

Bringing It All Together For Healthcare



Putting Patients and Providers First

Modular Solutions For Sensitive Healthcare Spaces

SLD Technology, LLC, designs and manufactures modular, rapidly-installed and fully-integrated ceiling airflow, lighting and equipment solutions for hospital operating rooms (ORs) and other sensitive healthcare spaces. Our AirFrame®, LEDiffuser® and AirLED® products provide low-turbulence, laminar airflow to control and move airborne particles away from patients and providers, while bathing them with clean, HEPA-filtered air. Compared to field built-up and traditional stick-built systems, SLD products are cost neutral with the added benefit of condensing the construction timeline to a revenue-generating facility.

Responding to the Changing Healthcare Landscape

Health systems and providers are rapidly reconfiguring facilities and services to better align with the quality of care and patient satisfaction metrics driving performance-based reimbursement levels included in the Patient Protection and Affordable Care Act (PPACA). Healthcare-Associated Infections (HAIs) represent an area targeted for performance-based reimbursement prior the PPACA. In October 2008, the Centers for Medicare and Medicaid Services (CMS) ceased reimbursing for treatment of several categories of HAIs not present on patient admission, but subsequently acquired within a healthcare facility. Among the targeted categories are Surgical Site Infections (SSIs) which account for nearly 22% of HAIs and cost U.S. Hospitals between \$3.5 to 10 billion annually. SSIs nearly double the patient length of stay in the hospital, in addition to resulting in more than 6 times the readmissions versus patients without an SSI. While progress has been made in reducing HAIs and SSIs since 2008, the latest statistics from the Centers For Disease Control (CDC) show that much work remains to be done.

HAI Statistics For U.S. Acute Care Hospitals

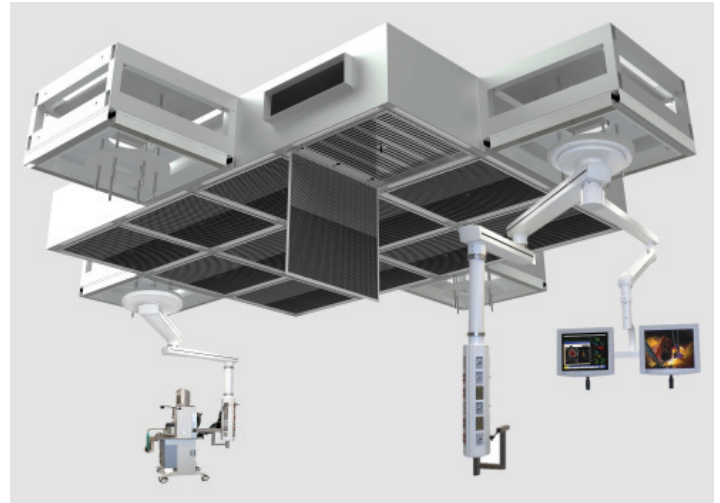
Description	Statistic
Total HAIs (2011) ¹	721,800
Total Deaths (2011) ¹	75,000
Total SSIs (2011) ¹	157,500
Average Cost of Medical Treatment per SSI ²	\$25,546
Average Hospital Length of Stay (Days) ³	10.56 (with SSI) 5.64 (no SSI)
Average Readmissions within 30 Days (per 100 procedures) ³	51.94 (with SSI) 8.19 (no SSI)
Estimated Annual Cost of SSIs in U.S. Acute Care Hospitals ²	\$3.5 to \$10 Billion

¹HAI Data and Statistics, CDC (March 2016)

²Scott, R. Douglas II, CDC (March 2009)

