Overview

Cleanroom HVAC

Innovation

Conclusion

HVAC and Cleanrooms Innovative Technology

Vorasen Leewattanakit (Vorasen@windchill.co.th)

ASHRAE Certified Professional Healthcare Facility Design (HFDP)

ASHRAE Certified Professional Building Commissioning (BCxP)

Professional Engineer ({PE)

Windchill Limited

November 21, 2024

ASHRAE VIETNAM SECTION

1

Overview

Cleanroom HVAC

Innovation

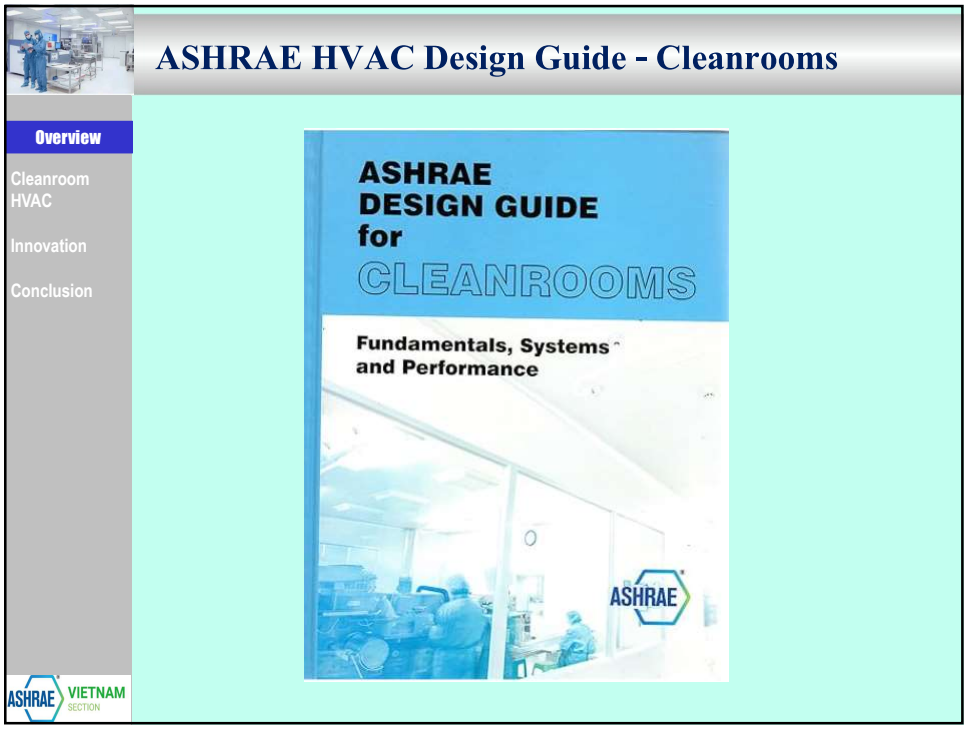
Conclusion

Today Topics

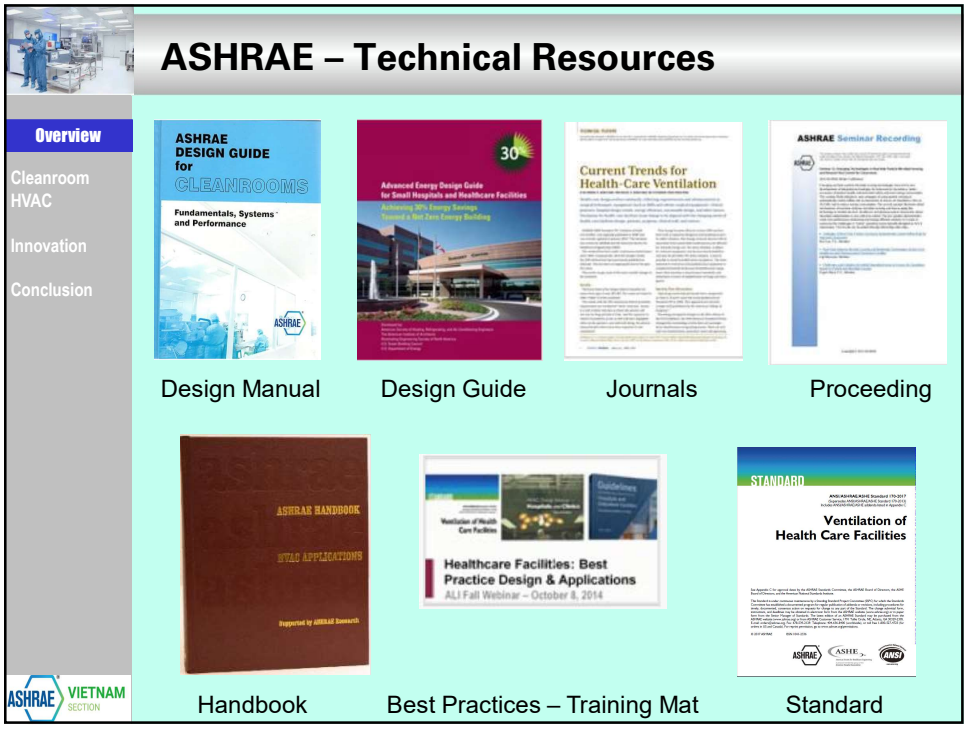
- *Overview of Cleanrooms Market*
- *Cleanrooms HVAC System*
- *Cleanrooms Innovative Technology*
- *Conclusion*

ASHRAE VIETNAM SECTION

2


ASHRAE HVAC Design Guide - Cleanrooms
Overview
Cleanroom HVAC
Innovation
Conclusion
ASHRAE DESIGN GUIDE for CLEANROOMS
Fundamentals, Systems and Performance
ASHRAE
ASHRAE VIETNAM SECTION

3


ASHRAE – Technical Resources
Overview
Cleanroom HVAC
Innovation
Conclusion
Design Manual
Design Guide
Journals
Proceeding
Handbook
Best Practices – Training Mat
Standard
ASHRAE VIETNAM SECTION

