EN

Light for recovery

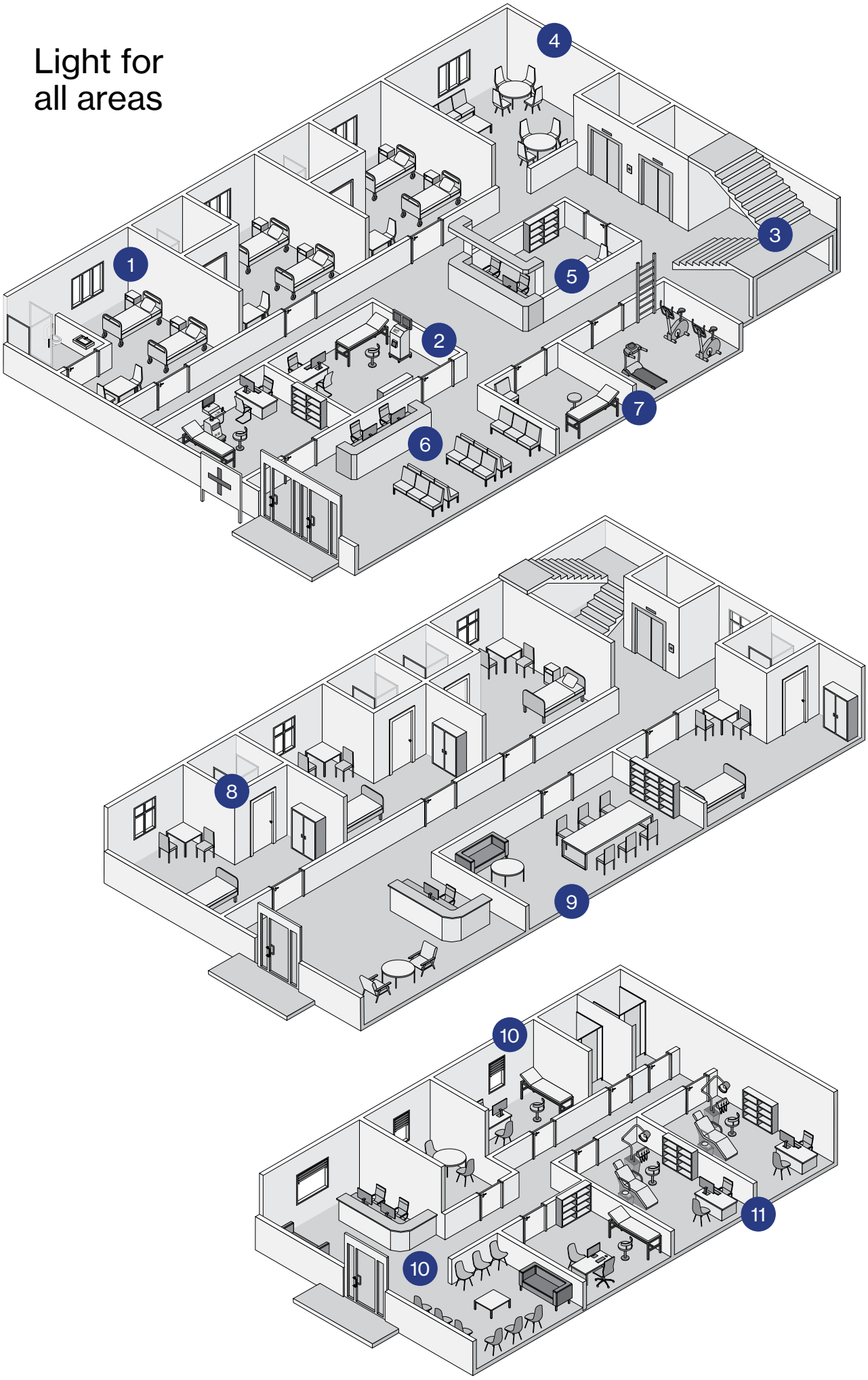
Light for healthcare facilities

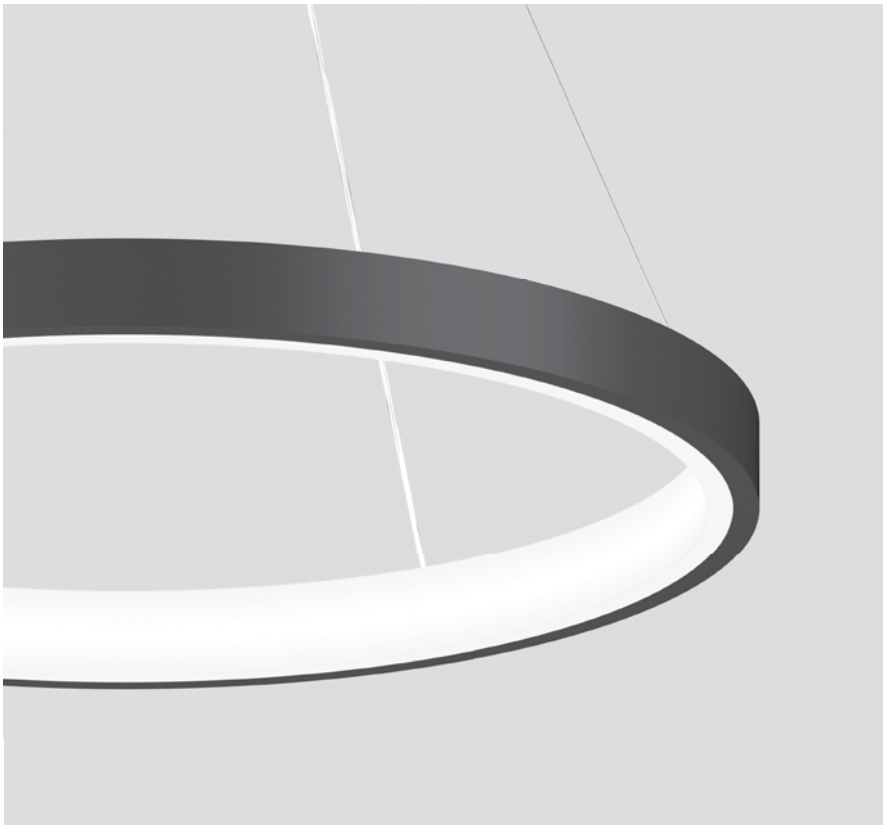
Geriatrics Simmering, AT –
by Josef Weichenberger architects + Partner

Light for recovery

The extent to which light conditions and the human organism are connected is only gradually being explored. One thing is certain: Light is a significant health factor. Lighting in the healthcare sector fulfils a wide range of functions. To ensure the best possible treatment quality and reliable diagnostics, a wide range of standard specifications must be complied with, from the mandatory brightness on the examination couch to glare-free lighting at the staff workstation. Different regulations apply in dental practices than in nursing homes. However, it is always important to focus on the needs of the individual to optimise treatment outcomes. Hospital lighting should be functional while creating a pleasant sense of space. Human Centric Lighting is a major focus. Natural daylight influences our hormone balance and controls a range of processes in the body. Therefore, patients recover best where artificial light is adjusted to their inner clock. Dynamic light changes gently from cool white in the morning to warm white in the afternoon. Paired with balanced room acoustics, patients thus enjoy deeper sleep and noticeably improved recovery – a decisive factor in healing and shortening hospital stays.

Light for all areas





XPECTRUM
Full-spectrum LED

XAL's XPECTRUM LEDs' light spectrum is similar to daylight: It is healthy, biologically effective light. The reduced blue light component shields the eye from overexposure to short-wave, energy-rich light rays and therefore from fatigue. Thanks to the raised cyan levels, the light has an additional non-visual (melanopic) effect on hormone levels, which improves sleep quality and promotes recovery. Excellent IES TM 30–15 R_f = 98 and R_g = 101 colour rendering optimises visual comfort and creates a vivid environment.

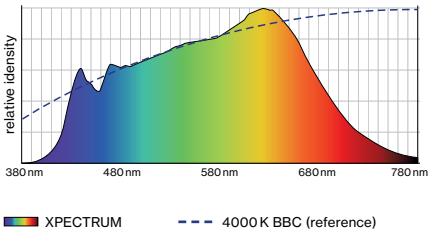
INO circle
suspended

Plasterboard ceiling / Concrete ceiling
3000 K, 4000 K, TW (Tunable White)

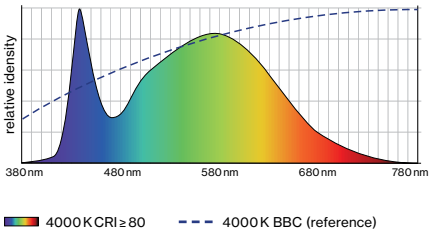
Ideal application
Corridors & staircases, Registration & waiting room

Colours
white, grey, black, gold and special colours

XPECTRUM LED



Commercially available LED 4000 K



Light scenes

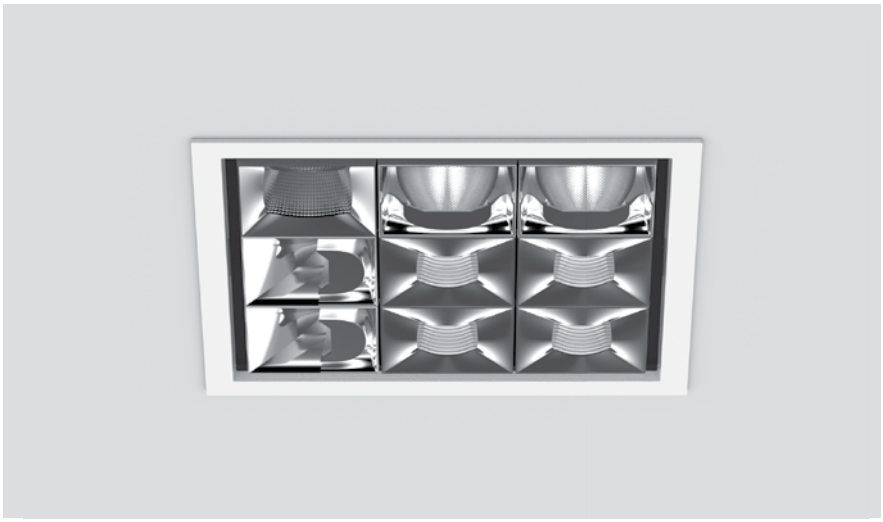
Depending on the situation, different lighting scenes can be activated via a modern lighting management system. During the day, cold white light can help to activate and improve concentration, while warm white light in the evening can help to calm and relax. Lighting scenes for different areas of a room are also possible, such as indirect ambient lighting, accent lighting, and high luminous intensities for demanding visual tasks.

TW – Tunable White

The body and circadian rhythm react strongly to changes in light colour. Lighting should adapt to our inner clock for optimal well-being and a healthy day-night balance. Tunable White dynamically adapts to the activity or time of day by smoothly shifting the colour temperature from 2700 K (warm light) to 6500 K (cold light).

Advanced sensor technology

Modern lighting management systems harness energy-efficient use of daylight. Sensors on the ceiling determine where and how much light is needed and control individual luminaires according to current lighting requirements. This means less light can be provided near windows than in darker areas of the room. Smart lighting control systems enable lighting regulation by using presence detectors and dimming or switching off the light in unused rooms. In addition, XAL's IoT Pro sensors can detect humidity, air quality, sound pressure, and temperature, opening further applications.



UNICO square / linear
recessed

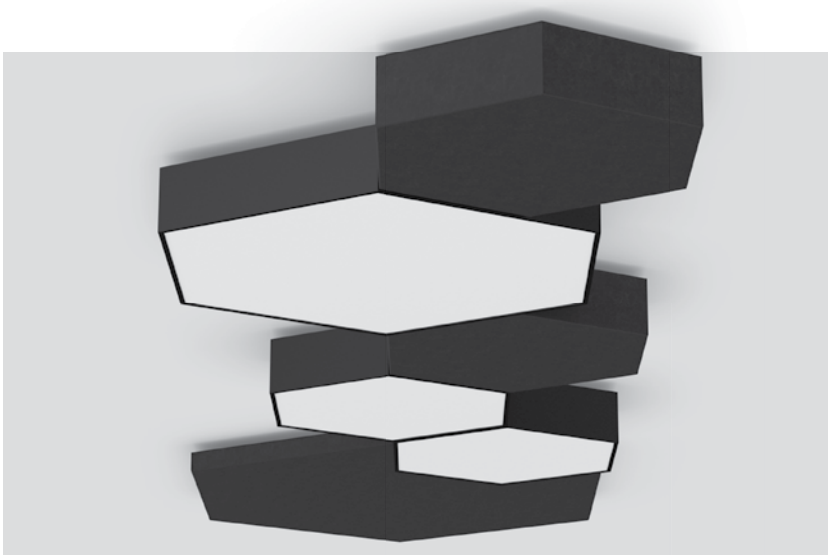
Plasterboard ceiling / Grid ceiling
2700 K, 3000 K, 4000 K,
TW (Tunable White), UGR ≤ 19

Ideal application
Corridors & staircases, 24-hour nurses' station, Registration & waiting room, Common areas, Therapy room & exercise area

Colours
white, black

XCS Customised Solutions

Some visions take up space – others create it. Even the largest product portfolio cannot always meet a design's specific requirements. That is why we work with you to develop bespoke lighting solutions precisely tailored to your project's architectural and aesthetic requirements. Depending on the scale of the project, we can realise both small adaptations to existing XAL products or completely new developments.



