OPERATING THEATER LIGHTS
<table>
<thead>
<tr>
<th>Hospital environment</th>
<th>Lighting specification</th>
<th>Illuminance (lux)¹</th>
<th>Colour rendition (Ra)¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reception</td>
<td>Relaxing</td>
<td>200</td>
<td>80</td>
</tr>
<tr>
<td>Waiting rooms/ Day rooms</td>
<td></td>
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<tr>
<td>Corridors</td>
<td>Transportation areas</td>
<td>200</td>
<td>80</td>
</tr>
<tr>
<td>Day</td>
<td></td>
<td>50</td>
<td>80</td>
</tr>
<tr>
<td>Night</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Offices (clinical)</td>
<td>Multipurpose use</td>
<td></td>
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</tr>
<tr>
<td>General</td>
<td></td>
<td>300</td>
<td>80</td>
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<tr>
<td>Examination</td>
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<td>1000</td>
<td>90</td>
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<td>Examination rooms</td>
<td>Visual inspections</td>
<td></td>
<td></td>
</tr>
<tr>
<td>General</td>
<td></td>
<td>500</td>
<td>90</td>
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<tr>
<td>Examination</td>
<td></td>
<td>1000</td>
<td>90</td>
</tr>
<tr>
<td>Patient rooms &amp; wards</td>
<td>Multi task</td>
<td></td>
<td></td>
</tr>
<tr>
<td>General</td>
<td></td>
<td>100</td>
<td>80</td>
</tr>
<tr>
<td>Reading</td>
<td></td>
<td>300</td>
<td>80</td>
</tr>
<tr>
<td>Simple examinations</td>
<td></td>
<td>300</td>
<td>80</td>
</tr>
<tr>
<td>Examinations/treatment</td>
<td></td>
<td>1000</td>
<td>90</td>
</tr>
<tr>
<td>Night/observation</td>
<td></td>
<td>5</td>
<td>80</td>
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<tr>
<td>Bathrooms and toilets</td>
<td></td>
<td>200</td>
<td>80</td>
</tr>
<tr>
<td>Hospital environment</td>
<td>Lighting specification</td>
<td>Illuminance (lux)</td>
<td>Colour rendition (Ra)</td>
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<tr>
<td>---------------------------</td>
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</tr>
<tr>
<td><strong>Intensive care</strong></td>
<td>Low level lighting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>General</td>
<td>400</td>
<td>90</td>
<td></td>
</tr>
<tr>
<td>Simple examinations</td>
<td>400</td>
<td>90</td>
<td></td>
</tr>
<tr>
<td>Examination/treatment</td>
<td>1000</td>
<td>90</td>
<td></td>
</tr>
<tr>
<td>Night watch</td>
<td>20</td>
<td>90</td>
<td></td>
</tr>
<tr>
<td><strong>Surgery &amp; out patients</strong></td>
<td>Specialised</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre-op/recovery</td>
<td>500</td>
<td>90</td>
<td></td>
</tr>
<tr>
<td>Operating theatre</td>
<td>1000</td>
<td>90</td>
<td></td>
</tr>
<tr>
<td>Operating cavity</td>
<td>40,000-160,000</td>
<td>90</td>
<td></td>
</tr>
<tr>
<td>Term</td>
<td>Description</td>
<td></td>
<td></td>
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<tr>
<td>----------------------------------</td>
<td>---------------------------------------------------------------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>lux (lx)</td>
<td>Unit for the amount of light at a given point. Measured using a luxmeter at that point. One lux equals one lumen per square metre.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Central illuminance ((E_c)^*)</td>
<td>Illuminance (lx) at 1m distance from the light emitting surface in the light field centre.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Light field centre</td>
<td>Point in the light field (lighted area) where illuminance reaches maximum lux. It is the reference point for most measurements</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depth of illumination*</td>
<td>The distance under the light emitting area where the illumination reaches 20% of the central illuminance.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shadow dilution*</td>
<td>The lights ability to minimise the effect of obstructions. An absence of cast shadow or coloured shadow is described as perfect shadow dilution.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Light field diameter ((d_{10})^*)</td>
<td>Diameter of light field around the light field centre, ending where the illuminance reaches 10% of Ec. The average of four different cross sections through the light field centre.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(d_{50})</td>
<td>Diameter of light field around the light field centre, ending where the illuminance reaches 50% of Ec. The average of four different cross sections through the light field centre.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Colour rendition index ((Ra)^*)</td>
<td>The effect the light source has on the appearance of coloured objects (tissue for example). A measure is an average measure of the colour spectrum of the light and is made up from the R1 to R8 measurements of each visible colour. R9 is of particular importance as it represents the red colour saturation, important for distinguishing tissue colours.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Colour temperature ((K))</td>
<td>Perceived coolness or warmth of light. Measured in kelvin.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fail safe</td>
<td>Backup possibility in case of interruption of the power supply. The light should be restored within 5 seconds with at least 50% of the previous illuminance (lux measurement), but not less than 40 000 lux. Within 40 seconds the light should be completely restored to the original output.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Requirements</td>
<td>Surgical luminaire</td>
<td></td>
<td></td>
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<tr>
<td>-----------------------------------</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>Minor (treatment)</td>
<td>Major and system</td>
<td></td>
</tr>
<tr>
<td><strong>Equipment classification</strong></td>
<td>Class I, or Class II with connector to PA (^a)</td>
<td>Class I, or Class II with connector to PA (^a)</td>
<td></td>
</tr>
<tr>
<td><strong>Fail safe</strong></td>
<td>No</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td><strong>Anaesthesia (intended purpose)</strong></td>
<td>Local/general</td>
<td>Local/general</td>
<td></td>
</tr>
<tr>
<td><strong>Intended location</strong></td>
<td>Operating room</td>
<td>Operating room</td>
<td></td>
</tr>
<tr>
<td><strong>Sterile handle (standard)</strong></td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td><strong>Central illuminance (E_o)</strong></td>
<td>40,000 - 160,000 lx</td>
<td>40,000 - 160,000 lx</td>
<td></td>
</tr>
<tr>
<td><strong>Light field diameter (d_{10})</strong></td>
<td>Test value required (^b)</td>
<td>Test value required (^b)</td>
<td></td>
</tr>
<tr>
<td><strong>Light distribution</strong></td>
<td>Test value required (^c)</td>
<td>Test value required (^c)</td>
<td></td>
</tr>
<tr>
<td><strong>Shadow dilution</strong></td>
<td>Test value required (^d)</td>
<td>Test value required (^d)</td>
<td></td>
</tr>
<tr>
<td><strong>Colour temperature (T_c)</strong></td>
<td>3000 – 6700 kelvin</td>
<td>3000 – 6700 kelvin</td>
<td></td>
</tr>
<tr>
<td><strong>Colour rendering index (R_a)</strong></td>
<td>85 – 100</td>
<td>85 – 100</td>
<td></td>
</tr>
<tr>
<td><strong>Maximum value for total irradiance (E_e)</strong></td>
<td>Test value required (^e)</td>
<td>Test value required (^e)</td>
<td></td>
</tr>
</tbody>
</table>

