Confederation of Indian Industry

IGBC Green Healthcare Facilities Rating System

Version 1.0

Abridged Reference Guide

October 2020

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IGBC

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Foreword from the Indian Green Building Council (IGBC)

India is witnessing tremendous growth in healthcare infrastructure. The sector is growing at a rapid pace owing to the awareness and importance of good health and wellbeing. As the sector continues to grow, it would pose host of challenges including environmental sustainability.

To sensitise various forms of built environment, CII established the Indian Green Building Council (IGBC) in 2001. IGBC, is a consensus driven not-for-profit Council, represents the building industry, consisting of more than 2,149 committed members. The Council encourages, builders, developers, owners, architects, doctors, consultants and several other stakeholders to embrace green, thereby contributing to the National goals on sustainability.

The Green Building Movement in India has been spearheaded by IGBC since 2001, by creating awareness amongst the stakeholders. So far, the Council has been instrumental in enabling 7.86 Billion sq.ft of green buildings in the country. The Council's activities have enabled a market transformation with regard to green building materials and technologies.

IGBC continuously works to provide tools that facilitate the adoption of green building practices in India. The development of IGBC Green Healthcare rating system® is another important step in this direction.

Acknowledgement

The IGBC Green Health Buildings rating system® Abridged Reference Guide has been made possible through the efforts of many dedicated volunteers, staff members and others in the IGBC community. The Pilot Version was developed by the IGBC Green Healthcare Core Committee and many other members in the year 2016. With the feedback from the healthcare stakeholders, technical committee members and experiences from the certified hospitals, IGBC has developed version 1.0 of the IGBC Green Healthcare Rating System.

Considering the current global pandemic situation, IGBC has also developed exclusive guidelines for COVID treatment centres. The IGBC's Green Guidelines for Fast Track and Emergency Facilities for Treating COVID-19 Patients, has been made possible through the efforts of dedicated Task Force members and stakeholders from the healthcare industry. IGBC would like to thank the following organisations and members for their participation and contribution in developing the guidelines.

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I. Introduction

The healthcare sector in India is growing at a rapid pace and contributing immensely to the growth of the quality of services. The sector is expected to grow several-fold in the next decade. While this augurs well for the country, there is an imminent need to introduce green concepts and techniques in this sector, which can aid growth in a sustainable manner.

Introducing green concepts in the healthcare facilities can help address National issues like infection, epidemics, handling of bio-medical waste, water efficiency, energy efficiency, reduction in fossil fuel use for commuting, consumer waste and in general conservation of natural resources. Most importantly, these concepts can enhance patients' health, recovery and well-being.

Against this background, the Indian Green Building Council (IGBC) has launched 'IGBC Green Healthcare rating system® to address National priorities. This rating programme is a tool which enables the designer to apply green concepts and reduce environmental impacts that are measurable. The rating system also covers diverse climatic zones.

IGBC has set up the Green Healthcare Facilities Core Committee to develop the rating programme. This committee comprises of key stakeholders, including doctors, hospital administrators, healthcare experts, IEQ experts, architects, builders, consultants, developers, owners, institutions, manufacturers and industry representatives. The committee, with a diverse background and knowledge has enriched the rating system, both in its content and process.

The current global pandemic has raised various challenges for the healthcare facilities. Also, many fast track and emergency facilities including temporary structures are being setup for treating thousands of COVID-19 patients in the country. Though these are immediate response centres, they need to have basic facilities, good indoor environment for the patients and the health care workers, reduce the spread of infection within the centres and resource efficient.

Addressing these challenges, the Version 1.0 of IGBC Green Healthcare Facilities rating system has been upgraded including 'Green Guidelines for Fast Track and Emergency Facilities for Treating COVID-19 Patients'.

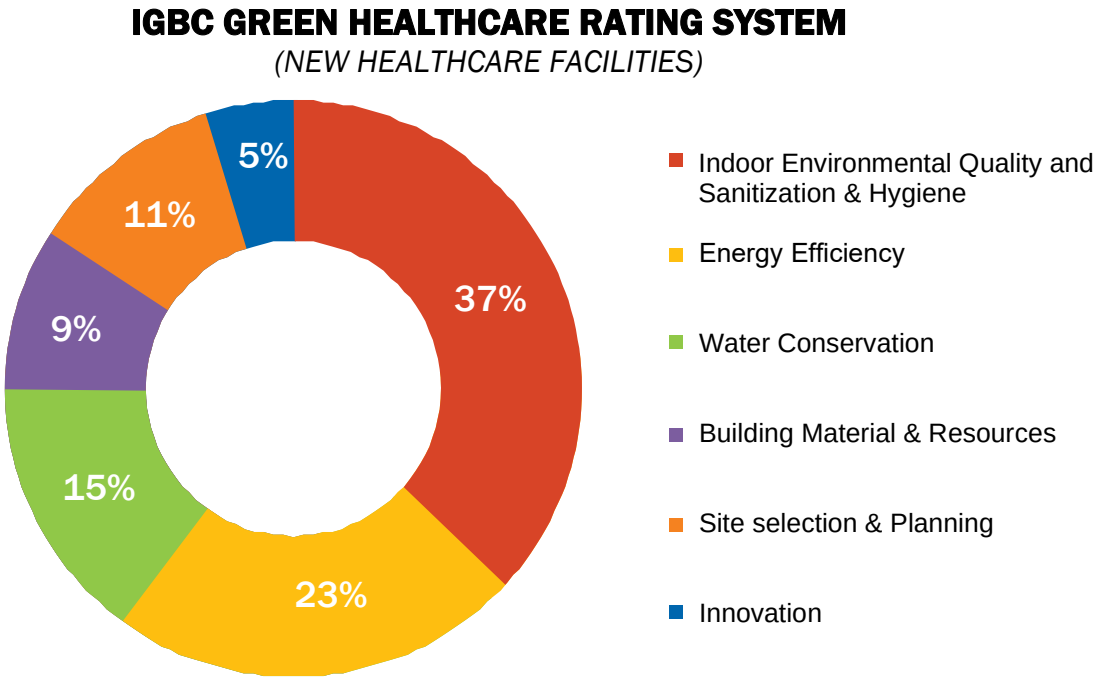
The guidelines for COVID centres have been included as addendum in the current version. IGBC encourages all key stakeholders including hospital owners, doctors, administrators and facility managers to incorporate and practice relevant measures to combat spread of COVID 19 in Healthcare facilities.

The guidelines have been broadly developed addressing areas of concern such as: Layout, Site Selection for Greenfield Facility, Modular Structures for Temporary Facilities, Hygiene Practice, Ventilation Parameters, Energy Efficiency, Water Conservation, Waste Management, Interior Furnishings, Facilities for Health Workforce

To encourage the upcoming and existing healthcare facilities to implement the guidelines, 5 credit points would be awarded under innovation category in the IGBC Green Healthcare Facilities Rating System.

II. Benefits of Green Healthcare Facilities

Green Healthcare facilities can have tremendous benefits, both tangible and intangible. The most tangible benefits are the reduction in water and energy consumption right from day one of occupancy. The energy savings could range from 20 - 30 % and water savings around 30 - 50%. The intangible benefits of green Healthcare facilities include enhanced air quality, faster patient recovery, daylighting for patients, connectivity to outdoor environment, health & hygiene of occupants & patients and safety benefits



III. National Priorities Addressed in the Rating System

The IGBC Green Healthcare rating system addresses the most important national priorities which include water conservation, handling waste, energy efficiency, reduced use of fossil fuels, lesser dependence on usage of virgin materials and health & well-being of patients & occupants. The rating system requires the application of National standards and codes such Indian Health Facility Guidelines, NBC, ECBC, MoEF guidelines, CPCB guidelines, and several others. The overarching objective is to be better than the national standards so as to create Healthcare benchmarks

a) Health and Well-being of Patients & occupants:

Health and well-being of patients & occupants are the most important aspects of IGBC Green Healthcare rating system. The rating system has addressed healing architecture / evidence-based design, adequate ventilation, daylighting, infection control mechanisms and patients well-being, which are so essential in healthcare facilities. The rating system also recognises measures to minimise indoor air pollutants and infections.

b) Water Conservation

Most of the Asian countries are water stressed and in country like India, the water table has reduced drastically over the last decade. IGBC Green Healthcare rating system encourages use of water in a self-sustainable manner through reduce, recycle and reuse strategies. By adopting this rating programme, green Healthcare facilities can save potable water to an extent of 30 - 50%.

c) Handling of consumer & biomedical Waste:

Handling of waste in hospitals is extremely sensitive. This continues to be a challenge to the municipalities which needs to be addressed. The rating system intends to address this by encouraging buildings to have proper systems in place

d) Energy Efficiency:

The healthcare sector is a large consumer of electrical energy. Through IGBC Green Healthcare rating system, these facilities can reduce energy consumption through energy efficient - building envelope, lighting, air conditioning systems, etc., The energy savings that can be realised by adopting this rating programme can be to the tune of 20 - 30%.

e) Reduced Use of Fossil Fuels:

Fossil fuel is a slowly depleting resource, the world over. The use of fossil fuel for transportation has been a major source of pollution. The rating system encourages the use of alternate fuel vehicles for transportation.

f) Reduced Dependency on Virgin Materials:

The rating system encourages projects to use recycled & reused material and discourages the use of virgin materials, thereby, addressing environmental impacts associated with extraction and processing of scarce natural resources.

IV. IGBC Green Healthcare Rating System®

IGBC has set up the Green Healthcare Core Committee to develop the rating programme. This committee comprises of key stakeholders, including doctors, healthcare experts, administrators, architects, builders, consultants, developers, owners, institutions, manufacturers and industry representatives. The committee, with a diverse background and knowledge has enriched the rating system, both in its content and process.

a) Preamble

By opting to apply for the rating it is understood and implied that the healthcare facility has taken cognisance of naturally occurring events like earthquake, flood, tsunami and geological phenomena during design.

b) Features

IGBC Green Healthcare rating system® is a voluntary and consensus-based programme. The rating system has been developed based on practices, materials and technologies that are presently available. The objective of IGBC Green Healthcare rating system is to facilitate a holistic approach to create environment friendly healthcare facilities.

The rating system evaluates certain mandatory requirements & credit points using a prescriptive approach and others on a performance-based approach. The rating system is evolved so as to be comprehensive and at the same time user-friendly. The programme is fundamentally designed to address national priorities and quality of life for patients.

Some of the unique aspects addressed in this rating system are as follows:

- Healing Architecture / Evidence based design
- Emphasis on infection control strategies
- Recognition for architectural excellence through integrated design approach
- Recognition for passive architectural features
- Based on the feedback from green building proponents, use of certified green products will be encouraged. IGBC has launched a new initiative to certify green products to transform markets. Products would be evaluated right from extraction to disposal.
- A site visit and audit is proposed before award of the rating.
- Projects are encouraged to report energy and water consumption data on an annual basis, to facilitate research in this area.

c) Scope

IGBC Green Healthcare rating system® is designed for both air-conditioned & non-air-conditioned existing and new healthcare facilities. Healthcare facilities with in-patient wards are only considered for certification.

However, small clinics with only OPD & Consultation are not considered under scope of healthcare rating system and are recommended to apply for certification under IGBC Green Service Buildings/ IGBC Green Interiors rating system, as applicable.

In case of Medical Universities, all buildings including healthcare facility in the campus can be considered for certification subject to:

- All the buildings shall meet the mandatory requirements and minimum number of credits required under respective IGBC rating systems. For example, residential building should meet mandatory requirement and minimum number of credit points applicable under IGBC Green Homes.
- Final rating awarded for the Medical University will be based on the rating achieved by the Healthcare Facility building.

Note: The project shall contact the IGBC technical team before registering the Medical Universities under the IGBC Green Healthcare Facilities Rating System.

d) The Future of IGBC Green Healthcare Rating System

Many healthcare specific green building materials, equipment and technologies are being introduced in the market. With continuous up-gradation and introduction of healthcare specific green technologies and products, it is important that the rating programme also keeps pace with current standards and technologies.

Therefore, the rating programme will undergo periodic revisions to incorporate the latest advancement and changes. It is important to note that project teams applying for IGBC Green Healthcare rating system® should register their projects with the latest version of the rating system. During the course of implementation, projects have an option to transit to the latest version of the rating system.

IGBC will highlight Healthcare developments on its website (www.igbc.in).

V. Overview and Process

IGBC Green Healthcare rating system® addresses green features under the following categories:

a) Indoor environmental Quality

b) Sanitization & Hygiene

c) Energy Efficiency

d) Water Conservation

e) Site Selection and Planning

f) Building Materials and Resources

g) Innovation in Design Process

The guidelines detailed under each mandatory requirement & credit enables the design and construction of Healthcare facilities of all sizes and types (as defined in scope). Different levels of certification are awarded based on the total credits earned. However, every green Healthcare facilities should meet certain mandatory requirements, which are non-negotiable.

The various levels of rating awarded are as below:

Certification Level	Recognition
Certified	Best Practices
Silver	Outstanding Performance
Gold	National Excellence
Platinum	Global Leadership

VI. When to use IGBC Green Healthcare rating System®

IGBC Green Healthcare rating system® is designed for Subcenter, Primary Health Centre, Community Health Centre, District Hospital, Government & Private Hospitals and Medical Universities.

The project team can evaluate all the possible points to apply under the rating system using a suitable checklist. The project can apply for IGBC Green Healthcare rating system® certification, if the project can meet all mandatory requirements and achieve the minimum required points.

VII. Registration

Organisations interested in registering their projects under IGBC Green Healthcare rating system Certification are advised to first register on IGBC website (www.igbc.in) under 'IGBC Green Healthcare rating System' tab. The website includes information on registration fee for IGBC member companies as well as non-members.

Registration is the first step which helps establish initial contact with IGBC and provides access to the required documents, templates, important communications and along with other necessary information.

IGBC website provides all important details on IGBC Green Healthcare rating system® registration & certification – process and fee.

VIII. Certification

To achieve the IGBC Green Healthcare rating, the project must satisfy all the mandatory requirements and the minimum number of credit points.

The project team is expected to provide supporting documents at preliminary and final stage of submission, for all the mandatory requirements and the credits attempted.

The project needs to submit the following:

a) General information about project, including

   i) Project brief stating project type, different types of spaces, occupancy, bed distribution, area provided per bed, number of floors, area statement, etc.,

   ii) General drawings (in PDF format only):

   - ♦ Master/ Site plan
   - ♦ Parking plans
   - ♦ Floor plans

- ♦ Elevations
- ♦ Sections
- ♦ HVAC layouts including details on pressurisation
- ♦ Medical equipment planning

iii) Photographs / Rendered images

b) Filled-in templates

c) Narratives and supporting documentation such as drawings, calculations (in excel sheets), declarations / contract documents, purchase invoices, manufacturer cut sheets / letters / material test reports, etc., for each mandatory requirement and credit.

The project documentation is submitted in two phases - Preliminary submittal and Final submittal:

Preliminary phase involves submission of all documents, which shall include the mandatory requirements and the minimum number of credits. After the preliminary submission, review is done by third party assessors and review comments would be provided within 30 days.

The next phase involves submission of clarifications to preliminary review queries and final submittal. This review will also be provided within 30 days, after which the rating is awarded.

It is important to note that the mandatory requirements and credits earned at the preliminary review are only considered as expected. These mandatory requirements and credits are not awarded until the final documents are submitted, along with additional documents showing implementation of design features. If there are changes in any 'expected credits' after preliminary review, these changes need to be documented and resubmitted during the final review.

The next phase involves submission of clarifications to preliminary review queries and final submittal. This review will also be provided within 30 days, after which the rating is awarded

It is important to note that the mandatory requirements and credits earned at the preliminary review are only considered as expected. These mandatory requirements and credits are not awarded until the final documents are submitted, along with additional documents showing implementation of design features. If there are changes in any 'expected credits' after preliminary review, these changes need to be documented and resubmitted during the final review.

The threshold criteria for certification levels are as under:

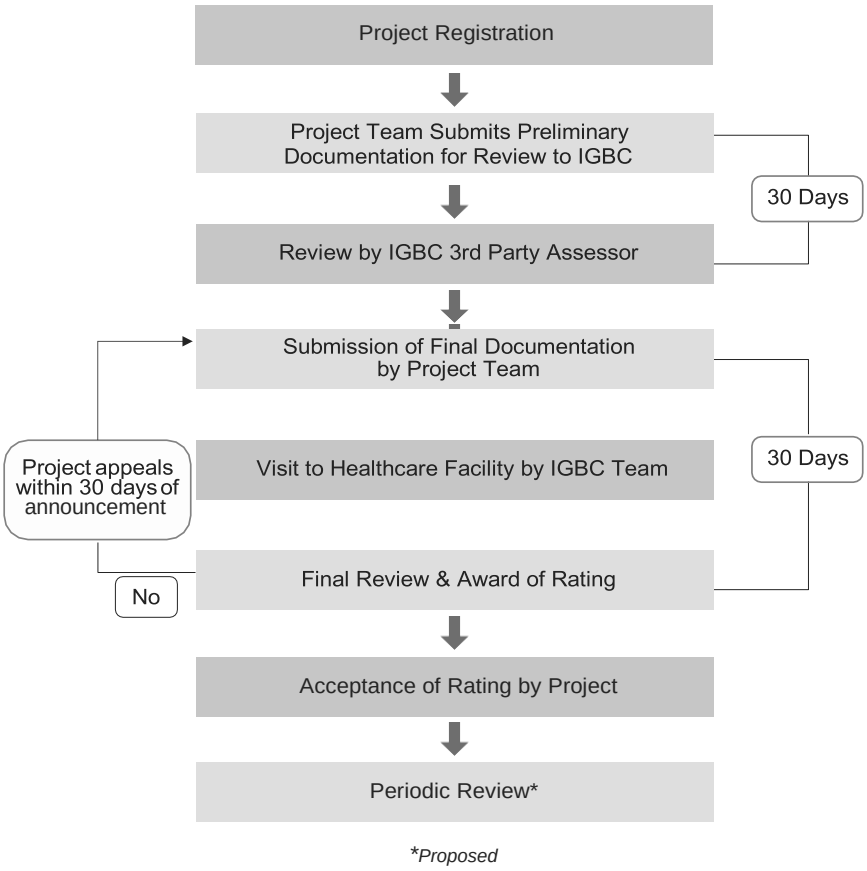
Certification Level	Credits (New Healthcare facilities)	Credits (Existing Healthcare facilities)	Recognition
Certified	50-59	45-53	Best Practices
Silver	60-69	54-62	Outstanding Performance
Gold	70-79	63-71	National Excellence
Platinum	80-100	72-90	Global Leadership

IGBC will recognise Green Healthcare Facilities that achieve one of the rating levels with a formal letter of certification and a mountable plaque

IX. Validity

The validity of certification will be three years from the date of award of rating.

