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Best Practices for Healthcare Lighting Operating Room & Hybrid OR

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Key Focus Areas









Current OR Design

- Tight spaces with many people
- New technology often makes spaces more crowded
- Risk of tripping, infections, accidentally harming each other with sharp instruments





Planning for Surgical & Diagnostic Spaces



An understanding of the following is required to inform the planning of diagnostic, surgical, and interventional spaces.



- Level of invasiveness, likelihood of infection
- Type of sedation used to conduct procedure
- Number of staff expected in the room during procedure
- Equipment needed to support procedure

Which, in turn, determine the design requirements:

• Room classification

Procedure room (formerly Class A) Operating room (formerly Class B & C) Type of Imaging room (new Class 1, 2, and 3)

- Room size
- Room finishes
- Room Infrastructure (MEP systems)



Three Classes of Rooms



Procedure Imaging Room Room Type Type		Use		
Exam/ Treatment Room	Class 1 Imaging Room	A room designated for the performance of patient care that may require high-level disinfected or sterile instruments but is not required to be performed with the environmental controls of a procedure room.		
Procedure Room	Class 2 Imaging Room	A room designated for the performance of patient care that requires high-level disinfection or sterile instruments and some environmental controls but is not required to be performed with the environmental controls of an operating room.		
Operating RoomClass 3 Imaging room (Hybrid OR)A root rest for pro con 170		A room that meets the requirements of a restricted area, is designated and equipped for performing surgical or other invasive procedures, and has the environmental controls for an OR as indicated in ASHRAE 170. An aseptic field is required for all procedures performed in an OR		

Operating Rooms & Hybrid Operating Rooms are **Class 3 spaces**, designated for surgical and invasive procedures.

An aseptic field is required for all procedures performed in these spaces.

OR & Hybrid OR Guidelines



Room Type	Use	Environmental Controls			In both areas
		Location	Ventilation	Surfaces	in both areas,
Class 3 Imaging room (Hybrid Operating Room)	Invasive procedures* Any Class 2 procedure during which the patient will require physiological monitoring and is anticipated to require active life support	Accessed from a semi- restricted area	 20 total ACH, Positive pressure Primary supply diffuser array extend a minimum of 12' beyond the footprint of the surgical table on each side At least two low sidewall return or exhaust grilles spaced at opposite corners or as far apart as possible 	 Ceiling: Monolithic, scrubbable, capable of withstanding cleaning and/or disinfecting chemicals, gasketed access openings Flooring: Cleanable and wear-resistant for the location; stable, firm, and slip-resistant Floor and wall base assemblies: Monolithic floor with integral coved wall base carried up the wall a minimum of 6 inches Wall finishes: Washable; free of fissures, open joints, or crevices 	 (1) monolithic, (2) scrubbable, (3) capable of withstanding disinfecting
Operating Room	Invasive procedures* Any procedure during which the patient will require physiological monitoring and is anticipated to require active life support			 Ceilings: Monolithic, scrubbable, capable of withstanding cleaning and/or disinfecting chemicals, gasketed access openings Floor and wall base assemblies: Monolithic with an integral coved wall base that is carried up the wall a minimum of 6' Wall finishes: Free of fissures, open joints, or crevices that may retain or permit passage of dirt particles 	chemicals (4) gasketed at access openings



OR Design: Conventional Wisdom



Laminar Flow Ventilation

Boom-Mounted Surgical Lights



Laminar Flow vs. Turbulent Flow





What's Above the Ceiling?





- **1.** Ceiling Super-Structure
- 2. Raceway
- **3.** Intermediate Structure
- 4. Air Diffuser Modules
- 5. Perimeter LED Troffers



Challenging The Conventional Wisdom

Laminar Air Flow

November, 2022

Better Operating Room Ventilation as Determined by a Novel Ventilation Index is Associated With Lower Rates of Surgical Site Infections

Ib Surial, Bernard MD*; Atkinson, Andrew PhD*; Külpmann, Rüdiger PhD*; Brunner, Arnold*.*; Hildebrand, Kurt*.5; Sicre, Benoît PhD*; Troillet, Nicolas MD^{1,1}; Widmer, Andreas MD^{1,4}; Rolli, Eveline*; Maag, Judith MPH¹; Marschall, Jonas MD*.^{1,**}

"Previous studies have ignored many parameters that influence air flow"

December, 2018

Cost Effectiveness of Laminar Flow Systems for Total Shoulder Arthroplasty: Filtering Money from the OR?

Daniel E. Davis, MD, MS¹; Benjamin Zmistowski, MD¹; Joseph A. Abboud, MD¹; Surena Namdari, MD, MSc¹

"Laminar flow would need to reduce the incidence of [periprosthetic joint infection] by **35.1%** to be a cost-effective strategy."

October 16, 2020

One More Study Showing No Benefit Associated With Laminar Flow in the Operating Room

E. Patchen Dellinger, MD¹

Boom-Mounted Surgical Lights

March, 2019

Influence of the Arrangement of Surgical Light Axes on the Air Environment in Operating Rooms

Tetsuya Kai, 1 Nobuyasu Ayagaki, 2 and Hidekazu Setoguchi 3

"Persistent stagnation of [air] was observed below single-axis lighting."

September, 2010

On the applicability of the laminar flow index when selecting surgical lighting W.A.C. Zoon, M.G.M. van der Heijden, M.G.L.C. Loomans, J.L.M. Hensen

"The infection risk was found to be proportional to the projected surface area of the lamp. Although different lamp shapes resulted in a distinctly different flow pattern in the room, this did not affect the infection risk in a significant way."