\(^a\) PA means potential equalisation conductor

\(^b\) Light field diameter \(d_{10}\) where the illuminance reaches 10% of Central illuminance \(E_o\)

\(^c\) Diameter \(d_{50}\) where the illuminance reaches 50% of central illuminance \(E_o\)

\(^d\) Percentage of the remaining illuminance when the beam is obstructed by one or two masks, with or without tube

\(^e\) Information on the total irradiance \(E_e\) for the given central illuminance \(E_o\)
## Summary of Lamp Differences

<table>
<thead>
<tr>
<th>Lamp type</th>
<th>Method of operation</th>
<th>End of life</th>
<th>Advantages/disadvantages</th>
</tr>
</thead>
</table>
| Incandescent  | Gas filled chamber & burning filament| Burn out-no warning| ✓ Excellent colour rendition  
× Large amount of heat produced |
| Gas discharge | Electrical current passes through gas | Dims over time    | ✓ More light emitted than incandescent  
× More expensive than incandescent |
| LED           | Semiconductor                        | Dims over time    | ✓ Do not generate heat  
✓ Fine adjustments to light  
× Small range of light emissions |
Figure 2. Depth of illumination*

* diagram reproduced from BS 60601-2-41:2000 [10]
Figure 3. Light field diameter
OPERATING THEATRE LIGHTS FOR MAJOR SURGERY: 300,000 LUX

- D 1200 (D600+D600): 300,000 LUX
- D 600: 150,000 LUX
- D 800 (D400+D400): 200,000 LUX
- D 1000 (D600+D400): 250,000 LUX
• **ELLIPTIC LIGHTS**

• The correct illumination of the operating field requires “Quality light”.