Acoustics

Light and room acoustics are considered the most important factors for our well-being. Studies show that a room's acoustics affect a patient's recovery. By supporting restful sleep, pleasant room-acoustic conditions can even shorten a hospital stay. XAL's acoustic lighting creates optimal lighting conditions and balanced room acoustics to promote well-being and health.

HEX-O / TRIG-O
surface / suspended

Plasterboard ceiling / Grid ceiling
3000 K, 4000 K, TW (Tunable White),
UGR ≤ 19

Ideal application
Corridors & staircases, Waiting areas

Colours: Luminaire: white, black and special colours / Acoustic elements: white, black

For heavy-duty use

SONO
recessed / surface / suspended

Plasterboard ceiling / Concrete ceiling
3000 K, 4000 K, TW (Tunable White)
IP 20, IP 40, IP 50, IP 54

Ideal application
Patient room, Examination room, Corridors & staircases, Therapy room & exercise area

Colour: white

Ultra-slim series

TASK S
surface / suspended

Plasterboard ceiling / Concrete ceiling
3000 K, 4000 K, TW (Tunable White)
UGR ≤ 19

Ideal application
24-hour nurses' station, Registration & waiting room, Therapy room, Examination room

Colours
Luminaire: white, black
Acoustic elements: white, grey, anthracite, black, light blue, indigo blue

Timeless perfection

VELA round
recessed / surface / suspended

Plasterboard ceiling / Grid ceiling
2700 K, 3000 K, 4000 K,
TW (Tunable White), UGR ≤ 19

Ideal application
Common rooms, Registration & waiting room, 24-hour nurses' station, Common areas, Corridors & staircases

Colours
white, black, silber, gold and special colours

For the right kind of reflection

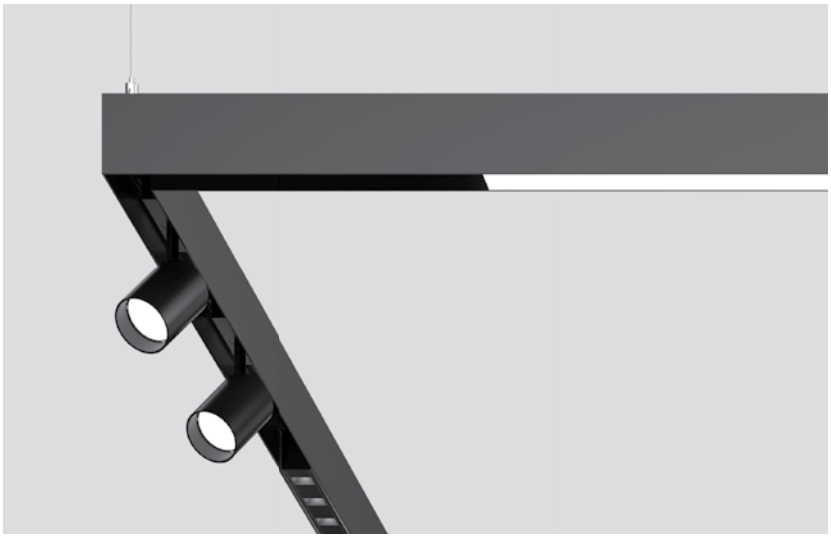
STRETTA
surface

Gipskartondecke / Concrete ceiling & wall, 2700 K, 3000 K, 4000 K

Ideal application
Medical practices, Sanitary areas

Colours
Housing: white, grey, black and special colours
End caps: white/chrome, grey/chrome, black/chrome and chrome

Everything on track



MOVE IT 25
recessed / surface / suspended

Plasterboard ceiling / Concrete ceiling
3000 K, 4000 K

Ideal application
Common rooms

Colours
white, grey, black, gold
and special colours

Be free to sharpen your profile

FRAME 60 / 100 system
recessed

Gipskartondecke / Concrete ceiling
3000 K, 4000 K, TW (Tunable White)
UGR ≤ 19

Ideal application
Patient room, Examination room,
24-hour nurses' station

Colours
white, grey

Always and anywhere

SPADO square / round
recessed

Plasterboard ceiling / Grid ceiling
3000 K, 4000 K, TW (Tunable White)
UGR ≤ 19, IP 44

Ideal application
Corridors & staircases

Colours
white, black

Combine with your design

SASSO 60 / 100
recessed / semi-recessed / surface

Plasterboard ceiling / Grid ceiling /
Concrete ceiling
2700 K, 3000 K, 4000 K, CWD
(Colour Warm Dimming), UGR ≤ 16

Ideal application
Patient room, Examination room,
Common rooms, 24-hour nurses'
station

Colours
Mounting frame: white, silver, black
Gehäuse: white, black, gold
Reflector: white, silver, black,
gold and bronze

Getting well with light

RECOVER

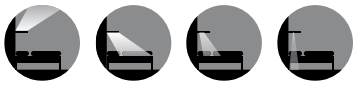
wall

Wall mounting
2200 K – 31000 K, TW (Tunable White)

Ideal application
Patient room, Residents' rooms

Colours
white, black

Light distributions



ambient light | examination light | reading light | nurse night light

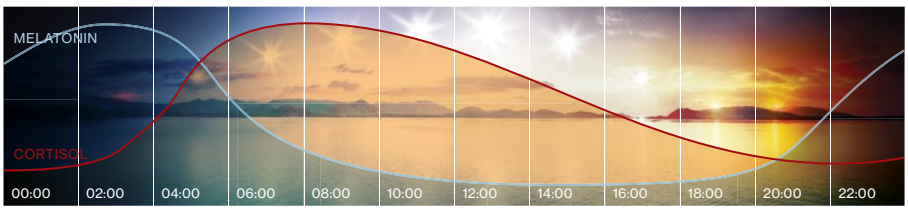
RECOVER

The next generation of contemporary healthcare lighting, RECOVER has been developed to simulate a natural light pattern. This is achieved by the dynamically changing colour temperature. It varies from activating morning light to a sleep-promoting evening glow. The luminaire supports the natural regeneration of the patient by supporting the human biorhythm. The 4-in-1 system includes ambient light, a reading light, a nurse's night light, and an examination light with a high CRI value which displays amorphous three-dimensional surfaces such as the skin correctly. RECOVER is designed to be particularly user-friendly. Lighting programmes can be quickly and flexibly adapted.

Day-night rhythm
Light affects well-being and health. Cool morning light promotes cortisol, the activating hormone. In the evening, when the blue component is missing, the sleep hormone melatonin is formed. High melatonin levels at night lead to more restful sleep, and we enjoy a positive start to the day through an increased release of the happiness hormone serotonin. The RECOVER luminaire taps this knowledge and supports the natural regeneration of patients, as the high indirect illuminance provides clear impulses to the inner clock..

Four lights in one
RECOVER combines four luminaires. Indirect, homogeneous ceiling lighting provides daytime brightness for the patient, while the examination light is used for doctor's visits.
A reading light ensures reflection-free illumination of the reading area. The nurse night light mounted on the side of the luminaire was integrated to avoid dazzling the patient at night.

Schedule light moods
The aim was to make RECOVER particularly user-friendly. Lighting moods and intensity levels can be programmed with simple software. You can even string together several different programmes to form an annual schedule. The intensity and colour temperature changes automatically with the season. The factory settings already store different daily sequences, which you can quickly adapt to your time requirements.



Kaiser-Franz-Josef-Spital Vienna, AT –
by Nickl & Partner Architekten AG

The hospital of the future

Interview with Studio Zweithaler
Architect Markus Pernthaler of Studio Zweithaler sees the trend in hospitals moving from four-bed to two-bed and one-bed rooms. This clearly shifts the focus to design measures that support patient recovery. Colour-changing light's use is undisputed from a medical perspective. In addition to health-promoting aspects in intensive care, lighting enables the creation of an atmosphere that helps patients recover and provides staff with an activating working environment. The combination of natural and artificial lighting plays a central role here because light is the strongest pacesetter for the inner clock. No medication has a comparably powerful effect. For patients waking up from a deep sleep, high illuminance significantly supports recovery. According to the hospital supplier HT Health Tec GmbH from Heideck in Germany, over 2000 lux should horizontally illuminate the bed's surface for several hours. A dynamic light curve is ideal for this.

Thanks to increasing digitalisation and lower costs, a large range of intelligent lighting systems with dynamic light sequences are already available. However, the acceptance of such complex lighting systems stands and falls with its operation. Appropriate, user-friendly solutions are therefore needed. How are multi-dimensional lighting systems understood, and – without training – operated? It has been shown that care staff often reject complex control systems because nothing is as intuitive and fail-safe as an analogue light switch.

Regarding epidemics and pandemics, changes are already emerging in floor plan configurations of access areas to take account of epidemiological requirements. Sustainability, the ecological, and economic framework conditions are core concerns. Energy and resource-saving products continue to pose an acute challenge. This also applies to lighting. The lighting system and its individual components must be easy to maintain, fully recyclable, and, ultimately, affordable.

Benjamin and Markus Pernthaler
Studio Zweithaler

Hospitals

- Patient room
- Examination room
- Corridors & staircases
- Recreation rooms
- 24-hour nurses’ station
- Registration & waiting room
- Therapy room & exercise area

Patient room

Health-promoting light in the patient room

The lighting mood greatly influences patient recovery. In bright, open rooms with natural light colours, the body can recover and regenerate better. Indirect light is particularly pleasant, as it makes the room appear larger. Since people in patient rooms spend a lot of time in bed, the lighting needs to be adapted to this position. The positioning and optical coverage of luminaires prevents bedridden patients being dazzled by room light.

Small reading lights are mandatory for each hospital bed, which must reach at least 300 lux at the reading position. The light emission direction prevents patients in neighbouring beds from being disturbed. Orientation light and night lighting are particularly important since patients are in an unfamiliar environment. They help patients navigate while also providing caregivers with sufficient light for routine checks. For nursing procedures, illuminance should be at least 300 lux at the examination level.

To best support recovery, lighting should be synchronised with the patient's internal clock. This requires sufficient illuminance to reach the patient's eye. Different light colours and illuminance levels create a special, biologically effective light pattern, based on the dynamics of daylight outdoors. As a result, the patients' physiological performance curve follows its natural rhythm, despite staying in the room all day. This improves awareness activity, enhances memory, and stabilises the day/night rhythm. Especially after a period of artificial deep sleep or a coma, patients can find their way back into their natural circadian rhythm more quickly and regenerate both physically and psychologically. DIN SPEC 67600 recommends a cylindrical illuminance of ≥ 250 MEDI lux for at least four hours during the mornings at the head position of a 32-year-old patient.