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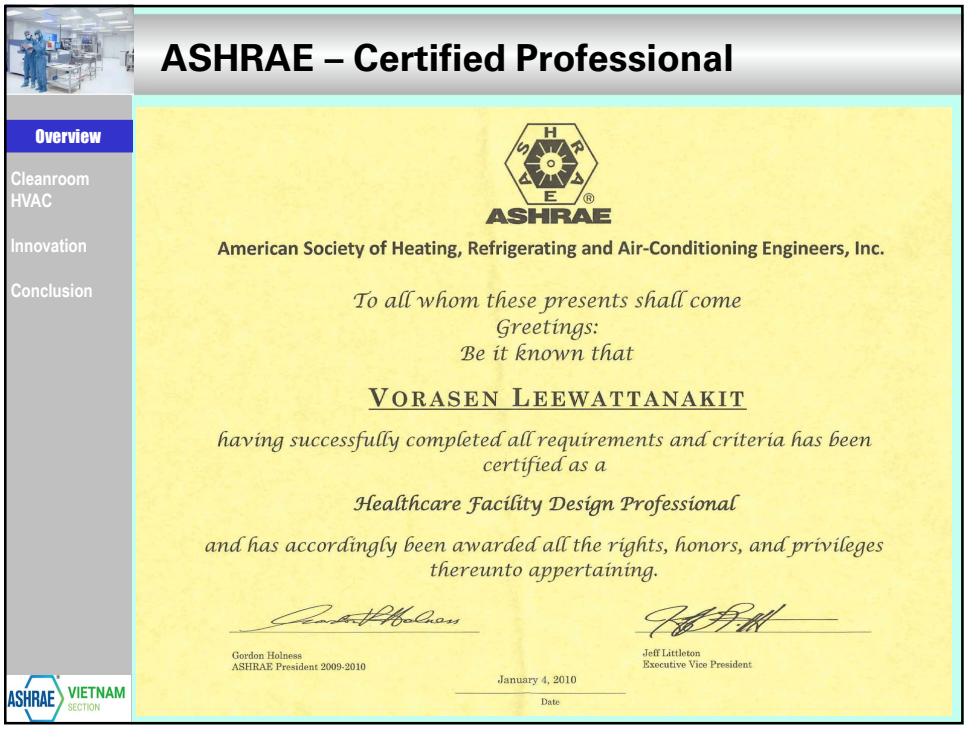
ASHRAE – Certified Professional
Overview
Cleanroom HVAC
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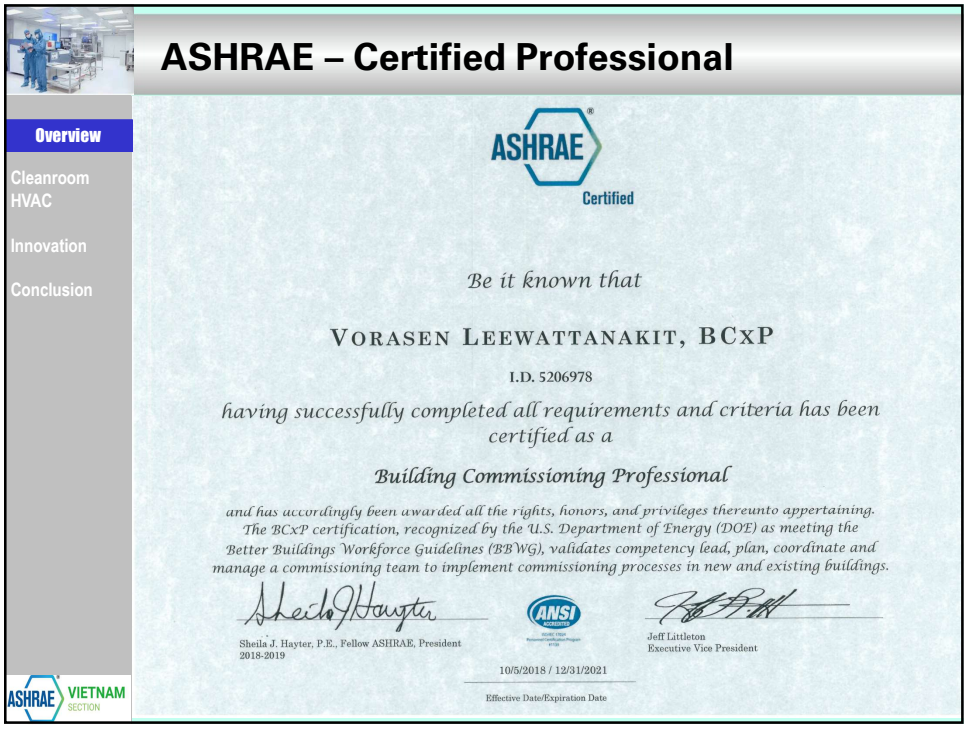
ASHRAE VIETNAM SECTION
ASHRAE
American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.
To all whom these presents shall come
Greetings:
Be it known that
VORASEN LEEWATTANAKIT
having successfully completed all requirements and criteria has been certified as a
Healthcare Facility Design Professional
and has accordingly been awarded all the rights, honors, and privileges thereunto appertaining.
Gordon Holness
ASHRAE President 2009-2010
Jeff Littleton
Executive Vice President
January 4, 2010
Date

5


ASHRAE – Certified Professional
Overview
Cleanroom HVAC
Innovation
Conclusion
ASHRAE VIETNAM SECTION
ASHRAE
Certified
Be it known that
VORASEN LEEWATTANAKIT, BCxP
I.D. 5206978
having successfully completed all requirements and criteria has been certified as a
Building Commissioning Professional
and has accordingly been awarded all the rights, honors, and privileges thereunto appertaining.
The BCxP certification, recognized by the U.S. Department of Energy (DOE) as meeting the Better Buildings Workforce Guidelines (BBWG), validates competency lead, plan, coordinate and manage a commissioning team to implement commissioning processes in new and existing buildings.
Sheila J. Hayter, P.E., Fellow ASHRAE, President
2018-2019
ANSI
Jeff Littleton
Executive Vice President
10/5/2018 / 12/31/2021
Effective Date/Expiration Date

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Overview of Cleanrooms Market
Overview
Cleanroom Technology Global Market Report 2024
The Business Research Company
$9.5 billion
CAGR 6.9%
$7.26 billion
$6.81 billion
2023
2024
2025
2026
2027
2028
Market Size (in billions of USD)
Cleanroom Technology Market Size 2024 And Growth Rate
The cleanroom technology market size has grown strongly in recent years. It will grow from $6.81 billion in 2023 to $7.26 billion in 2024 at a compound annual growth rate (CAGR) of 6.7%. The growth in the historic period can be attributed to increase in the semiconductor industry, rising demand for pharmaceutical sector, production of optical components, increasing awareness of public health.
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WINDCHILL
THE AIR HANDLING SYSTEMS
Turnkey Service for Healthcare, Laboratory and Pharmaceutical Industries.
Laminar Air Flow Diffuser
Modular Operating Room
Custom AHUs
Our Services
Design and Manufacture
Service and Maintenance
Testing and Commissioning
New Construction and Renovation
Windchill, No.1 in air handling systems for premium healthcare.
+66 2 885 2995
sales@windchill.co.th
@windchill
Windchill Ltd.
www.windchill.co.th
THE AIR HANDLING SYSTEMS
Custom AHUs for Healthcare, Laboratory, and Pharmaceutical Industries.
CONTACT
Lami-Flow
LAMINAR AIR FLOW DIFFUSER
CONTACT
ASHRAE VIETNAM SECTION

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A Leading Manufacturer
State-of-the-art customized AHU production plant spans over 10,000 sq. m.
Specialize in designing and manufacturing custom AHUs to meet the specific needs of our customers.
ISO 9001 Certified Quality Management System
ISO 13485 Certified Quality Management System for Medical Devices :
* Design, manufacture, installation and maintenance service of cleanrooms for healthcare industries, including operating theaters, airborne infection isolation units, biosafety laboratories and pharmaceutical factories
WINDCHILL
ASHRAE VIETNAM SECTION