X. Certification Process



**Proposed*

XI. Credit Interpretation Ruling (CIR)

In some instances, there is a possibility that the design team may encounter certain challenges in applying or interpreting a mandatory requirement or a credit. It can also happen in cases where the project can opt to achieve the same intent through a different compliance route.

To address this, IGBC uses the process of Credit Interpretation Ruling (CIR) to ensure that interpretations are consistent and applicable to other projects as well.

The following are the steps to be followed in case the project team encounters any difficulty:

- Refer the Abridged Reference Guide for description of the credit intent and compliance options.
- Review the intent of the mandatory requirement / credit and self-evaluate whether the project satisfies the intent.
- Review the Credit Interpretation Ruling web page for previous CIRs on the relevant mandatory requirement or credit. All projects registered under IGBC Green Healthcare rating system will have access to this page.
- If a similar CIR has not been addressed or does not answer the question sufficiently, submit a

credit interpretation request. Only registered projects are eligible to post credit interpretation request. Two CIRs are answered without levying any fee, and for any CIR beyond the first two CIRs, a fee is levied.

XII. Appeal

In rare cases, mandatory requirements / credits get denied due to misinterpretation of the intent. On receipt of the final review and if the project team feels that sufficient grounds exist to appeal a credit denied in the final review, the project has an option to appeal to IGBC for reassessment of denying mandatory requirements / credits. The documentation of the mandatory requirements / credits seeking appeal may be resubmitted to IGBC along with necessary fees. IGBC will take 30 days to review such documentation. If an appeal is pursued, please note that a different review team will be assessing the appeal documentation. The following documentation should be submitted:

1. General information about project, including
    a. Project brief stating project type, different type of spaces, occupancy, number of floors, area statement, etc.,
    b. General drawings (in PDF format only):
        i. Master/ Site plan
        ii. Parking plans
        iii. Floor plans
        iv. Elevations
        v. Sections
    c. Photographs / Rendered views
2. Filled-in templates for respective mandatory requirement / credit.
3. Resubmittal and appeal submittal documentation for only those mandatory requirements / credits that the project is appealing for. Also, include a narrative for each appealed mandatory requirement / credit to describe how the documents address the reviewer's comments and concerns.

XIII. Fee

Registration, Precertification, Certification and CIR fee details are available on the IGBC website (www.igbc.in) or can be obtained from IGBC (igbc@cii.in).

XIV. Updates and Addenda

As the rating system continues to improve and evolve, updates, addenda and errata to the abridged reference guide will be made available through IGBC website. The additions thereof will be suitably incorporated in the next version of the rating system

IGBC Green Healthcare Rating- Checklist			
Module		New Healthcare Facility	Existing Healthcare Facility
Indoor environmental Quality & Wellbeing			
IEQ Mandatory Requirement 1	Minimum Fresh Air Ventilation	Required	Required
IEQ Mandatory Requirement 1	Tobacco Smoke Control	Required	Required
IEQ Credit 1.1	Healing Architecture- Day lit Spaces	2	2
IEQ Credit 1.2	Healing Architecture- Connectivity to Nature	2	2
IEQ Credit 1.3	Healing Architecture- Green Open Spaces	2	2
IEQ Credit 1.3	Healing Architecture- Patient-centric Healing Garden	2	2
IEQ Credit 1.5	Healing Architecture- Colour Psychology	2	2
IEQ Credit 2	Acoustical Design	3	3
IEQ Credit 3	Ergonomics	2	2
IEQ Credit 4	Stress Relieving Spaces	2	2
IEQ Credit 5	Low Emitting Materials	4	4
IEQ Credit 6	Building Flushout, During Construction & Before Occupancy	1	Not Applicable
IEQ Credit 7	Air Quality Monitoring & Testing, After Occupancy	1	2
		23	23

Sanitisation & Hygiene			
SH Mandatory Requirement 1	Municipal Solid Waste Management, Post-occupancy	Required	Required
SH Mandatory Requirement 2	Bio-medical Waste Management, Floor & Centralised level	Required	Required
SH Credit 1	Infection control within the Spaces	5	5
SH Credit 2	Isolation Room	2	2
SH Credit 3	Sanitation Facilities	1	1
SH Credit 4	Eco-friendly Cleaning Practices	2	2
SH Credit 5	Automated Solid Waste Management System	2	Not Applicable
SH Credit 6	Organic Waste Management	2	2
		14	12

IGBC Green Healthcare Rating- Checklist			
Module		New Healthcare Facility	Existing Healthcare Facility
Energy Efficiency			
EE Mandatory Requirement 1	Ozone Depleting Substances	Required	Required
EE Mandatory Requirement 2	Minimum Energy Efficiency	Required	Required
EE Mandatory Requirement 3	Commissioning Plan for Building Equipment & Systems	Required	Not Applicable
EE Credit 1	Eco-friendly Refrigerants	1	1
EE Credit 2	Enhanced Energy Efficiency	12	12
EE Credit 3	On -site Renewable Energy	5	5
EE Credit 4	Off-site Renewable Energy	2	2
EE Credit 5	Commissioning, Post-installation of Equipment & Systems	1	Not Applicable
EE Credit 6	Energy Metering & Management	2	2
		23	22

Water Conservation			
WC Mandatory Requirement 1	Rainwater Harvesting, Roof & Non-roof	Required	Required
WC Mandatory Requirement 2	Water Efficient Plumbing Fixtures	Required	Required
WC Credit 1	Rainwater Harvesting, Roof & Non-roof	3	3
WC Credit 2	Water Efficient Plumbing Fixtures	5	5
WC Credit 3	Landscape Design	2	2
WC Credit 4	Management of Irrigation Systems	1	1
WC Credit 5	Wastewater Treatment and Reuse	3	3
WC Credit 6	Water Metering	1	1
		15	15

Building Materials & Resources			
BMR Mandatory Requirement 1	Handling of Waste Materials, During Construction	Required	Not Applicable
BMR Credit 1	Sustainable Building Materials	3	Not Applicable
BMR Credit 2	Certified Green Building Materials, Products & Equipment	5	5
BMR Credit 3	Eco-friendly furniture and medical furnishing	1	1
		9	6

IGBC Green Healthcare Rating- Checklist			
Module		New Healthcare Facility	Existing Healthcare Facility
Site Selection & Planning			
SSP Mandatory Requirement 1	Local Building Regulations & Safety Compliance	Required	Required
SSP Mandatory Requirement 2	Soil Erosion Control	Required	Required
SSP Credit 1	Integrated Design Process	1	Not Applicable
SSP Credit 2	Passive Architecture	2	Not Applicable
SSP Credit 3	Value Added Services	1	1
SSP Credit 4	Proximity to Public Transport	1	1
SSP Credit 5	Low-emitting Vehicles	1	1
SSP Credit 6	Heat Island Reduction, Non-roof	1	1
SSP Credit 7	Heat Island Reduction, Roof	1	1
SSP Credit 8	Outdoor Light Pollution Reduction	1	1
SSP Credit 9	Universal Design	1	1
SSP Credit 10	Basic Facilities for Construction Workforce	1	Not Applicable
		11	7

Innovation in Design Process			
ID Credit 1.1	Innovation in Design Process	1	1
ID Credit 1.2	Innovation in Design Process	1	1
ID Credit 1.3	Innovation in Design Process	1	1
ID Credit 1.4	Innovation in Design Process	1	1
ID Credit 2	IGBC Accredited Professional	1	1
		5	5
	Total	**100**	**90**

Indoor Environmental Quality & Well-being

Minimum Fresh Air Ventilation

IEQ Mandatory Requirement 1

Required

Intent:

Ensure all regularly occupied spaces are adequately ventilated, thereby improving health and well-being of the occupants

Compliance options:

❖ **Case A: Mechanically Ventilated Spaces**

➢ Demonstrate that the fresh air ventilation (minimum outdoor air change) in all regularly occupied areas to meet the minimum ventilation rates, as prescribed in ASHRAE 170-2013 'Ventilation of Health Care' – Table 7 'Design Parameter'

Type of space	Minimum out air change hour
Recovery Room	2
Critical & Intensive care	2
Trauma room	3
Laboratory, sterilizing	2
Medication room	2

Refer Annexure-III 'Ventilation design parameter' for elaborative list of spaces
Source: ASHRAE 170-2013 'Ventilation of Health Care' – Table 7 'Design Parameter'

The facility should also have air scavenging system in all critical areas.

❖ **Case B: Non-Air-conditioned Spaces**

➢ Provide operable windows and / or doors to the exteriors, in atleast 50% of the regularly occupied areas*, such that the operable area is designed to meet the criteria as outlined in the Table below:

Category	Percentage of Openable Area
Regularly Occupied Area (≤ 100 sq.m)	8%
Regularly Occupied Area (> 100 sq.m)	12%

➢ **Cross Ventilation**

Ensure atleast 50% of the regularly occupied spaces shall have an opening (door/ ventilators/ windows) to the outdoor environment, in atleast two of the orientation

Note:

- *Regularly occupied spaces include Patient area, Clinical support area, administration and recreational areas. Refer Annexure-II 'Classification of spaces in healthcare facilities' for elaborative list.*

Documentation Required:

Case A: Mechanically Ventilated spaces

1. Narrative stating the building's fresh air ventilation design in the project.
2. Calculations indicating fresh air intake volumes in all regularly occupied spaces, for each zone, as per Ventilation Rate Procedure prescribed in ASHRAE Standard 62.1 – 2010 and ASHRAE 170-2013 'Ventilation of healthcare'
3. Floor plans indicating the location of AHU's, TFA's and fresh air intake louvers.

Case B: Non-Air-conditioned Spaces

1. Floor plans with window and door schedule.
2. Building elevations showing operable windows and doors.
3. Calculations indicating the openable area of windows and doors to the carpet area, for each of the regularly occupied spaces in percentage.
4. Photographs showing the operable windows and doors to the exteriors, in all the regularly occupied areas.

Tobacco Smoke Control

IEQ Mandatory Requirement 2

Required

Intent:

Minimise exposure of non-smokers to the adverse health impacts arising due to passive smoking in the building.

Compliance options:

- Demonstrate that smoking is prohibited in the building and is in accordance with the regulations of Ministry of Health & Family Welfare, Government of India.
- Demonstrate that smoking is prohibited within 100 m of the site entrance.

  A permanent no smoking signage at the main entrance indicating that smoking is prohibited within 100 meters from the hospital site entrance.

Documentation Required:

1. Copy of organisation's policy on 'no smoking' (or) Declaration letter from the project owner/ developer stating that 'smoking' will be prohibited in the project.
2. Narrative describing the strategies (e.g., signages, posters, brochures, building guidelines, etc.,) to communicate 'no smoking policy' to all the building occupants/ tenants and visitors.
3. Photographs showing 'no smoking' signages installed in the project.

Healing Architecture- Day lit Spaces

IEQ Credit 1.1

Point(s): 1, 2

Intent:

Incorporate principle of healing architecture through adequate daylighting, thereby facilitating faster recovery.

Compliance options:

❖ **Day lit spaces**

- Demonstrate that atleast 50% of the patient areas and 25% of regularly occupied spaces achieve daylight illumination levels of minimum 110 Lux. Areas with daylight illumination levels more 2,200 Lux shall not be considered.

Percentage of Patient area with daylighting	Percentage of other regularly occupied spaces with daylighting	Points
50 %	25 %	1
75 %	50 %	2

The project can demonstrate the compliance through either of two methodologies:

- **Option 1: Simulation Approach**

  Demonstrate the compliance through computer simulation in a clear sky condition on 21st September at 12 noon, at working plane.

- **Option 2: Measurement Approach**

  Demonstrate the compliance through portable Lux Meter with resolution of 10 lux. The measurement shall be taken after installation of furniture, equipment & systems at work plane height at 9 am, 12 pm, and 3 pm, on a 10-foot square grid. To show compliance, consider the average of the measurements taken at 9 am, 12 pm, and 3 pm.

Note:

- *Regularly occupied spaces include Administration, Recreational, Patient, and Clinical support areas. Refer Annexure-II 'Classification of spaces in healthcare facilities' for elaborative list.*

Documentation Required:

Option 1: Simulation Approach

1. Daylight simulation report with sky conditions (such as date & month; time; ambient Lux levels) and wall, floor & roof reflectance properties, for all the regularly occupied spaces in the building. During simulation, consider shading devices and 'shadow effect' of adjacent buildings.
2. Site/ master plan showing all the buildings.
3. Floor/ roof plans with window and skylight schedule.

4. Manufacturer brochure/ cut-sheet/ letter of the glass installed showing the Visual Light Transmittance (VLT).
5. Photographs showing the building elevations (all sides) and interiors spaces at different floors.

Option 2: Measurement Approach

1. Daylight analysis report indicating daylight illuminance levels measured at work plane height, for all the regularly occupied spaces in the building.
2. Site/ master plan showing all the buildings.
3. Floor/ roof plans with window and skylight schedule.
4. Manufacturer brochure/ cut-sheet/ letter of the glass installed showing the Visual Light Transmittance (VLT).
5. Photographs showing the building elevations (all sides) and interiors spaces at different floors.

Healing Architecture- Connectivity to nature

IEQ Credit 1.2

Point(s): 1, 2

Intent:

Incorporate principle of healing architecture by connecting indoor environment with outdoors, thereby facilitating faster recovery

Compliance options:

❖ **Connectivity to nature**

➢ Demonstrate that atleast 25% of the patient areas and regularly occupied spaces achieve direct line of sight to vision glazing between 0.9 meters (3 feet) and 2.1 meters (7 feet) above the finished floor level.

Percentage of patient area with connectivity to nature	Percentage of other regularly occupied spaces with connectivity to nature	Points
25 %	25 %	1
50 %	50 %	2

➢ Also, the project shall comply with the following criteria:

♦ The building occupants must not have any obstruction of views at least 8 meters (26.2 feet) from the exterior vision glazing.

(Or)

♦ The building occupants must have direct access either to sky or flora & fauna or both.

Note:

Regularly occupied spaces includes Administration, Recreational, Patient and Clinical support areas. Refer Annexure-II 'Classification of spaces in healthcare facilities' for elaborative list.

Documentation Required:

1. Site/ master plan showing all the buildings.
2. Furniture layouts of all the floors.
3. Sectional drawings indicating the direct line of sight to vision glazing, for each typical floor.
4. Calculations (floor-wise) indicating the patient's area & other regularly occupied spaces having access to outdoor views to the total regularly occupied spaces.
5. Photographs showing the outdoor views, for all the floors.

Healing Architecture- Green open Spaces

IEQ Credit 1.3

Point(s): 1, 2,

Intent:

Incorporate principle of healing architecture by integrating green spaces, thereby providing therapeutic environment for faster recovery.

Compliance options:

- **Green open Spaces**
  - Demonstrate that atleast 20% of the project area (excluding the building footprint) is covered with green open spaces.

Percentage of Green Open Space	Points
20%	1
30%	2

Notes:

- *Only native/ adaptive shall be considered for this credit compliance*
- *The green open spaces shall be accessible to visitors, patients & staff*
- *Potted plants & Artificial landscape shall not be considered for the credit calculations*

Documentation Required:

1. Site drawing highlighting the area with green open space.
2. Calculations indicating the total area with green open space to the total site area, in percentage.
3. Photographs showing the site area with green open space.

Healing Architecture- Patient-centric Healing Spaces

IEQ Credit 1.4

Point(s): 1, 2,

Intent:

Incorporate principle of healing architecture by integrating patient centric healing spaces, within the built environment, thereby providing therapeutic environment for faster recovery.