Requirements

- Minimum illuminance of 100 lux (floor level)
- Indirect light enlarges the room visually and has a relaxing effect
- Dynamic light curves for a natural sleep-wake rhythm
- For reading, an illuminance of 300 lux (e.g., thanks to an adjustable reading light in the bed area)
- The unified glare rating must not exceed UGR ≤ 19

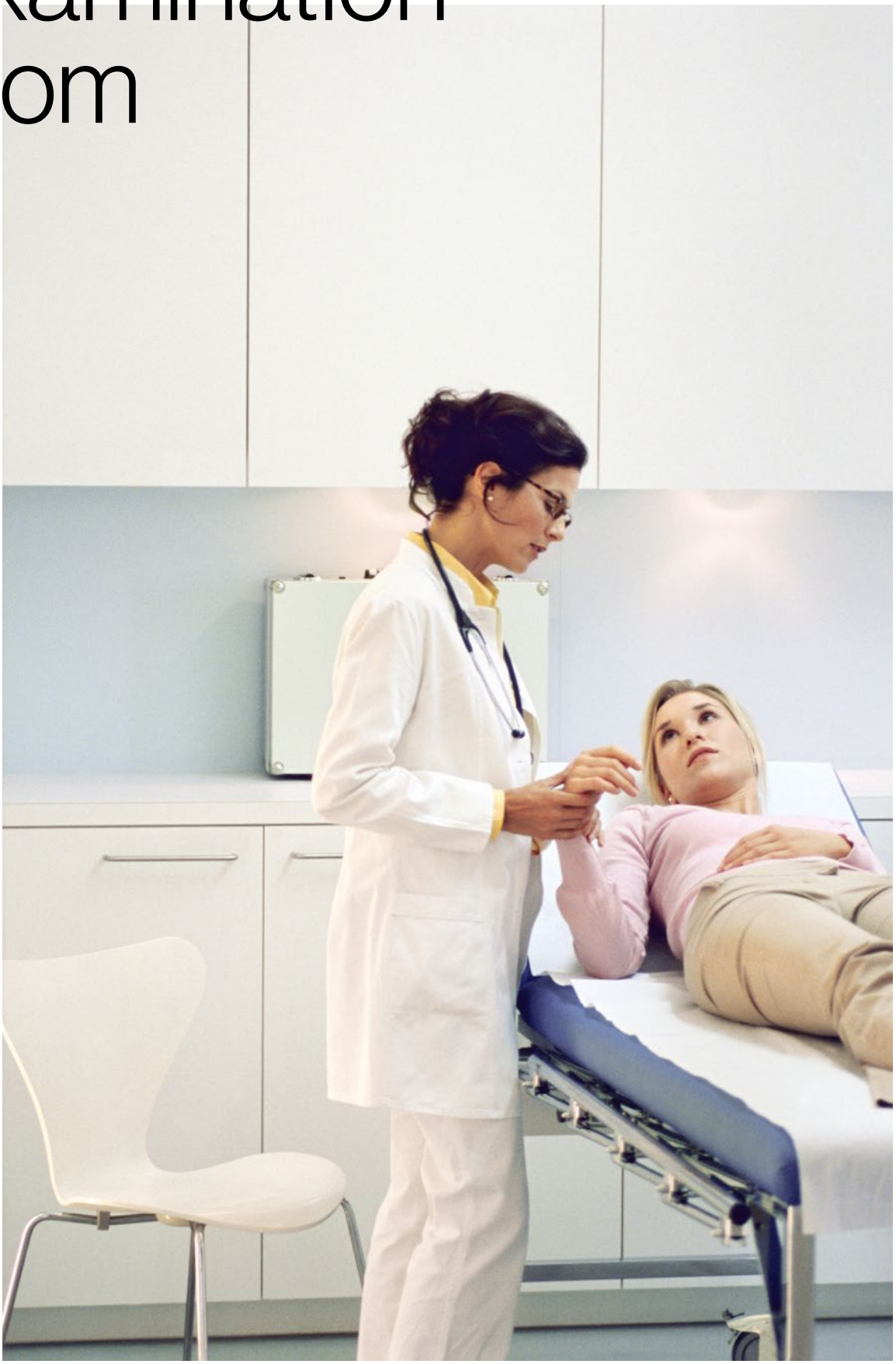
RECOVER **FRAME** **FLOW**

SPADO **BETO** **SASSO**

COMBO **VELA** **TASK**

EMCO private clinic
Bad Dürrnberg/Salzburg, AT –
by FLEOS architektur with
lighting design by Das Licht

Examination room



Top colour fidelity and light quality in the examination room

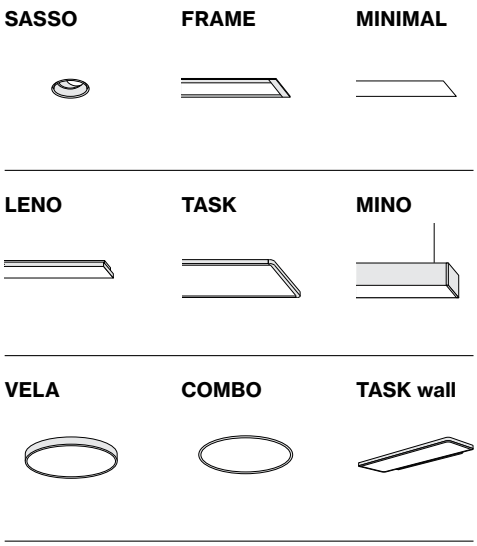
Light combines two essential aspects in the examination and treatment room. A warm, friendly atmosphere helps patients feel calm and safe and relax during treatment. Physicians, meanwhile, need sufficient brightness and a high quality of light during treatment. According to EN 12464-1, a general illuminance of 500 lux and an examination illuminance of 1000 lux must be achieved. The right lighting in the examination room, combined with homely and clearly designed furnishings, form the basis for this.

Ceiling luminaires with a combination of direct and indirect light are suitable for general lighting. Indirect lighting is pleasant and relaxing as it makes the room appear larger. Direct lighting around the examination couch ensures optimal lighting conditions. However, care must be taken not to dazzle a patient looking at the ceiling. EN 12464-1 standard specifications of 1000 lux with a uniformity of $U_0 \geq 0.7$ and a colour rendering value of $R_a \geq 90$ apply. The high colour fidelity enables physicians to differentiate the finest colour nuances on a patient's skin. XAL's new full-spectrum LEDs offer an excellent colour rendering of R_a 97, with almost natural-frequency wavelengths. As in daylight, there is a lot of light blue radiation which adapts the pupil size as it would in nature. This protects the eyes during strenuous visual tasks.

The lighting in the examination room should not create glare or reflection points on computer screens. The correct positioning of the luminaires is therefore crucial. If they are not mounted centrally above the workstation but to the left and right of it, they ensure good visibility without distracting reflections.

Requirements

- Direct and indirect ceiling luminaires provide a sense of well-being
- Overall room illuminance of 500 lux, an examination illuminance of 1000 lux
- Examination level ≥ 1000 lux with increased uniformity of illuminance of $U_0 \geq 0.7$ and a colour rendering value of $R_a \geq 90$
- DIN SPEC 67600 recommends the examination light's colour temperature be between 4000 K and 6500 K



Medbase Zürich Oerlikon, CH
by Outlog Architektur + Planung AG

Physiozentrum Zürich Oerlikon, CH
by Outlog Architektur + Planung AG

Corridors & staircases

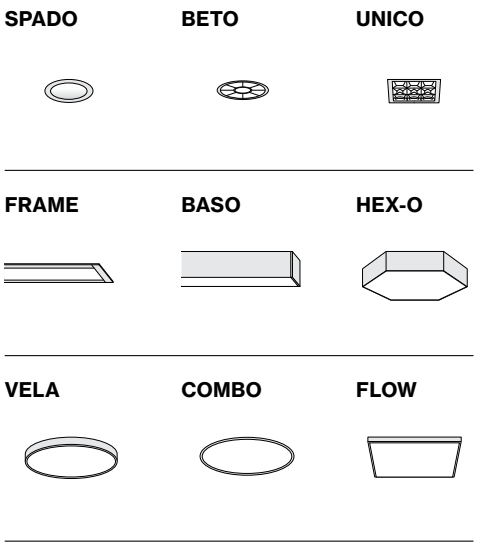
Smart and professional orientation lighting

Corridors and staircases are the main circulation routes in a hospital. Patients, visitors, and staff should be able to navigate quickly and safely. They also make a significant contribution to the first impression people form of the hospital. Bright, professional lighting is crucial for this. During the day, illuminance levels of at least 200 lux (according to EN 12464-1) must be achieved; operating theatre wing corridors even require ≥ 300 lux. When planning ceiling lighting, it is important to bear in mind that patients are often transported while lying down. A high indirect component prevents glare by reducing the contrast between the ceiling and the light emission surface. Vertical illumination, or brightening of the walls, is another option as it visually enlarges the room. In high-ceilinged rooms, large suspended luminaires with direct/indirect light components are a good choice for pleasant illumination.

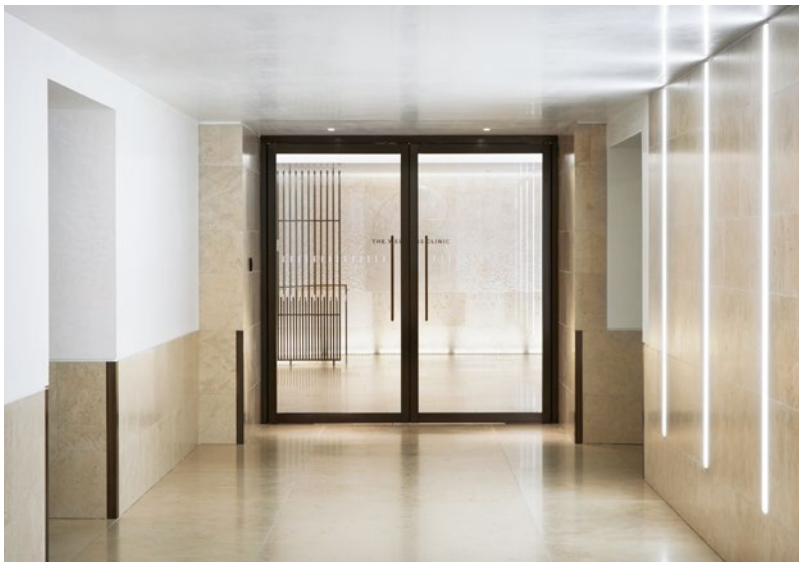
The biological standard specifications for the lighting of hospital corridors and staircases are set out in DIN SPEC 67600. During the day, a melanopic and day-equivalent illuminance of ≥ 250 MEDI lux is recommended. This corresponds to about 370 lux at head position for a 32-year-old observer. For older persons, significantly higher cylindrical illuminance levels are necessary for a biological effect. To correspond to the natural hormone release of the human organism, cool white light colours up to 5700 K are well suited in the morning, while very warm white colour temperatures of ≥ 2700 K should predominate at night. Since corridors and staircases in the hospital are used around the clock, they are also illuminated at night. To save energy, the light intensity may be dimmed down to 50 lux at night. An automatic light control system dynamically adjusts the brightness to the time of day. Special sensor-controlled luminaires can be easily programmed and create dynamic, natural lighting conditions that also reduce energy consumption.

Requirements

- Corridors: 200 lux during the day, operating theatre wing corridors 300 lux, 50 lux at night
- Automatic adjustment of light intensity for energy efficiency
- Planning recommendations for biologically effective lighting (DIN SPEC 67600)
- During the day 250 MEDI lux, for example, at 5700 K, at night 50 lux at 2700 K



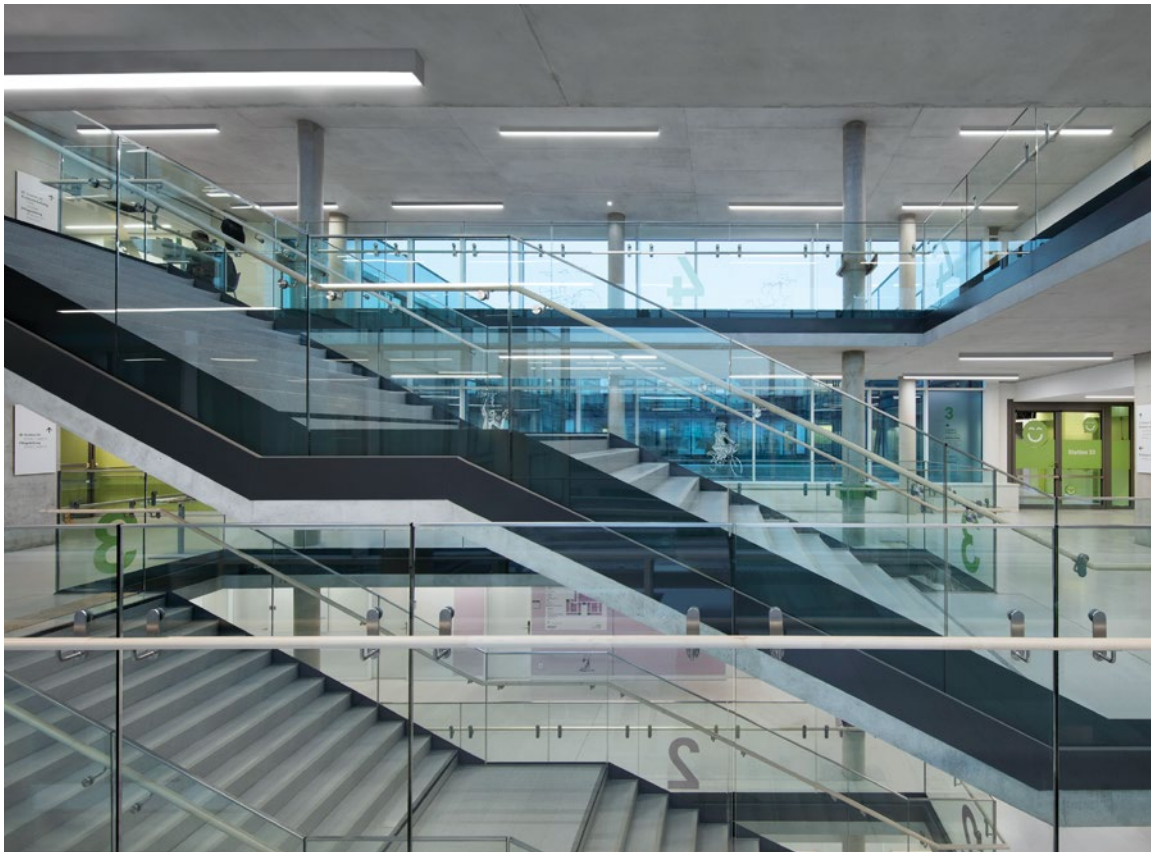
Harrods Wellnes Clinic London, UK –
by Stanton Williams with lighting
design by Nulty Lighting