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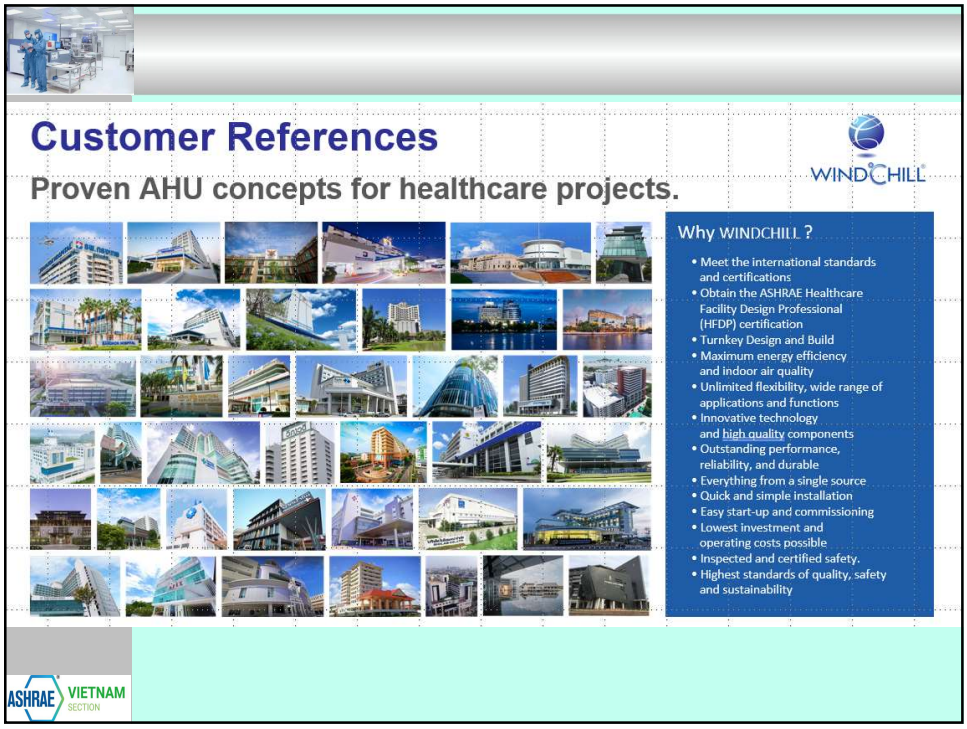
Customer References
Proven AHU concepts for healthcare projects.
WINDCHILL
Why WINDCHILL ?
• Meet the international standards and certifications
• Obtain the ASHRAE Healthcare Facility Design Professional (HFDP) certification
• Turnkey Design and Build
• Maximum energy efficiency and indoor air quality
• Unlimited flexibility, wide range of applications and functions
• Innovative technology and high quality components
• Outstanding performance, reliability, and durable
• Everything from a single source
• Quick and simple installation
• Easy start-up and commissioning
• Lowest investment and operating costs possible
• Inspected and certified safety.
• Highest standards of quality, safety and sustainability
ASHRAE VIETNAM SECTION

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SUSTAINABLE DEVELOPMENT GOALS
WINDCHILL
CERTIFICATE
At WINDCHILL, we are committed to promoting global sustainability by creating healthier indoor environments that consume less energy. We believe that sustainability is a shared responsibility and we strive to do our part by implementing sustainable practices throughout our business.
Green Power for Windchill Site
The electricity consumption of our manufacturing plant is covered by renewables. Passive design is one of the key strategies.
NET-ZERO
ASHRAE VIETNAM SECTION

11


Operating Theater
MAQUET
MAQUET
MAQUET

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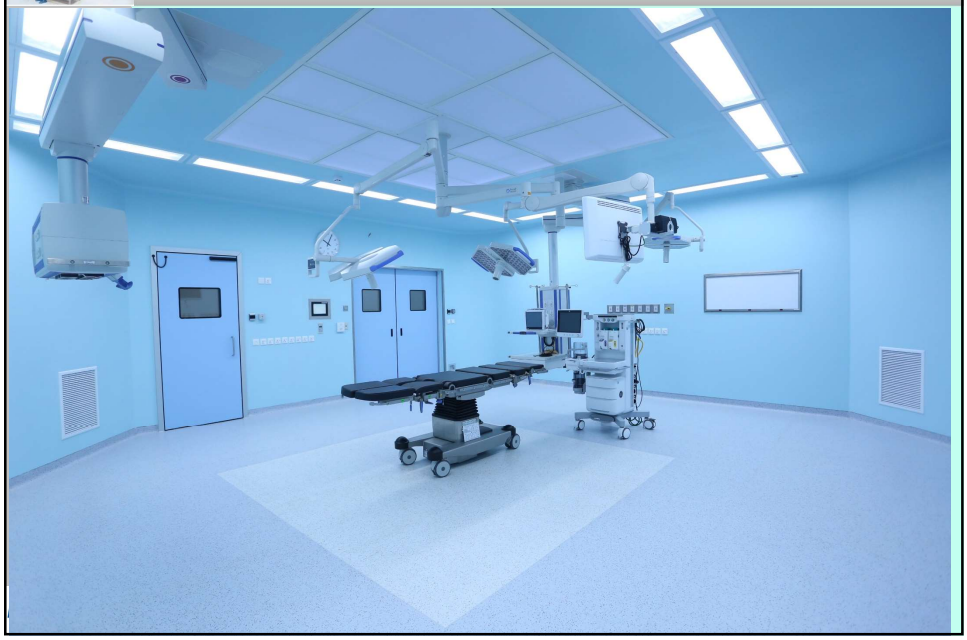
Operating Theater



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Class 100 - Laminar Air Flow Diffuser

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Today Topics

Overview
Cleanrooms HVAC
Innovation
Conclusion

- *Overview of Cleanrooms Market*
- *Cleanrooms HVAC System*
- *Cleanrooms Innovative Technology*
- *Conclusion*

ASHRAE VIETNAM SECTION

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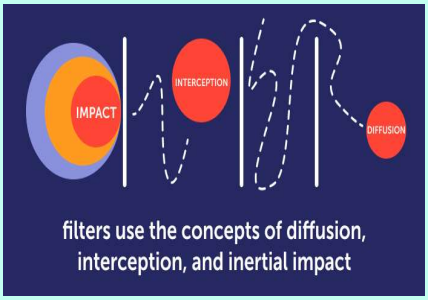
Cleanrooms HVAC System

Overview
Cleanrooms HVAC
Innovation
Conclusion

Description	Normal HVAC	Cleanrooms HVAC
Air Filtration	Standard Filter – Remove Dust and Pollen	Hi Eff Filer – HEPA or ULPA – remove particle, 0.3micron