• Quality GIMA offer, satisfy requisites of quality:
  - exact reproduction of IRC colours
  - total elimination of the shadows on the operation field
  - deep illumination to highlight smallest details
  - cold light, avoiding dehydration of the tissue
  - uniform wave length
- Luminous intensity can be adjusted electronically by 20,000 lux up to maximum intensity
- Central and lateral non stop 360° rotation
- Rapid engagement handle sterilizable at 134°C
- Diffusion screen in tempered glass protects luminous source
- Light aluminium structure (Ø 60 mm) for easy installation
- Optional battery group consisting of batteries, battery charger, and electric circuit with 1 hour autonomy.
- “Elliptic” reflector for excellent luminous intensity
- DLE device consisting of electronic commutation card and reserve lamp for immediate reserve lamp switch-on in case of damage of main lamp (standard for D600, optional for D400).
- Lights include iron anchoring tube, ceiling welded plate, covering and control board with transformer
• Technical-illumination performance, unique of its kind
• Complex mathematical calculations permitted the creation of the original and revolutionary stratified and in-depth elliptical reflector for intense shadowless light.
• The reduced dimensions and the lightness of the reflector give the product stability and make it extremely easy to handle.
• Special filters eliminate the infrared rays generated by the halogen lamp, guaranteeing cold light.
• The luminous beam is always in focus, from a minimum distance of 60 cm.
• The diameter of the illuminated field is manually adjustable by rotating the sterilizable handle at the centre of the reflector.
LED LIGHT INNOVATIVE TECHNOLOGY

This new source of compact light provides many advantages:

- LED do not emit infrared rays so that the light generated is completely cold
- LED do not emit ultra violet rays
- The life of LED is over 50,000 hours (over 25 times than traditional lamp)
- The colour temperature always remain constant
- Every parabola reflects homogeneous white light without showing edges of colour on the illuminated part
- Low power consumption for a more economic solution (increasing battery autonomy up to 4 hours)
• **PENTALED 30 (15+15): double colour selection**
• Is a high-tech surgical light with LED Technology.
• Light beams are indirectly reflected through an elliptical parabola to obtain shadowless light.
• Light can be easily selected through an electronic device to obtain two different colour temperature of 4,500°K or 5,000°K.
• Only 30 LEDS for 100 Klux.
• Optional battery with 4 hours autonomy.
<table>
<thead>
<tr>
<th>Technical Specifications</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light Intensity at 1 m distance (Ec)</td>
<td>60 to 100 Klx</td>
</tr>
<tr>
<td>Colour temperature - switchable</td>
<td>4,500 to 5,000 °K</td>
</tr>
<tr>
<td>Colour rendering Index (CRI)</td>
<td>94 / 90 Ra</td>
</tr>
<tr>
<td>Light field diameter where the Illuminance reaches 10% of Ec (d10)</td>
<td>200 mm</td>
</tr>
<tr>
<td>Light field diameter where the Illuminance reaches 50% of Ec</td>
<td>90 mm</td>
</tr>
<tr>
<td>Total radiated energy Ee where the Illumination reaches max level</td>
<td>112 W/m²</td>
</tr>
</tbody>
</table>
SINGLE BULB THEATRE LIGHT
100,000 LUX
• Modern theatre light with innovative design.
• Its single bulb system focuses the light deeply inside tissues and not only around them.
• A sterilizable handle enables the user to adjust light field size.
• Uniform parabola shape for easy cleaning.

Theatre light with battery group.
• Available with battery group and automatic charger, lead acid battery, maintenance free, 1 hour autonomy, 6 hours recharging time.

DLE - Lamp switch automatic system - available on request
• Light can be equipped with 2 electronically controlled halogen lamps.
• In case the main lamp does not work, the second lamp automatically takes over and a LED flashes to warn.
TECHNICAL SPECIFICATIONS

- Halogen bulb 100 W 24V G 6.35
- Power consumption: 100 W
- Bulb life: 2,000 h at 22.8 V
- Light intensity: 100,000 lux from the distance of 1 m
- Colour temperature: 4,200 K +/- 5%
- Diameter illuminated field: from 100 to 180 mm
- External diameter of the reflector: 400 mm
- Colour: white RAL 9003
- Regulations: IEC 60601-2-41 93/42/EEC, EMC 89/336CEE
- Weight: 38 Kg (mobile stand version)
- Power supply: 230/24 V - 50/60 Hz. (110V on request)
THEATRE LIGHTS - 3 HALOGEN BULBS - 50,000 LUX

THEATRE LIGHT with three 25W-12V halogen bulbs
- The multiple luminous fonts and the parabolic arch calculated for each parabola avoid shaded areas.
- Sensible mechanical movement allows easy positioning and adjustability.
- A practical sterilizable handle allows to focus the light beam.
- Does not require periodical maintenance.
- Bulb-replacement (life 3,000 hours) is extremely easy.