Praxis Dr. Helga Raidl
Leopoldsdorf im Marchfelde, AT –
by ordinationsplanung.at, Architekt DI Andreas Kanzian

Medicover Clinic Budapest, HU –
by Plusdesign Studio

Kaiser-Franz-Josef-Spital Vienna, AT –
by Nickl & Partner Architekten AG



Recreation rooms

Feel-good atmosphere thanks to light zones and colour spectra

Colour changes, varying brightness, and indirect lighting in the room help patients in hospital recreation rooms enjoy a feeling of security and make the ambience more cosy and less clinical. These zones provide respite from the hospital bed and allow visitors to be received away from the patients' rooms. The more comfortable the atmosphere in the recreation room, the more positive its effect on well-being and recovery. A cosy and homely lighting atmosphere is created by a high proportion of indirect light. The better the ceiling is illuminated, the more pleasant the room feels. Wallwashers also create a protected, intimate sense of space.

For patients who have little or no outdoor exposure during their hospital stay, the light dose is insufficient to keep their internal clock set. This can be prevented by circadian light sequences. They adjust the illuminance and colour temperature to the level required to create a natural hormone and performance curve. 5000 – 10000 lux/h per day vertically at head level is considered a reference value for an adequate supply of light. As a result, patients fall asleep more easily and regeneration during sleep is improved, as though under natural conditions with sufficient exposure to daylight.

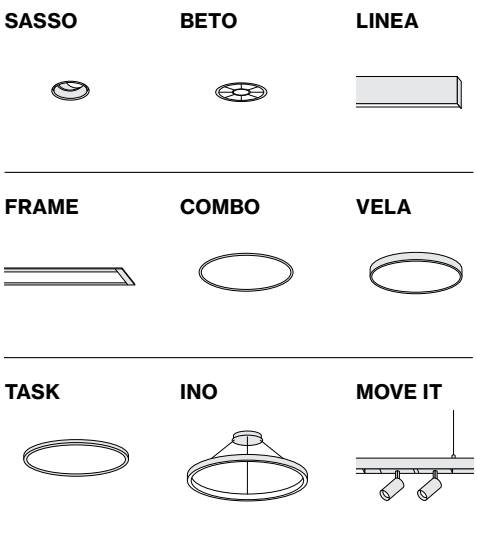
Besides patients, doctors and care staff often spend long periods in the hospital. The use of luminaires with higher colour rendering can positively support visual performance and prevent fatigue. XAL's full-spectrum LEDs use a natural composition of wavelengths, reducing the short-wave radiation impacting the retina. They are therefore gentler on the eyes, even at the same luminous intensity and the same colour variance. Their excellent colour rendition also helps display objects in the recreation room clearly and with extreme colour fidelity. This creates a lively environment, lifts the spirits, and thus supports the healing process.

Requirements

- Illuminance ≥ 200 lux with a uniformity of $U_0 \geq 0.6$

Recommendations

- A dynamic daylight curve
- A cylindrical illuminance of at least 250 MEDI lux in the mornings > 4 hours, e.g., at 5700 K, and 50 lux at 2700 K at night is biologically effective
- The highest possible colour rendering value has a mood-enhancing effect, for example with full-spectrum LEDs



Psychiatrische Klinik Königshof Krefeld, DE –
by a|sh sander.hofrichter architekten GmbH

24-hour nurses' station

Support and care around the clock

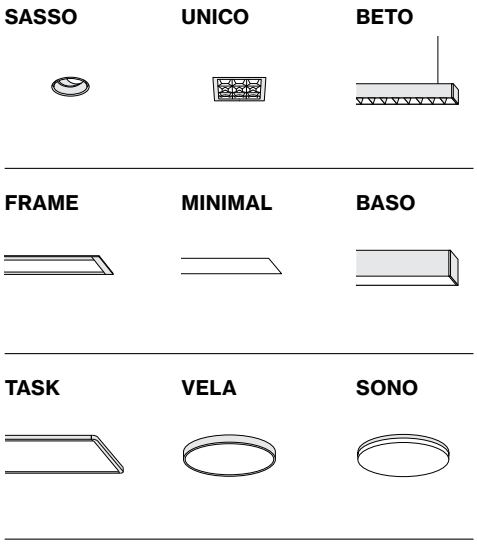
The hospital's 24-hour nurses' station is the contact point for patients around the clock. This is where medication is stored and dispensed, and office work performed. The lighting at the 24-hour nurses' station must reconcile partly suboptimal spatial conditions with long shifts and high traffic. Boosting its central accessibility, the round-the-clock station is often located deep inside the building. This results in minimal natural daylight. Since employees work here for long periods, the artificial lighting must provide a healthy supply of light similar to daylight. Generously dimensioned indirect lighting with dynamic light colour curves helps with daytime orientation.

EN 12464-1 stipulates that ceiling illuminance should be just 50 lux. Paired with square LED panels, the high luminance contrast creates an almost oppressive spatial impression. In comparison, round or ring-shaped luminaires with a large indirect light component and an illuminance of between 500 and 1000 lux create an open, friendly impression. This both creates a more comfortable environment for staff and patients, and the 24-hour station suggests a sense of security – essential factors in stressful or tense situations.

In some areas of activity, higher illuminance may be appropriate in places. For example, doctors and carers can read the package inserts for medicine or information on medical utensils better and provide information more quickly. The lighting should be glare-free and reflection-free at the computer workstations in the 24-hour nurses' station. To eliminate reflected glare, luminaires are not positioned above the field of vision but to the left and right of the workstation. The degree of direct glare is described by the UGR value, which is a maximum of 19 in the office area. This is where the use of high-quality office luminaires pays off. They ensure pleasant and healthy working conditions at a particularly challenging hub in the hospital.

Requirements

- E_m at the workplace ≥ 500 lux
- Direct glare UGR ≥ 19
- Uniformity U_0 ≥ 0.6
- Colour rendering R_a ≥ 80
- Cylindrical illuminance E_z ≥ 150 lux (@H = 1.2 m)
- Modelling E_z / E_{hoz} 0.3 – 0.6 (@H = 1.2 m)
- Reflected glare: no lights above the field of view
- Direct glare: applied luminance optical cover above 65° ≤ 3000 cd / m²



Registration & waiting room

The right light for the first conversation

The registration area is the first point of contact for patients and visitors to the hospital. It should be inviting while also serving an orientation function. For this purpose, it is advisable to work with higher illuminance levels above the reception counter. This creates a visual separation between the registration desk and the waiting area and creates an atmosphere of trust. Especially in situations of stress or pain, a clearly illuminated face can convey a sense of security to patients. The correct illumination for this is specified in EN 12464-1 by means of a modelling factor. At head height, the ratio between cylindrical and horizontal illuminance should be between 0.3 and 0.6.

For a standing position in the registration area, this ratio should be achieved at around 1.6 m; in the waiting area, where people are usually seated, this height is 1.2 m. The best visual conditions are important for employees in the registration area. A well-lit and glare-free work area supports concentration and performance and counteracts fatigue.

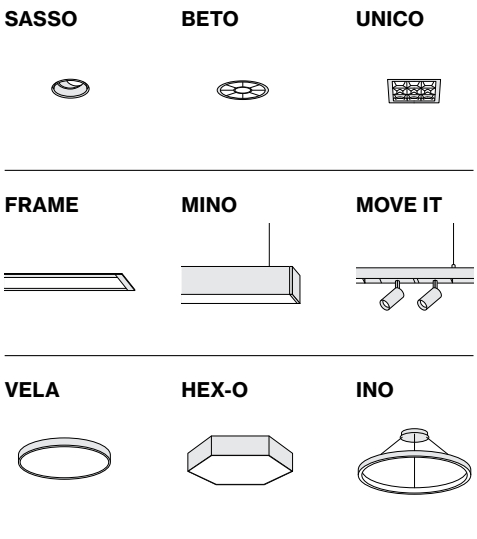
One often feels tension and nervousness in the waiting room. Here, lighting can have a calming effect on patients and create a relaxing ambience. Wall or ceiling lights with warm white light create a pleasant atmosphere. Floor luminaires or ring luminaires with soft light distribution also create a homely character. If the light is to change dynamically with the time of day, Tunable White luminaires are the solution; their light colour changes in line with daylight, creating a pleasant lighting atmosphere. Since patients and caregivers spend most of the day indoors, synchronising their internal clock is all the more important. This increases well-being, raises the performance level, and improves sleep quality.

Registration requirements

- High illuminance on walls and ceilings for an inviting spatial impression in the reception area
- Communication promotion through cylindrical illuminance of ≥ 150 lux
- Good modelling with moderate ratio of cylindrical to horizontal illuminance (EN 12464-1)
- Increased illuminance in the registration area and reduced illuminance in the waiting area for visual separation and zoning

Waiting room requirements

- Warm light colours and dynamic light sequences for well-being with a basic brightness of at least 200 lux



HNOplus Höhr-Grenzhausen, DE –
by two_space + product

Medbase Zürich Oerlikon, CH
by Outlog Architektur + Planung AG

Kaiser-Franz-Josef-Spital Vienna, AT –
by Nickl & Partner Architekten AG

Therapy room & exercise area

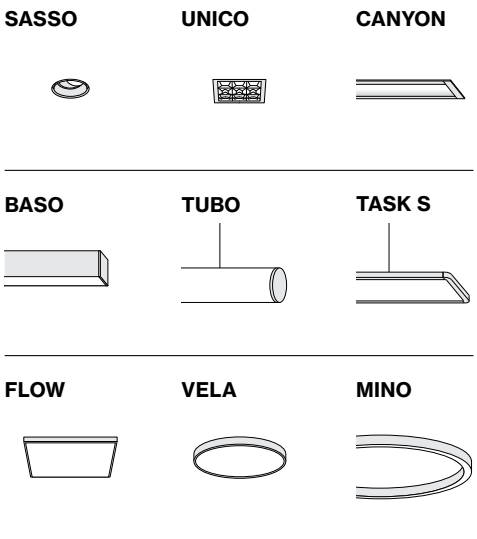
Biodynamic light for rapid rehabilitation

The rehabilitation phase in a therapy centre follows an often long and arduous history of illness. A rehabilitation centre's mission is to stabilise patients through specialised therapies, accelerate their recovery, and teach new strategies for dealing with pain or impairment. In addition, patients are prepared to return to work or to independent living. In this phase, the feel-good factor and relaxation are particularly important. A harmonious environment has a significant influence on recovery; the quality of the lighting in the rehabilitation centre is crucial to this. A balanced mix of room and accent lighting in therapy rooms creates a pleasant atmosphere in which patients feel safe and secure. Luminaires with high colour rendering values are suitable for this stimulation at the sensory and emotional level because they present the surroundings in a more vivid and three-dimensional way. Ideally, the basic brightness in the room is achieved by indirect lighting, e.g., via illuminated walls or ceiling surfaces. Additional direct lighting increases the plasticity of the room and facilitates orientation. Spotlights can set light accents on the wall, guide the eye, and provide visual variety.