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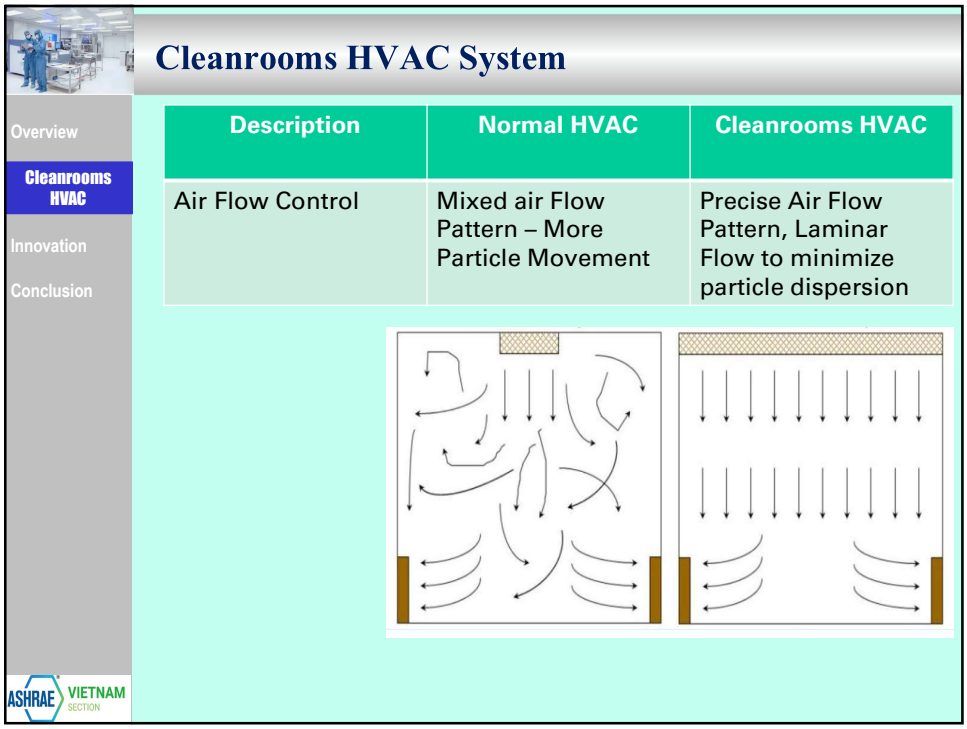

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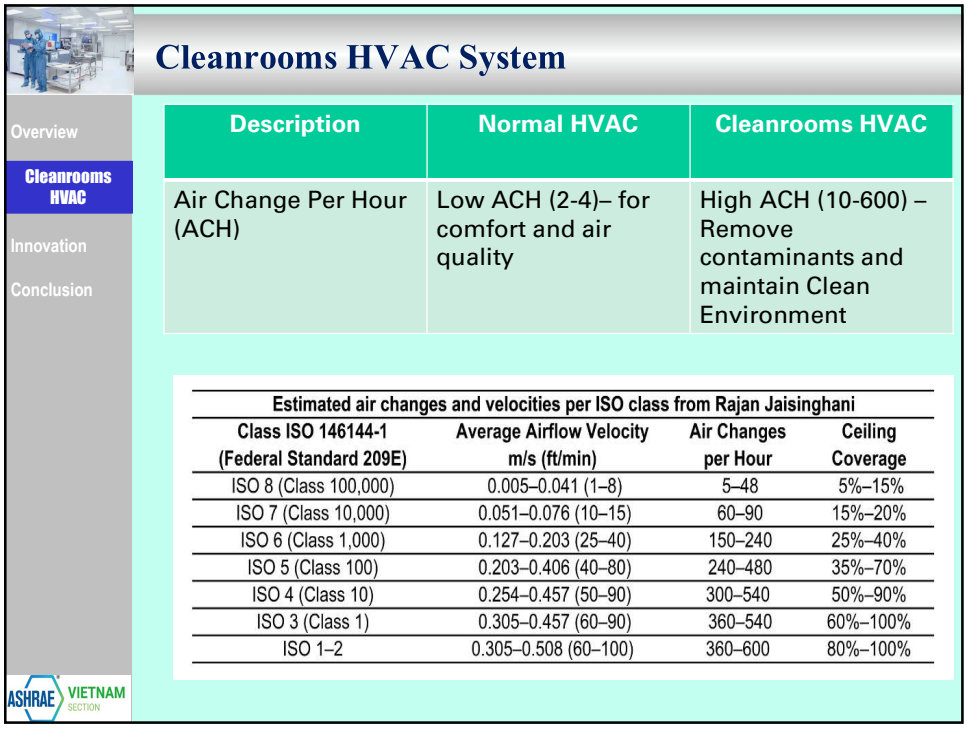

Estimated air changes and velocities per ISO class from Rajan Jaisinghani

Class ISO 146144-1 (Federal Standard 209E)	Average Airflow Velocity m/s (ft/min)	Air Changes per Hour	Ceiling Coverage
ISO 8 (Class 100,000)	0.005–0.041 (1–8)	5–48	5%–15%
ISO 7 (Class 10,000)	0.051–0.076 (10–15)	60–90	15%–20%
ISO 6 (Class 1,000)	0.127–0.203 (25–40)	150–240	25%–40%
ISO 5 (Class 100)	0.203–0.406 (40–80)	240–480	35%–70%
ISO 4 (Class 10)	0.254–0.457 (50–90)	300–540	50%–90%
ISO 3 (Class 1)	0.305–0.457 (60–90)	360–540	60%–100%
ISO 1–2	0.305–0.508 (60–100)	360–600	80%–100%

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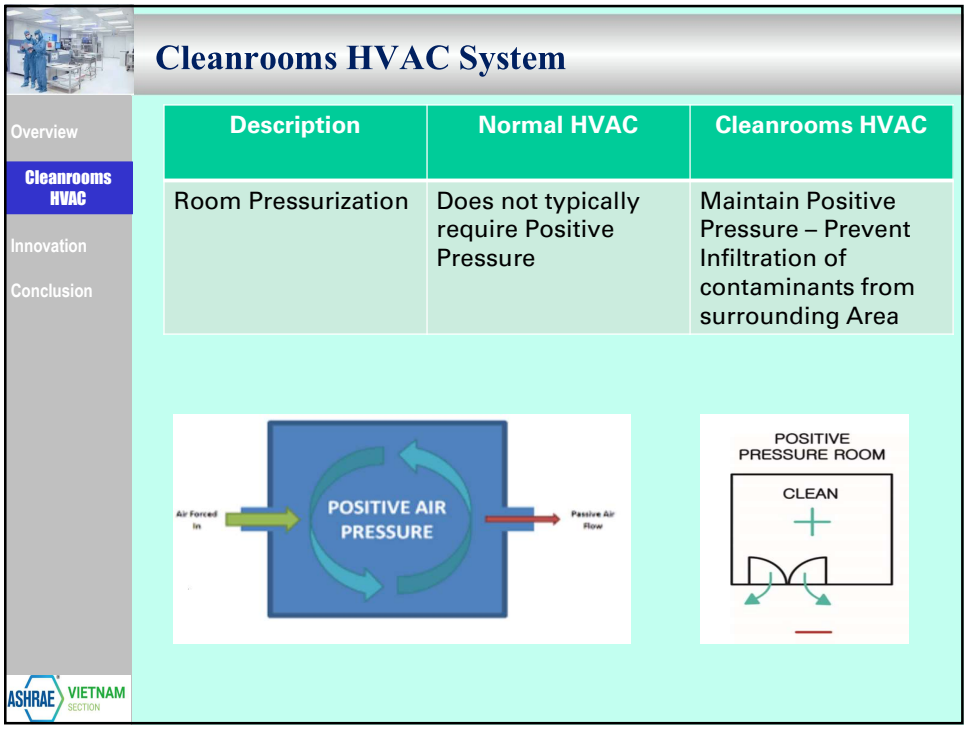
Cleanrooms HVAC System
Overview
Cleanrooms HVAC
Innovation
Conclusion
Description
Normal HVAC
Cleanrooms HVAC
Room Pressurization
Does not typically require Positive Pressure
Maintain Positive Pressure – Prevent Infiltration of contaminants from surrounding Area
POSITIVE AIR PRESSURE
POSITIVE PRESSURE ROOM
CLEAN
ASHRAE VIETNAM SECTION