³Shepard, et. al., JAMA Surg., 2013;148 (10):907-914

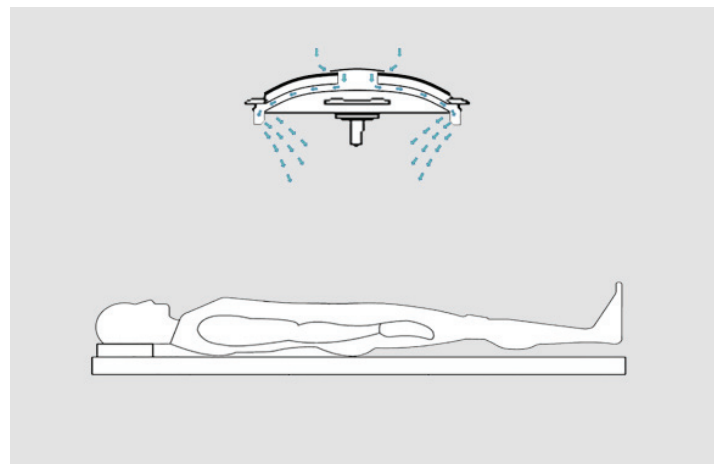
AirFrame® Modular OR and Pharmacy Ceiling Systems



LEDiffuser® Integrated LED Light and Airflow Diffuser



AirLED® Airflow Equalizer System for Surgical Lights



Superior Single Large Diffuser (SLD) Design

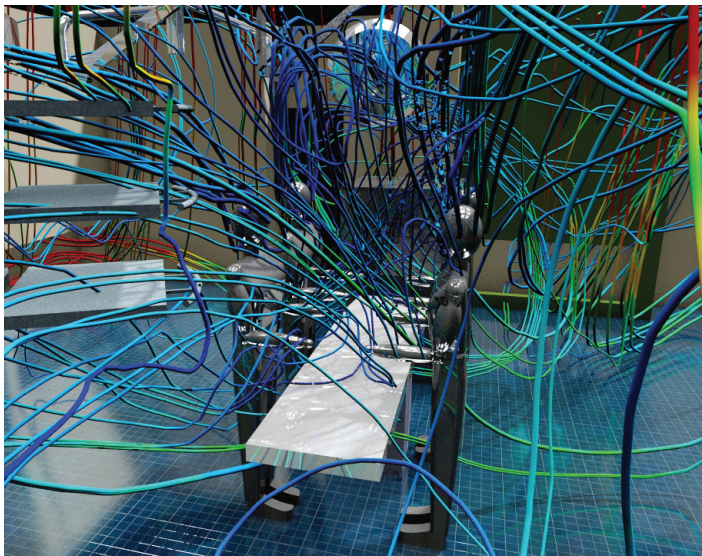
Airborne Particle Contamination Does Happen

Up to 20% of SSIs originate from airborne pathogens, including bacteria.⁴ Squames, or skin scales, are the primary source of bacteria transmission⁵, and nearly 1.15×10^6 to 0.9 to 10^8 squames are generated in a typical 2 to 4 hour surgical procedure.⁶ That is a lot of particles generated from patients and providers, all of which are bouyant and capable of carrying bacterial pathogens!

In an OR, the targeted *sterile field* typically includes the area from the ceiling to the patient and extending 12 inches beyond the edge of the operating table on all sides. Because it is also the area where the patient and providers are concentrated, providing a mechanism to control and remove airborne particles from the sterile field is a necessity to avoid the possibility that they will settle on the surgical site.

Using uni-directional, low turbulence (laminar) airflow is the generally accepted method to effectively grab and sweep airborne contaminants away from a sterile field in a clean space. To achieve this desired effect, semiconductor and other sensitive manufacturing (commercial) cleanroom environments have relied on a SLD airflow design for more than 25 years, virtually eliminating human particle contamination and dramatically improving product yields.

Particle trace model of an OR airflow delivery system designed to meet ASHRAE Standard 170 and FGI guidelines. The erratic particle movement is the result of turbulence in the sterile field, created from the <30% gap allowed in airflow delivery.