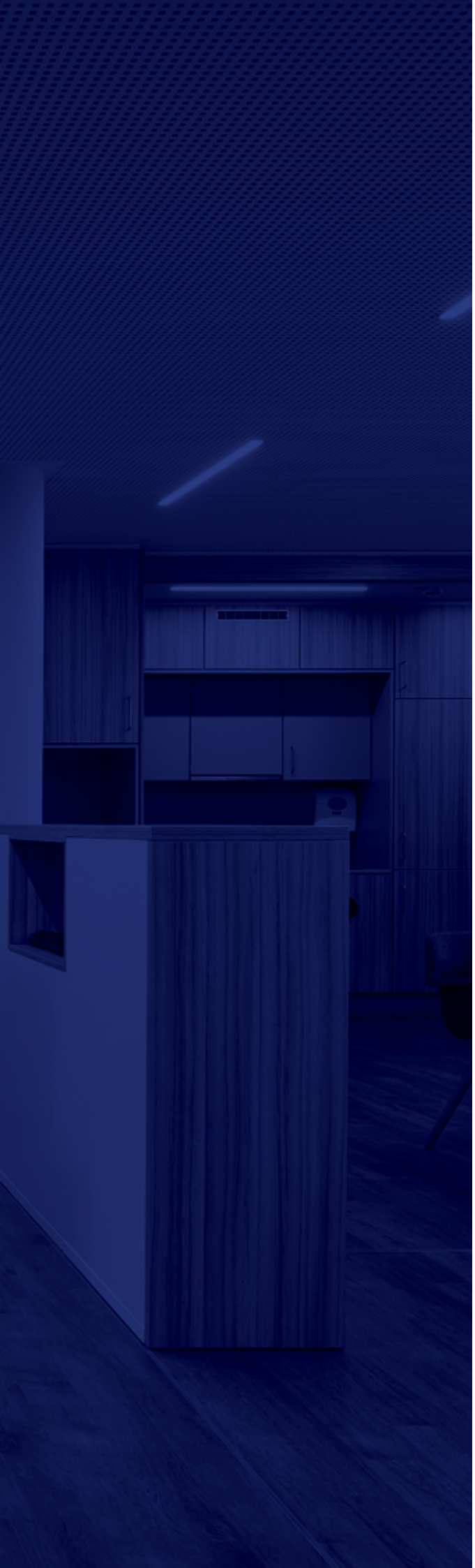
There are separate specifications for treatment and therapy rooms in the physical, radiological, and electromedical fields. An illuminance of at least 300 lux with a colour rendering index of R_a 80 must be achieved in the treatment room. To be able to precisely assess the condition of a patient, the even higher colour rendering of full-spectrum LEDs is recommended. They offer excellent colour fidelity of R_a 98. Dynamic light has an additional beneficial effect on rehabilitation. High day-dependent illuminance levels, based on the natural daylight progression, support the human circadian rhythm, and thus contribute to a patient's more rapid recovery. Tunable White luminaires are used for this purpose, with a colour temperature of up to 5700 K during the day. In the evening, warm white light colours from 2700 K are suitable for inducing relaxation, preparing the organism for rest, and improving patients' sleep in the rehabilitation centre.

Requirements

- Mix of room and accent lighting for a pleasant atmosphere
- Basic brightness via indirect lighting or direct lighting with planar light
- Accents via spots on walls, pictures, or plants
- Therapy rooms: minimum illuminance of 300 lux with a colour rendering index of R_a 80 or higher
- Warm white light colours for well-being



Nursing homes



- Residents’ rooms
- Common areas

Residents' rooms

Age-appropriate lighting in residents' rooms

As we age, visual performance decreases, accompanied by strongly reduced colour and depth perception as well as a deteriorated adaptation of the eyes. The spectral lens permeability decreases due to age-related clouding. The lens diameter also decreases, which means that significantly less light falls on the retina. 90-year-old patients need about five times the illuminance of patients in their early thirties. However, these impairments can be noticeably reduced by the right lighting. DIN SPEC 5031-100 includes correction factors for calculating age-appropriate illuminance which enable older people to achieve the same visual performance as a 32-year-old reference observer.

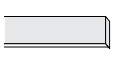
The lighting in the resident's room must generally consider the state of elderly people's health. Compounding declining eyesight are increasing physical limitations. The hospital environment should be as homelike as possible to encourage elderly patients and residents to remain active. According to the standard, the minimum requirement for general lighting in residents' rooms is at least 100 lux. Considering the correction factors according to DIN SPEC 5031-100, the age-appropriate lighting level for a patient over 90 years of age should be above 1000 lux. This increases safety and orientation, well-being and activation, and demonstrably improved sleep.

A mix of direct and indirect light enhances the homeliness of the resident's room; additional variety is created by combining ceiling, wall, and table luminaires. This allows residents to switch the lights on or off individually and creates a feel-good atmosphere. In the mornings and evenings, one should work with a light colour between 2700 and 3500 K. A cool, activating light is ideal during the day. The best lighting for the night is very warm white light with a colour temperature of ≤ 2700 K. Pre-programmed light scenes and dynamic light sequences enable the lighting to support the human circadian rhythm. Especially for patients who are rarely exposed to natural daylight due to their condition, a circadian lighting system noticeably improves well-being and sleep quality.

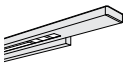
Requirements

- Create contrasts: illuminate stairs, edges, and unevenness well
- Increased lighting level with warm light colours with a mixture of direct and indirect lighting
- Pre-programmed light scenes increase comfort for staff and residents

LINEA



RECOVER



TASK wall

TASK table

SASSO

ARY

VELA

COMBO

TASK

Residents' rooms
Visualisation

Common room

Natural lighting atmosphere in the common room

The common room plays a central role in nursing homes. It is a place of encounter and exchange. Residents use this space to socialise, play card or board games, or watch movies together. Various factors need to be considered to ensure that lighting meets all these requirements and maintains a pleasant lighting atmosphere. The EN 12464-1 standard specifies 200 lux for lighting in recreation rooms during the day. However, this is not sufficient, especially for older people and more demanding visual tasks. At least 1000 lux illuminance should be provided by additional luminaires. This can be achieved, for example, with separately switchable floor luminaires or reading luminaires. An important point in lighting design are the age-specific correction factors according to DIN SPEC 5031-100. Because vision deteriorates with age and the eye's ability to adapt declines, the elderly need significantly higher illuminance.

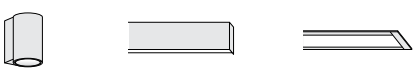
In addition, there is the influence of light on our circadian rhythm. The light colours in the interior are in direct contact with our hormonal system and control the day/night rhythm. Elderly, less mobile care home residents often spend all day indoors. As there is no synchronisation of the inner clock with standard lighting, the consequences can be listlessness, poor sleep, or depressive moods. To counteract this, biologically effective luminaires are used whose light colour changes dynamically with the time of day and reproduces the natural changes in daylight inside the room. XAL's full-spectrum LEDs enable these dynamics with an increased light-blue light component. In addition to excellent colour rendering, this also ensures high visual comfort and reduces eye fatigue. To create a pleasant sense of space, high illuminance should be provided by large ceiling and wall surfaces with indirect lighting. This creates basic brightness in the room which should be supplemented by accent lighting. Additional light sources such as wallwashers craft a homely atmosphere in the room.

Requirements

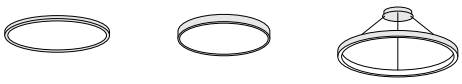
- High illuminance on walls and ceilings for an inviting room
- Communication promotion through increased cylindrical illuminance
- Good modelling with moderate ratio of cylindrical to horizontal illuminance (EN 12464-1)
- Min. 500 lux and dimmable, adapted for different activities
- Basic brightness via indirect lighting should be supplemented by accent lighting
- Wall or floor luminaires create a homely atmosphere

SASSO PRO **BETO** **UNICO**

SASSO wall **LINEA** **FRAME**



TASK **VELA** **INO**



Medical practices

- Reception, waiting area & treatment
- Dentist

Reception, waiting area & treatment

Orientation and relaxation in the doctor's office

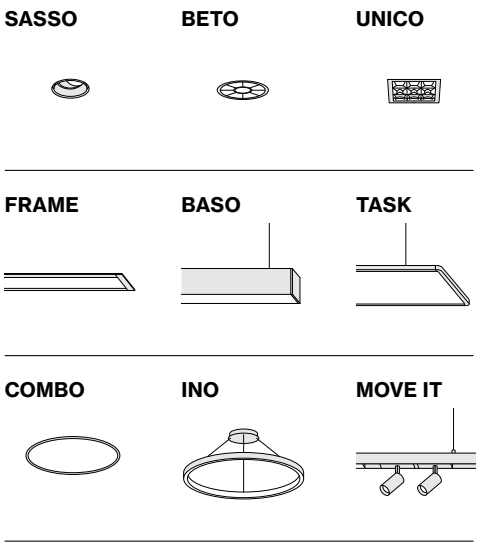
In medical practices, various specific lighting solutions are required, be it the registration desk at the reception, the waiting room, or the patient consultation in the examination room. The reception is a medical practice's business card and a patient's first point of contact. It should be lit in a bright and friendly manner and offer patients orientation. Separate accent lighting can add emphasis to the reception area and guide visitors more clearly through the practice.

Staff, however, spend many hours at the computer. Thus, attention must be paid to ergonomic, standard-compliant computer workstation design. A UGR value of at most 19 ensures moderate direct glare. Higher illuminance is generally recommended above the desk. This creates good visibility and a visual separation between the reception, entrance, and waiting areas. Above all, the reception is an area of communication, so it is even more important to create an atmosphere of trust and security. Cylindrical illuminance should be at least 150 lux at eye level. This can be achieved with suspended luminaires above the counter or indirect light from the wall or ceiling. For good communication, the ratio of cylindrical to horizontal illuminance is defined as between 0.3 and 0.6 in the lighting standard. This modelling indicator shows how well the face and facial expressions are recognisable, which influences our interactions decisively.

Lighting plays a calming role in the waiting room. EN 12464-1 stipulates a basic brightness of 200 lux. However, to ensure that patients have sufficient light when reading or completing questionnaires, a significantly higher illuminance is recommended. Warm-toned light in waiting rooms has a relaxing effect, lowers stress levels, and conveys a sense of security. In doctors' consulting rooms, at least 500 lux is required; in examination and treatment rooms, 1000 lux is required on the examination areas – depending on the medical specialisation. It is important to use luminaires in the practice that have good glare control so that patients lying down are not dazzled from above. A high indirect light component improves the UGR value and reduces the contrast to the light emission surface.

Requirements

- Reception: counters with higher Illuminance levels to separate registration and waiting area
- Waiting room: warm light colours and dynamic light sequences for well-being
- Waiting room: basic brightness min. 200 lux
- Consulting room: illuminance of 500 lux
- Examination areas: up to 1000 lux and sometimes more



Anima Mentis Vienna, AT –
by ROOMS GmbH

Pallas Klinik für Augenheilkunde Olten, CH –
by BFB Architekten AG

Dentist

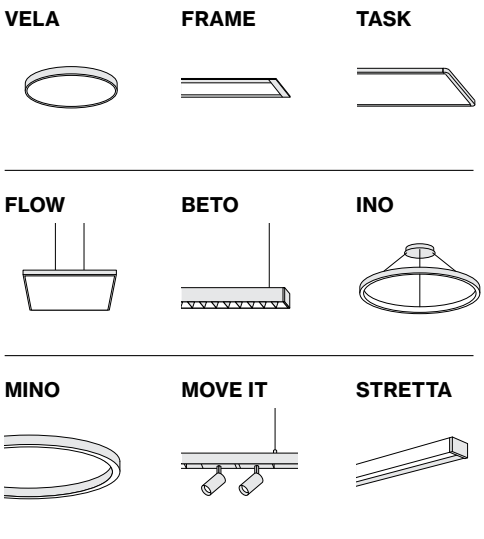
High colour rendering and light quality in dental practices

One usually works with three light zones in a dental practice. In the patient treatment area, an illuminance of 1000 lux is specified (in accordance with EN 12464-1), while 500 lux is sufficient for general lighting in the treatment environment. Special luminaires providing 5000 to 10000 lux are used to illuminate the operating area. The demand on colour reproduction quality is particularly high in a dental practice. In cosmetic corrections or when matching artificial teeth with the patient's own teeth, even minimal colour differences between teeth can impair the overall aesthetic appearance. Therefore, neutral or daylight white illumination by high-quality LED luminaires is required throughout the room. These achieve R_a values of up to 98 – for an almost true-colour result.

A double-sided or circumferential rectangular-square luminaire arrangement must be provided above the examination chair so that patients are not dazzled when lying down. Full spectrum LEDs create exceptionally natural working and medical assessment conditions thanks to their high colour fidelity.