Compliance options:

❖ **Patient centric Healing Spaces**

➢ Demonstrate that atleast 5% of the in-patient occupants are having access to patient centric healing spaces

Percentage of Healing Spaces	Points
5%	1
10%	2

Note:

- *Healing garden should be accessible only to the patients and the staff. The provided area should be located near in-patient wards.*
- *Healing garden is one that comprises of natural landscape elements (such as trees & plants) and can foster restoration from stress and faster recovery of patients*
- *Trees & plants that generates more oxygen, medicinal plants shall be considered*
- *Vegetation on the ground as well as vegetation over built structures such as roofs, basement, podiums shall be considered*
- *Patient centric healing spaces may include but not limited to:*
  - *Theme gardens such vertical garden, roof garden, zen garden etc.*
  - *Yoga/ meditation room*
  - *Art gallery*
  - *Reading, prayer room etc.*
  - *Kid's play area*
  - *Minimum of 250 sq.m of area should be provided for credit compliance.*

Documentation Required:

1. Site drawing/floor plan highlighting the area designed for healing garden/ spaces.
2. Calculations indicating the area covered with healing garden/ spaces to the in-patient carpet area, in percentage.
3. Photographs showing the healing garden/ spaces.

Healing Architecture- Colour Psychology

IEQ Credit 1.5

Point(s): 1, 2

Intent:

Incorporate principle of healing architecture through concept of colour psychology, thereby providing therapeutic environment for faster recovery

Compliance options:

❖ **Colour Psychology**

Ensure that the healthcare spaces (such as Patient areas, Administration & Recreational areas etc.), are designed considering the positive effects of colours on patients & staff.

The design scheme may cover (not limited to) the following (minimum 2):

- Interior walls & ceilings
- Furniture
- Soft furnishing
- Textile (Bed-linen, Curtain)

Health Problem	Healing Colour
Depression	Light red
Low level of oxygen supply to brain	Orange
Sore throat	Green Light
Tremors, twitching & muscle spasms	Green
Anxiety	Purple
Upset Stomach, Normal headaches	Pink
Nervousness & irritability	Blue light
Boredom, depressive affect & appetite, high heartbeat, high blood pressure, temperature, Muscle pain	Shades of Blue
Agitated, Hypertensive, or anxious individual	Cool colours (smoke, ash, chrome, white, frost, grey, charcoal, graphite, silver, stone)

Source: Colour + Design, Ron Reed, 2012: Functional Colour & Design in Healthcare Environments; by Glidden Professional

Documentation Required:

1. Narrative stating the design & colour scheme incorporated in the project.
2. Photographs showing the incorporation of healing colour in spaces such as patient areas, administration areas, recreation areas.

Acoustic Design

IEQ Credit 2

Point(s): 1, 2,3

Intent:

Encourage acoustic design, to promote patients' well-being and productivity & communication of staff

Compliance option:

- Demonstrate that following area shall meet the acoustics design criteria:

Areas	Points
Administration & Recreational areas	1
Patient areas	1
Support areas	1

- Acoustic Design Criteria:

  Acoustic design should meet the following criteria:

Acoustic Guidelines for Healthcare Facilities			
No	Room/Space	BNL[a)] (dBA)	RT[a)] (sec)
01	Assembly/preparation, Reception/clerical Lounge/ Activity room, Waiting room	40-50	< 0.5
02	Staff room, Staff station	40-45	< 0.7
03	Interview room, Consult room	35-45	< 0.5
04	Office, Staff & technical support	35-45	< 0.7
05	Treatment room, procedure room, Angiography procedure, Operating room, Birthing room-LDR, Multi-patient bed room, Patient bay	40-50	< 0.6
06	Quiet lounge/seclusion room, Private/single bedroom, Observation room	35-45	< 0.6
07	Laboratories, ECG, Echo room trans oesophageal, Radiopharmacy, CT/ MRI scanning room, Dental plant room, EP laboratory/ Microbiology Lab	45-55	< 0.6
08	Multi-function activity room, Occupational therapy room, Gymnasium, Dental surgery, Library/ study area, play area	40-45	< 0.6
09	Audiology testing room c)	< 35	< 0.4
10	Clean-up/ Decontamination, Sterilising/Dental sterilising	40-45	< 0.5
11	Courtyard, Secure courtyard, Corridor	40-50	< 0.6
12	Pharmacy counter	45-50	< 0.5
13	Staff dinning	50-55	< 0.6
14	Meeting room	30-40	< 0.6
15	Record processing, Pantry/servery	40-50	< 0.7

Source: Indian Health facility Guidelines

The project can follow one of the below approaches for calculating the reverberation time:

- The reverberation time (RT) shall be calculated based on Sabine's Formula of RT 60

  $$RT = 0.161 \times (V / A)$$

  V = room volume in m^3

  A = α • S

  α = absorption coefficient

  S = surface area

- The measurement methodology of ISO 3382-2:2008- Measurement of room acoustic parameters - Part 2: Reverberation time in ordinary rooms shall be followed.

  The minimum resolution and accuracy of the instrument Table 10- 'Specifications of the instruments to be used for measuring IEQ parameters' of ISHRAE's draft Indoor Environmental Quality standards

Notes:

- *Please note BNL& RT denote the background noise level and reverberation time, respectively*
- *Refer Part E - Access, Mobility, OH&S - Isolation Room for design details, Indian Health Facility Guidelines*

Documentation Required:

1. Narrative describing approach to acoustic design adopted in the project.
2. Calculations indicating reverberation time calculated for administration & recreational areas,

   patient areas and support areas.
3. Manufacturer cut- sheets/ brochures/ Materials Safety Data Sheet (MSDS), indicating the Background noise levels of the products used.
4. Photographs showing installed materials.

Ergonomic Design

IEQ Credit 3

Point(s): 1, 2

Intent:

Design a healthcare facility with Ergonomics design, so as to ensure the comfort & safety of the occupants

Compliance options:

1. Internal Furniture in Spaces (1 point)

- Ensure that the internal furniture design meets the Indian Health facility Guidelines- Part C Access, Mobility OH&S, Section 2- Ergonomics, '2.3-Standard Table' (or) equivalent standard to design the spaces based on the function

Item	Condition	Depth mm	Height mm	Thickness mm
Workbench	Utility	600	900	32
Writing bench 1	Typing	900	720	Max 50
Writing bench 2	Typing	750	720	Max 50
High Counter (parcel Shelf)	Over bench	250	1150	20-32
Shelving	Over 900 ht bench	350	1520-1810	20
Shelving	Over 720 ht bench	350	1370-1710	20
Shelving Unit	Full Height	350-400	1500-1810	20

Source: Indian Health Facility Guidelines

❖ **Circulation Parameters in Spaces (1 point)**

➢ Ensure that atleast 75% of the spaces meet the circulation parameters as mentioned in the Indian Health Facility Guidelines- Part C Access, Mobility OH&S, Section 1- Space Standards & Dimensions, Table 1.5 'Schedule of Circulation Percentages' (or) equivalent standard to design the circulation spaces

No	Department or Functional Planning Unit (FPU)	Minimum Circulation (%)
01	Acute mental health units	32
02	Administration unit	20
03	Allied health unit	25
04	Biomedical engineering	20
05	Catering unit	25
06	Cleaning / housekeeping unit	10
07	Clinical information unit	15
08	Coronary care unit	35
09	Day surgery/ procedure unit	35
10	Dental unit	20
11	Education & training unit	15
12	Emergency unit	40
13	Engineering & maintenance unit	15
14	Inpatient accommodation unit	32
15	Intensive care units	40
16	Laundry/ linen handling unit	10
17	Medical imaging units	35
18	Mortuary unit	15
19	Nuclear medicine unit	30
20	Obstetric unit	35
21	Operating unit	40
22	Pediatric / adolescent unit	32
23	Pathology unit	25
24	Pharmacy unit	25
25	Public amenities unit	10
26	Radiation oncology unit	30
27	Rehabilitation unit	32
28	Renal dialysis unit	32
29	Staff amenities unit	10
30	Sterile supply unit	20
31	Supply unit	10
32	Waste management unit	20

Source: Indian Health Facility Guidelines

Documentation Required:

Internal Furniture in Spaces

1. Narrative describing ergonomic design of furniture along with the dimension details considered.
2. Photographs of the internal furniture.

Circulation Parameters in Spaces

1. Floor plan highlighting the circulation areas of functional planning units.
2. Calculation indicating the circulation areas considered in the project.

Stress Relieving Spaces

IEQ Credit 4

Point(s): 1, 2

Intent:

Design spaces to enhance physical, emotional & spiritual well-being of the healthcare workforce, thereby minimizing stress and anxiety.

Compliance options:

- **Space designed for Physical Fitness (1 point)**

  Demonstrate that atleast one of the following facility is available for 10% of staff, throughout the day

  - Adequate space for facilities such as gymnasium, aerobics
  - Any indoor / outdoor games facility such as badminton, table tennis, carom, chess etc.

- **Space designed for Mental Relaxation (1 point)**

  Demonstrate that atleast three of the following facilities are available for 10% of staff, throughout the day

  - Adequate space for facilities such as yoga, meditation etc.
  - Recreation spaces such as TV room, spa facilities for staff
  - Dedicated recreational space/ Music room for doctors
  - Dedicated dining space for staff & visitors
  - Crèche facility for staff
  - Library

Documentation Required:

Spaces designated for Physical Fitness

1. List of stress reliving spaces (such as gymnasium, aerobics, or any indoor / outdoor games etc) provided in the project, with the location details.
2. Site/ floor plans highlighting the location of stress reliving facilities.
3. Calculations indicating the number of staff catered through physical fitness facilities to the total number of staff, in percentage.
4. Photographs showing the physical fitness facilities.

Spaces designated for Mental Relaxation

1. List of stress reliving spaces (such as yoga/meditation room, TV room, Music room etc) provided in the project, with the location details.
2. Site/ floor plans highlighting the location of stress reliving facilities.
3. Calculations indicating the number of staff catered through facilities for mental relaxation to the total number of staff, in percentage.

Low-emitting Materials

IEQ Credit 5

Point(s):1-4

Intent:

Encourage use of material with low emissions, so as to reduce adverse health impacts on the occupants

Compliance options:

❖ **Paints & Coatings (1 point)**

Use paints and coatings (including primers) with low or no VOC content (as specified in Table-9 given below) for 95% of interior wall and ceiling surface area.

S No	Type of Paints & Coatings	VOC Limit (g/L less water)
1	Non-flat (Glossy)	150
2	Flat mat	50
3	Anti-corrosive/ Anti-rust	250
4	Clear Wood Finish: Varnish	350
5	Clear Wood Finish: Lacquer	550
6	Floor Coatings	100

❖ **Adhesives (1 point)**

For adhesives used in the interiors, ensure that the VOC content does not exceed the limits as specified in Table-10 given below.

S No	Type of Adhesives	VOC Limit (g/L less water)
1	Glazing adhesives	100
2	Ceramic tile adhesives	65
3	Drywall and panel adhesives	50
4	Wood substrata adhesives	30
5	Wood flooring adhesives	100
6	HVAC duct insulation	850
7	Indoor Carpet adhesives	50

❖ **Carpets (1 point)**

All carpets installed in the building interior must comply with CRI Green Label Plus Carpet Programme.

Notes:

- *Project is eligible for this credit point only if, the carpet is installed in at least 10% of the project total carpet area.*
- *Carpets certified by IGBC under Green Product Certification Programme can be used by the project to show compliance, as and when the certified materials are available.*

❖ **Composite Wood (1 point)**

Composite wood and Agri-fiber materials used in the building must not contain added urea-formaldehyde resins.

Notes:

- *Composite wood consists of wood or plant particles or fibers bonded together by a synthetic resin or binder. Examples include plywood, particle-board, and Medium-Density Fiberboard (MDF).*
- *Composite wood that are certified by CII under Green Product Certification Programme (GreenPro) or by a third party agency approved by IGBC can be used by the project to show compliance.*

Documentation Required:

Paints & Coatings:

1. List of low or no VOC content paints & coatings (make & model) used in the building interiors, along with the VOC content (in g/L, less water).
2. Test certificate (or) Manufacturer cut-sheets/ brochures/ Materials Safety Data Sheet (MSDS), indicating the VOC content (in g/L, less water) of the paints & coatings sourced.

Adhesives:

1. List of low or no VOC content adhesives (make & model) used in the building interiors, along with the VOC content (in g/L, less water).
2. Test certificate (or) Manufacturer cut-sheets/ brochures/ Materials Safety Data Sheet (MSDS), indicating the VOC content (in g/L, less water) of the adhesives sourced.

Carpets:

1. Floor plans highlighting the location of the carpet in the project.
2. Calculations indicating the area of the carpet proposed in the project to the total carpet area, in percentage.
3. Certificate stating that the carpet is compliant with CRI Green Label Programme or equivalent.
4. Photographs showing the carpet installed in the project.

Composite Wood:

1. List of composite wood based materials used in the project, with make and model.
2. Manufacturer letter/ Test certificate stating the type of resin used in the composite wood based material. Certificate issued by the agency for the used certified product.
3. Photographs showing all the composite wood based materials.

Building Flush out, During Construction & Before occupancy

IEQ Credit 6

Point(s): 1

Intent

Reduce indoor air quality problems resulting from construction activities, and promote comfort & well-being of construction workers and building occupants

Compliance options:

Develop and implement an Indoor Air Quality (IAQ) management plan during construction and pre-occupancy phase, addressing the following measures, as applicable:

Note:
Consider 'During Construction Indoor Air Quality Management Guidelines' from National Building Code (NBC) of India, Part 7 - Constructional Practices and Safety.

- **Scheduling**
  - Coordinate construction activities to minimise disruption of occupied spaces
  - Carefully sequence construction activities to minimise IAQ issues
  - Protect stored on-site and installed absorptive materials from moisture damage. Do not install moisture-damaged materials unless they have been properly dried
- **Electrical & Mechanical equipment & Systems Protection**
  - Store equipment & systems in a clean, dry location
  - Protect ducts and equipment by sealing openings
  - Clean air plenums before use
- **Housekeeping**
  - Implement practices to ensure a clean job site to control potential contaminants such as dirt, dust and debris
  - Clean up spills, and keep work areas dry
- **Isolate Clean Areas**
  - Isolate areas to prevent contamination of clean or occupied spaces using physical separation
- **Source Control**
  - Avoid use of finish materials with high VOC and formaldehyde levels
  - Isolate and ventilate, as appropriate, when using any toxic materials or creating exhaust fumes
  - Implement measures to avoid the tracking of pollutants into the work area and occupied portions of the building

Documentation Required

1. Indoor Air Quality management plan describing the strategies implemented (during construction and pre-occupancy phase) addressing – scheduling, equipment & systems protection, housekeeping, isolating clean areas and source control.
2. Photographs addressing IAQ measures taken at various stages of the project - construction, installation, commissioning and before occupancy of the building.

Air Quality Monitoring & testing

IEQ Credit 7

Point(s): 1, 2

Intent:

Encourage monitoring and maintenance of indoor environmental quality, to ensure occupants' comfort and well-being

Compliance options:

❖ **Continuous Monitoring Systems (New & Existing Healthcare Facilities) (1 point)**

Demonstrate that the project is monitoring the following indoor environmental parameters:

- Temperature
- Humidity
- TVOC
- Particulates
- CO2

Have a public display system in common spaces such as reception areas, waiting lounges indicating the above levels

❖ **Quarterly Monitoring (Existing Healthcare Facilities) (1 point)**

Conduct baseline IAQ testing using testing protocols consistent with the ISO method and demonstrate that the maximum concentration levels of contaminants are not exceeded than follows

Category	Maximum Concentration
TVOC	500 micrograms per cubic meter
Particulates (PM 2.5)	60 micrograms per cubic meter
CO2	530 ppm differential

The minimum resolution and accuracy of the instrument can be referred from Table 10- 'Specifications of the instruments to be used for measuring IEQ parameters' of ISHRAE's draft Indoor Environmental Quality standards.

Notes:

- *The facility should also have air scavenging system in all critical areas.*

Documentation Required:

Continuous Monitoring System

1. Narrative describing the details of indoor air quality testing in regularly occupied and common areas of the building including the test procedure followed.
2. Indoor air quality test report for each of the regularly occupied and common areas.
3. Photographs showing public display system.

Quarterly Monitoring System

1. Narrative describing the details of indoor air quality testing in regularly occupied and common areas of the building including the test procedure followed
2. Indoor air quality test report for each of the regularly occupied and common areas.

Sanitisation and Hygiene

Municipal Solid Waste Management, Post-occupancy

SH Mandatory Requirement 1

Required

Intent:

Segregate municipal waste generated in healthcare facilities at source, so as to prevent the waste being sent to land-fills and reduce negative impacts on the environment.

Compliance options:

- **Building-level Facility**

  Provide separate bins to collect dry waste (paper, plastic, metals, glass, etc.,) and wet waste (organic), at all floors and common areas of the facility, as applicable. Divert the collected waste to a centralised facility, which is easily accessible for hauling

  (And)

- **Centralised Facility**

  In addition to dry and wet waste bins, provide separate bins for safe disposal of the following hazardous waste, at the centralised facility:

  - **Battery**
  - **'e' waste**
  - **Lamps**

  Note:

  - *The project has to follow the Hazardous Waste Management Guidelines as prescribed by the Ministry of Environment & Forest (MoEF), Government of India.*

Documentation Required:

1. Narrative describing the strategies implemented to:
   i. Segregate and divert dry waste (paper, plastic, metals, glass, etc.,) and wet waste from the building(s), to the easily accessible common facility
   ii. Divert dry & wet waste and other waste such as batteries, e-waste, lamps, and medical waste (if any), from the common facility
2. Floor plans showing the location of waste bins at floor level and common areas, as applicable
3. Site/ floor plan showing the location of the centralised facility for segregation of waste.
4. Photographs showing the waste bins provided at floor level and centralised facility.