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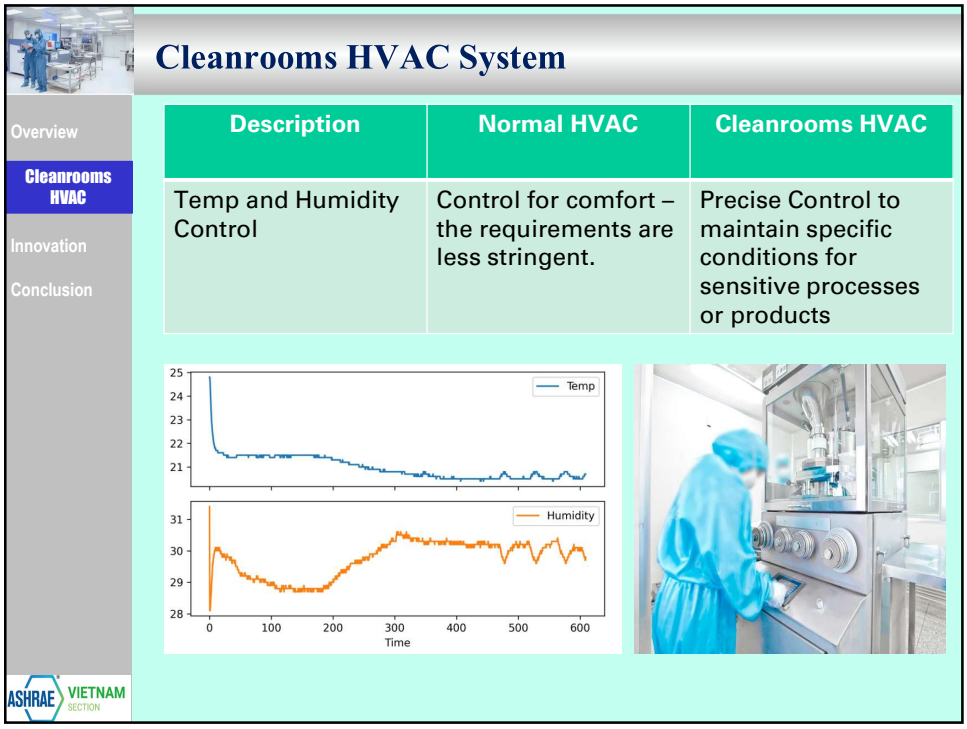
Cleanrooms HVAC System
Overview
Cleanrooms HVAC
Innovation
Conclusion
Description
Normal HVAC
Cleanrooms HVAC
Temp and Humidity Control
Control for comfort – the requirements are less stringent.
Precise Control to maintain specific conditions for sensitive processes or products
Temp
Humidity
Time
ASHRAE VIETNAM SECTION

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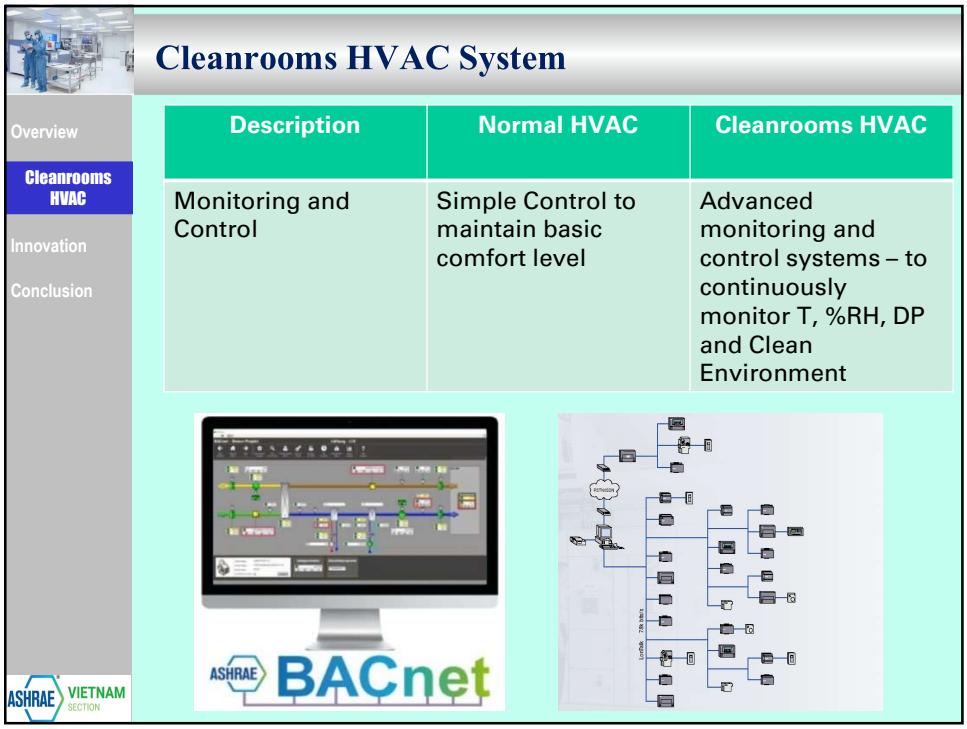
Cleanrooms HVAC System
Overview
Cleanrooms HVAC
Innovation
Conclusion
Description
Normal HVAC
Cleanrooms HVAC
Monitoring and Control
Simple Control to maintain basic comfort level
Advanced monitoring and control systems – to continuously monitor T, %RH, DP and Clean Environment
ASHRAE BACnet
ASHRAE VIETNAM SECTION

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Today Topics
Overview
Cleanroom HVAC
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Conclusion
Overview of Cleanrooms Market
Cleanrooms HVAC System
Cleanrooms Innovative Technology
Conclusion
ASHRAE VIETNAM SECTION

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Cleanrooms Innovative Technology

Overview
Cleanroom HVAC
Innovation
Conclusion

- Advanced Air Filtration Systems
- Energy Efficiency HVAC Systems
- Smart Control and Automation
- Sustainable Materials and Construction Practices
- Renewable Energy Integration

ASHRAE VIETNAM SECTION

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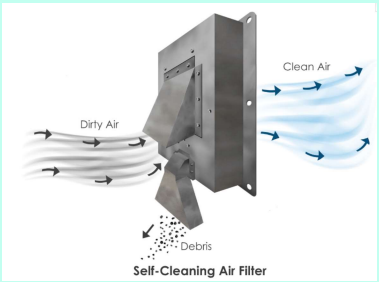
Advanced Air Filtration Systems