Requirements

- A colour rendering value of $R_a \geq 90$ is required throughout
- In addition, even higher colour rendering values are useful for checking colour nuances in dentures
- In the visual task area, ≥ 500 lux is required as horizontal illuminance
- In the patient area during treatment horizontal ≥ 1000 lux
- A high indirect component of the lighting reduces unpleasant glare for the patient
- In the operating area, the special requirements of EN ISO 9680 apply



Dental practice Coornaert (Tandartscentrum Atlas)
Kortrijk, BE –
by Maison Jane

Dental practice Wachtebeke, BE

Dental practice Coornaert (Tandartscentrum Atlas)
Kortrijk, BE –
by Maison Jane

Biological light effect

Lighting in harmony with the inner clock
Light has always been closely connected with humankind. Irrespective of advances in civilisation and technology, light influences many processes that take place in the human body every day.

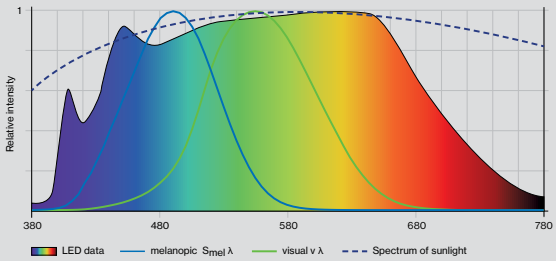
That is why artificial lighting is increasingly geared to the circadian rhythm – the day-night rhythm – of human beings. This so-called inner clock is largely set by the two hormones melatonin and cortisol. Cortisol, also called the stress hormone, is released in high concentrations in the morning and is the basis for alertness, focus, and physical and mental performance. In contrast, the sleep hormone melatonin is responsible for regeneration by supporting deep and relaxing sleep.

Both hormones are produced in the central brain and their release is directly regulated by the blue light components that strike the retina. This means the amount of daylight we are exposed to has a direct influence on our hormonal system. The blue light components hitting the eye's retina suppress the production of the sleep hormone melatonin. As a direct result, melatonin levels shoot up significantly at night. If the melatonin fluctuation is strong, this also results in a significant cortisol fluctuation. We are efficient during the day and at night we sleep soundly.

If artificial lighting is geared to these processes, it is perceived as more pleasant and also promotes physical health. Long-term studies in care homes, for example, show that residents behave much more actively, openly, and independently when they are in rooms with a circadian-controlled lighting system. High illuminance levels with increased blue wavelengths during the day and warm, long-wave light colours in the evening hours reproduce the natural daylight curve inside the room.

Human Centric Lighting (HCL)
An HCL concept puts the focus on people. Research has shown us for many decades what our needs are regarding light. Yet in many places lighting is still seen as an expedient rather than a factor in our cognitive and physical health.

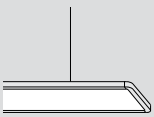
Human Centric Lighting is a lighting concept that offers the variability that the human organism demands. The amount of light provided varies according to the time of day and season – it adapts to the natural daylight curve in the respective area. Both the amount of light and the light colour play a role.



Artificial light in coordination with daylight
The best light source is always natural light. Therefore, this should be used as far as possible and integrated into the lighting concept, especially for buildings in the health sector. Large window areas and atriums allow natural daylight to enter the building. Using smart sensor technology, modern lighting control systems can already measure how much light is entering the room and adjust the supplementary lighting accordingly. This dynamic regulation maximises natural brightness, paired with cleverly designed artificial light scenes.

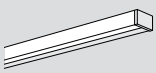
MINO
surface / suspended

TASK S
suspended

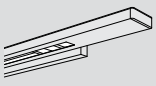


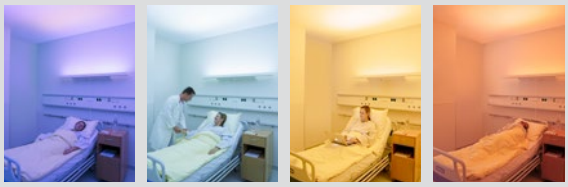
INO
surface / suspended

STRETTA
wall



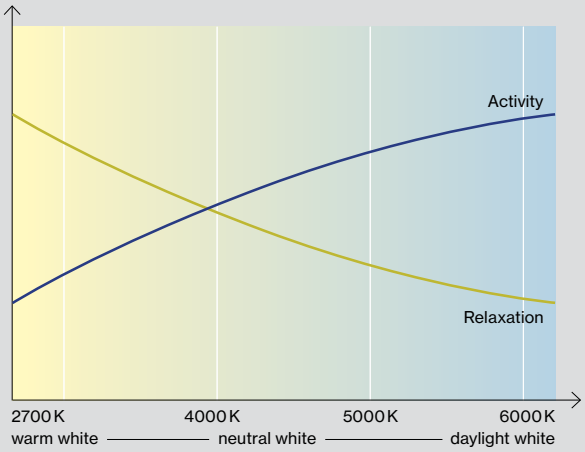
RECOVER
wall





In the biologically effective light spectrum
Biologically effective lighting is based on the imitation of nature through artificial lighting. This is achieved via both the luminous intensity and the light colours. Outdoors, the light intensity is several thousand lux – indoors, 1000 – 2000 lux already affects our hormone system. Large areas with high luminance are important here, so that the sensitive receptors are reached over a large area of the retina.

To imitate daylight in terms of colour, the entire light spectrum must be covered, and the dynamics and variability of natural light must be reproduced. The light colour is specified as colour temperature in Kelvin (K). Ranges below 3300 K are considered warm white, whereas light colours above 5300 K are called cool white or daylight white. The cooler the shade of white, the higher the proportion of blue, short-wave components which have an activating effect on the organism. In modern luminaires with full-spectrum LEDs, specific attention has been paid to achieving a frequency content of the wavelengths that is close to natural. Thus, artificial light achieves a biological effect similar to daylight.



Increased need for light in old age
With increasing age, fewer and fewer light stimuli reach the retina. From birth, lens opacity and pupil constriction increase, specifically allowing fewer blue wavelengths to reach the retina. However, this blue light is needed to regulate the day-night rhythm of the body and to trigger the evening release of melatonin.

In nursing homes and care centres a decrease in activity due to lack of light can be observed. If the body is not sufficiently activated during the day, sleep deteriorates – listlessness and even depressive moods are the result. A research project at the Albert Schweitzer Clinic in Graz has demonstrated a biological effect. The combined amount of artificial and daylight was measured over 12 hours. On average ~ 530 lx / h was measured. This provides a daily dose of 6360 lx / h. Depending on the location with respect to the window and the patient's age, a daily dose of 5000 – 10000 lx / h will achieve a biological effect. A daily synchronisation of the inner clock is essential for an active life in old age.

Factors for near-natural lighting design
Lighting design oriented towards people is inspired by lighting conditions in the open air and their positive effects on health – it is modelled on nature. To this end, artificial lighting reproduces daylight inside the building and allows the human organism to maintain its natural rhythm.

The most important factors for a biodynamic lighting concept are:

- High cylindrical illuminance: > 370 lx
- Take age-specific correction factors into account: with an MR of 0.75 this means 554 lx of cylindrical illuminance for a 50-year-old, 1153 lx for a 75-year-old, and 1907 lx for a 90-year-old
- Expansiveness: The light should be emitted over large luminous areas (similar to the daytime sky) if possible
- Light direction: This must be selected such that the circadian effective light comes from the front and above
- Melanopic efficiency: The non-visual efficiency of the luminaires should be MR > 0.75
- Dynamic gradients: Slow and, if possible, infinitely variable adjustment of colour temperature and illuminance correspond to the natural daylight curve

Acoustics for healthcare facilities

Room acoustics in the health sector
Noise pollution in hospitals is increasing worldwide. This is due both to the buildings' technical equipment and to increasingly complex medical devices. Treatment and monitoring equipment generate a constant background noise level with a sound pressure level of around 70 dB – roughly the background noise of a canteen with 50 people. Studies have shown that the average noise exposure in large hospitals is equivalent to that on a major road.

Better sleep and quicker recovery time
We have known for a long time that noise is partly responsible for mental and physical stress. Environmental noise levels have a demonstrable effect on our nervous system, our concentration, and our well-being. From 58 dB already the heart rate increases, and it can lead to disturbed sleep. However, rest and sleep are the most important factors in recovery and rehabilitation. Just as a long-term increase in noise levels makes us tense, silence has a relaxing and health-promoting effect.

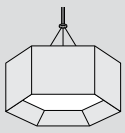
Balanced room acoustics are just as beneficial to recovery as stabilising the patients' circadian rhythm. Biodynamic lighting concepts support natural hormone levels during the course of the day and thus regulate the alertness and tiredness curves. The higher the activation during the day, the more relaxed and regenerative the sleep. In addition, reduced noise levels in the hospital are beneficial for the regeneration of patients and reduces their length of stay in hospital.

Modern acoustic products
Designing rooms such that people feel comfortable in them is a central requirement of modern architecture, lighting, and acoustic planning. This is particularly true in the health sector. For many people, visits to the doctor and hospital stays are associated with anxiety and nervousness. Here, anticipatory spatial planning can help lower stress levels, reduce tension, and allow people to feel safe in the treatment environment. This begins at the reception or in the waiting area and continues in the examination room as well as at the 24-hour nurses' station or in the patient's room.

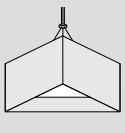
Bright, calm, and friendly rooms counteract the clinical sterility of a hospital environment. In addition to pleasant, homogeneous lighting, the room's acoustics also play their part. The more balanced the background noise, the better the organism can rest. Modern, design-oriented acoustic elements optimise the acoustic conditions in the room and act as decorative design elements that guide the patient's gaze.

Optimised communication in the hospital
In addition, balanced acoustic planning improves the quality of communication. In a medical environment, it is essential that the doctor, carer, and receptionist are clearly mutually intelligible and that the flow of information is not impaired by reverberation, disturbing sound propagation, or background noise. Speech intelligibility in particular plays a major role. It must be sufficient to enable information to be passed on clearly and quickly. However, privacy must be maintained during confidential medical consultations. For example, at the 24-hour nurses' station it is important to be able to communicate the most important things quickly while exchanging sensitive data without this being overheard by other patients. Good room acoustics therefore have a positive effect on the well-being and recovery of patients and also optimise the processes in healthcare facilities themselves.

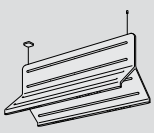
HEX-O
surface / suspended



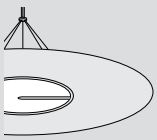
TRIG-O
surface / suspended



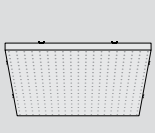
MUSE
suspended



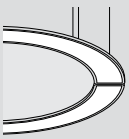
SONIC
free standing / susp.



MOVE IT acoustic
system inlay



TASK
surface / suspended



Stress reduction for staff
Healthcare workers operate under stressful conditions. They carry out critical activities and must make serious decisions – often under high pressure. Precision in every action is a prerequisite, as is efficiency in treatment, to provide adequate care to all patients as quickly as possible.

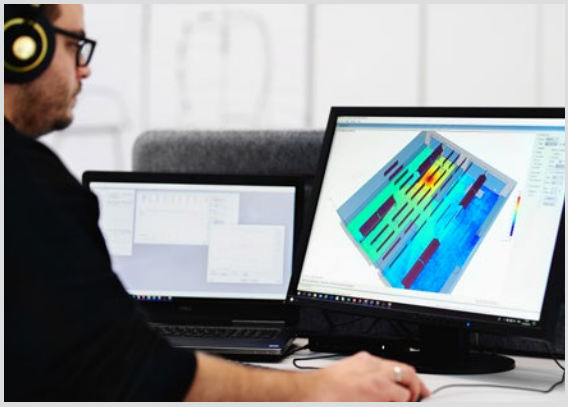
High noise levels act as an additional stress factor. It affects both the well-being of the staff and the quality of their work. Studies have shown that the psychological effects of noise in clinical settings have a negative impact on concentration and performance, as well as accelerating fatigue. Poor comprehension, irritability, and a feeling of being overwhelmed thus put a strain on medical support as well as on the relationship with the patient. Room acoustics tailored to requirements counteract this by creating a harmonious working environment even where high noise levels are unavoidable. This increases the quality of work and the satisfaction of the staff.

Age-appropriate acoustic conditions
Elderly people are overrepresented in hospitals and care homes due to their physical constitution. Since visual and auditory performance declines with age, lighting and room acoustics need to be adapted accordingly. Appropriate acoustic measures enable elderly patients to perceive their surroundings better and to organise their day more actively. Improved acoustics also promote communication and participation in social life in the care home.

Sound-absorbing surfaces are ideal because they reduce the reverberation time and thus optimise speech intelligibility. This has a considerable influence on the relationship between doctor and patient, for which mutual intelligibility is critical.