Bio-medical Waste Management, Floor & Centralised level

SH Mandatory Requirement 2

Required

Intent:

Segregate bio-medical waste at source, so as to prevent direct exposure, thereby improving sanitation & hygiene

Compliance options:

❖ **Solid Bio-medical Waste Management**

Provide separate bins at all floor levels to collect biomedical waste. The segregation & storage shall adhere Schedule-I of Bio-Medical Waste (Management and Handling) Rules-2016

Refer Appendix-III 'Bio-medical waste categories'

Biomedical waste categories & colour coding of bins are as follows:

SNo	Type of Waste	Colour Coding
1	Human Anatomical Waste	Yellow
2	Animal Anatomical Waste	
3	Soiled Waste	
4	Expired or Discarded Medicines	
5	Chemical Waste	
6	Contaminated Waste (Recyclable)	Red
7	Waste sharps including Metals	White
8	Glassware	Blue
9	Metallic Body Implants	

Source: Bio-Medical Waste (Management and Handling) Rules-2016

❖ **Chemical Liquid Bio-medical Waste Management**

Provide separate collection system (at lab & centralized level) to carry chemical liquid waste leading to effluent treatment system (ETP)

- **Option A:** Divert the chemical liquid waste with the help of third party approved by Central Pollution Control Board (CPCB)
- **Option B:** Provide inhouse ETP
- **Option C:** Combination of Option A and B

Note: In case of Healthcare facilities generating less quantity of chemical waste, the project should have a contract in place with the approved third-party service provider.

The chemical liquid waste shall be pre-treated before mixing with other wastewater. The combined discharge shall conform to the discharge norms given below:

SNo	Parameter	Permissible Limits
1	pH	6.5-9.0
2	Suspended Solids	100 mg/l
3	Oil & Grease	10 mg/l
4	BOD	30 mg/l
5	COD	250 mg/l
6	Bio-assay test	90% survival of fish after 96 hours in 100% effluent

Notes:

- *Ensure the process of disposing the biomedical waste adhere to methodology indicated by MOEF's Biomedical Waste Management Rules 2016*
- *Bio-medical waste means any waste, which is generated during the diagnosis, treatment or immunization of human beings or animals or research activities. (Bio-Medical Waste-Management and Handling Rules)*
- *Chemical liquid waste is waste generated due to use of chemicals in production of biological and used or discarded disinfectants, Silver X-ray film developing liquid, discarded Formalin, infected secretions, aspirated body fluids, liquid from laboratories and floor washings, cleaning, house-keeping and disinfecting activities etc. (Bio-Medical Waste- Management and Handling Rules)*

Documentation Required:

1. Narrative describing the strategies implemented to segregate and processes involved:
    i. Solid bio-medical waste.
    ii. Chemical Liquid bio-medical waste
2. Site/ floor plan showing the location of the centralised facility for segregation of waste.
3. Photographs showing the waste bins provided in the facility.
4. Water quality test report for ETP.
5. Copy of contract with the approved third-party service provider, if applicable.

Infection Control within the Spaces

SH Credit 1

Point(s):1-5

Intent:

Provide appropriate infection control parameters & systems in healthcare facilities, thereby reducing the nosocomial infections

Compliance options:

❖ **Filtration (1 Point)**

Demonstrate that the minimum efficiency reporting values in all spaces to meet ASHRAE 170 - 2013 'Ventilation of Health Care' – Table 6.4

SNo:	Space Designation (According to Function)	Filter Bank No. 1 (MERV)[a]	Filter Bank No. 2 (MERV)[a]
1	Operating rooms (Class B and C surgery); inpatient and ambulatory diagnostic and therapeutic radiology; inpatient delivery and recovery spaces	7	14
2	Inpatient care, treatment, and diagnosis, and those spaces providing direct service or clean supplies and clean processing (except as noted below);AII (rooms)	7	14
3	Protective environment (PE) rooms	7	HEPA[c,d]
4	Laboratories; Procedure rooms (Class A surgery), and associated semi restricted spaces	13[b]	NR
5	Administrative; bulk storage; soiled holding spaces; food preparation spaces; and laundries	7	NR
6	All other outpatient spaces	7	NR
7	Nursing facilities	13	NR
8	Psychiatric hospitals	7	NR
9	Resident care, treatment, and support areas in inpatient hospice facilities	13	NR
10	Resident care, treatment, and support areas in assisted living facilities	7	NR

❖ **Pressurization (1 Point)**

Demonstrate that the pressurization methodology in all regularly occupied spaces shall meet the pressure relationship to the adjacent areas, as prescribed in ASHRAE 170-2013 'Ventilation of Health Care' – Table 7

type of space	Pressure Relationship to the adjacent areas
Operating room	Positive
Delivery room	Positive
Medical/anesthesia gas storage	Negative
Laboratory, general	Negative

Refer Annexure-II 'Ventilation Design Parameter' for elaborative list of spaces

❖ **Purification (1 Point)**

➢ **Air-conditioned healthcare facilities:**

Install one of the following air purification technologies for meeting the compliance

- ♦ Germicidal/ UV lamps in Air Handling Unit (AHU) cooling coils
- ♦ Photo Hydro Ionization O+ (PHIO+) at duct level

➢ **Non Air-conditioned healthcare facilities:**

Install one of the following air purification technologies for meeting the compliance

- ♦ Upper room UVGI
- ♦ Standalone systems with minimum 90% microbial reduction capability

❖ **Antibacterial surfaces (1 Point)**

Demonstrate that the high touch surfaces that are prone to infections, adopt one of the following

➢ Copper/ copper coating approved by International Copper Association India (ICAI)

➢ Bacteriostatic coatings

Use coatings comprised of a material that is antimicrobial, abrasion-resistant, non-leaching and is supported by valid tests on common microbial.

Refer Annexure-III for list of high touch surfaces as defined by Centre for Disease Control & Prevention

❖ **Entryway System (1 Point)**

➢ Install entryway systems of minimum 2 meters (6 feet) in length, at all building main entrances (public entrance and service entrance)

Documentation Required:

1. Narrative describing strategies implemented to minimise infection control within the spaces

2. Filtration:

i. Purchase invoice and technical cut-sheets of the MERV filters installed at filter bank-1 & filter bank-2.

ii. Floor plans highlighting the location of AHU rooms.

iii. Photographs showing MERV filters installed.

3. Purification:

i. Purchase invoice and technical cut-sheets of the purification system installed.

ii. Floor plans highlighting the location of AHU rooms.

iii. Cross-sectional drawings highlighting the location of germicidal/ UV lamp/ photo hydroionization in the AHU's/ TFA's/duct level.

iv. Photographs showing purification technique installed.

4. Pressurization:

i. Pressure relations in all the patient and regularly occupied areas.

5. Antibacterial Surfaces:

i. Cu+ test certificate by International Copper Association, India.

ii. Purchase invoice and technical cut-sheets of the bacteriostatic coatings.

iii. Photographs of antibacterial surfaces.

6. Entryway System:

i. Floor plans highlighting the location of entryway systems at the building main entrance(s).

ii. Photographs of the installed entryway systems.

Isolation Room

SH Credit 2

Point(s):1,2

Intent:

Ensure provision of adequate & well-designed isolation rooms, thereby eliminating the risk of Hospital Acquired Infections (HAI) to the occupants.

Compliance options:

- **Isolation Rooms**
  - **10% of the total Inpatient Accommodation Beds/ Units shall be designed as isolation room, Class S – Standard Pressure (1 point)**

    Recommended elements for Class S Isolation Rooms are as follows:

    - A clinical handwash basin within the room
    - An Ensuite shower and toilet.
    - A self-closing door.

    Source: Isolation rooms design, Indian Health Facility Guidelines
  - **Filtration and Pressurization (1 point)**

    The Filtration and Pressurization Parameters for isolation room shall meet the requirements as prescribed in ASHRAE 170-2013 'Ventilation of Health Care' – Table 7.1 'Design Parameter'

    Refer Annexure-II 'Ventilation Design Parameter' for elaborative list of spaces

Documentation Required:

Isolation rooms

1. Calculations indicating the total isolation rooms provided in the project
2. Cross-sectional drawings highlighting the location and fresh air ventilation system provided in the isolation room.
3. Photograph of the isolation room

Filtration & Pressurisation

1. Purchase invoice and technical cut-sheets of the MERV filters installed at filter bank-1 & filter bank-2.
2. Photographs showing MERV filters installed.

Sanitation Facilities

SH Credit 3

Point(s):1

Intent:

Ensure adequate sanitation facilities, to reduce cross infections, thereby reducing risk of Hospital Acquired Infections (HAI) to the occupants.

Compliance option:

❖ **Washrooms**

Ensure the quantity and facilities provided in washrooms shall adhere to the requirement of National Building Code-Part 9, Table 13, 14 & 15 or Indian Public Health Standards (IPHS) Guidelines.

The facilities in washrooms for Indoor Patient Wards, Outdoor Patient Department, Administrative Block & Nursing Homes shall include (not limited to) the following:

- Water closets
- Washbasin
- Showers
- Urinals
- Ablution tap

Refer Annexure-V 'Wash Room Design' for elaborative list of spaces

Documentation required:

Sanitation facilities

1. Narrative describing measures implemented along with statement indicating no. of washrooms provided in the facility
2. Floor plans highlighting the location of washrooms

Ecofriendly Cleaning Practices

SH Credit 4

Point(s): 1, 2

Intent:

Ensure use of eco-friendly housekeeping chemicals and maintain cleanliness & hygiene thereby reducing the impact of Hospital Acquired Infection (HAI).

Compliance option:

- **Eco-friendly Housekeeping Chemicals (1 point)**

  Demonstrate that project is using housekeeping chemicals that meet green seal standard (GS-37) or other Indian/ European equivalent standards, for all building applications

- **Cleaning Protocol in spaces (1 point)**
  - **Outpatient wards, Inpatient wards and Specialized patient areas**

    Ensure regular cleaning of areas including Outpatient wards, Inpatient wards and Specialized patient areas, as recommended by Centre for Disease Control & Prevention (CDC) for evaluating Environmental Cleaning in Hospitals

  - **High touch Surfaces**

    Ensure that the High Touch Surfaces in all regular occupied spaces are mopped, sanitized on a daily basis (frequency as required)

    The project may adopt protocol provided by Centre for Disease Control & Prevention (CDC) for evaluating Environmental Cleaning in Hospitals.

High-touch Surfaces	Cleaned	Not Cleaned	Not Present in Room
Bed rails / controls			
Tray table			
IV pole (grab area)			
Call box / button			
Telephone			
Bedside table handle			
Chair			
Room sink			
Room light switch			

Room inner doorknob			
Bathroom inner door knob / plate			
Bathroom light switch			
Bathroom handrails by toilet			
Bathroom sink			
Toilet seat			
Toilet flush handle			
Toilet bedpan cleaner			

Source- CDC

Documentation required:

Eco-friendly Housekeeping Chemicals

1. List of all building applications where housekeeping chemicals are used.
2. List of eco-friendly housekeeping chemicals to be used in the project
3. Purchase invoices of eco-friendly housekeeping chemicals procured in the past 1 year.
4. Material Safety Data Sheet (MSDS)/ product datasheets for all housekeeping chemicals.

Cleaning Protocol in spaces

1. Schedule of cleaning in spaces such as Outpatient wards, Inpatient wards and Specialized patient areas
2. List of high touch surfaces identified in regularly occupied spaces
3. Narrative on cleaning and monitoring practices adopted by the project

Automated Solid Waste Management System

SH Credit 5

Point(s): 2

Intent

Facilitate automatic waste collection system to reduce human intervention & exposure in handling hospital waste, thereby improving sanitation & hygiene

Compliance option:

- **New healthcare facilities**

  Install automatic waste collection systems for handling 95% of total solid waste (including domestic and biomedical waste):

Documentation Required:

1. Calculations indicating the quantity of solid waste handled by automated waste management system
2. Section highlighting the location of automated waste management system installed in the project.
3. Manufacturer brochure/ cut-sheet
4. Purchase invoice/ payment receipts of the installed automated waste management system.
5. Photographs showing the installed automated waste management system.

Organic Waste Management

SH Credit 6

Point(s): 1, 2

Intent:

Ensure effective organic waste management, so as to avoid domestic waste being sent to landfills

Compliance options:

❖ Install an on-site waste treatment system for handling at least 50% of the organic (kitchen, landscape) waste generated in the facility.

Percentage of Organic waste treated	Points
50%	1
75%	2

Notes:

- *For calculation of occupants in inpatient wards and food courts (inhouse kitchen is provided), food waste can be considered as 0.25 kg per person per day or as prescribed by the local byelaw, whichever is more stringent*
- *For calculation of healthcare workforce & staff (kitchen is not provided), food waste can be considered as 0.1 kg per person or as prescribed by the local byelaw, whichever is more stringent*
- *If the project is having an organic waste convertor in an enclosed room, then design such area with exhaust system, self-closing door, deck-to-deck partition/ hard ceiling*
- *The generated manure from the composting shall be utilised in the landscape area of the project*

Documentation Required:

1. Narrative describing the strategies to handle kitchen waste, and the on-site organic waste treatment system.
2. Site plan highlighting the location of on-site organic waste treatment system installed in the project.
3. Calculations indicating the quantity of organic waste treated in the project (including tenant-occupied areas) to the quantity of organic waste generated, in percentage.
4. Manufacturer brochure/ cut-sheet of the installed organic waste treatment system.
5. Purchase invoice/ payment receipts of the installed organic waste treatment system.
6. Photographs showing the installed organic waste treatment system.

If the project is having an organic waste convertor in an enclosed room:

1. Floor plans highlighting the location of organic waste convertor.
2. Details of exhaust system such as negative pressure maintained/ air changes/ exhaust rate.
3. Photographs showing exhaust system, self-closing door, deck-to-deck partition/ hard ceiling.

Energy Efficiency

Ozone Depleting Substances

EE Mandatory Requirement 1

Required

Intent:

Encourage use of eco-friendly refrigerants and halons in the facility, thereby minimizing negative impact on the ozone layer.

Compliance options:

- **CFC-free Refrigerants**

  Demonstrate that refrigerants used in the facility Heating, Ventilation & Air-conditioning (HVAC) equipment are CFC (Chloro Fluoro Carbon)-free.

  (And)

- **Halon-free Fire Suppression Systems**

  Demonstrate that fire suppression systems used in the facility are free from Halons or any other ozone depleting substances

Documentation Required:

CFC-free Refrigerants

1. Declaration letter signed by the owner/ HVAC consultant stating the type of refrigerants installed in the HVAC systems.
2. If HVAC systems (including unitary air-conditioners) are not installed in the project, provide a declaration letter signed by the owner stating that no HVAC systems are installed in the project.
3. Manufacturer cut-sheet/ brochure of HVAC systems indicating the type of refrigerant installed in the project.

Halon-free Fire Suppression Systems

1. Declaration letter signed by the owner/ MEP consultant stating the type of fire suppression systems installed in the project.
2. Manufacturer cut-sheet/ brochure of fire suppression systems installed in the project.
3. Photographs of the fire suppression system.

Minimum Energy Efficiency

EE Mandatory Requirement 2

Required

Intent:

Optimise energy consumption, so as to reduce negative environmental impacts from excessive energy use.

Compliance options:

❖ **New healthcare facilities**

➢ **Case A - Air-conditioned healthcare facilities**

Design the facility to comply with Energy Conservation Building Code (Revised Version May, 2008) (or) ASHRAE Standard 90.1-2013 (without amendments) through one of the following approaches:

♦ Option 1 - Performance based approach (Whole building simulation)

Demonstrate compliance of the facility performance by whole facility simulation, as per the baselines outlined in ECBC (or) ASHRAE Standard 90.1-2013 (without amendments), Appendix - G. Simulation is to be carried out at comfort temperatures of 24 $\pm$ 2 deg C.

♦ Option 2 - Prescriptive approach

The total annual energy consumption of the building should not exceed the total base case energy consumption computed, as per ECBC (or) ASHRAE Standard 90.1-2013.

Notes:

Option 1 - Performance based approach (Whole building simulation)

- *In cases where lighting systems are yet to be installed, the proposed case LPD during simulation shall be same as the base case.*
- *Projects that use on-site renewable energy sources (such as solar energy, wind power, biomass, etc.,) can subtract renewable energy generated from the total annual energy consumption of the proposed case (this is applicable only for mandatory requirement).*
- *Projects that use solar hot water systems can model the systems in the proposed case, as against electrical heaters in the base case, to show energy savings.*
- *Projects which have process loads not related to building operations should be considered during simulation. While reporting, such loads can be excluded from the base case and proposed case annual energy consumption. The process loads which are excluded shall be justified with a narrative.*
- *Project with multiple buildings (including projects with common basement) must independently meet the Minimum Energy Performance criteria for each building.*

Option 2 - Prescriptive Approach

The project should meet the applicable criteria as established in prescriptive measures of ECBC (or) ASHRAE Standard 90.1-2013 (without amendments).

- **Case B - Non air-conditioned healthcare facilities: (Prescriptive Approach)**

Non air-conditioned facilities are those which are not serviced and will not be serviced in the future, either through central air-conditioned systems or unitary air-conditioners.