(image courtesy of Autodesk)

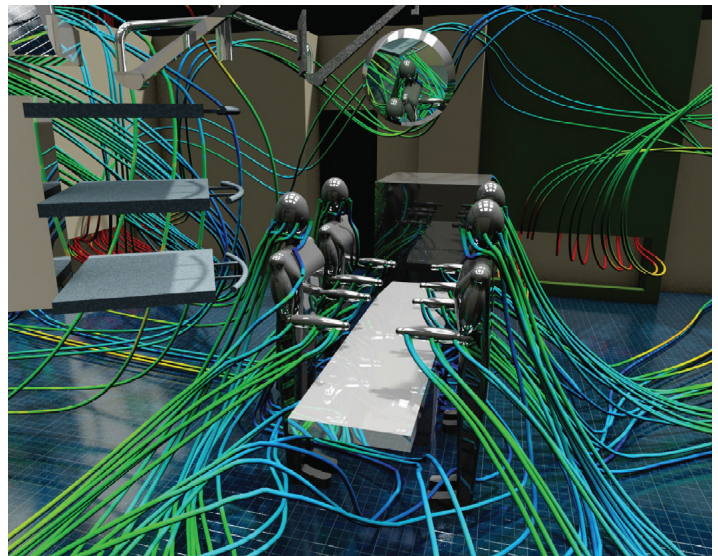
SLD Airflow Design and the OR Environment

SLD airflow systems are designed to provide a contiguous blanket of clean, filtered laminar airflow through the entire sterile field to avoid low pressure zones that naturally result in turbulence. ORs present challenges to achieving laminar airflow in the sterile field versus commercial cleanrooms:

- The environment is dynamic—personnel, procedures and patient vulnerabilities vary for each surgical procedure versus static, process-oriented commercial cleanrooms.
- Ceiling-hung equipment, such as surgical lights, booms and imaging equipment, are a necessity and often traverse the sterile field, blocking airflow from the ceiling.

But perhaps the most important difference involves guidelines and standards. Commercial cleanrooms are defined from Class 1 to 10 (with 1 being cleanest) based on the number and size of airborne particles in the sterile field at any given time using ISO Standard 14644. ORs are designed around ASHRAE Standard 170 and FGI guidelines that specify the number of air exchanges, temperature and humidity in the space, but do not address particle concentrations. The result is that impact of the nearly 30% of an OR ceiling system that can be devoted to non-airflow delivery goes un-noticed in terms of its impact on turbulence and particle movement (see images below).

Particle trace model of an OR airflow delivery system following the same guidelines but using an SLD ceiling system design. With no turbulence in the sterile field, airborne particles are grabbed and swept away from the patient and providers to low level returns.



(image courtesy of Autodesk)

⁴Brachman. Nosocomial infection—Airborne or not? (1970)

⁵Memarzadeh and Manning, Comparisons of Operating Ventilation Systems in Protection of the Surgical Site (2002)

⁶Memarzadeh and Manning, Reducing Nosocomial Infections in ORs (2003)

AirFrame® Modular Ceiling Systems

The Ideal Solution For All Types of ORs

The AirFrame modular ceiling system represents a leap forward in meeting current OR ceiling system design requirements and simplifying future adaptability. The system integrates all OR ceiling-mounted components – including ventilation, filtration and integral lighting and other electrical components, as well as mounting plates, rails or other connection points for medical gas, audio visual, equipment/ lighting booms and imaging equipment – into factory-assembled modules.

