of lamp determines light colour, service life, efficiency and light intensity
- uniformity: optimised reflector for even illumination of areas
- range of tilt for directional luminaires with high glare protection
- light output ratio is increased by optimised reflector technology

Uplights
Uplights feature an upwards directed beam with symmetrical light distribution. The narrow, rotationally symmetrical beams are used for highlighting objects.

Directional luminaires
Directional luminaires are used for highlighting individual areas or objects with a medium to narrow light distribution. The beam can be tilted.

Uplight, diffuse
Recessed floor luminaires with diffuse light intensity distribution are used for marking paths or emphasising architectural lines.
Applications

Accent lighting or floodlighting for:
- theatres
- presentational areas
- sales areas
- reception and entrance areas
- architectural features

Recessed floor luminaires are inconspicuous architectural details. They should correspond to the architecture in their arrangement and form.

Projects:
Hotel Palais Coburg Residenz, Vienna
Centro de Historia de Zaragoza, Zaragoza
The Aldrich Contemporary Art Museum, Ridgefield
Bar Library, Belfast
**Guide**

**Indoor lighting | Luminaire groups**

**Orientation luminaires**

The defining feature of orientation luminaires is that they are designed first and foremost to provide orientation. Such luminaires may also function as sources of illumination or as signals.

Criteria for orientation luminaires - luminance: noticeability of the luminaires in their surroundings

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**Light**

**Orientation luminaires, local**

Orientation luminaires with point-form front lens act as a local orientation light.

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**Floor washlights**

Floor washlights form points of light on the wall and serve as an orientation light on the floor surface.

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**Applications**

For identifying:
- architectural lines
- steps or restricted areas
- entrances
- routes
- emergency exit routes

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**Projects:**
- Sevens department store, Düsseldorf
- Hilton Hotel, Dubai
- Instituto Frances, Barcelona
- Hilton Hotel, Dubai
Directive luminaires provide information or give directions by way of pictograms or texts. Emergency lighting refers to luminaires that indicate the escape route to improve orientation in emergency situations.

Criteria for emergency lighting and directive luminaires:
- Luminance: noticeability of the luminaire in its surroundings
- Form and colour: to comply with the standards
- Luminaire position: to describe correctly the escape route
- Emergency power supply
- Effectiveness: to continue lighting signs upon mains power failure

Light

Luminaires
Emergency lighting and directive luminaires can be subdivided into three groups:
- Directive lighting: pictograms or texts providing information
- Emergency lighting: lighting for escape routes, anti-panic lighting and emergency lighting for work places with special hazards
- Backup lighting: takes over the function of providing artificial lighting for maintaining operations over a limited period

Applications

For identifying:
- Exits
- Emergency exits, fire exits
- Escape and rescue routes

Directive luminaires are often secondary lighting features and should match with the architecture. Luminaires that change colour allow controllable dynamic route markings. Safety and rescue sign luminaires must comply with the regional guidelines.

Projects:
Palazzo della Ragione, Bergamo
Potsdamer Platz, Berlin
Norwegian Aviation Museum, Bodo
GIRA, Radevormwald
Light plays a central and multifaceted role in the design of a visual environment. In addition to the requirements and demands made by the user on lighting design, the architectonic concept also stipulates a framework for the design of the illumination.
Illuminating a horizontal surface is one of the most common lighting tasks. Most of the lighting tasks governed by workplace standards and standards for pedestrian traffic routes come under this category, whether these be the illumination of work surfaces or the actual floor.
Demanding visual tasks not only require general lighting but also additional lighting for the workstation. With task lights the light can be directed to the task in hand. Light structures with fluorescent lamps emit diffuse light. Directional luminaires emit an accentuating light onto the workstation. Indirect light with uplights lends the room general background lighting.

To provide an energy efficient lighting, the general lighting can be lower than the illumination of the working area. Combined lighting with direct and indirect components provides good visual comfort both in the room and on the work surface.