- Air-conditioning may be considered for critical areas, not more than 10% of the total regularly occupied area.
- Spaces with unitary air-conditioners shall comply with IEQ Mandatory Requirement 1

  - Fresh Air Ventilation, Non air-conditioned buildings criteria

Non air-conditioned buildings shall meet the following prescriptive measures, as applicable:

1) Building envelope:

The project must ensure that the following building envelope measures meet the baseline criteria as outlined in Annexure - VII

- Solar Heat Gain Coefficient (SHGC) *
- Window Glazing U-value (only if WWR > 40%) **
- Overall Wall Assembly U-value
- Overall Roof Assembly U-value

Notes:

- *For Climatic Zones of India, please refer Annexure - VI.*
- **Low SHGC value can be achieved through chajjas or other sun shading devices or efficient fenestration or a combination of both. For details, refer ECBC section 4.3.3 - Vertical Fenestration, Exception to ECBC 4.3.3.*
- ***Compliance for window glazing U-value should be shown only if Window-to-Wall Ratio (WWR) is more than 40%.*

2) Lighting:

The Lighting Power Density (LPD) in the building interior, exterior and parking areas shall be reduced by minimum 10% over ECBC base case.

Notes:

- *Compliance for the lighting power density shall be shown either through 'Building Area Method' or 'Space Function Method'. If 'Building Area Method' is considered, compliance for parking area lighting shall be shown separately.*
- *Exterior areas illuminated by lighting only should be considered for lighting power density calculations.*
- *The LPD should include power consumption of complete fixture, including lamps and ballasts*

3) Air-conditioning Systems:

Projects having air-conditioners (as per criteria the defined for non air-conditioned buildings), shall consider unitary air-conditioners with BEE 3-star rating (or) air-conditioners with a COP equivalent to 3.1 (EER of 10.58), or more.

4) Heating Systems:

Projects having more than 150 Heating degree days** (HDD18) shall consider heating systems in proposed case to meet a base line COP of 2.5 (EER of 8.53), when heat pumps are installed in the building.

Notes:

- *** Degree day: The difference in temperature between the outdoor mean temperature over 24 hour period and a given base temperature.*
- ***Heating degree day base 18oC, (HDD 18): For any one day, when the mean temperature is less than 18oC, there are as many degree-days as degree centigrade temperature difference between the mean temperature for the day and 18oC.*

Annual heating degree-days (HDDs) are the sum of the degree-days over the calendar year.

5) Fans:

Fans installed in the building shall have an efficiency equivalent to BEE 3-star rating or more.

6) Pumps & Motors:

Pumps & Motors installed in the building shall have an efficiency equivalent to BEE 3-star rating or more.

General Notes:

- *Projects which use on-site renewable energy sources (such as solar energy, wind power, biomass, etc.,) can subtract renewable energy generated from the total energy of the proposed case.*
- *Projects installing solar hot water systems can assume electrical heating in the base case.*
- *Energy efficient materials, products and equipment that are certified by IGBC under Green Product Certification Programme or by a third party agency approved by IGBC can be used by the project to show compliance*

❖ **Existing healthcare facilities:**

➢ **Option 1- EPI Approach**

Demonstrate that the annual energy consumption in the facility is within the Energy Performance Index (EPI) limits as mentioned in the table below:

Climatic Zone	EPI range
Warm & Humid	275
Composite	264
Hot & Dry	261
Moderate	247

Source: Implementing Energy Efficiency in Buildings (A report by UNDP, BEE)

➢ **Option 2 - Performance Based Approach (Whole Building Simulation)**

Demonstrate compliance of the facility performance by whole building simulation, as per the baselines outlined in ECBC (or) ASHRAE Standard 90.1-2010 (without amendments), Appendix - G. Simulation is to be carried out at comfort temperatures of 24 $\pm$ 2 deg C

Documentation Required

New Healthcare Facilities

Case A – Air-conditioned healthcare facilities

Option 1: Performance Based Approach (Whole Building Simulation):

1. Building simulation analysis with the following information, as applicable:

Note: The baselines should be as per Energy Conservation Building Code (Revised Version May, 2008) (Or) ASHRAE Standard 90.1-2010 (without amendments).

i. Narrative stating the climate zone and the list of Energy Conservation Measures (ECMs) implemented in the project.

ii. Note: The list should include all ECMs that differ from the baseline building performance to proposed building performance.

iii. Window-to-wall ratio (WWR) calculations for each building.

iv. Comparison between the baseline building performance and the proposed building performance with percentage improvement.

v. The schedules for lighting power, thermostat set-point, HVAC system, miscellaneous equipment power, etc., for the proposed building, as determined by the designer.

vi. Input and output report(s) from the simulation program or compliance software including a breakdown of energy usage for the following components, but not limited to: interior lighting and exterior lighting, space cooling & heat rejection equipment, space heating equipment, fans, other HVAC equipment (such as pumps), internal and external equipment loads, etc., The output reports should also show the unmet hours by the HVAC system, for both the proposed design and baseline building design.

vii. An explanation of any error messages noted in the simulation program output.

2. Details of the glazing along with the specifications (SHGC value, U-value and VLT).
3. Construction details and sectional drawings of the wall assembly (including wall insulation material, etc.,), along with the U-value of the overall wall assembly.
4. Construction details and sectional drawings of the roof assembly (including roof insulation material, etc.,), along with the U-value of the overall roof assembly.
5. Details of the lighting systems and controls including the list of interior and exterior lighting fixtures, with make and model.
    i. LPD calculations, as per 'Building Area Method' or 'Space-by-Space method/Space function method'.
    ii. Interior and exterior lighting layout.
6. Details of the air-conditioning system indicating the COP/ EER values, along with make and model.
7. Details of the space heating system indicating the COP/ EER values, along with make and model.
8. Details of solar water heating system such as calculations, plans showing location of solar water heating system.
9. Other Energy Conservation Measures (ECMs) details.
10. Manufacturer brochures/ cut-sheets/ letters indicating the efficiency parameters for glazing (SHGC value, U-value and VLT), wall and roof insulation materials, lighting fixtures & systems, air-conditioning system and space heating system, solar water heating system, as applicable.
11. Purchase invoices of energy conservation measures implemented in the project such as glass, wall and roof insulation, lighting systems, chillers, heat recovery wheel, solar hot water system, etc., as applicable.

Option 2: Prescriptive Approach:

Document the prescriptive measures outlined in Energy Conservation Building Code (Revised Version May, 2008) (Or) ASHRAE Standard 90.1-2010 (without amendments) with the following information, as applicable:

1. Narrative stating the climate zone and the list of Energy Conservation Measures (ECMs) implemented in the project.
2. Window-to-wall ratio (WWR) calculations for each building.
3. Comparison between the baseline building parameters and the proposed building parameters.
4. Details of the glazing along with the specifications (SHGC value, U-value and VLT).
5. Construction details and sectional drawings of the wall assembly (including wall insulation material, etc.,), along with the U-value of the overall wall assembly.
6. Construction details and sectional drawings of the roof assembly (including roof insulation material, etc.,), along with the U-value of the overall roof assembly.
7. Details of the lighting systems and controls including the list of interior and exterior lighting fixtures, along with make and model.

i. LPD calculations, as per 'Building Area Method' or 'Space-by-Space method /Space function method'.

ii. Interior and exterior lighting layout.

12. Details of the air-conditioning system indicating the COP/ EER values or BEE star rating, along with make and model.
13. Details of the space heating system indicating the COP/ EER values or BEE star rating, along with make and model.
14. Details of solar water heating system such as calculations, plans showing location of solar water heating system.
15. Other Energy Conservation Measures (ECMs) details.
16. Manufacturer brochures/ cut-sheets/ letters indicating the efficiency parameters for glazing (SHGC value, U-value and VLT), roof insulation materials, lighting fixtures, air-conditioning system and space heating system, as applicable.
17. Purchase invoices of energy conservation measures implemented in the project such as glass, wall and roof insulation, lighting sensors, chillers, solar hot water system, etc., as applicable.

Case B – Non Air-conditioned healthcare facilities *(through Prescriptive Approach)*

Document the prescriptive measures outlined in the rating system, as applicable:

1. Narrative stating the climate zone and the list of Energy Conservation Measures (ECMs) implemented in the project.
2. Window-to-wall ratio (WWR) calculations for each building.
3. Comparison between the baseline building parameters and the proposed building parameters. For baseline criteria of building envelope measures, refer Annexure – I.

Building Envelope

1. Details of the glazing along with the specifications (SHGC value, U-value and VLT).
2. Construction details and sectional drawings of the wall assembly (including wall insulation material, etc.,), along with the U-value of the overall wall assembly.
3. Construction details and sectional drawings of the roof assembly (including roof insulation material, etc.,), along with the U-value of the overall roof assembly.

Lighting

1. Details of the lighting systems and controls including the list of interior and exterior lighting fixtures, along with make and model.

   i. LPD calculations, as per 'Building Area Method' or 'Space function method'.

   ii. Interior and exterior lighting layouts.

Air-conditioning Systems

Details of the air-conditioning system indicating the COP/ EER values or BEE star rating, along with make and model.

Heating Systems

Details of the space heating system indicating the COP/ EER values or BEE star rating, along with make and model.

Fans

Details of the fans indicating the BEE star rating or efficiency, along with make and model.

Pumps & Motors

Details of the pumps & motors indicating the BEE star rating or efficiency, along with make and model.

Supporting Documents

1. Manufacturer brochures/ cut-sheets/ letters indicating the efficiency parameters for glazing (SHGC value, U-value and VLT), roof insulation materials, lighting fixtures, air-conditioning system, space heating system, fans, pumps & motors, as applicable.
2. Purchase invoices of energy conservation measures implemented in the project such as glass, wall and roof insulation, lighting controls, air- conditioning systems, heating systems, fans, pumps & motors, as applicable.

Existing Healthcare Facilities

Option 1: EPI Approach:

1. Electricity consumption details including utility power, captive generation and renewable energy of preceding 1 year.
2. EPI calculations

Option 2: Performance Based Approach (Whole Building Simulation):

1. Building simulation analysis with the following information, as applicable:

   The baselines should be as per Energy Conservation Building Code (Revised Version May, 2008) (Or) ASHRAE Standard 90.1-2010 (without amendments).

   i. Narrative stating the climate zone and the list of Energy Conservation Measures (ECMs) implemented in the project.

   ii. Note: The list should include all ECMs that differ from the baseline building performance to proposed building performance.

   iii. Window-to-wall ratio (WWR) calculations for each building.

   iv. Comparison between the baseline building performance and the proposed building performance with percentage improvement.

   v. The schedules for lighting power, thermostat set-point, HVAC system, miscellaneous equipment power, etc., for the proposed building, as determined by the designer.

vi. Input and output report(s) from the simulation program or compliance software including a breakdown of energy usage for the following components, but not limited to: interior lighting and exterior lighting, space cooling & heat rejection equipment, space heating equipment, fans, other HVAC equipment (such as pumps), internal and external equipment loads, etc., The output reports should also show the unmet hours by the HVAC system, for both the proposed design and baseline building design.

vii. An explanation of any error messages noted in the simulation program output.

2. Details of the glazing along with the specifications (SHGC value, U-value and VLT).
3. Construction details and sectional drawings of the wall assembly (including wall insulation material, etc.,), along with the U-value of the overall wall assembly.
4. Construction details and sectional drawings of the roof assembly (including roof insulation material, etc.,), along with the U-value of the overall roof assembly.
5. Details of the lighting systems and controls including the list of interior and exterior lighting fixtures, with make and model.

1. LPD calculations, as per 'Building Area Method' or 'Space-by-Space method /Space function method'.
2. Interior and exterior lighting layout.
6. Details of the air-conditioning system indicating the COP/ EER values, along with make and model.
7. Details of the space heating system indicating the COP/ EER values, along with make and model.
8. Details of solar water heating system such as calculations, plans showing location of solar water heating system.
9. Other Energy Conservation Measures (ECMs) details.
10. Manufacturer brochures/ cut-sheets/ letters indicating the efficiency parameters for glazing (SHGC value, U-value and VLT), wall and roof insulation materials, lighting fixtures & systems, air-conditioning system and space heating system, solar water heating system, as applicable.
11. Purchase invoices of energy conservation measures implemented in the project such as glass, wall and roof insulation, lighting systems, chillers, heat recovery wheel, solar hot water system, etc., as applicable.

Commissioning Plan for Building equipment & Systems

EE Mandatory Requirement 3

Required

Intent:

Verify and ensure that the facility's equipment & systems are commissioned to achieve performance as envisaged during the design stage.

Compliance options:

The project shall comply with the following requirements:

- Demonstrate that the project owner has signed an agreement with third party commissioning authority, not involved in the design. The commissioning authority is also required to have at least 3 years prior experience in equipment & systems.

  Notes:

  - Air-conditioned healthcare facilities: Projects with less than 2,000 sq.m of built-up area, the owner or the designer can submit the commissioning plan.
  - Non air-conditioned healthcare facilities: For non-air-conditioned projects, the owner or the designer can submit the commissioning plan.

  (AND)

- Document owners brief in terms of performance expectations from the facility.
- Submit a plan to show how the facility would be audited for its green building performance after occupancy, with regard to the following:
  - HVAC systems - chiller, VRV systems, primary & secondary water pumps, cooling tower, AHU fans, fresh air fans and flow settings, fresh air treatment units, heat recovery wheel, VFDs
  - Unitary air-conditioners
  - Temperature and RH measurements in individual spaces
  - Pumps & motors
  - Lighting systems
  - Renewable energy systems
  - CO2 monitoring system
  - Energy & Water metering
  - Building management system
  - DG sets or Back-up systems
  - Sewage treatment plant
  - Any other equipment and systems

- Report specific observations and variations identified by commissioning authority to the project owner, for each equipment & system, with respect to commissioning plan and how they were addressed.
- Submit measurement & verification plan for yearly reporting.
- Submit post-occupancy survey to verify occupant comfort (lighting levels, temperature, relative humidity, noise levels, etc.,)
- Report on green building performance of the equipment & systems listed in commissioning plan. The report for each of the equipment & systems should cover the following:
  - Equipment specifications
  - Test results with specific comments from the Commissioning Authority, at the time of commissioning
  - Key monitoring aspects to sustain performance
  - Estimated energy & water consumption
  - Scope for performance enhancing in future, and savings thereof

Documentation Required

1. Copy of an agreement signed between the owner and the third- party commissioning authority.

   Note: The project may choose not to disclose the financials.
2. Narrative describing the experience of commissioning authority, on similar projects.
3. Owners brief in terms of performance expectations from the building.
4. Commissioning plan describing how the building would be audited for its green building performance after occupancy, with regard to the equipment and systems.
5. Report specific observations and variations identified by commissioning authority to the project owner, for each equipment and system with respect to commissioning plan and how they were addressed.
6. Measurement & verification plan for yearly reporting.
7. Post-occupancy survey to verify occupant's comfort (lighting levels, temperature, relative humidity, noise levels, etc.,).
8. Report on green building performance of the equipment & systems listed in commissioning plan.

Eco-friendly Refrigerants

EE Credit 1

Point(s): 1

Intent

Encourage use of eco-friendly refrigerants in the facility, thereby minimising impact on the ozone layer.

Compliance options

❖ Demonstrate that refrigerants used in the facility Heating, Ventilation & Air-conditioning (HVAC) equipment are eco-friendly and have low or no Ozone Depletion Potential (ODP) and Global Warming Potential (GWP).

The projects HVAC equipment must comply with the following formula, which sets a maximum threshold for the combined contributions to ozone depletion and global warming potential:

$$LCGWP + LCODP \times 10^5 < 13$$

LCODP : [ODPr x (Lr x Life +Mr) x Rc]/Life

LCGWP : [GWPr x (Lr x Life +Mr) x Rc]/Life

LCODP : Lifecycle Ozone Depletion Potential (kg CFC 11 / kW-Year)

LCGWP : Lifecycle Direct Global Warming Potential (kg CO2 / kW-Year)

GWPr : Global Warming Potential of Refrigerant (0 to 12,000 kg CO2 / kg r)

ODPr : Ozone Depletion Potential of Refrigerant (0 to 0.2 kg CFC 11 / kgr)

Lr : Refrigerant Leakage Rate (0.5% to 2.0%; default of 2% unless otherwise demonstrated)

Mr : End-of-life Refrigerant Loss (2% to 10%; default of 10% unless otherwise demonstrated)

Rc : Refrigerant Charge (0.065 to 0.65 kg of refrigerant per kW of gross AHRI rated cooling capacity or Eurovent Certified cooling capacity)

Life : Equipment Life (10 years; default based on equipment type, unless otherwise demonstrated)

Notes:

- *For multiple types of equipment, a weighted average of all base building HVAC&R equipment must be calculated using the following formula:*

$$\Sigma \frac{(LCGWP + LCODP \times 10^{5}) \times Q_{unit}}{Q_{total}} \leq 13$$

Qunit = Eurovent Certified cooling capacity of an individual HVAC or refrigeration unit (kW) (or) Gross AHRI rated cooling capacity of an individual HVAC or refrigeration unit (kW)

Qtotal = Total Eurovent Certified cooling capacity of all HVAC or refrigeration (kW) (or) Total gross AHRI rated cooling capacity of all HVAC or refrigeration

- *Small HVAC units (containing less than 0.25 kg of refrigerant) need not be considered in calculation*

Documentation Required:

1. Type of refrigerants installed in the HVAC systems.
2. Calculations indicating the combined contributions of the refrigerant installed in the HVAC system, to ozone depletion and global warming.

Enhanced Energy Efficiency

EE Credit 2

Point(s): 1-12

Intent:

Optimise energy consumption, to reduce negative environmental impacts from excessive energy use.