Unlike OR ceiling systems advertising modular construction but requiring significant field build-up of separate assemblies, Airframe systems are truly modular – installing in complete modules requiring little or no field assembly beyond pre-determined, factory-integrated connections to services and

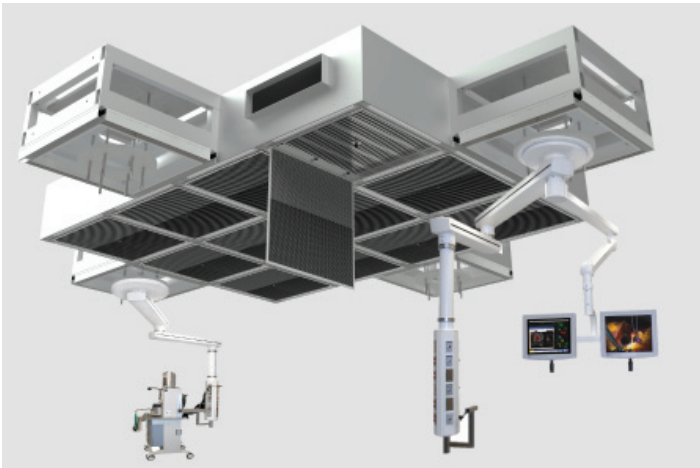
ceiling hung equipment. AirFrame systems are load-bearing, including all forms of ceiling hung equipment and come with a complete set of fully-executed, stamped structural engineering calculations, per local requirement and including all integrated items. And with our 25+ years experience in providing systems for airborne contaminant control and removal in sensitive spaces, you can rest assured that our products are designed with patients and providers at the forefront of achieving the ideal balance between airflow performance, design flexibility, rapid deployment and future adaptability.

Also Ideal For Pharmacy Applications

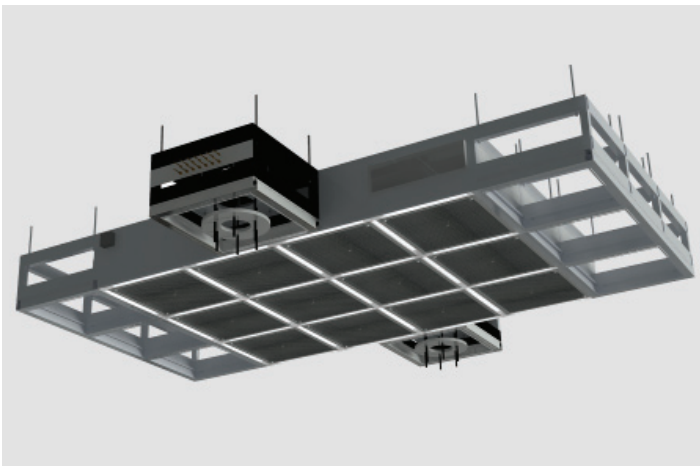
The AirFrame modular ceiling system is certifiable to exceed Class 7 The United States Pharmacopeial Convention. <797> Pharmaceutical Compounding-Sterile Preparations. Revision Bulletin. 2008, p.26.

Configurations

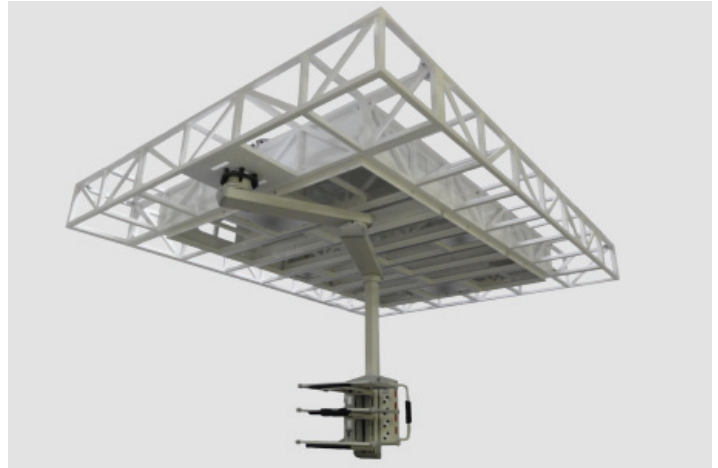
Patent pending FTruss® system provides the lowest first cost and enables ceiling mounted booms and other equipment to be mounted in a 360° circumference around the SLD perimeter.