May, 2009

Influence of the shape of surgical lights on the disturbance of the airflow Zoon, W.A.C.^{1,2}, Heijden, M.G.M. van der^{1,2}, Hensen, J.L.M.¹ and Loomans, M.G.L.C.¹

"Operating room ventilation systems are used to keep the wound area of a patient free from airborne bacteria. Surgical lighting is one of the major disturbances in operating room ventilation systems."



Challenging The Conventional Wisdom

December, 2018

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"The increased rate of [infection] is potentially explained by obstruction of laminar flow from overhead theater lights leading to eddies of contaminated air above the surgical field."





NBBJ's "OR 21" Concept

- Designed in 2015, this proposed "operating room of the future" combines laminar flow with hands-free *recessed motorized* surgical lights
- Could this be the best of both worlds – laminar flow without pathogen "eddies"?
- Now possible, with **INFRALED PRO** from Kirlin!





The Future of ORs

- COVID has shown how rigid current healthcare spaces are
- More nimble designs in the future
- Traditional boundaries blurring on where procedures take place





Lighting an OR with Recessed Sealed Fixtures

Enhanced Visual Acuity

ORs require powerful, accurate surgical lighting in combination with proper perimeter lighting to prevent eye strain



A Safer Environment

Over 20% of all HAIs originate in the Operating Room. Cleanroom-Rated IP65 and IP66 luminaires (fixed or motorized) help prevent infection.





Best Practices: Lighting the Modern OR





Surgical Site Lighting in the Operating Room



PRO 45: Surgical Site Lighting

Kirlin Lighting's INFRALED[®] PRO 45 provides ideal lighting for the Operating Room



Enhanced Visual Acuity

- 360° rotation and up to 45° tilt for illumination of surgical site
- Fully dimmable & remote-adjustable



A Safer Environment

- Fully recessed with IP66 trim and sealed housing
- Sterile and easy to clean



• Replaces imposing boom lights





INFRALED[®] PRO: Better than the Boom!



- Difficult to clean or disinfect
- Often under-powered
- Physical hazard with drift issues

- Difficult to clean or disinfect
- Often under-powered
- Impossible to find
- Trip & fall hazard

- Fully recessed with IP66 trim & anti-microbial finish
- Easy to disinfect (luminaires & controls)
- One touch direction and intensity control

High CRI in Multiple Chromaticities

The difference is **95 CRI** with ultra-high R6, R9, R13 and R15





3 Chromaticities (Color Temperatures)

3500K	Labor/Delivery
Mid-White	NICU
4100K	ICU
Cool White	Cath Lab
5000K	EP Lab
Ultra-Cool White	Hybrid OR



Ambient & Perimeter Lighting in the Operating Room



Infection in the Hospital



THE PROBLEM

Without lensing, gasketing, or a sealed housing, pathogens and bacteria from the environment mix freely with pathogens and bacteria from the plenum, increasing the risk of widespread infection throughout the hospital.



Three Levels of Infection Control





Kirlin Cleanroom Lighting in the OR: Level 3



LRC-04IPD





BioGard Antimicrobial Finish



IP66 Ingress Protection



ISO 5 / Class 100 Cleanroom



Why Green (521nm)?

Surgeons tend to prefer "**lights out**" along the perimeter of the OR during video-assisted procedures, for optimal monitor viewing.

Others in the room, such as anesthesiologists and nurses, require illumination to perform their tasks.

Green light is the best compromise – it leads to **enhanced monitor-viewing** with low glare, while providing **sufficient ambient light** for other necessary tasks around the room.





MRI-Safe Lighting in the Hybrid OR

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CARE+CLEAR

8000l

Ban



Lighting the Future Since 1895

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SmartLED[™] MRI Lighting System



IRLIN

The #1 Turn-Key MRI lighting system engineered to ensure accurate scans throughout the life of the magnet:

- **29 Fixtures:** Downlights, Adjustables, Wall Washers, Sconces, Surface Mounts, Scenic Panels, 2x2 White Panels, Linear Slot
- SmartLED[™] Remote Driver Cabinet
- SmartLED[™] RFI/EMI Filter (Two Models)
- Emergency Power



Spotlight: Operating Rooms & Hybrid ORs at David Koch Center



First-of-its-Kind MRI/PET/Angiography Suite





- Procedural Lighting
- Ambient Lighting

In the Specifier's Words:

"We are proud to have collaborated with NYP to create this unique space. This colocation and arrangement of equipment allows clinicians to diagnose, plan, and precisely guide procedures all in one place, at one time."

- Shawn Billiard, Project Architect, Ballinger



Fun Fact: Look Down!



In MRI suites & Hybrid Operating Rooms, there is often a **5 Gauss Line** on the floor.

5 Gauss = 0.0005 T, and that is the point where the magnetic field is weak enough that **ferrous materials pose no harm**.

In a hybrid OR, this is the "do not cross" line for all standard operating room tools and fixtures.



Hybrid Operating Room with X-Ray Imaging





- Perimeter Lighting
 Surgical-Grade Downlights: MRR-07830
 CCT: 3500K
 Output: 2000L
- Procedural Lighting
- Ambient Lighting



Operating Room – Center for Women & Newborns





- Laminar Ceiling
- Green Lighting
- Perimeter Lighting
 Surgical-Grade Downlights: MRR-07550
 CCT: 3500K
 Output: 1500L



Best Practices: Lighting the Modern OR









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<u>Kirlin</u>

Lighting the Future Since 1895

QUESTIONS?