Compliance options:

❖ **New Healthcare facilities**

➢ **Case A - Air-conditioned healthcare facilities:**

Design the facility to comply with ASHRAE Standard 90.1-2013, Appendix - G (without amendments) through Performance based approach (Whole building simulation). Simulation is to be carried out at comfort temperatures of 24 + 2 deg C.

Points are awarded based on energy cost percentage savings as detailed below:

Percentage of Energy Cost Savings over ASHRAE Standard 90.1-2013 Base case	
New Healthcare Facilities	Points
6%	1
8%	2
10%	3
12%	4
14%	5
16%	6
18%	7
20%	8
22%	9
24%	10
26%	11
28%	12

Notes:

- *Project with multiple buildings (including projects with common basement) must independently meet the minimum energy performance criteria for each building, to be eligible for Enhanced Energy Performance.*
- *Major Renovation Buildings are those buildings where significant modifications have been made in the building envelope, mechanical and electrical systems.*
- *Energy efficient materials, products and equipment that are certified by IGBC under Green Product Certification Programme or by a third party agency approved by IGBC can be used by the project to show compliance.*

- **Case B - Non air-conditioned healthcare facilities: (Prescriptive Approach)**

Non-air-conditioned facilities shall meet or exceed the following prescriptive measures, as
applicable:

1) Building envelope: (3 Points)

The project must ensure that at least three of the following building envelope measures meet the baseline criteria as outlined in Annexure - VIII.

- Solar Heat Gain Coefficient (SHGC)
- Window Glazing U-value
- Overall Wall Assembly U-value
- Overall Roof Assembly U-value

2) Lighting:

- **Lighting Power Density: (2 Points)**

The lighting power density in the building interior, exterior and parking areas shall be reduced by minimum 20% over ECBC base case.

Points are awarded as below:

Reduction in Lighting Power Density	Points
≥ 20 %	1
≥ 30 %	2

- **Lighting Controls: (1 point)**

All non-emergency exterior & common area lighting such as façade, pathways, landscaping, surface and covered parking, street lighting, staircases should have at least one of the following:

- **Daylight sensor**
- **occupancy / Motion sensor**
- **timer**

3) Air-conditioning Systems: (2 Point)

Projects having 90% of air-conditioners (as per the criteria defined for non-air conditioned buildings), shall consider unitary air-conditioners with BEE 5-star rating (or) air-conditioners with a COP equivalent to 3.5 (EER of 11.95), or more.

4) Heating Systems: (1 Point)

Projects having more than 150 Heating degree days** (HDD18) shall consider heating systems in proposed case and show a minimum of 10% efficiency over the baseline COP of 2.5 (EER of 8.53), when heat pumps are installed in the building.

5) Fans: (2 Points)

Fans installed in the building shall have an efficiency equivalent to BEE 5-star rating

6) Pumps & Motors: (1 Point)

Pumps & Motors installed in the building shall have an efficiency equivalent to BEE 5-star rating.

Note:

- *Energy efficient materials, products and equipment that are certified by IGBC under Green Product Certification Programme or by a third party agency approved by IGBC can be used by the project to show compliance.*

❖ **Existing Healthcare Facilities:**

➢ **Option 1- EPI Approach**

Demonstrate that the annual energy consumption in the building is within the Energy Performance
Index (EPI) limits as mentioned in the table below.

Climatic Zone	EPI range
Warm & Humid	275
Composite	264
Hot & Dry	261
Moderate	247

Source: Implementing Energy Efficiency in Buildings (A report by UNDP, BEE)

➢ **Option 2 - Performance Based Approach (Whole Building Simulation)**

Demonstrate compliance of the building performance by whole building simulation, as per the
baselines outlined in ECBC (or) ASHRAE Standard 90.1-2013 (without amendments), Appendix
- G. Simulation is to be carried out at comfort temperatures of 24 + 2 deg C

Points are awarded based on energy percentage savings as detailed
below: (for Option 1 & Option 2)

Percentage of Energy Savings over EPI	
New Healthcare Facilities	Points
6%	1
8%	2
10%	3
12%	4
14%	5
16%	6
18%	7
20%	8
22%	9
24%	10
26%	11
28%	12

Documentation Required:

New Healthcare Facilities

Case 1 – Air-conditioned healthcare facilities (through Performance Based Approach/ Whole BuildingSimulation)

Please refer to the 'Documentation required' under EE Mandatory Requirement 2 – Minimum Energy Efficiency: Case 1 – Air-conditioned Buildings, Option 1- Performance Based Approach (Whole Building Simulation).

Case 2 – Non-Air-conditioned healthcare facilities (through Prescriptive Approach)

Please refer to the 'Documentation required' under EE Mandatory Requirement 2 – Minimum Energy Efficiency: Case 2 – Non-Air-conditioned Buildings (through Prescriptive Approach).

Document the prescriptive measures outlined in the rating system, as applicable:

1. Narrative stating the climate zone and the list of Energy Conservation Measures (ECMs) implemented in the project.
2. Window-to-wall ratio (WWR) calculations for each building.
3. Comparison between the baseline building parameters and the proposed building parameters. For baseline criteria of building envelope measures, refer Annexure – I.

Building Envelope

1. Details of the glazing along with the specifications (SHGC value, U-value and VLT).
2. Construction details and sectional drawings of the wall assembly (including wall insulation material, etc.,), along with the U-value of the overall wall assembly.
3. Construction details and sectional drawings of the roof assembly (including roof insulation material, etc.,), along with the U-value of the overall roof assembly.

Lighting

Details of the lighting systems and controls including the list of interior and exterior lighting fixtures, along with make and model.

i. LPD calculations, as per 'Building Area Method' or 'Space function method'.

ii. Interior and exterior lighting layouts.

Air-conditioning Systems

Details of the air-conditioning system indicating the COP/ EER values or BEE star rating, along with make and model.

Heating Systems

Details of the space heating system indicating the COP/ EER values or BEE star rating, along with make and model.

Fans

Details of the fans indicating the BEE star rating or efficiency, along with make and model.

Pumps & Motors

Details of the pumps & motors indicating the BEE star rating or efficiency, along with make and model.

Supporting Documents

i. Manufacturer brochures/ cut-sheets/ letters indicating the efficiency parameters for glazing (SHGC value, U-value and VLT), roof insulation materials, lighting fixtures, air-conditioning system, space heating system, fans, pumps & motors, as applicable.

ii. Purchase invoices of energy conservation measures implemented in the project such as glass, wall and roof insulation, lighting controls, air- conditioning systems, heating systems, fans, pumps & motors, as applicable.

New Healthcare Facilities

Option 1 – EPI Approach

Please refer to the 'Documentation required' under EE Mandatory Requirement 2 – Minimum Energy Efficiency: Option 1 – EPI Approach.

Option 2 – Performance based approach (Whole Building Simulation)

Please refer to the 'Documentation required' under EE Mandatory Requirement 2 – Minimum Energy Efficiency: Option 2 – Performance based approach (Whole Building Simulation)

On-site Renewable energy

EE Credit 3

Point(s): 1-5

Intent:

Encourage the use of on-site renewable technologies, to minimise the environmental impacts associated with the use of fossil fuel energy

Compliance options:

❖ **Option 1:**

Demonstrate on-site renewable energy generation for at least 1% of total annual energy consumption of the facility (interior & exterior areas).

Points are awarded as below:

Percentage of On-site Renewable Energy Generated to the Total Annual Energy Consumption	Points
≥ 1 %	1
≥ 2 %	2
≥ 3 %	3
≥ 4 %	4
≥ 5 %	5

❖ **Option 2:**

If the annual energy consumption is not yet know, demonstrate on-site renewable energy generation for at least 4% of total connected load (interior & exterior areas).

Percentage of On-site Renewable Energy Generated to the Total Annual Energy Consumption	Points
≥ 4 %	1
≥ 8 %	2
≥12 %	3
≥16 %	4
≥ 20%	5

Documentation Required:

Option 1:

1. Narrative describing the installed renewable energy systems, along with the technical details.
2. Drawing showing the location of installed renewable energy systems.
3. Calculations indicating the total annual energy generation from the on-site renewable energy systems (kWh) to the total annual energy consumption (kWh) of the building (interior & exterior areas), in percentage. Also, provide the details of capacity of the renewable energy system (kW).
4. Purchase invoice/ Payment receipts of the installed renewable energy systems.
5. Photographs showing the renewable energy systems.

Option 2:

1. Narrative describing the installed renewable energy systems, along with the technical details.
2. Drawing showing the location of installed renewable energy systems.
3. Calculations indicating the total annual energy generation from the on-site renewable energy systems (kWh) to the total connected load (kWh) of the building (interior & exterior areas), in percentage. Also, provide the details of capacity of the renewable energy system (kW).
4. Purchase invoice/ Payment receipts of the installed renewable energy systems.
5. Photographs showing the renewable energy systems.

Off-site Renewable Energy

EE Credit 4

Point(s): 1, 2

Intent:

Encourage the use of off-site renewable technologies, to minimise the environmental impacts associated with fossil fuel energy use.

Compliance options

❖ **Option 1: Off-site Renewable Energy Investments**

➢ Demonstrate that the project has invested in off-site renewable energy equivalent to at least 50% of the total annual energy consumption of the facility.

Note:

- *The contract with the off-site renewable energy developer to generate energy shall be for a minimum period of two years.*

Points are awarded as below:

Percentage of Off-site Renewable Energy Generated to the Total Annual Energy Consumption	Points
≥ 50%	1
≥ 95%	2

(OR)

❖ **Option 2: Renewable Energy Certificates (RECs)**

➢ Demonstrate that the project has purchased Renewable Energy Certificates (RECs) equivalent to at least 25% of the total annual energy consumption of the building

Points are awarded as below:

Percentage of Renewable Energy Certificates (RECs) Purchased	Points
≥ 25%	1
≥ 50%	2

Notes:

- *Composite wood consists of wood or plant particles or fibers bonded together by a synthetic resin or binder. Examples include plywood, particle-board, and Medium-Density Fiberboard (MDF)*

General Notes:

- *Type of renewable energy source shall be in compliance with the Ministry of New and Renewable Energy (MNRE), Government of India and respective State Regulatory Commissions.*
- *Off-site renewable energy so generated shall be counted only once.*
- *Hydro power projects with 25 MW or lesser size shall only be considered under this credit.*
- *For credit calculations, RECs purchased in the last 6 months of building operation can also be considered, to show compliance.*
- *In case, the Project purchases RECs through an Authorised Agency of exchange, then a legal contract should exist between the Authorised Agency and the Project*
- *The total annual energy consumption can be arrived either through Performance based approach (Whole building simulation) or Prescriptive approach*

Documentation Required:

Option 1: Off-site Renewable Energy Investments

1. Extract copy of contract agreement signed between the project owner/ developer and the green power developer.
2. Calculations indicating the total annual energy generation from the off-site renewable energy systems (kWh) to the total annual energy consumption (kWh) of the building (interior & exterior areas), in percentage.
3. Detailed report with technical details of the off-site renewable energy systems.

Option 2: Renewable Energy Certificates (RECs)

1. Calculations indicating the total annual energy generation from the off-site renewable energy systems (kWh) to the total annual energy consumption (kWh) of the building (interior & exterior areas), in percentage.
2. Copy of Renewable Energy Certificates (RECs).

Commissioning, Post-installation of Equipment & Systems

EE Credit 5

Point(s): 1

Intent:

Verify and ensure that the facility equipment & systems are commissioned to achieve performance as envisaged at the design stage.

Compliance options:

The project shall comply with the following requirements:

- Report specific observations and variations vis-à-vis the plan drawn under EE MR 3, identified during post occupancy commissioning and report how they were addressed.
- Demonstrate that there is an agreement in place for post occupancy commissioning by a third party commissioning authority for a period of one year, to ensure that the commissioned equipment & systems perform efficiently.

Documentation Required:

1. Report specific observations and variations vis-à-vis the plan drawn under 'EC MR 2 – Commissioning Plan for Building Equipment & Systems', identified during post occupancy commissioning and report how they were addressed.
2. Copy of the contract agreement signed between the owner/ developer and the commissioning authority for a period of one year, to ensure that the commissioned equipment & systems perform efficiently.

   Note: The project may choose not to disclose the financials.

Energy Metering & Management

EE Credit 6

Point(s): 2

Intent:

Encourage sub-metering and continuous monitoring to identify improvement opportunities in facility's energy performance.

Compliance options:

- **Case A: Energy Metering: (1 point)**

  Demonstrate sub-metering for at least five of the following energy use applications, as applicable:

  - Interior & Common area lighting
  - Exterior area lighting
  - Municipal water pumping
  - Ground water pumping
  - Treated waste water pumping
  - Renewable energy generation
  - Power backup systems (Generators sets, Gas turbines, etc.,)
  - Elevators, Escalators, Travelators, etc.,
  - Any other energy consuming equipment and systems

  (And / or)

- **Case B: Building Management System: (1 point)**

  Demonstrate that the building management system is in place to monitor and control the following systems, as applicable:

  - Air-conditioning management system
  - Lighting management system
  - Renewable energy management system
  - Elevator management system
  - Fresh air monitoring system
  - CO2 control and monitoring system

  Also, commit to provide the annual total building energy consumption data to IGBC. The energy data shall be provided for all the major energy consuming equipment and systems

Documentation Required:

Case 1: Energy Metering

1. Narrative describing the energy meters installed in the project.
2. Single line drawing showing the energy meters.

Case 2: Building Management System

1. Narrative describing the building management system installed in the project, to control and monitor equipment and systems.
2. Declaration letter from the project owner/ developer stating that the project will provide the annual total building energy consumption data to IGBC.

Water Conservation

Rainwater Harvesting, Roof & non-roof

WC Mandatory Requirement 1

Required

Intent:

Enhance ground water table and reduce municipal water demand through effective rainwater management.

Compliance options:

❖ Design rainwater harvesting system to capture at least 'one-day rainfall*' runoff volume from roof and non-roof areas.

* One-day rainfall can be derived from 'percentage of average peak month rainfall' given in Table below

To arrive at average peak month rainfall, consider an average of at least last 5 years peak month rainfall (of the respective year).

Table - Criteria to arrive at 'One-day Rainfall'

S No	Average Peak Month Rainfall (in mm)	One-day Rainfall (% of Average Peak Month Rainfall)
1	Upto 250	9%
2	251 – 350	7.5%
3	351 – 500	6%
4	501 – 700	4.5%
5	701 & above	3%

In areas where the Central / State Ground Water Board does not recommend artificial rain water recharge (or) if the groundwater table is less than 8 meters, the project is required to provide justification for not implementing rainwater harvesting system.

Notes:

- *For rainfall information, refer Indian Meteorological Department data at http://www.imd.gov.in*
- *Runoff volume = Surface area x Runoff Coefficient x Rainfall.*
- *Consider Rainwater Harvesting Guidelines (as and when available) from the National Building Code (NBC) of India, Part 11 - Approach to Sustainability, Section 7.2 - Rainwater Harvesting-Surface Runoff.*
- *In areas where the water percolation is limited, collection tanks / water bodies may be provided to meet the above requirement.*
- *Filtering of suspended solids shall be ensured by providing suitable filtering media before letting the water into the collection tanks, water bodies, municipal storm water drains*

Runoff Coefficients for Typical Surface Types

S No	Surface Type	Runoff Coefficient
1	Cemented / Tiled Roof	0.95
2	Roof Garden (<100 mm thickness)	0.5
3	Roof Garden (100 – 200 mm thickness)	0.3
4	Roof Garden (201 – 500 mm thickness)	0.2
5	Roof Garden (> 500 mm thickness)	0.1
6	Turf, Flat (0 - 1% slope)	0.25
7	Turf, Average (1 – 3% slope)	0.35
8	Turf, Hilly (3 - 10% slope)	0.4
9	Turf, Steep (> 10% slope)	0.45
10	Vegetation, Flat (0 - 1% slope)	0.1
11	Vegetation, Average (1 - 3% slope)	0.2
12	Vegetation, Hilly (1 - 3% slope)	0.25
13	Vegetation, Steep (> 10% slope)	0.3
14	Concrete Pavement	0.95
15	Gravel Pavement	0.75
16	Open-grid Concrete Pavement	0.75
17	Open-grid Grass Pavement	0.5
18	Water Bodies (lined) Ex: Swimming Pool	0.95
19	Water Bodies (un-lined) Ex: Water Pond	0

Documentation Required:

1. Narrative describing the strategies implemented to capture/ harvest rainwater from roof & non-roof areas.
2. Calculations indicating the run-off volume captured/ harvested from roof and non-roof.
3. External storm water drain layout highlighting the location of rainwater harvesting - ponds, pits, storage tanks, etc., as applicable, including cross- sectional drawings of rain water harvesting systems.
4. Photographs of rainwater harvesting systems, taken during and after construction.

   Areas where Central/ State Ground Water Board don’t recommend artificial rainwater

   Hydrology report (approved by third-party) indicating the level of water table, at different locations within the project site.

Water Efficient Plumbing Fixtures

WC Mandatory Requirement 2

Required

Intent:

Enhance efficiency of plumbing fixtures, thereby minimising potable water use.

Compliance options:

❖ Use water efficient plumbing fixtures (as applicable) whose flow rates meet the baseline criteria in aggregate. The total annual water consumption of the healthcare facility should not exceed the total base case water consumption computed.