Battery group with automatic charger:
- Light is available with battery group.
- Lead acid battery, maintenance free, 1 hour autonomy, 6 hours recharging time.
TECHNICAL SPECIFICATIONS

- Light intensity: 50,000 lux from a distance of 1 m
- Diameter of the reflector: 400 mm
- Light field size adjustable from-to: 84-160 mm
- Bulbs: 3 x 25 W - 12 V halogen - life 3,000 h
- Colour temperature: 4,000° K +/- 5%
- Power supply: 230/12V - 50/60 Hz (110V on request)
- Norms: IEC 60601-1, IEC 60601-2-41 - MDD 93/42/EEC
SATURNO MINOR SURGERY
OPERATING LIGHTS - 40,000 LUX

Rotation at 10° on the vertical stand without need to rotate base

Cold light: the parabola in optical glass is vacuum treated with deposit of thin layers to filter the infrared rays (heat) and allows issuing cold light onto the operative field

30705

4 antistatic rubber castors (2 with brake)

360° rotation without stopping

Vertical movement

Load bearing “Light structure” in aluminium with tubing Ø 45 mm facilitates installation for any type of ceiling or wall

30706

30707
• SATURNO MINOR SURGERY LAMP
• SATURNO is a shadow-less type lamp suitable for small surgery and first-aid room.
• Available in three versions: mobile with castors, wall and ceiling.
  - Light beams are generated from a 75W 12V halogen bulb.
  - Vacuum treated glass parabola eliminates 98% of IR rays enabling cold light.
  - Heat is dissipated through aluminium reflector.
  - Glass protection filter grants colour temperature of 3,500K.
  - Parabolic arc grants shadow less and deep light, no focus adjustment needed.
TECHNICAL SPECIFICATION

Light intensity at 1 m distance
Colour temperature of radiated energy
Halogen bulb 75W 12V G.6.35
Consumption
Average lamp life of halogen bulb approximately at 12V
CRI (chromatic rendering Index)
Light field where the Illumination reaches 10% of Ec (d10)
Depth of Illumination (L1+L2) at 20%
Focusable at a distance from - to
Absorption Infra-red rays
Total radiated energy Ec
Light body diameter/Glass parabola diameter
Useful lighting surface of the cupola
Sterilizable handle
Weight (ceiling, mobile, wall)
Power requirements
Minimum height of the room (ceiling version)

Standards: IEC 60601-2-41, MDD 93/42 CEE, medical device of Class I,
PENTALED 12 - 50,000 LUX
PENTALED 12

- Pentaled 12 is a perfect combination of technological developments, innovative, ergonomic and compact design, ultra-light and handy structure.

- Five versions available (trolley, ceiling, ceiling double, trolley with battery group and wall) and technical performances make Pentaled 12 suitable in any situation for precision operations, diagnostic use, preoperating theatres and test laboratories.

- Battery group available on request also for wall and ceiling models.

LED LIGHT

- 5,000K bright and cold light reproduces colours faithfully, assuring excellent definition of details.
• The physical principle of reflection is applied through a system of ellipses.
• They reflect the light rays emitted by the LED on the lighting surface, obtaining a high light intensity with a reduced number of LED: over 50,000 lux at a distance of 1 metre with just 12 LED.
• The indirect light does not dazzle and does not strain the eyes and favours concentration.
• ERGONOMIC
• The ultra-flat lighting body is equipped with ultra-resistant polycarbonate screen which guarantees protection against accidental collisions.
• PENTALED12 can be easily positioned by rotation on 4 axes:
  - The structure has a side full-circle handling without any stops
  - The arm moves vertically thanks to a spring-compensated balancing system
  - The reflector can be rotated on the vertical and horizontal axis.
## TECHNICAL SPECIFICATIONS