Bespoke acoustic planning for healthcare facilities
In the health sector, acoustic planning is indispensable. In places where people get back on their feet after illness or accidents or reorient themselves, environments are needed that facilitate this.

The requirements for comprehensive room-acoustic planning in the healthcare sector are many and varied. Numerous standards must be considered, as well as the individual needs of patients. To meet this complexity, we work with a network of different partners. This allows us to perfectly coordinate lighting and acoustics. In addition, we offer acoustic planning in three service packages, which – depending on room size and specific project requirements – include different services. We design different variants for each order, including an acoustically optimised ideal situation for your hospital, medical practice, or care facility. If you have any questions or would like to arrange a consultation for your project, please contact us at akustikplanung@xal.com



Efficiency and sensor technology

Efficiency and comfort through modern lighting control
A functional lighting system is of central importance for patients and staff. For employees in healthcare facilities, lighting must meet the requirements of the visual task – from examinations to care and service to laboratory activities. To ensure that patients feel comfortable in their rooms, the lighting should both comply with standards and also be individually adaptable. The lighting should also be easy and intuitive to control.

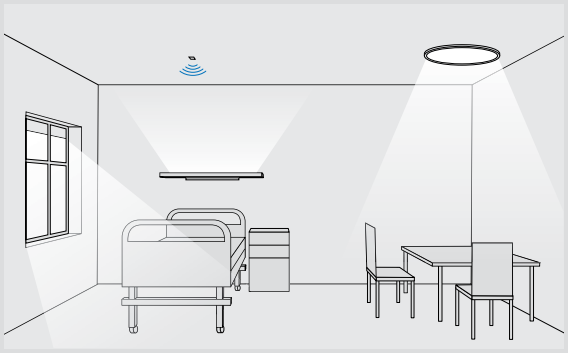
This is where simple, self-explanatory operating devices help. Special functions may not be immediately apparent to the user, but they are all the more helpful for building services. These include integrated power measurement, system diagnostics, operating hours counters, and status reports.

Light output as required
Large hospitals and care homes are busy around the clock. In addition to medical equipment, lighting is a major cost factor. Sensor-controlled luminaires increase comfort and safety, and also reduce energy costs in the long term by regulating light output as required.

Sensors measure movement and ambient brightness and switch on the lighting only where needed. Modern lighting management can control each individual luminaire separately and thus dim or switch off the light in unused rooms or in areas illuminated by daylight. In the case of luminaires close to windows, this saves up to 50% energy. Orientation lighting in corridors or staircases can also be planned according to time of day and dimmed during quiet periods.

Smart IoT sensors contribute significantly to patient recovery by measuring important indoor climate values. Air humidity, air quality, sound pressure, sound levels, and room temperature are all factors that influence the well-being of the people in the room – which is particularly crucial when patients are in their rooms for days or weeks at a time. If the room climate is optimised based on these parameters, this can noticeably shorten the recovery time and the stay in hospital.

Indoor climate analysis with IoT Pro
If the values are to be more than just a snapshot, an extension with XAL's IoT Pro sensors is recommended. These offer a comprehensive indoor climate analysis. In this process, the measured values are recorded and evaluated over a certain period, whereby trends emerge. Analyses of the presence sensors record, for example, the bed occupancy rate or the activity of patients, which in turn can be considered in cleaning or room allocation. Based on indoor climate assessments, sensible, cost- and time-saving plans can be drawn up for ventilation or the operation of air-conditioning systems.



HCL: Faster recovery through circadian daylight patterns
Patients recover more quickly the more comfortable they feel in a healthcare facility. Suitable lighting systems create a feeling of calm and security and support the regeneration of body and mind by adjusting the lighting to the needs of the human organism. Since patients and residents often spend long periods in closed rooms, it is essential to create lighting conditions that are as close as possible to natural daylight.

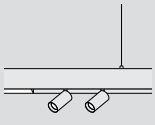
Human Centric Lighting (HCL) is used for this purpose. Dynamic colour gradients imitate the natural daylight curve from cold white, activating light in the morning to relaxing, warm white light colours in the afternoon and evening hours. Slow dimming and gentle changes between light scenes make the lighting pleasant and lively. Brightness and lighting mood vary both from morning to night and with the seasons. A modern lighting system's pre-programmed or manually controllable algorithms can equip the lighting with different curves and thus optimally adjust the light to its natural equivalent at any given moment.

UNICO
recessed / ceiling

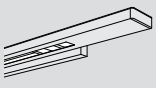
VELA
surface / suspended

MINO
surface / suspended

MOVE IT 25 system
suspended



RECOVER
wall



Area-adapted, flexible lighting control
Each area in a hospital has different lighting requirements. Multiple lighting standards apply, each of whose limit values must be met. For example, different lighting conditions are required at a 24-hour nurses' station, where staff carry out computer work, than in a waiting room or in a dental treatment chair. The lighting system must be flexible across administrative desk activities to diagnostic discussions to lighting in a care centre's common room. To ensure that this complexity is straightforward for the building services, the control systems can be maintained centrally. Wireless solutions enable remote control and thus rapid response to changes in demand in individual wings of the healthcare facility.

Straightforward operation and central management
Even though light plays an important role in the health and care sector, it should not cost employees more attention than necessary. It is therefore necessary to implement complex technology in simple systems. The lighting control system must be easy to operate. The more intuitive a system, the shorter the required training time and the faster it can be commissioned. If support is needed, remote maintenance and configuration save time-consuming travel. Cloud support provides a quick overview of multiple systems. In large hospitals, a doctor's office, or a care centre, lighting is best combined in a system that can be easily and centrally managed.

Data mining in the health sector
Particularly revealing data is used in the health care sector. This is precisely where lighting systems equipped with smart sensor technology can provide valuable insights. For example, movement or air conditions in patient rooms, which in turn can be used to derive cleaning schedules or climate control. The lighting system provides more than "just" the right lighting here. Collected values and data analyses contribute to smart, energy-efficient building use and provide insights into the patients' regeneration process.

Requirements
- Energy Monitoring Converter
- Current transformers on measuring circuits
- Calculating the current consumption from the dimming level

Measured
- Power consumption
- Network quality
- Patient attendance history
- Patient activity (for patients who must be deliberately activated or who must remain still)

Patient room planning example

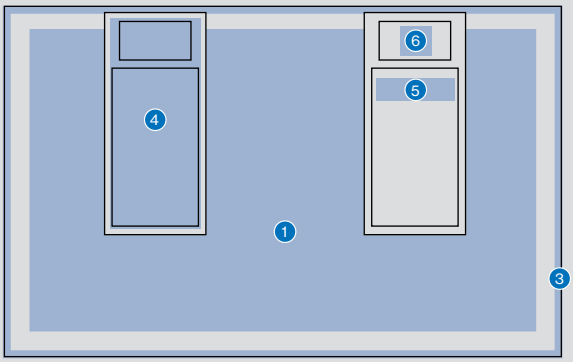
The lighting in a patient's room must meet many requirements. We selected two RECOVER PRO units of 1350 mm length in this example. The minimum requirements of the lighting standard are only sufficient to fulfil the visual task in question. Since the biological light effect especially contributes to patients' healing success, significantly higher illuminance levels are available at the patient's eye in this example.

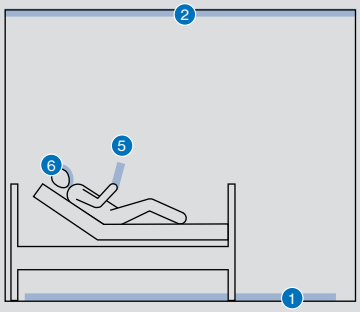
In this case, the biologically necessary vertical illuminance and age-related correction factors are considered. The RECOVER luminaires run a full day's curve, from dawn to dusk in the room. This activates patients in the morning and relaxes them in the evening.

Lighting standard EN 12646-1 minimum requirement

- Floor, wall, and ceiling with minimum illuminance of 100 lx, 75 lx, and 50 lx
- Size of reading range defined in DIN 5035-3, minimum 300 lx
- 300 lx at the examination level, at a height of 85 cm for simple examinations
- 1000 lx at the examination level, at a height of 85 cm for examinations and treatments, with a colour rendering of $R_a \geq 90$
- Glare limitation UGR ≤ 19

Specifications





Measured surfaces
1 Floor
2 Ceiling
3 Walls
4 Examination level
5 Reading area
6 Visual field

Room dimensions twin room:
5,66 × 3,6 m
Ceiling height: 3 m
Luminaire height: 1,80 m

Reflection
Floor 40 %, walls 80 %, ceiling 90 %
Maintenance factor: 0.8

MEDI lux – what biological illuminance is required vertically at the resident's eye?

According to DIN SPEC 67600, 250 MEDI lux (Melanopic Equivalent Daylight Illuminance) must be present vertically on the eye for at least four hours in the mornings. MEDI lux is the melanopic and daylight equivalent assessed illuminance.

How does one convert to visual lux?
In our example we assume 4000 K with a MR of 0.75. First, the assumed 250 MEDI lux are divided by the melanopic effect factor of MR = 0.75 [250 / 0.75 = 333 lx]. To arrive at the daylight equivalent illuminance, the result is then multiplied by the constant daylight correction factor of 1.103 [333 lx × 1.103 = 368 lx]. This 368 lx is the biologically necessary vertical illuminance for a 32-year-old observer.

DIN SPEC 5031-100 has two age-specific correction factors. Multiplying both factors produces 0.664. For a 50-year-old observer, 554 lx vertical illuminance is calculated [368 lx / 0.664 = 554 lx].

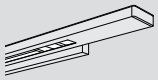
The age-specific correction factors for a 75-year-old observer result in a factor of 0.319. Thus, 1153 lx vertical illuminance is calculated [368 lx / 0.319 = 1153 lx].

In this example, there is sufficient vertical illuminance for a 75-year-old patient.

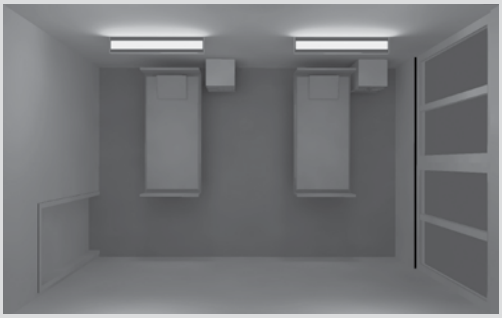
RECOVER PRO

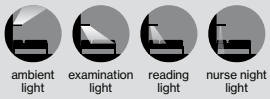
Ambient light / 5500 K activating light mood, in the mornings for at least four hours

RECOVER PRO
wall

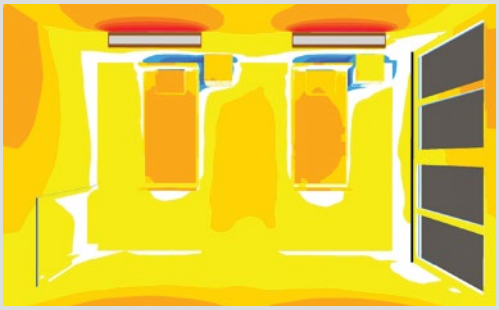


Ambient light /
2500 K relaxing lighting mood, in the evenings



Number	Luminaire	
2	RECOVER PRO 1350 / 2200 K – 31000 K - ambient light 14600 lm (160 W) - examination light 1969 lm (35 W) - reading light 626 lm (12 W) - nurse night light 2 × 147 lm (2 × 2.3 W)	

Ambient & examination light



Ceiling soffit

Measured surface	Standard requirement (EN 12464-1)	Luminous intensity (calculated at 4000 K ambient & examination light)
1 **Floor**	E_m 100 lx	E_m 662 lx
2 **Ceiling**	E_m 50 lx	E_m 1348 lx
3 **Walls** (ø of all walls)	E_m 75 lx	E_m 756 lx
4 **Examination level**		
a) simple examination	E_m 300 lx	✓
b) examination & treatment	E_m 1000 lx	E_m 1199 lx
5 **Reading area**	E_m 300 lx	E_m 364 lx (reading light)
6 **Visual field**		
- for communication	E_m 150 lx	E_m 1292 lx
- biologically effective	**Recommendation** (DIN SPEC 67600/5031-100)	
a) 32-year-old patient	$E_m \geq 368$ lx	✓
b) 50-year-old patient	$E_m \geq 554$ lx	✓
c) 75-year-old patient	$E_m \geq 1153$ lx	✓

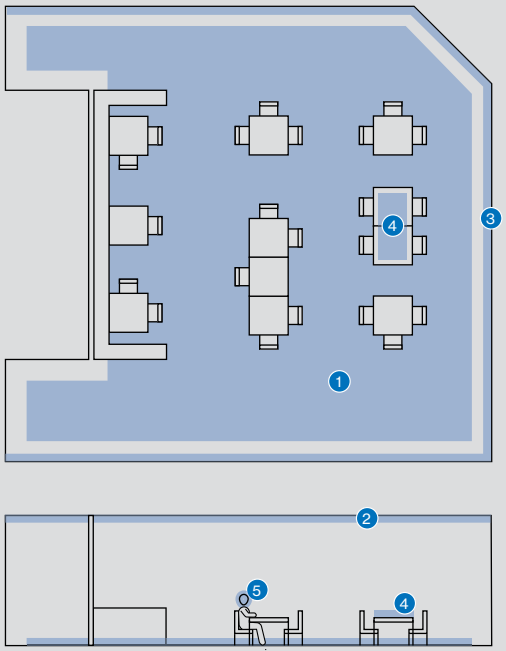
Recreation room planning example

A recreation room's lighting must meet many requirements. Since care home residents usually spend a lot of time in the recreation room, we selected an HCL design in this example. Human Centric Lighting meets both the minimum requirements for the respective visual task and also fulfils biological needs, in our case those of 75-year-old residents. Furthermore, emotional lighting components must also be available. To meet emotional needs, we have chosen a dynamic lighting control system that offers a very high colour rendering of $R_a / R_e \geq 90$ across all colour temperatures. On the walls, narrow-beam CWD spotlights produce a cosy atmosphere at off-peak times.