Note:

- *Use of treated wastewater/ captured rain water shall not be considered to show water savings.*

The baseline criteria is as below:

Baseline Flow Rates / Consumption for Plumbing Fixtures

Fixture Type	Maximum Flow Rate/ Consumption	Duration	Estimated Daily Uses per FTE **
Water Closets (Full-flush)	6 LPF	1 flush	1 for male; 1 for female
Water Closets (Half-flush)	3 LPF	1 flush	2 for female
Urinals	4 LPF	1 flush	2 for male
Faucets / Taps*	6 LPM	15 seconds	4
Health Faucet*	6 LPM	15 seconds	1
Showerhead / Handheld Spray*	10 LPM	8 minutes	0.1

Source: Uniform Plumbing Code - India

*Reporting pressure for these fixtures shall be at 3 bar.

**Full Time Equivalent (FTE) represents a regular building occupant who spends 8 hours per day in the building. Part-time or overtime occupants have FTE values based on their hours per day divided by 8.

Notes:

- *Water fixtures do not include irrigation systems.*
- *Faucets / Taps installed for hand wash in rest rooms and canteen shall be considered; whereas, faucets / taps installed for dish washing and washing clothes need not be considered.*
- *Rain showers (if any) need to be considered in the calculations under Showerhead.*
- *The baseline flows can be demonstrated at a flowing water pressure of 3 bar. Flowing water pressure of 3 bar does not mean that the water supply in the building is at 3 bar. The building fixtures can operate at lower pressures, however to show compliance under this credit, the design flow rates are to be submitted at 3 bar.*
- *Default occupancy shall be considered as 50% for male and female.*
- *FTE occupancy shall be considered in calculation, including visitors.*
- *Plumbing fixtures that are certified by IGBC under Green Product Certification Programme or by a third party agency approved by IGBC, can be used by the project to show compliance*

Documentation Required:

1. List of plumbing fixtures (flow and flush) installed in the project, with respective make & model and flow rates.
2. FTE occupancy calculations for the building occupants and visitors.
3. Manufacturer cut-sheets/ brochures/ letters indicating the flow rates of the plumbing fixtures (flow and flush) at 3 bar flowing water pressure.

   Note: The manufacturer letters should be project specific.
4. Purchase invoice of plumbing fixtures (flow and flush) with make & model.

Rainwater Harvesting, Roof & non-roof

WC Credit 1

Point(s): 1,2,3

Intent:

Enhance ground water table and reduce municipal water demand through effective rainwater management.

Compliance options:

❖ **Case A: Rainwater Harvesting, Roof & non-roof**

Design rainwater harvesting system to capture at least 'one-day rainfall*' runoff volume from roof and non-roof areas.

* One-day rainfall can be derived from 'percentage of average peak month rainfall' given in Table below

To arrive at average peak month rainfall, consider an average of at least last 5 years peak month rainfall (of the respective year).

Table - Criteria to arrive at 'One-day Rainfall'

S No	Average Peak Month Rainfall (mm)	One-day Rainfall (% of Average Peak Month Rainfall)		
		1 point	2 points	3 points
1	Upto 250	12%	15%	18%
2	251 – 350	10%	12.5%	15%
3	351 – 500	8%	10%	12%
4	501 – 700	6%	7.5%	9%
5	701 & above	4%	5%	6%

❖ **Case B: High Ground Water table**

Design rainwater harvesting system to capture at least 'one-day rainfall*' runoff volume from roof and non-roof areas.

* One-day rainfall can be derived from 'percentage of average peak month rainfall' given in Table below

Table - Criteria to arrive at 'One-day Rainfall'

S No	Average Peak Month Rainfall (mm)	One-day Rainfall (% of Average Peak Month Rainfall)		
		1 point	2 points	3 points
1	Upto 250	6%	9%	12%
2	251 – 350	5%	7.5%	10%
3	351 – 500	4%	6%	8%
4	501 – 700	3%	4.5%	6%
5	701 & above	2%	3%	4%

Notes:

- *For rainfall information, refer Indian Meteorological Department data at http://www.imd.gov.in*
- *Runoff volume = Surface area x Runoff Coefficient x Rainfall.*
- *Consider Rainwater Harvesting Guidelines (as and when available) from the National ode (NBC) of India, Part 11 - Approach to Sustainability, Section 7.2 - Rainwater Harvesting-Surface Runoff.*
- *In areas where the water percolation is limited, collection tanks may be provided to meet the above requirement.*
- *Filtering of suspended solids shall be ensured by providing suitable filtering media before letting the water into the collection tanks, water bodies, and municipal storm water drains.*

Exemplary Performance:

This credit is eligible for exemplary performance under ID Credit 1 - Innovation in Design Process, if rainwater runoff from roof & non-roof areas is captured and / or recharged, as per Table listed below:

Table - Criteria to arrive at 'One-day Rainfall' for Exemplary Performance

S No	Average Peak Month Rainfall (mm)	One-day Rainfall (% of Average Peak Month Rainfall)	
		Case A	Case B
1	Upto 250	21%	15%
2	251 – 350	17.5%	12.5%
3	351 – 500	14%	10%
4	501 – 700	10.5%	7.5%
5	701 & above	7%	5%

Documentation Required:

1. Hydrology report (approved by third-party) indicating the level of water table, at different locations within the project site.
2. Narrative describing the strategies implemented to capture/ harvest rain water from roof & non-roof areas.
3. Calculations indicating the run-off volume captured/ harvested from roof and non-roof.
4. External storm water drain layout highlighting the location of rain water harvesting storage tanks/ pits, etc., as applicable, including cross-sectional drawings of rain water harvesting systems.
5. Photographs of rain water harvesting systems, taken during and post construction.

Water Efficient Plumbing Fixtures

WC Credit 2

Point(s): 1-5

Intent:

Enhance efficiency of plumbing fixtures, thereby minimizing potable water use

Compliance options:

❖ Use water efficient plumbing fixtures (as applicable) whose flow rates are 8% less than the baseline criteria table given below, in aggregate.

Note:

- *Use of treated waste water / captured rain water shall not be considered to show potable water savings under this credit.*

The baseline criteria is as below:

Baseline Flow Rates / Consumption for Plumbing Fixtures

Fixture Type	Maximum Flow Rate / Consumption	Duration	Estimated Daily Uses per FTE**
Water Closets (Full-flush)	6 LPF	1 flush	1 for male;
Water Closets (Half-flush)	3 LPF	1 flush	2 for female
Urinals	4 LPF	1 flush	2 for male
Faucets / Taps*	6 LPM	15 seconds	4
Health Faucet*	6 LPM	15 seconds	1
Showerhead / Handheld Spray*	10 LPM	8 minutes	0.1

Source: Uniform Plumbing Code - India

*Reporting pressure for these fixtures shall be at 3 bar

**Full Time Equivalent (FTE) represents a regular building occupant who spends 8 hours per day in the building. Part-time or overtime occupants have FTE values based on their hours per day divided by 8.

Points are awarded as below:

Water Efficient Plumbing Fixtures (Individually or in aggregate)	Points
8% less than baseline criteria	1
12% less than baseline criteria	2
16% less than baseline criteria	3
20% less than baseline criteria	4
24% less than baseline criteria	5

Notes:

- *Water fixtures do not include irrigation systems.*
- *Faucets / Taps installed for hand wash in rest rooms and canteen shall be considered; whereas, faucets / taps installed for dish washing and washing clothes need not be considered.*
- *Rain showers (if any) need to be considered in the calculations under 'Showerhead'.*
- *The baseline flows can be demonstrated at a flowing water pressure of 3 bar. Flowing water pressure of 3 bar does not mean that the water supply in the building is at 3 bar. The building fixtures can operate at lower pressures, however to show compliance under this credit, the design flow rates are to be submitted at 3 bar.*
- *Default occupancy shall be considered as 50% for male and female.*
- *FTE occupancy shall be considered in calculation, including visitors.*
- *Plumbing fixtures that are certified by IGBC under Green Product Certification Programme or by a third party agency approved by IGBC can be used by the project to show compliance*

Documentation Required:

Please refer to the 'Documentation required' under WC Mandatory Requirement 2 – Water Efficient Plumbing Fixtures.

Landscape Design

WC Credit 3

Point(s): 1, 2

Intent:

Design landscape to ensure minimum water consumption.

Compliance option:

Limit use of turf on the site to conserve water and / or ensure that landscaped area is planted with drought tolerant / native / adaptive species.

Notes:

- *This credit is applicable only for those projects which have at least 10% of the site area landscaped.*
- *Landscape areas over built structures such as basements, podium, roofs, etc., can be considered for this credit calculation.*

Points are awarded as below:

Type of Landscape	Percentage of the Total Landscaped Area	Points
Turf Area	< 30%	1
Drought Tolerant / Native / Adaptive Species Area	> 30%	1

Notes:

- *The landscape here refers to soft landscaping, which includes only pervious vegetation.*
- *Landscape shall not be designed with monoculture plant species, since such species would not promote habitat and biodiversity.*
- *Drought tolerant species are those species that do not require supplemental irrigation. Generally accepted time frame for temporary irrigation is 1 - 2 years.*
- *Vertical Landscaping to the external walls can also be considered for this credit calculation.*
- *Potted plants shall not be considered as vegetation.*
- *Areas planted with turf should not exceed a slope of 25 percent (i.e. 4 to 1 slope).*

Documentation Required:

1. Landscape plan(s) highlighting the area covered with turf, drought tolerant species & other plant species, on the ground and over built structures.
2. Calculations indicating the total landscape area (on the ground and over built structures) to the total site area, in percentage.
3. List of turf, drought tolerant, native and adaptive species used in the project.
4. Photographs showing the landscaped areas.
5. Turf: Calculations indicating the area covered with turf (on the ground and over built structures) to the total landscape area, in percentage.
6. Drought Tolerant Species: Calculations indicating the area covered with drought tolerant species/ native/ adaptive species (on the ground and over built structures) to the total landscape area, in percentage.

Management of Irrigation Systems

WC Credit 4

Point(s): 1

Intent:

Reduce water demand for irrigation through water efficient management systems and techniques

Compliance options:

Provide or install highly efficient irrigation systems incorporating the features mentioned below:

(Minimum four features)

- ❖ Central shut-off valve
- ❖ Soil moisture sensors integrated with irrigation system
- ❖ Turf and each type of bedding area must be segregated into independent zones based on watering needs
- ❖ At least 75% of landscape planting beds must have a drip and sprinkler irrigation system to reduce evaporation Time based controller for the valves such that evaporation loss is minimised and plant health is ensured
- ❖ Pressure regulating device(s) to maintain optimal pressure to prevent water loss
- ❖ Any other innovative methods for watering

  Notes:

  - *This credit is applicable only for those projects which have at least 10% of the site area landscaped.*
  - *Landscape areas over built structures such as basements, podium, roofs, etc., can be considered for this credit calculation.*

Documentation Required:

1. Narrative describing the water efficient irrigation systems and techniques installed in the project.
2. Landscape plan highlighting the irrigation systems, including soil moisture sensors.
3. Schematic drawing indicating the location of the irrigation systems such as central shut-off valve, soil moisture sensors, drip irrigation layout, pressure regulating device(s) etc.
4. Manufacturer cut-sheets/ brochures of the installed water efficient irrigation systems and techniques.
5. Photographs showing the installed irrigation systems and techniques.

Waste Water treatment and Reuse

WC Credit 5

Point(s): 1, 2, 3

Intent:

Treat waste water generated on-site, so as to avoid polluting the receiving streams by safe disposal.

Use treated waste water, thereby reducing dependence on potable water.

Compliance options:

- **Waste Water treatment: (1 Point)**

  Have an on-site treatment system to handle 100% of waste water generated in the building, to the quality standards suitable for reuse, as prescribed by Central (or) State Pollution Control Board, as applicable.

  (And)

- **Waste Water Reuse: (2 Points)**

  Use treated waste water for at least 25% of the total water required for landscaping, flushing, and cooling tower make-up water (if the project uses water-cooled chillers).

  Points are awarded as below:

Application (in aggregate)	Percentage of Total Water catered through Treated Waste Water	Points
Landscaping, Flushing and Cooling tower make-up	≥ 25%	1
Landscaping, Flushing and Cooling tower make-up	≥ 50%	2

Notes:

- *Waste water here refers to both grey and black water.*
- *The credit point(s) can be claimed only if the waste water is treated in-situ and reused in- situ. In case the local authorities insist the project to divert waste water to a centralized / common waste water treatment plant, then the project can show compliance with 'Case-2' given above, by reusing treated wastewater from the centralised / common / any other waste water treatment plant*
- *Treated waste water sourced from other sites / local authorities through permanent piped connections or other means can also be considered to show compliance for 'waste water reuse'.*
- *Water from sources such as bore wells, natural wells, municipal water systems is considered as potable water.*

- *Captured rain water can also be considered to show compliance.*
- *The water requirement and average number of watering days for landscaping shall be considered as 6 liters per sq.m. per day (i.e. 6 liters / sq.m. / day) for a minimum of 300 days, (or)*
- *Justify if the water requirement and the average number of watering days for landscaping is less than the above requirement.*
- *Potted plants shall not be considered under vegetation*

Documentation Required:

Waste Water Treatment

1. Narrative describing the installed on-site waste water treatment system, along with the capacity & efficiency of treatment plant and the quality standards of waste water treated.
2. Daily and annual water balance of the project.
3. Site plan highlighting the location of installed on-site waste water treatment system.
4. Photographs showing the on-site waste water treatment system installed.

Waste Water Reuse

1. Calculations indicating the water requirement for landscaping, flushing and air-conditioning cooling tower make-up water (including evaporative losses, blow down losses and drift losses).
2. Daily and annual water balance of the project.

   Note: The water balance shall include calculations (approximate) showing the water demand for landscaping, flushing and air-conditioning cooling tower make-up water (if the project uses water-cooled chillers), and quantity of waste water reused for such applications.
3. Schematic drawing showing the plumbing lines connected to flush fixtures, cooling tower and landscaping, if treated waste water is reused for these applications.

Water Metering

WC Credit 6

Point(s): 1

Intent:

Encourage sub-metering to improve water performance of the healthcare facilities, and thereby save potable water.

Compliance Options:

❖ **Building-level Metering**

Demonstrate sub-metering for at least three of the following water use applications, as applicable:

- Municipal water supply
- Bore water consumption
- Treated waste water consumption
- Water consumption for landscape requirements
- Water consumption for flushing
- Water consumption for air-conditioning cooling tower makeup
- Any other major source of water consumption

Documentation Required

1. Narrative describing the water meters, installed in the project.
2. Schematic diagram showing the location of water meters, installed in the project.
3. Manufacturer cut-sheets/ brochures of the installed water meters.
4. Purchase invoices and Photographs of the installed water meters.

Building Materials & Resources

Handling of Waste Materials, During Construction

BMR Mandatory Requirement 1

Required

Intent:

Facilitate segregation of construction and demolition waste at source to encourage reuse or recycling of materials, thereby avoiding waste being sent to landfills.

Compliance options:

Demonstrate that at least 50% of waste generated during construction (as per owner / developer's scope) is diverted from landfills, for reuse or recycling. Use consistent metrics, either weight or volume, to show compliance.

Notes:

- *Construction waste here refers to civil & interior building waste.*
- *Excavated earth & stones should not be considered under this credit, as these are natural resources.*
- *Temporary materials such as materials used for formwork, scaffolding, etc., shall not be considered for this credit calculation*

Documentation Required:

1. Narrative describing the strategies implemented to handle construction waste.

   Note: The narrative shall also include the following:

   - List of construction waste materials generated and diverted for reuse, recycle & land-fill.
   - Applications of construction waste materials diverted for reuse, within or outside the project.

2. Site plan highlighting the construction waste management yard.
3. Calculations indicating the quantity of construction waste generated to the total quantity of construction waste reused, recycled and sent to landfill, in percentage.
4. Letters from scrap dealers/ contractors stating the type and quantity of construction waste received/ reused from the project site, for recycling/ reuse.
5. Photographs taken at various stages of the project showing the construction waste management yard.

Sustainable Building Materials

BMR Credit 1

Point(s): 1, 2, 3

Intent:

Encourage the use of building materials to reduce dependence on materials that have associated negative environmental impacts.

Compliance options

❖ **Materials with Recycled Content (1 Point)**

Use materials with recycled content in the building (as per owner / developer's scope) such that the total recycled content constitutes at least 10% of the total cost of building materials.

Points are awarded as below:

Percentage of Materials with Recycled Content	Points
≥ 10%	1

Notes:

- *Recycled Content is the content in a material or product derived from recycled materials versus virgin materials. Recycled content can be materials from recycling programs (post-consumer) or waste materials from the production process or an industrial/agricultural source (pre-consumer or post-industrial)*
- *Materials (with recycled content) that are certified by IGBC under Green Product Certification Programme or by a third party agency approved by IGBC can be used by the project to show compliance.*

❖ **Local Materials (1 Point)**

Ensure at least 20% of the total building materials (by cost) used in the building (as per owner / developer's scope) are manufactured locally within a distance of 400 km.