Overview
Cleanroom HVAC
Innovation
Conclusion

- Low Pressure Drop High Efficiency Particulate Air (HEPA) Filter
- Molecular Filters
- Self-cleaning Filters



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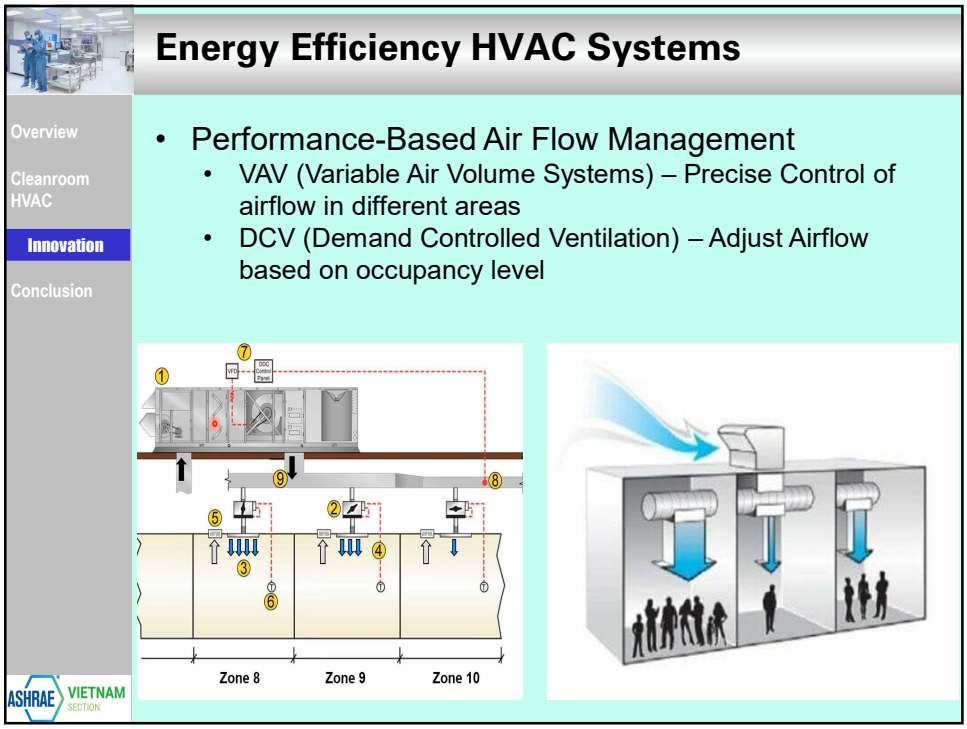
Energy Efficiency HVAC Systems
Overview
Cleanroom HVAC
Innovation
Conclusion
• Performance-Based Air Flow Management
• VAV (Variable Air Volume Systems) – Precise Control of airflow in different areas
• DCV (Demand Controlled Ventilation) – Adjust Airflow based on occupancy level
Zone 8
Zone 9
Zone 10
ASHRAE VIETNAM SECTION

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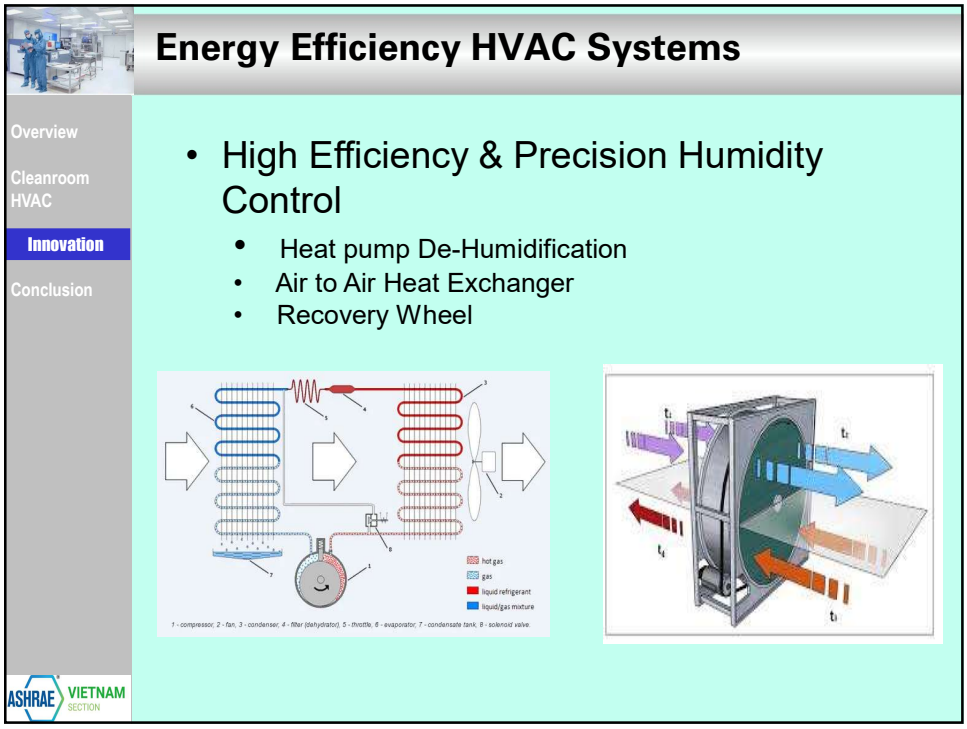
Energy Efficiency HVAC Systems
Overview
Cleanroom HVAC
Innovation
Conclusion
• High Efficiency & Precision Humidity Control
• Heat pump De-Humidification
• Air to Air Heat Exchanger
• Recovery Wheel
hot gas
gas
liquid refrigerant
liquid/gas mixture
ASHRAE VIETNAM SECTION

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Flexibility for Future Change

Overview
Cleanroom HVAC
Innovation
Conclusion

- Oversize of ductwork and piping
- Provision of spare equipment capacity
  - Hi Safety Factor
  - Hi Fan Static Pressure
  - Lower Filter Face Velocity
- Provision of space where equipment modification can occur with minimum impact
- Bacnet – Open Standard / Vendor Independent

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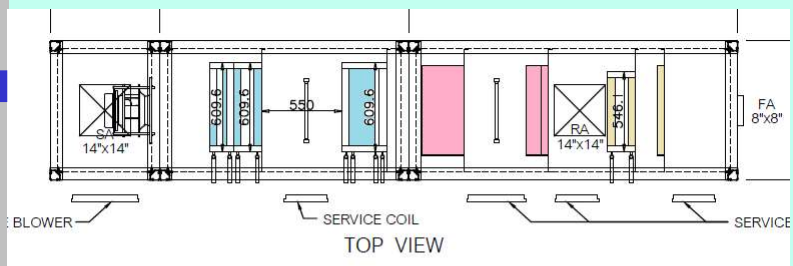
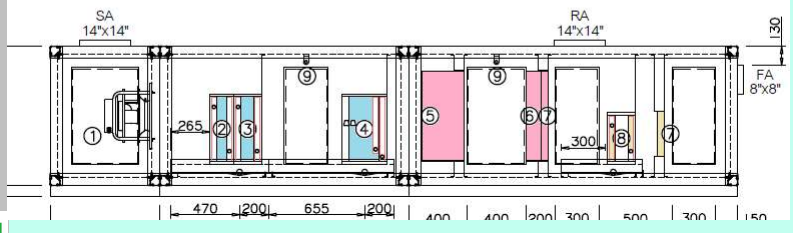
Flexibility for Future Change