Lighting criteria for task lighting:
- illuminance level dependent on activity
- illuminance distribution for avoiding direct- and secondary glare
- cut-off angle and position of the luminaire restrict glare and increase visual comfort
- the choice of lamp determines the light colour and colour rendition
Arrangement

High luminances reflected from surfaces or objects cause secondary glare. The luminaires should not be positioned in the critical areas. Indirect illumination with diffuse light reduces the secondary glare. When aiming the beam of light, care should be taken to avoid shadows on the work surface.

Applications

The quantitative lighting criteria are primary considerations for task lighting. Energy can be saved by reducing the general lighting in favour of local task lighting and daylight dependent control.

Preferred luminaire group
- task lights
- light structures
- directional luminaires

Projects:
Shanghai Museum
Success advertising agency
Palacio de la Aljaferia, Zaragoza
Fibanc, Barcelona
Usable areas can be illuminated directly and indirectly: downlights and pendant downlights emit direct illumination into the room. Light structures have a diffuse light distribution. Uplights illuminate the room indirectly with a diffuse, uniform light.
**Conclusion**

Compared to indirect lighting with diffuse light, the direct aimed light results in better modelling capability. Combined lighting with direct and indirect components ensures good visual comfort both in the room and on the work surface.

**Lighting criteria for usable areas:**
- Illuminance level dependent on activity
- Luminance distribution to avoid direct and secondary glare
- Cut-off angle and position of the luminaire restrict glare and increase visual comfort
- The choice of lamp determines the light colour and colour rendition

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**Applications**

The quantitative lighting criteria are paramount considerations for lighting usable areas.

**Applications**
- Office workstations
- Conference rooms
- Workshops and shopfloors
- Reception and entrance areas

**Preferred luminaire groups**
- Light structures
- Downlights
- Uplights

**Projects:**
- Dansk Design Center, Copenhagen
- DZ Bank, Berlin
- Fincan, Barcelona
- Fondation Beyeler, Basel
Under consideration of the energy aspects, direct lighting with permanently mounted downlights are the most suitable for large rooms.

Whereas downlights represent fixed-location general lighting, spotlights can be used flexibly in the area of exhibitions and presentations. Due to their narrow-beam light distribution, spotlights have high glare control. Directed light results in good modelling capabilities.

Observation

Conclusion

Lighting criteria for usable areas:
- illuminance level, depending on the activity
- luminance distribution to avoid direct and secondary glare
- cut-off angle and position of the luminaire restrict glare and increase visual comfort
- the choice of lamp determines the light colour and colour rendition
The quantitative lighting criteria are paramount considerations for lighting usable areas. Direct illumination here is considerably more economical than indirect illumination.

General lighting for:
- workshops and shopfloors
- museums
- exhibitions
- sales and representational areas

Preferred luminaire groups:
- downlights

Projects:
Reichstag, Berlin
Bank of China, Beijing
ERCO, Lüdenscheid
Ständehaus art gallery, Düsseldorf
Wall lighting can fulfil a number of tasks. Firstly, it can be aimed at fulfilling vertical visual tasks on the walls, whether this be informative material such as notice boards, presentational objects such as paintings or merchandise, architectonic structures or the surface of the wall itself. Wall lighting can, however, also be aimed solely at presenting the wall in its capacity as the surface delineating the room; finally, wall illumination can be a means of indirect general lighting for a room.
Walls can be lit using point-form or linear luminaires. Wallwasher spotlights offer flexible adjustment for different wall heights. Wallwashers are characterised by the even progression of brightness along the wall. Lens wallwashers have special lens reflector systems. Washlights project the light evenly onto the wall surface, while maintaining the downlight effect on the room. Linear light sources for wallwashing with fluorescent lamps brighten the wall with perfect uniformity. Using a Softec lens achieves an extremely even illumination of the whole wall even in the higher area right up to the ceiling. Perimeter illumination out of a haunch is positioned directly on the wall. It produces a grazing light effect emphasising the surface texture. The evenness of the wallwashing is only secondary here.
Conclusion

Vertical illumination emphasises the wall faces in terms of their physical make-up. The room is made to look bigger by brightening its walls and ceiling etc. Point light sources make the wall surface much more vivid, whereas with linear luminaires a higher uniformity is achieved.