Lighting standard EN 12646-1 minimum requirement

- Floor, wall, and ceiling with minimum illuminance of 200 lx, 75 lx and 50 lx
- 200 lx are required in the visual task area
- As the recreation room is a communication room, cylindrical illuminance of E_z 150 lx is required
- Glare limitation UGR ≤ 22

Specifications



Measured surfaces
1. Floor
2. Decke
3. Wände
4. Nutzebene
5. Gesichtsfeld

Recreation room dimensions
Floor area: 114,39 m²
Ceiling height: 3 m
Luminaire height: LINEA system 2,05 m / VELA 2,3 m

Reflection
Floor 40 %, walls 80%, ceiling 90%
Maintenance factor: 0.8

MEDI lux – what biological illuminance is required vertically at the resident's eye?

According to DIN SPEC 67600, 250 MEDI lux (Melanopic Equivalent Daylight Illuminance) must be present vertically on the eye for at least four hours in the mornings. MEDI lux is the melanopic and daylight equivalent assessed illuminance.

How does one convert to visual lux?
In our example we assume 4000 K with a MR of 0.75. First, the assumed 250 MEDI lux are divided by the melanopic effect factor of MR = 0.75 [250 / 0.75 = 333 lx]. To arrive at the daylight equivalent illuminance, the result is then multiplied by the constant daylight correction factor of 1.103 [333 lx × 1.103 = 368 lx]. This 368 lx is the biologically necessary vertical illuminance for a 32-year-old observer.

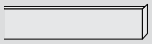
DIN SPEC 5031-100 has age-specific correction factors for lens opacity and pupil constriction. Multiplied by this, the factor for a 75-year-old observer is 0.319. For a 75-year-old observer, 1153 lx of vertical illuminance is calculated [368 lx / 0.319 = 1153 lx].

In this example, there is enough vertical illuminance for a 75-year-old resident.

LINEA | VELA | SASSO PRO

5500 K activating light atmosphere, in the mornings for at least four hours

LINEA system
wall

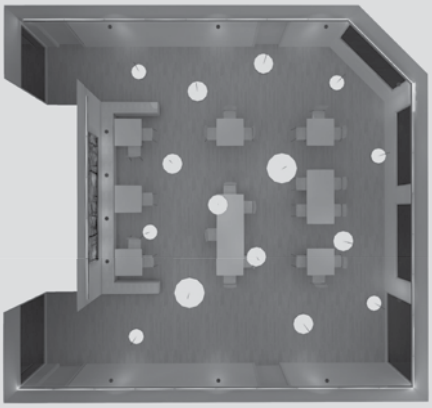


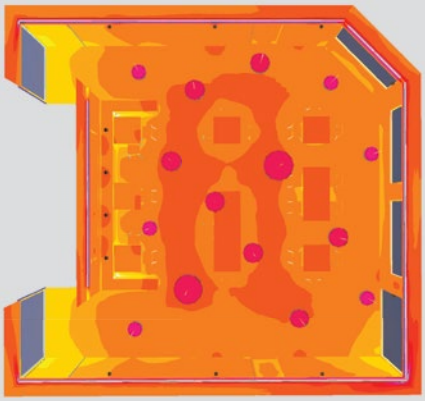
VELA 450 / 600 / 900
suspended

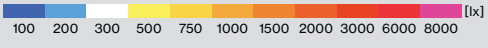
SASSO PRO 100
recessed

2500 K relaxing lighting mood, in the evenings

Number	Luminaire
35	LINEA system biodynamic (indirect 15° + 30°), 9327 lm (92 W) | XCS
7	VELA 450 (direct/indirect), TW, 4975 lm (7 W / 27 W)
5	VELA 600 (direct/indirect), TW, 8546 lm (14 W / 45 W)
3	VELA 900 (direct/indirect), TW, 15524 lm (25 W / 71 W)
12	SASSO PRO 100, CWD, 1412 lm (14.5 W)







Measured surface	Standard requirement (EN 12464-1)	Luminous intensity (calculated at 4000 K)
1 **Floor**	E_m 200 lx	E_m 1671 lx
2 **Ceiling**	E_m 50 lx	E_m 1968 lx
3 **Walls** (ø of all walls)	E_m 75 lx	E_m 1586 lx
4 **User level** (table 0.8 m)	E_m 200 lx	E_m 2199 lx
5 **Visual field** seated position - for communication	E_m 150 lx	E_m 1452 lx
- biologically effective for:	**Recommendation** (DIN SPEC 67600 / 5031-100)	
≤ 75-year-old patient	E_m ≥ 1153 lx	✓

24-hour nurses' station planning example

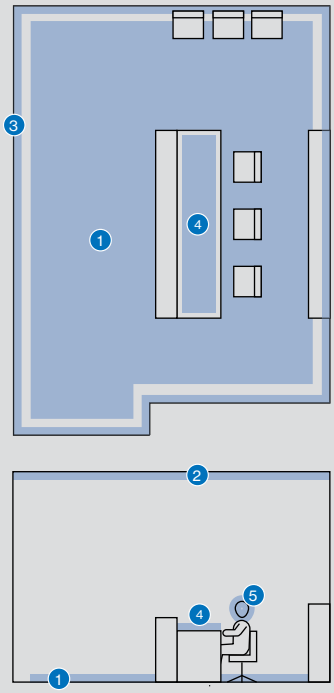
The lighting of a 24-hour nurses' station must meet many requirements. This area must be suitable for office work as well as for communicative exchange. Furthermore, the night-time lighting situation must be set. Therefore, we selected an HCL design for this example. Human Centric Lighting meets both the minimum requirements for the respective visual task and also fulfils biological needs, in our case those of 50-year-old carers. Furthermore, emotional lighting components must also be available. To meet emotional needs, we have chosen a dynamic lighting control system that offers a very high colour rendering of $R_a / R_e \geq 90$ across all colour temperatures. On the walls, narrow-beam CWD spotlights produce a cosy atmosphere at off-peak times.

During the night, the colour temperature is reduced to ≤ 2700 K. The workplace lighting can be adjusted as desired via a dimmer. In the corridor area, illuminance can be reduced to 50 lx.

Lighting standard EN 12646-1 minimum requirement

- For the workplace, the requirements of an office are used, and for the area around the base, the requirements of a corridor with multiple uses are used
- Floor, wall, and ceiling with minimum illuminance of 200 lx, 75 lx and 50 lx
- 500 lx are required in the visual task area
- As the nurses' station is a communication room, a cylindrical illuminance of E_z 150 lx must be available
- Glare limitation UGR ≤ 19

Specifications



Measured surfaces
1 Floor
2 Decke
3 Wände
4 Arbeitsfläche
5 Gesichtsfeld

24-hour nurses' station room dimensions:
Floor area: 40,05 m²
Ceiling height: 3,3 m
Luminaire height: LINEA system 2,35 m

Reflection
Floor 40 %, walls 80 %, ceiling 90 %
Maintenance factor: 0.8

MEDI lux – what biological illuminance is required vertically at the resident's eye?

According to DIN SPEC 67600, 250 MEDI lux (Melanopic Equivalent Daylight Illuminance) must be present vertically on the eye for at least four hours in the mornings. MEDI lux is the melanopic and daylight equivalent assessed illuminance.

How does one convert to visual lux?
In our example we assume 4000 K with a MR of 0.75. First, the assumed 250 MEDI lux are divided by the melanopic effect factor of MR = 0.75 [250 / 0.75 = 333 lx]. To arrive at the daylight equivalent illuminance, the result is then multiplied by the constant daylight correction factor of 1.103 [333 lx × 1.103 = 368 lx]. This 368 lx is the biologically necessary vertical illuminance for a 32-year-old observer.

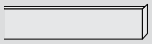
DIN SPEC 5031-100 has age-specific correction factors for lens opacity and pupil constriction. Multiplied by this, the factor for a 50-year-old observer is 0.664. For a 50-year-old observer, 554 lx of vertical illuminance is calculated [368 lx / 0.664 = 554 lx].

In this example, there is enough vertical illuminance for a 50-year-old carer.

LINEA | SASSO PRO | BETO | SONO FLEX

5500 K activating light atmosphere, in the mornings for at least four hours

LINEA system
wall

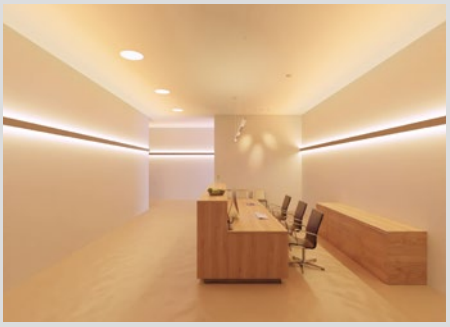


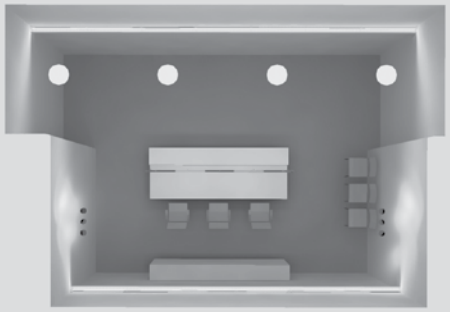
SASSO PRO 100
recessed

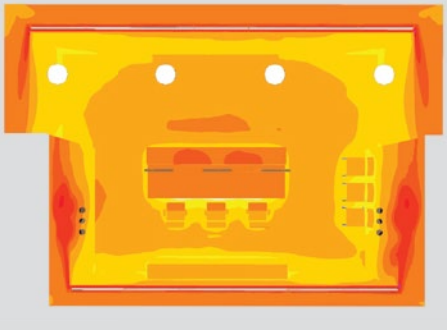
BETO
suspended

SONO FLEX
recessed

2500 K relaxing lighting mood, in the evenings







Number	Luminaire
13	LINEA system (direct opal / indirect asym.), TW, 3690 lm (38 W) | XCS
6	SASSO PRO 100, CWD, 1403 lm (14.5 W)
3	BETO suspended (direct/indirect), TW, 4298 lm (30.5 W)
4	SONO FLEX 350 IP54, CWD, 1503 lm (16 W)

Measured surface	Standard requirement (EN 12464-1)	Luminous intensity (calculated at 4000 K)
1 **Floor**	E_m 200 lx	E_m 982 lx
2 **Ceiling**	E_m 50 lx	E_m 916 lx
3 **Walls** (ø of all walls)	E_m 75 lx	E_m 812 lx
4 **Arbeitsfläche**	E_m 500 lx	E_m 1188 lx
5 **Visual field** seated position - for communication	E_m 150 lx	E_m 691 lx
- biologically effective for:	**Recommendation** (DIN SPEC 67600 / 5031-100)	
≤ 50-year-old caregiver	E_m ≥ 554 lx	✓

Notes

Personal note

We have made it our mission to develop and perfect unique projects in cooperation with the architects and planners.

We see ourselves as your partner. From the lighting design to the right product selection and from the control system to commissioning and maintenance, we are at your side at all stages of your project. Let's talk about your project: **office@xal.com**

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List of photographers

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