Overview
Cleanroom HVAC
Innovation
Conclusion

Space for future expansion / Maintenance





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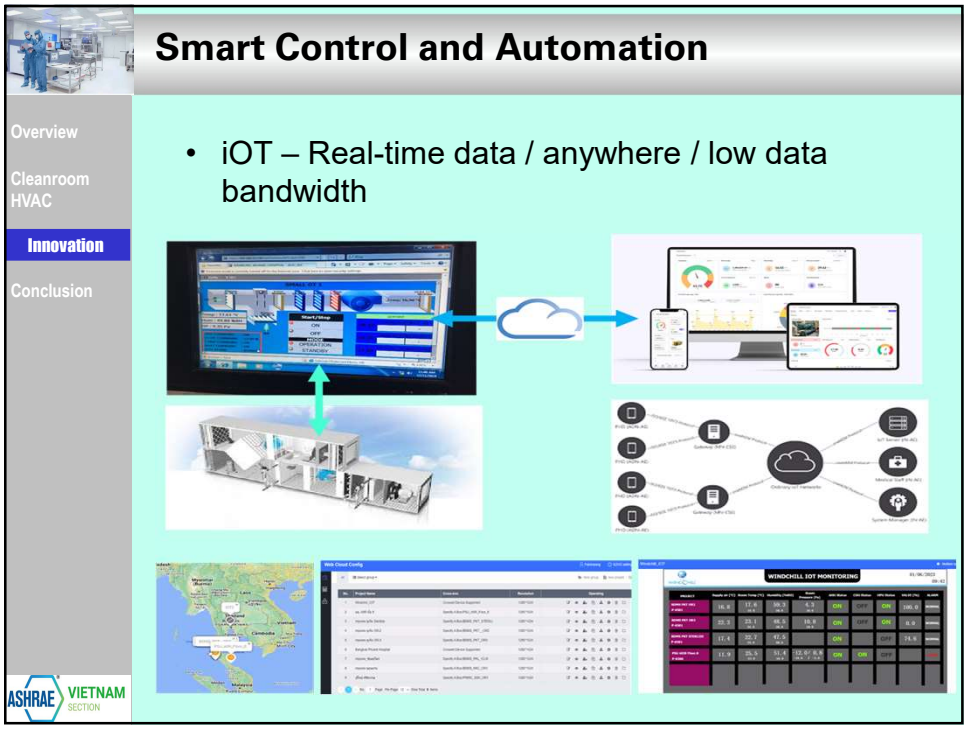
Smart Control and Automation
Overview
Cleanroom HVAC
Innovation
Conclusion
• iOT – Real-time data / anywhere / low data bandwidth
ASHRAE VIETNAM SECTION

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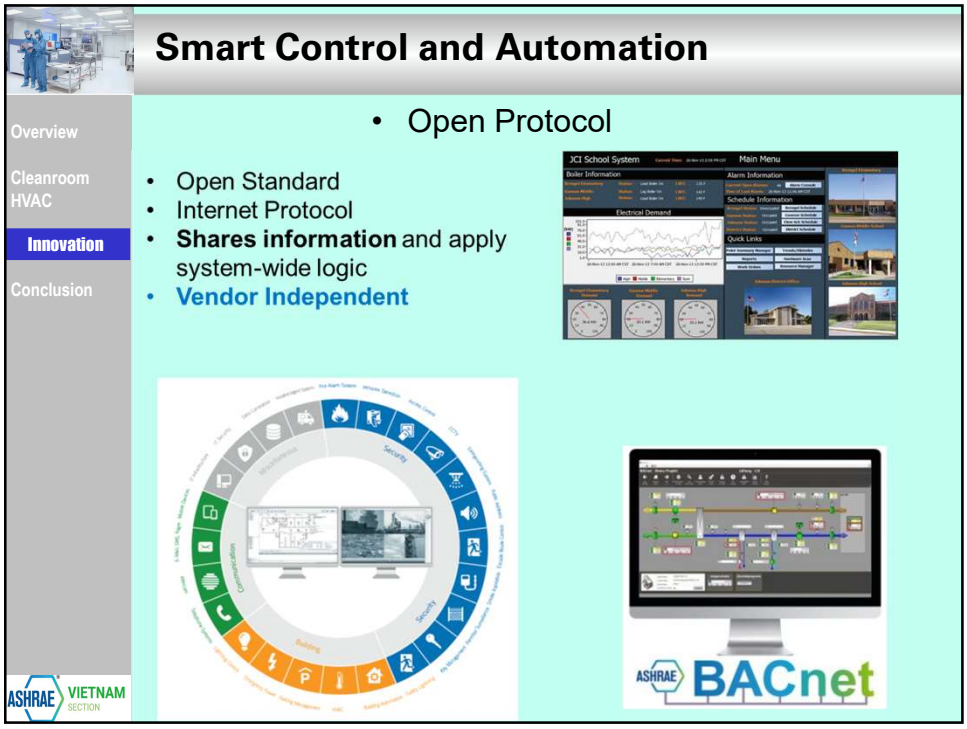
Smart Control and Automation
Overview
Cleanroom HVAC
Innovation
Conclusion
• Open Protocol
• Open Standard
• Internet Protocol
• Shares information and apply system-wide logic
• Vendor Independent
JCI School System
Main Menu
ASHRAE BACnet
ASHRAE VIETNAM SECTION

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Smart Control and Automation

Overview
Cleanroom HVAC
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Conclusion

- Predictive Maintenance
  - Uses time series historical and failure data to predict the future potential health of equipment and so anticipate problems in advance

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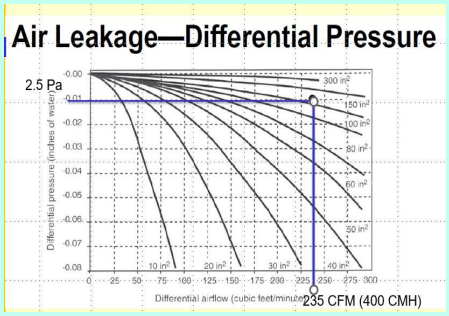
Sustainable Materials and Construction Practices

Overview
Cleanroom HVAC
Innovation
Conclusion

- Passive / Energy-Efficient Building Design
  - Optimal Insulation and Air Tightness



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Sustainable Materials and Construction Practices

Overview
Cleanroom HVAC
Innovation
Conclusion

- Sustainable Building Materials

* Bamboo
* Recycled Steel
* Recycled Glass
* Reclaimed Wood
* Rammed Earth

Top Sustainable Construction Materials

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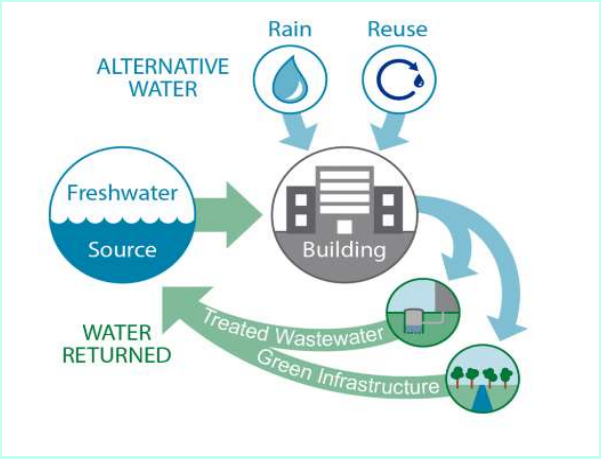
Sustainable Materials and Construction Practices