Lighting criteria for walls:
- uniformity of the lighting
- the choice of lamp determines the light colour and colour rendition
Arrangement

The offset from the wall should be at least one third of the room height. Alternatively, the offset from the wall is where a 20 degree line projected from the base of the wall intersects the ceiling. An optimum evenness is obtained when the luminaire spacing is the same as the offset from the wall. Wallwashers only develop their optimal evenness as of a minimum number of three luminaires. The position of a wallwasher in a room corner should lie on the 45° line.

Applications

Washlighting illumination for vertical surfaces of:
- museums
- exhibitions
- trade-fair stands
- sales and representational areas

Preferred luminaire groups
- wallwashers
- washlights
- lens wallwashers
- double washlights
- perimeter luminaires

Projects:
British Museum, London
Crescent House, Wiltshire
Museum Punta della Dogana, Venice
Weimar College of Music
In high rooms the luminaires are beyond the direct field of vision. As the room height increases the brightness of the wall decreases, if the lighting remains constant. Wallwashers are characterised by the even progression of brightness along the wall. Lens wallwashers have special lens reflector systems. Linear light sources for wallwashing with fluorescent lamps provides a perfectly uniform brightening of the room. Using a Softec lens, an extremely even illumination of the whole wall can be achieved even in the higher area right up to the ceiling. The perimeter illumination out of a haunch is positioned directly on the wall. It produces a grazing light effect and emphasises the surface texture. The evenness of the wallwashing is secondary.
Conclusion

Vertical illumination emphasises the walls – or other room limits – in terms of their physical make-up. The room is made to look bigger by brightening the wall faces. Point-form light sources make the wall surface much more vivid while with linear luminaires a higher uniformity is achieved. As the room height increases the distance of the luminaire to the wall must be increased. The reduction of the mean illuminance in higher rooms can be compensated for by having a higher lamp power and by increasing the number of luminaires. Wallwashing only produces an even brightness on matt surfaces.

Lighting criteria for high walls
- uniformity of the lighting
- the choice of lamp determines the light colour and colour rendition
Arrangement

Whereas for normal room heights the luminaire spacing is the same as the offset from the wall, in higher rooms it must be reduced to compensate for the otherwise sinking illuminance. The offset from the wall is where a 20 degree line projected from the base of the wall intersects the ceiling. The position of a wallwasher at the end of the wall should lie on the 45 degree line.

Applications

Washlighting illumination for vertical surfaces in:
- museums
- exhibitions
- trade-fair stands
- sales and representational areas

Preferred luminaire groups
- wallwasher
- washlights
- lens wallwashers
- perimeter luminaires

Projects:
Heart of Jesus Church, Munich
Bank of China, Beijing
BMW factory, Leipzig
Martin-Gropius building, Berlin
Observation

Point-form wallwashers make surface textures clearly visible. When using linear light sources the wall face appears even and the surface texture is only emphasised to a limited extent. When using perimeter luminaires mounted directly on the wall, there is no evenness and great vividness is created.
**Conclusion**

Linear light sources at a short offset from the wall most vividly enhance the surface texture. Conversely, point-form light sources at a short offset from the wall produce their own light pattern that, admittedly, does accentuate the texture, but does not permit an even wallwashing. Grazing light on walls can accentuate any surface irregularities.

**Applications**

The smaller the offset from the wall, the clearer the surface texture is enhanced. When using grazing light, the evenness of the wall illumination is greatly reduced.