Custom AirFrame systems can be configured to incorporate equipment or imaging rail systems in the SLD and in combination with the FTruss or PTruss for specialized requirements.



Patent pending PTruss® system provides low first cost and ultimate flexibility to locate ceiling mounted equipment in a 360° circumference around the SLD perimeter now and in the future.



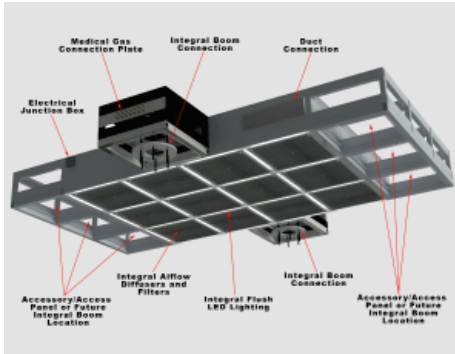
Pharmacy configuration certifiable to exceed Class 7 The United States Pharmacopeial Convention. <797> Pharmaceutical Compounding-Sterile Preparations. Revision Bulletin. 2008, p.26.



User-Friendly Design, Superior Performance

Features and Benefits

Modular design integrates all components into modules requiring no field assembly beyond pre-determined, factory-integrated connections to services and ceiling-hung equipment.



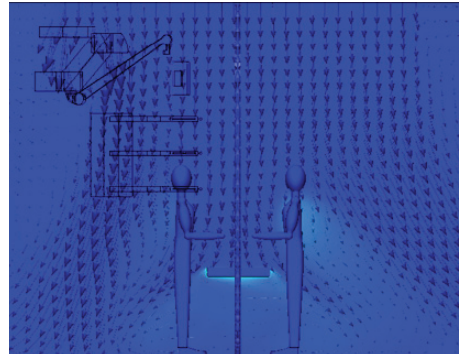
Integral, flush LED lights are UL Listed, dimmable and replace the need for light troffers in the sterile field while providing between 150 to 400 foot candles over the patient.



MERV 14 or ultra-high efficiency HEPA filters include a gel seal edge and are replaceable by a single person from the OR room without removing the diffuser screen or airflow balancing damper.

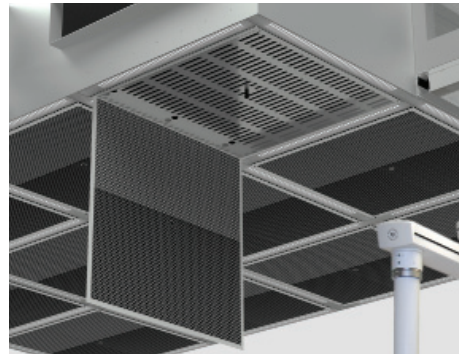


Single Large Diffuser (SLD) provides contiguous laminar airflow to the sterile field to effectively control and remove airborne contaminants from the patient and providers.



(image courtesy of Autodesk)

Hinged diffuser screen and airflow balancing damper provides easy access to filters for change-outs without physically removing the diffuser screen or airflow balancing damper.



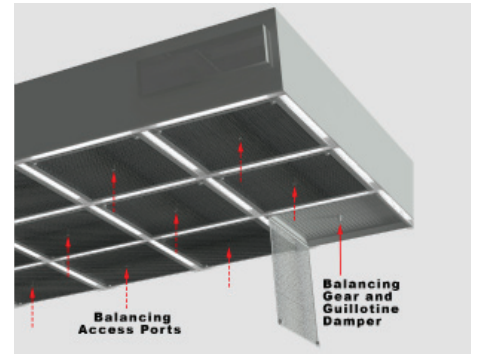
Choose your equipment manufacturer and we provide a complete set of fully-executed, stamped structural engineering calculations, per local requirements, for the entire AirFrame system.