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Light intensity at 1 m distance</td>
<td>Lux 50,000</td>
</tr>
<tr>
<td>Colour temperature</td>
<td></td>
</tr>
<tr>
<td>LED</td>
<td></td>
</tr>
<tr>
<td>Average LED life</td>
<td>12,000</td>
</tr>
<tr>
<td>CRI (Chromatic rendering Index)</td>
<td>90</td>
</tr>
<tr>
<td>Light field where the illumination reaches 50% of Ec (d50)</td>
<td>Ø mm 85</td>
</tr>
<tr>
<td>Light field where the illumination reaches 10% of Ec (d10)</td>
<td>Ø mm 140</td>
</tr>
<tr>
<td>Depth of Illumination (L1+L2) at 20%</td>
<td>mm 150</td>
</tr>
<tr>
<td>Total radiated energy Ec</td>
<td>W/m² 119</td>
</tr>
<tr>
<td>Weight (ceiling, mobile, wall, double)</td>
<td>Kg 18-13-12-20</td>
</tr>
<tr>
<td>Power supply</td>
<td>V/Hz 100-230V, 50-60Hz</td>
</tr>
<tr>
<td>Minimum height of the room (ceiling version)</td>
<td>mm 2200</td>
</tr>
</tbody>
</table>

Standards: IEC 60601-2-41, MDD 93/42 CEE, medical device of Class I,
ESALED SHADOWLESS, COLD LIGHT LAMP - 30,000 LUX
• **COLD LIGHT LAMP WITH LED TECHNOLOGY SHADOWLESS TYPE**

• - 6 white LED of 2.5W each 24V - 30,000 lux at 50 cm distance

• Six leds light sources of 2.5W each with glass lens to optimize the light performance.

• It is possible to assure shadowless light and low radiated energy temperature.

• ESALED is suitable for examination purposes, it is unsuitable for surgery room.

• Other fixing system, available (wall, rail, table).

HALOGEN LIGHTS

- **30700 POLAR LIGHT** - on trolley
  Scalytic-type lamp with cold and deep light Halogen 50W 24V - 40,000 lux
  The light beam is generated by halogen.

- **30747 SOLESUD 2** - on trolley
  Halogen examination light with articulated joint arm.
  30747 SOLESUD 2 lux.

- **30760 SIMPLEX** - on trolley
  Halogen examination light with flexible arm.

- **40,000 LUX**

- **WITH 2 BULBS**
  40,000 LUX

- **30,000 LUX**
  73/23
  Length of arm + lamp 95 cm
MAGNIFYING FLUORESCENT COLD LIGHTS - 3 DIOPTRES

SOLENORD
Suggested for dermatology. It is equipped with a biconvex magnifying glass diameter 120 mm, in optical glass. The cold fluorescent light allows prolonged use. Light source protection in plexiglass. Thanks to its spring arm and to the 5 castors trolley it is easy to change its position whenever necessary. Fluorescent circline 230 V. Certified by IMQ, the most important Italian notified body. Made in Italy.

GIMANORD
Magnifying glass self-illuminating fluorescent cold light 3 dioptres (1.75 x). Suggested for dermatology. It is equipped with a biconvex magnifying glass Ø 120 mm in optical glass. The cold fluorescent light allows prolonged use. Light source protection in plexiglass. Available also with wall support. Made in Italy.
WOOD BLUE LIGHTS: TROLLEY, MANUAL AND POCKET MODELS

- **31195** WOOD DELUXE - manual
  - **31199** WOOD DELUXE - on trolley
  These new models have integrated rectangular biconvex magnifying glass 105x53 mm - 4 dioptres.
  Size: 200x195xh47 mm - Weight: 0,3 kg
  - **31198** NEON BULB 4W - spare
  (135xØ 25 mm)
  - **30769** TROLLEY for 31199 - spare

- **31191** WOOD BLUE LIGHT - manual
  - **31192** WOOD BLUE LIGHT - on trolley
  Special blue fluorescent light for the detection of details and colours invisible under normal light system.
  - **31193** 1.5X MAGNIFYING LENS - optional
  - **31194** NEON BULB 6W - spare
  (210x Ø 25 mm)
  - **30773** TROLLEY for 31192 - spare

- **31189** POCKET WOOD LIGHT
  Pocket ultraviolelt light, to detect skin disorders. Also provided with a standard white light 3W. Works with 4xAA batteries with 4-6 hours autonomy.

**TECHNICAL SPECIFICATIONS**
(31191-31192-31195-31199)

- Length long wave 360 nm
- Norms: CEI 62-5, IEC 601-1, CE 93/42/EEC
- Operating voltage: 230 V-50 Hz (60 Hz on request)
  (not available at 110 V)

- Weight 110 g w/o batteries
- Size: 17 x 6 x 2 cm
References

- Buyers Guide: Operating Theater Lights By NHS
- 08A-Medical-light-ING – Medical Lights User Manual