Preferred luminaire groups
- wallwashers
- washlights
- lens wallwashers
- perimeter luminaires

Projects:
- Bodegas Portia, Gumiel de Izán
- Neues Museum (New Museum), Berlin
- ABN AMRO, Sydney
- Heart of Jesus Church, Munich
With ceiling illumination, either light is shone to illuminate the ceiling in its own right or the ceiling is merely used as a reflector for general lighting. The ceiling is primarily emphasised, when it has an intrinsic communicative value, e.g. due to architectonic structures. Illuminating the ceiling to provide indirect general lighting requires it has a high reflectance. It should be noted the ceiling will then be the brightest surface in the room and will therefore be emphasised.
Guide

Indoor lighting | Lighting applications | Ceiling

Ceiling, plan

Observation

The luminaires for washlighting the ceiling can be mounted on the walls or in the ground. As linear luminaires, light structures act as independent architectural elements, whereas ceiling washlights are more secondary to the architecture. Light structures emit diffuse light with low brilliance.

Light structures

Ceiling washlights

Conclusion

The choice of luminaire type is dependent on the ratio of room area to room height. In low rooms with large floor areas an even illumination of the ceiling using light structures presents itself as the best option. Ceiling washlights require a large distance from the ceiling due to their asymmetric light distribution.

Arrangement

The prerequisite for ceiling illumination is a sufficiently high room in order to achieve an even distribution of light. Ceiling washlights should be mounted above eye-level. The distance from the ceiling depends on the level of evenness required and should be at least 0.8m.
Applications

Washlighting ceiling illumination for
- offices
- historical buildings
- churches
- theatres
- passages

Preferred luminaire groups
- ceiling washlights
- uplights
- light structures

Projects:
Weimar College of Music
Shanghai Museum
Ezeiza Airport, Buenos Aires
Observation

Luminaires for lighting support structures can be mounted on the structure itself, on the walls or in the floor. A washlighting illumination adds emphasis to the whole ceiling surface. Narrow-beamed luminaires accentuate the support structure in particular.

Light structures

Light structures with ceiling washlights

Ceiling washlights

Spotlights
Applications

Indirect ceiling lighting for
- historical buildings
- churches
- theatres
- passages

Preferred luminaire groups
- spotlights
- light structures
- ceiling washlights

Project:
Palacio de la Aljafería, Zaragoza
Observation

For floor lighting, either washlighting is applied to the floor surface alone or the room as a whole is illuminated with downlights with direct light from above. Floor washlights particularly highlight the floor surface and its physical make-up.

Downlights

Due to their asymmetric light distribution, floor washlights provide grazing light illumination of the floor. They ensure a high degree of visual comfort thanks to their low mounting height. The elimination of glare from downlights is determined by the cut-off angle. The evenness of the downlight lighting is higher.

Floor washlights

Conclusion
Applications

Projects:
Lamy Innovation Workshop, Heidelberg
Konrad Adenauer Fund, Berlin

Floor washlighting for:
- walkways and foyers in hotels, theatres, cinemas and concert halls
- hallways
- steps and stairs

Preferred luminaire groups:
- downlights
- floodlights
Objects can be accentuated with great effect to turn them into real eye-catchers. Visual impressions can be given an unusual appearance by selecting a crisp edged illumination. The opposite of such dramatic lighting is a uniform, large area lighting solution.
Observation

Objects in the room or area can be illuminated flexibly using track-mounted spotlights or floodlights. When illuminating an object with one spotlight in the direction of vision, the modelling effect is weak. Two spotlights, with sculpture accessories, shining from different directions create a balanced, three-dimensional effect. The brightness contrasts are milder compared to when using just one spotlight. Illuminating from below produces interesting effects since the light is coming from an angle which is unusual for the observer.

Spotlight, front elevation

Spotlight, side elevation

Spotlight, isometric

Spotlight, underside
Floodlights

Narrow beam spotlights accentuate the object while floodlights show the object in the context of its surroundings. This reduces the modelling effect. Lighting from below can have the effect of making things look very strange. The possibility of dazzle must be prevented here in particular.