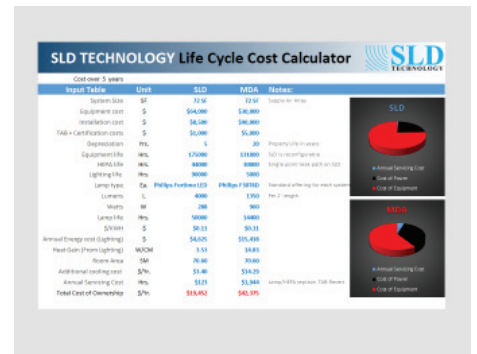
Patent pending AirFrame SLD design includes integral LED lighting, hinged diffuser screens, bottom load filters with a gel seal edge and room-side air balancing with all components in place.



The AirFrame system can be **balanced by a single person from the OR room**, through the individual diffuser screens and directly to the air balancing damper, without touching installed filters.



High efficiency, low maintenance design features include low watt, low heat gain LED lights, minimal leak paths to maximize filter life and a scratch/cleaner-resistant powder coat finish.



AirLED® Airflow System For Surgical Lights

Taking Laminar Airflow in the OR to the Next Level

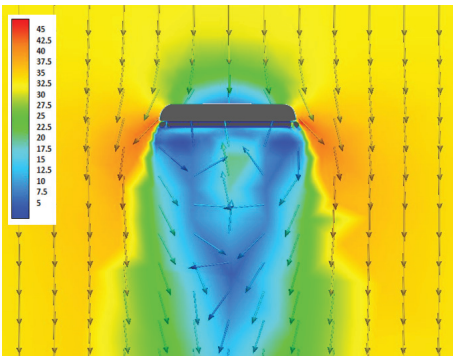
The patent pending AirLED system introduces HEPA-filtered airflow under a surgical light—equalizing pressure beneath the light head to avoid developing low pressure pockets that promote turbulence and unpredictable particle movement.

Surgical lights are one of the most common items introduced into the sterile field. While they are absolutely necessary to illuminate surgical procedures, these lights block airflow coming from the ceiling system, creating a low pressure pocket that will eventually result in updrafts and turbulence.

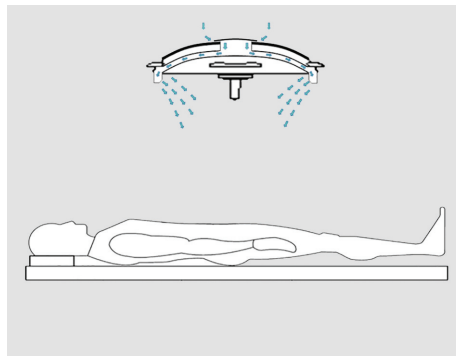
The AirLED concept is integral to the surgical light and uses a small blower and motor to draw air into and through the light head to create a constant mini-clean environment of HEPA-filtered air underneath the light. The system is designed to have no impact on lighting performance, while helping to preserve the laminar airflow environment from ceiling to patient.

Currently under development, the AirLED system will be usable with all major surgical light brands, leaving you ultimate flexibility to use your manufacturer of choice.

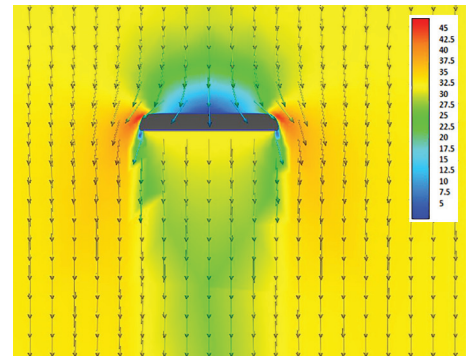
CFD model showing the low pressure zone and turbulence resulting from a surgical light blocking airflow.



The AirLED concept delivers airflow beneath the surgical light head to equalize pressure.



CFD model showing the equalized pressure and elimination of turbulence when using the AirLED system.