Overview
Cleanroom HVAC
Innovation
Conclusion

- Water Efficiency Equipment
- Waste-water management



ASHRAE VIETNAM SECTION

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Overview

Cleanroom HVAC

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Renewable Energy Integration

- Solar Energy
- Wind Energy
- Geo-Thermal Heat Pump

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Overview

Cleanroom HVAC

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Cleanrooms Innovative Technology

- Energy Efficiency HVAC Systems
- Smart Control and Automation
- Sustainable Materials and Construction Practices
- Renewable Energy Integration

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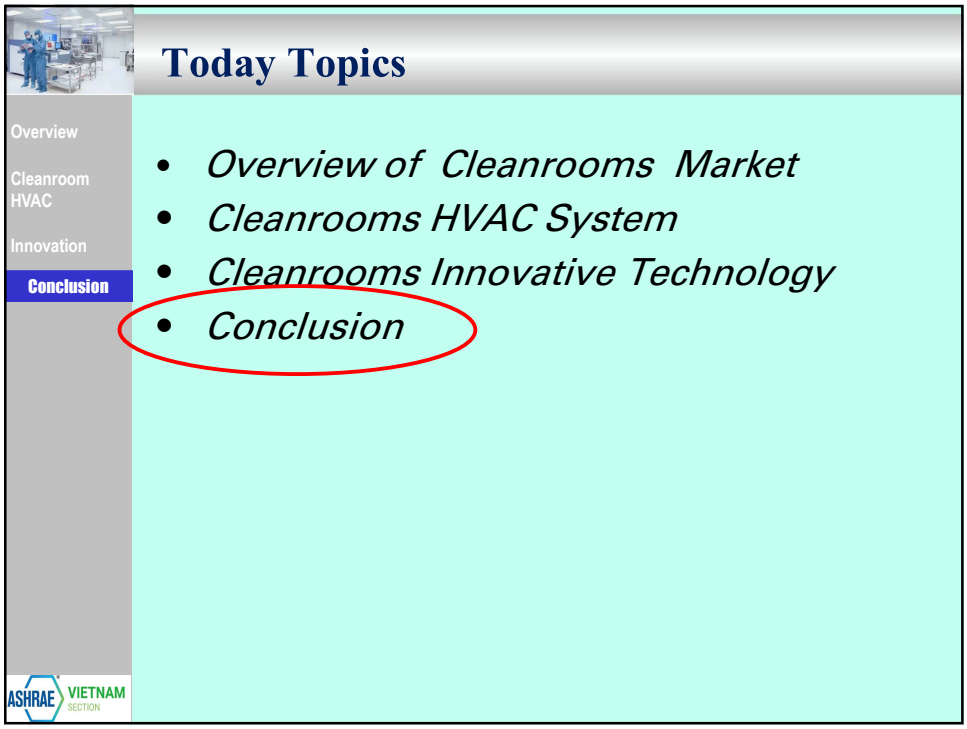
Today Topics
Overview
Cleanroom HVAC
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Conclusion
Overview of Cleanrooms Market
Cleanrooms HVAC System
Cleanrooms Innovative Technology
Conclusion
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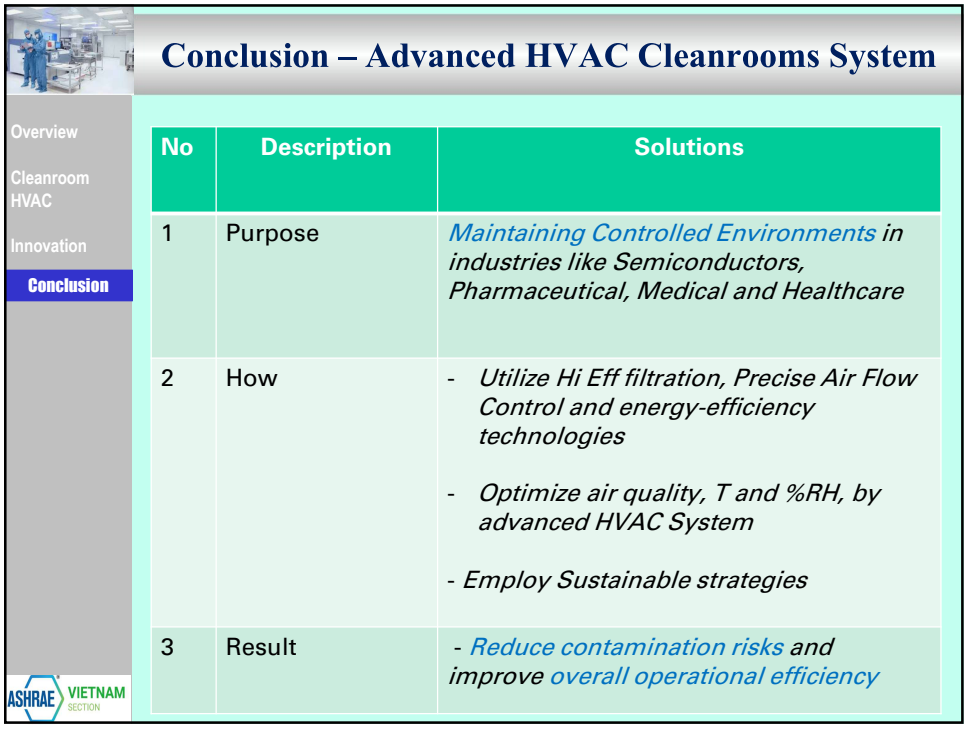
Conclusion – Advanced HVAC Cleanrooms System
Overview
Cleanroom HVAC
Innovation
Conclusion
No
Description
Solutions
1
Purpose
Maintaining Controlled Environments in industries like Semiconductors, Pharmaceutical, Medical and Healthcare
2
How
- Utilize Hi Eff filtration, Precise Air Flow Control and energy-efficiency technologies
- Optimize air quality, T and %RH, by advanced HVAC System
- Employ Sustainable strategies
3
Result
- Reduce contamination risks and improve overall operational efficiency
ASHRAE VIETNAM SECTION

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Today Topics

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- *Overview of Cleanrooms Market*
- *Cleanrooms HVAC System*
- *Cleanrooms Innovative Technology*
- *Conclusion*

ASHRAE VIETNAM SECTION

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Overview

Cleanroom HVAC

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HVAC and Cleanrooms Innovative Technology

Vorasen Leewattanakit (Vorasen@windchill.co.th)

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ASHRAE Certified Professional Building Commissioning (BCxP)

Professional Engineer ({PE)

Windchill Limited

November 21, 2024

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