Conclusion

Objects in the room can be illuminated with an angle of incidence of 30° to 45° to the vertical. The steeper the incident light, the stronger the shadows. When the angle of incidence is 30°, strong reflection or undesirable shadows on people and objects are avoided.

Arrangement

Accent lighting for
- museums
- exhibitions
- trade-fair stands
- sales and representational areas

Preferred luminaire groups
- spotlights
- floodlights

Applications

Projects:
Passeig de Gràcia, Barcelona
Museum of Contemporary Art, Helsinki
Guggenheim Museum, Bilbao
Hermitage, Saint Petersburg
**Observation**

Objects on the wall can be flexibly illuminated with track-mounted spotlights or floodlights. Spotlights highlight the wall-mounted picture and create a decorative effect. Individual wallwashers accentuate the picture more discretely than spotlights. Several wallwashers illuminate the wall evenly. The object is not emphasised. Floodlights provide a homogenous illumination of the entire wall surface. A contour spotlight ensures very strong, effective emphasis of the wall-mounted picture.

**Spotlights**

**Wallwasher spotlights**

**Floodlights**

**Contour spotlights**
Conclusion

Narrow beam spotlights accentuate the object while floodlights show the object in the context of its surroundings. Contour spotlights can illuminate the object with a crisp focused beam and thus highlight particularly well. This can result in an effect that makes the object look strange because the object itself seems to emit light.

Arrangement

Objects on the wall can be illuminated with an angle of incidence of 30° to 45° to the vertical. The steeper the incident light, the more vivid the object appears. On reflective surfaces, e.g. artworks behind glass or oil paintings, care must be taken that the angle of incidence does not cause secondary glare in the observer’s line of vision. In addition, unwanted shadow, e.g. cast by the picture frame onto the picture surface, should also be avoided.

Applications

Accent lighting for
- museums
- exhibitions
- trade-fair stands
- sales and representational areas

Preferred luminaire groups
- spotlights
- wallwashers
- floodlights

Projects:
Museum of Contemporary Art, Barcelona
Museo Deu, El Vendrell
Palacio Real de Madrid
Reichstag, Berlin
Observation

Orientation lighting is defined first and foremost by the task of providing orientation. This can be done using luminaires that provide visibility or ones that act as a sign. Floor washlights and wall-mounted downlights provide orientation by illuminating either the floor surface or the room. Orientation luminaires and recessed floor luminaires typically provide orientation by being arranged into lines or by marking out areas.

Floor washlights

Wall-mounted downlights

Recessed floor luminaires

Orientation luminaires
Orientation lighting

Low illumination levels are sufficient for orientation purposes. Small luminaires with high luminance clearly set themselves apart from their surroundings.

Applications

Orientation lighting for the identification of:
- architectural lines
- steps and exclusion zones
- entrances
- routes
- emergency exit routes

Preferred luminaire groups
- floor washlights
- wall-mounted downlights
- recessed floor luminaires
- orientation luminaires

Projects:
- Light and Building, Frankfurt
- Palazzo della Ragione, Bergamo
- Canteen, Lüdenscheid
- Sevens, Düsseldorf
Observation

Directive luminaires provide information or give directions by way of pictograms and inscriptions. Safety and rescue sign luminaires inform on the direction of an escape route or emergency exit.

Applications

Application: for identification of:
- exits
- emergency exits, fire exits
- escape and rescue routes

Directive luminaires are often secondary lighting features and should match with the architecture. Luminaires that change colour allow controllable dynamic route markings. Safety and rescue sign luminaires must comply with the regional guidelines.

Preferred luminaire groups
- directive luminaires
- safety sign luminaires
- luminaires for pictograms

Projects:
Palazzo della Ragione, Bergamo
Deutsches Historisches Museum (German Historical Museum), Berlin
Norwegian Aviation Museum, Bodo
Taschenberg-Palais, Dresden