LEDiffuser™ LED Light And Airflow Diffuser

One Fixture, Two Functions For Smaller Spaces

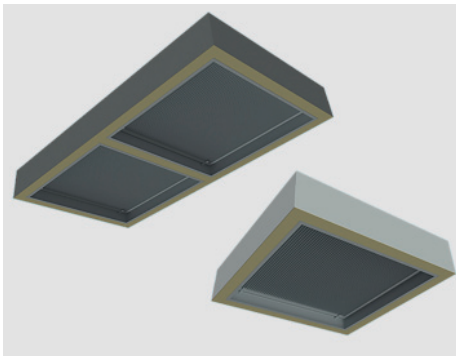
The LEDiffuser provides an economical solution for healthcare procedure, exam, patient and emergency rooms benefiting from uni-directional, low turbulence (laminar) airflow and superior lighting.

This combined LED light and airflow diffuser installs as a single fixture, simplifying room design and cutting in half the time to install separate components. In addition, the LEDiffuser operates as a single fixture—serving the integrated purpose of providing optimized lighting and creating a mini-laminar airflow environment directly beneath its ceiling location.



Features and Benefits

2 x 2 and 2 x 4 ft. versions meet varying coverage needs and include all lighting, filtration and ventilation components.



Hinged diffuser screen and airflow balancing damper provides easy access to filters for change-outs by a single person.



Can be **balanced by a single person from the room with all components in place** and without touching installed filters.



MERV 14 or ultra-high efficiency HEPA filters are replaceable by a single person from the room.



Wall-mounted dimmer control enables doctors, nurses or patients to adjust lighting to their preference or requirements.



High efficiency, long life LED lights provide 3X the lumens, use less than 1/3 the watts and last 3X as long as fluorescents.



OR Ceiling System Comparison

SLD

AirFrame Modular OR Ceiling System. Single source, factory-built and integrated system including all boom mounts, lighting and ventilation components in modules that are attached to the building structure using a few connection points

CSS

Competitive Modular OR Ceiling System. Single source, factory-built and integrated system including all boom mounts, lighting and ventilation components in modules that are attached to the building structure using a few connection points.

SSFB

Single source system that requires structural, boom mount supports, lighting and ventilation components that are individually field-installed and integrated. In many cases, equipment/lighting booms are not included as part of the system and must be coordinated separately.

ISFB

Individually sourced structural, boom mount supports, lighting and ventilation components are field-installed and integrated.

Feature	SLD	CSS	SSFB	ISFB
Factory-built quality	YES	YES	NO	NO
Low turbulence SLD airflow delivery design to help reduce HAIs/SSIs	YES	YES	NO	NO
Integrated mounts for all ceiling-hung equipment	YES	YES	NO	NO
Load bearing capabilities encompass Cath Labs & specialized equipment	YES	YES	NO	NO
Fully executed, stamped structural calculations	YES	YES	NO	NO
Low onsite trade coordination (structural, electrical, HVAC)	YES	YES	NO	NO
Integrated, flush LED lighting (dimmable)	YES	YES	NO	NO
Minimally invasive, low noise construction process	YES	YES	NO	NO
Rapid install, minimum lost revenue time for install	YES	YES	NO	NO
Organized layout and easy access above OR ceiling	YES	YES	NO	NO
Enclosed system, sealed off from interstitial space to avoid dust build-up	YES	YES	NO	NO
5-year property life	YES	YES	NO	NO
Maximum configurability for current needs and future upgrades	YES	NO	NO	NO
Standardized lights and filters (stock or local source)	YES	NO	NO	NO
Field-adjustable height of ceiling-hung equipment mounts	YES	NO	NO	NO
Hinged access panels for filters	YES	NO	NO	NO
Filters easily replaced room-side by one person without removing screens	YES	NO	NO	NO
Room-side air balance by one person with all components in place	YES	NO	NO	NO
Damper control downstream of filter to avoid damage during balancing	YES	NO	NO	NO



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