Points are awarded as below:

Percentage of Local Materials Sourced	Points
≥ 20%	1

Notes:

- *Local Materials are those which are manufactured within a distance of 400 km. Assembly of building materials shall not be considered.*
- *Extraction and processing of raw materials need not be considered as part of this credit calculation.*
- *Local Materials that are certified by IGBC under Green Product Certification Programme or by a third party agency approved by IGBC can be used by the project to show compliance.*

❖ **Wood Based Materials (1 Point)**

Ensure at least 50% of all new wood based materials (by cost) used in the building (as per owner / developer's scope) are:

- Rapidly renewable

  (And / Or)

- Wood certified by Forest Stewardship Council (FSC) or Programme for the Endorsement of Forest Certification (PEFC) or equivalent

Points are awarded as below:

Percentage of Rapidly Renewable or Certified Wood	Points
≥ 50%	1

Notes

- *Rapidly renewable materials are agricultural products that take 10 years or less to harvest.*
- *Certified wood shall be compliant with Forest Stewardship Council (FSC) or Programme for the Endorsement of Forest Certification (PEFC) or equivalent system. For a list of certified wood suppliers and product manufacturers, visit the official website of respective certification bodies.*
- *Salvaged wood based materials shall not be considered under 'Wood Based materials' calculations.*
- *Wood based Materials that are certified by IGBC under Green Product Certification Programme or by a third party agency approved by IGBC can be used by the project to show compliance.*

General Notes:

- *Building materials here refer to civil & interior materials.*
- *Material Cost = Total Cost - (Labour Cost + Installation Cost).*
- *If Labour and Installation Cost is not known, the default material cost should be considered as 60% of the total cost of the material.*
- *The cost of electrical, mechanical & plumbing - equipment, systems & appliances, and movable materials & furniture shall not be considered in the total material cost.*
- *Temporary materials such as materials used for formwork, scaffolding, etc., should not be considered for this credit calculation*

Documentation Required

Materials with Recycled Content:

1. Narrative describing the strategies implemented to source materials with recycled content.

   Note: The narrative should also include the list of materials specifying recycled content, with manufacturer name.

2. Calculations indicating the materials with recycled content (in terms of cost) to the total materials cost of the project, in percentage.
3. Manufacturer letters/ cut-sheets/ brochures indicating the recycled content in the materials sourced.

Local Materials:

1. Narrative describing the strategies implemented to source local materials.

   Note: The narrative should also include the list of local materials with manufacturer's name, specifying approximate distance from the project site to the place of manufacturing unit.

2. Calculations indicating the local materials sourced (in terms of cost) to the total materials cost of the project, in percentage.
3. Manufacturer letters indicating the distance from the project site to the place of manufacturing unit.

Wood Based Materials:

1. Narrative describing the strategies implemented to source new wood based materials – rapidly renewable materials (and/ or) wood certified by Forest Stewardship Council (FSC) / Programme for the Endorsement for Forest Certification (PEFC) / equivalent.

i. Note: The narrative should also include a list of rapidly renewable material (and/ or) certified wood by FSC/ PEFC/ equivalent, with their applications and manufacturer name.

2. Calculations indicating the cost of rapidly renewable material (and/ or) certified wood by FSC/ (PEFC)/ equivalent to the total cost of new wood in the project, in percentage.
3. If certified wood is sourced, provide Manufacturer Chain-of-Custody (CoC) certificate and purchase invoices from the manufacturers indicating the CoC number and the type of wood e.g. pure, mixed, etc.,

Certified Green Building Materials, Products & Equipment

BMR Credit 2

Point(s): 1-5

Intent:

Use certified green building materials, products, and equipment, so as to reduce dependence on materials that have associated negative environmental impacts.

Compliance options:

Ensure that the project uses at least five passive or active green building materials, products, and equipment that are certified by IGBC under Green Product Certification Programme (Green Pro) or by a third party agency approved by IGBC.

Points are awarded as below:

Number of Certified Green Products used	Points
1	1
2	2
3	3
4	4
5	5

Notes:

- *Passive Products & Materials include glazing, insulation, paints & coatings, adhesives & sealants, flyash blocks, cement, concrete, composite wood, certified new wood, housekeeping chemicals, false ceiling materials, flooring materials, gypsum based products, high reflective materials & coatings, etc.,*
- *Active Products include Electrical systems (Lighting Systems & Controls, Pumps & Motors, etc.,), Mechanical systems (unitary air conditioners, etc.,), Plumbing Fixtures (faucets, showers, etc.,)*
- *Until CII-IGBC launches Green Product Certification Programme, materials, products and equipment (eg. high reflective materials, water fixtures, lighting fixtures, carpets, etc.,) certified by any third party agency will be accepted to show credit compliance*

Documentation Required

1. Narrative describing the strategies to source passive or active green building materials, products, and equipment, that are certified by IGBC under Green Product Certification Programme or by a third party agency approved by IGBC.

   Note: The narrative should also include the list of passive or active green building materials, products, and equipment, with certification details.

2. Purchase Invoices and Test certificates/ reports of the passive or active green building materials, products, and equipment.

   Note: Until IGBC launches the Green Product Certification Programme for all the products or releases the approved list of third party agencies, the project can submit third party test reports/ certificates of passive or active green building materials, products and equipment such as high reflective materials, furniture, carpets, BEE rated products, IAPMO labelled water efficient fixtures, etc.,

Eco-friendly Furniture & Medical Furnishings

BMR Credit 3

Point(s): 1

Intent:

Encourage the use of eco-certified interior products that consider impacts through the life cycle, thereby resulting in lower environmental impacts

Compliance options:

Procure atleast 10% (by cost) of furniture & medical furnishings shall be certified by certified by IGBC under Green Product Certification Programme (Green Pro) or equivalent standard

Documentation Required

1. Narrative describing the strategies to source passive or active green building materials, products, and equipment, that are certified by IGBC under Green Product Certification Programme or by a third party agency approved by IGBC.
2. Calculations indicating the cost of furniture & medical furnishing to the total cost of furniture & medical furnishing procured
3. Purchase Invoices and Test certificates/ reports of the furniture & medical furnishing

Site Selection & Planning

Local Building Regulations & Safety Compliance

SSP Mandatory Requirement 1

Required

Intent:

Ensure that the building complies with necessary statutory and regulatory codes.

Compliance options:

The project shall comply with following statutory approvals from the Government of India or State Government authorities, as applicable:

- Approved site plan (and/ or) building plans for construction, as applicable
- Status of completion or Completion certificate signed by Architect/Engineer/Owner or Third party Commissioning Authority (OR) Occupancy certificate from Local Authority
- Structural Safety Certificate
- Non Structural Safety Certificate
- No Objection Certificate (NOC) for fire safety
- Approved Parking plans
- Environmental clearance certificate, if applicable
- Radiation clearance from Atomic Energy Regulation Board (AERB), if applicable

Note:

- *Buildings with 20,000 sq.m built-up area or more shall submit 'Environmental Clearance Certificate' or 'Environmental Impact Assessment (EIA) Study Report', as applicable, approved by Ministry of Environment & Forests (MoEF) or State Environment Impact Assessment Authority (SEIAA) to show compliance for certification.*

Documentation Required:

1. As-built drawings (site plan, floor plans, elevations, sections, etc.,) approved by local Government authority.
2. Status of completion or Completion certificate signed by Architect/ Engineer/ Owner or Third party Commissioning Authority (OR) Occupancy certificate from Local Authority.
3. Structural Safety Certificate by Local Authority.
4. NOC for fire safety.
5. Photographs of the site and building taken at various stages of construction.

Soil erosion Control

SSP Mandatory Requirement 2

Required

Intent:

Control soil erosion and sedimentation, thereby, reducing negative impacts to the site and surroundings.

Compliance options:

Implement the following measures, as applicable:

- **New healthcare facilities**
  - Soil erosion control measures taken before construction and during construction must conform to the best management practices highlighted in the National Building Code (NBC) of India 2005, Part 10, Section 1, Chapter 4 - Protection of Landscape during Construction and Chapter 5 - Soil and Water Conservation.
  - Fertile topsoil to be stockpiled prior to construction, for future reuse or donation.
  - Develop appropriate measures to address soil erosion, after occupancy.
- **Existing healthcare facilities**
  - Adopt measures to prevent carrying away of soil during storms
  - Develop appropriate measures to address soil erosion, after occupancy

  Note:

  - *If the top soil (10-20 cm) in the project is not fertile (or) suitable for preservation, in such a case the project may provide relevant justification.*

Documentation Required:

1. Narrative describing the Erosion and Sedimentation Control (ESC) measures implemented, during construction and post occupancy.
2. Site drawings highlighting ESC measures implemented on-site, during construction and post occupancy.
3. Photographs showing ESC measures taken at variousstages of construction, before construction, during construction and post occupancy.

Integrated Design Approach

SSP Credit 1

Point(s):1

Intent:

Encourage integrated design approach to construct a high performance healthcare facility, thereby reducing negative environmental impacts.

Compliance options:

- Demonstrate that the project has involved team members from multi-disciplinary fields for effective decision-making and enhanced building performance, right from conceptual stage till completion of the project.
  - Ensure that the project owner involves the following project team members, as applicable, at each stage of the project:
  - Architect, Commissioning Authority, Healthcare Consultant, Energy Modeler, Facility Managers, General Contractor, Green Building Consultant, Interior Designer, Landscape Architect, MEP Consultant, Project Management Consultant, Structural Consultant, and other project team members.
  - Document at least three project meetings at different stages of the project.

Documentation Required:

1. List of all the project team members along with their role.
2. Narrative describing the contribution of project team members to the integrated design approach, along with the date of appointment/ award of contract.
3. Minutes of Meeting (MoM) of at least three meetings held at different stages of the project, on green building design and construction aspects.
4. Photographs of the meetings held at different stages of the project.

Passive Architecture

SSP Credit 2

Point(s):1, 2

Intent:

Adopt passive architectural design features to minimise negative environmental impacts

Compliance options:

❖ **Option 1: Simulation Approach**

Demonstrate that the passive architecture measures implemented in the project has resulted in at least 2% energy savings of total annual energy consumption (through whole building simulation approach).

The approach shall address the following aspects, but not limited to:

- Climate-responsive concepts and design features
- (Eg: orientation, skylights, light wells, courtyard, shaded corridors, shading devices, shading from trees & adjacent buildings, pergolas, punched windows, extended louvers, horizontal and vertical landscaping)
- Passive cooling / heating technologies
- (Eg: wind tower, earth tunnel, geothermal technologies)
- Points are awarded as below:

Percentage of Energy Savings achieved through Passive Architecture	Points
≥ 2%	1
≥ 4%	2

❖ **Option 2: Prescriptive Approach**

Demonstrate that the project has implemented at least one of the following passive measures that result in energy savings: (1 point for each measure; maximum 2 points)

- **Exterior openings**

At least 80% of the exterior openings (fenestration) have a Projection Factor* of 0.5 or more

*Projection Factor is a ratio of the length of overhang projection divided by height from window sill to the bottom end of the overhang (must be permanent). For more details, please refer Energy Conservation Building Code (ECBC).

- **Skylights**

  Skylights shall comply with the maximum U-factor and maximum SHGC requirements as prescribed in Energy Conservation Building Code 2007 (ECBC),Table 4.6: Skylight U-Factor and SHGC Requirements.

	Maximum U-factor		Maximum SHGC	
Climate Zone	With Curb	Without Curb	0 - 2% SRR	2.1 - 5% SRR
Composite	11.24	7.71	0.40	0.25
Hot and Dry	11.24	7.71	0.40	0.25
Warm and Humid	11.24	7.71	0.40	0.25
Moderate	11.24	7.71	0.61	0.40
Cold	11.24	7.71	0.61	0.40

SRR: Skylight Roof Ratio which is the ratio of the total skylight area of the roof, measured to the outside of the frame, to the gross exterior roof

- **Daylighting**

  50 % of the regularly occupied spaces with daylight illuminance levels for a minimum of 110 Lux (and a maximum of 2,200 Lux) in a clear sky condition on 21st September at 12 noon, at working plane (through simulation or measurement approach)

- **Passive Cooling / Heating technologies**

  (Eg: wind tower, earth tunnel, geothermal technologies)

- **Any other passive measures**

Notes:

- *All enclosed roof areas, including podium, covered surface parking and utility blocks, which are exposed to the sky (at and above ground level) shall be considered for this credit calculation.*
- *Exposed roof area need not include equipment platforms, areas covered with solar photovoltaic & solar water heaters, water body, driveways, pathways, roads, play areas etc.,*
- *Skylights provided on the basement/ podium areas can also be considered for credit calculations*

Documentation Required:

Option 1: Simulation Approach

1. List of the passive architectural measures implemented in the building.
2. Simulation report indicating the energy savings achieved in the project through passive architecturalfeatures.
3. Drawings and photographs (such as site plan, floor plans, sections & elevations, images, as applicable) showing the passive architectural features.

Option 2: Prescriptive Approach

1. Narrative describing the strategies proposed to design passive architecture measures, as applicable.
2. Drawings and photographs (such as site plan, floor plans, sections & elevations, images, as applicable) showing the passive architectural features.

Exterior Openings (ProjectionFactor):

Detail calculations indicating the number of exterior openings (fenestration) having a Projection Factor of 0.5 or more to the total number of the exterior openings (fenestration), in percentage.

Skylights:

Calculations indicating the roof area with skylights to the total roof area, in percentage.

Daylight:

Simulation Approach

1. Site/ master plan showing all thebuildings.
2. Floor/ roof plans with window and skylight schedule.
3. Daylight simulation report with sky conditions (such as date & month; time; ambient lux levels) and wall, floor & roof reflectance properties, forall the regularly occupied spaces in the building. During simulation, consider shading devices and 'shadow effect' of adjacent buildings.
4. Manufacturer brochure/ cut-sheet/ letter of the glass installed in the project showing the Visual Light Transmittance (VLT).

Measurement Approach

1. Site/ master plan showing all thebuildings.
2. Floor/ roof plans with window and skylight schedule.
3. Daylight analysis report indicating daylight illuminance levels measured at work plane height, for all the regularly occupied spaces in the building.
4. Manufacturer brochure/ cut-sheet/ letter of the glass installed in the project showing the Visual Light Transmittance (VLT).

Passive Cooling / Heating Technologies:

Narrative describing the passive cooling / heating technologies, along with drawings and other supporting documents.

Value Added Services

SSP Credit 3

Point(s):1

Intent:

Provide access to Value Added Services, so as to reduce negative impacts caused from automobile use.

Compliance options:

Select a site with access to at least seven Value Added Services, within a walking distance of 1 km from the building entrance.

List of Value Added Services:

- ATM / Bank
- Crèche / School
- Grocery store / Supermarket
- Laundry / Dry cleaners
- Courier service
- Restaurant / Cafeteria
- Service apartment / Hotel
- Place of worship
- Pharmacy
- Library
- Park
- Fitness Centre

Notes:

- *The* Value Added Services *shall be functional at the time of project completion.*
- *Restaurants & Pharmacy can be considered twice. Rest amenities are to be considered only once.*
- *The services shall be accessible to building occupants and other users of the building.*
- Value Added Services *within the campus can also be considered to show compliance.*

Documentation Required:

1. Site vicinity map (with scale) highlighting the location of existing basic amenities within 1 km from project. Also, show pedestrian access from the project to the basic amenities.
2. Photographs of the basic amenities.

Proximity to Public transport

SSP Credit 4

Point(s):1

Intent:

Encourage use of public transport, so as to reduce negative impacts caused from automobile use.

Compliance options:

❖ **Option 1: Public transport**

Locate the building within 800 meters walking distance from an intra-city railway station (or) a bus-stop (or) other modes of public transport.

Note:

- *For campus projects with multiple buildings, the compliance can be shown from the entrance of the campus/ zone*

❖ **Option 2: Shuttle Service**

The project can operate or have a contract in place for shuttle services (from / to the nearest intra-city railway station or bus-stop), for atleast 25% of the building occupants.

Documentation Required:

Option 1: Public Transport

1. Site vicinity map (with scale) highlighting the location of intra-city railway station (or) a bus-stop, within 800 meters from project. Also, show pedestrian access from the project to the public transport facility.
2. Photographs showing the intra-city railway station (or) a bus-stop.

Option 2: Shuttle Services

1. Copy of contract agreement signed between the project owner and the shuttle service provider.
2. Details of shuttle services - type and number of vehicles, frequency (peak and non-peak hours), seating capacity, route details (boarding & destination points), etc.,
3. Site plan showing the alighting point of shuttle services.
4. Photographs of shuttle services.

Low-emitting Vehicles

SSP Credit 5

Point(s):1

Intent:

Encourage the use of non-fossil fuel vehicles, thereby reducing negative impacts resulting from fossil fuel based automobiles.

Compliance options:

- **Option 1: Low-emitting Vehicles**
  - **Option 1 A: electric Vehicles**

    Use electric vehicles within or outside the site, to cater at least 5% of the building occupants (excluding visitors). Also, designate preferred parking spaces for such vehicles within the site.

    Additionally, the project shall install electric charging facilities within the projects' parking area to cater to the electric vehicles.
  - **Option 1 B: Compressed natural Gas (CnG) Powered Vehicles**

    Use Compressed Natural Gas (CNG) powered vehicles within or outside the site, to cater at least 5% of the building occupants (excluding visitors). Also, designate preferred parking spaces for such vehicles within the site.

    Additionally, the project shall have at least one CNG filling station within 5 km distance from the projects' campus entrance.
- **Option 2: Charging Facilities for Low-emitting Vehicles**

  Provide charging facilities for low-emitting vehicles within the site, to cater atleast 5% of the total parking capacity (excluding visitor parking).

  Notes:

  - *Preferred parking spaces refer to the spaces that are easily accessible to the building entrance.*
  - *Low-emitting vehicles sourced on contract by the owner/ developer for building occupants can also be considered to show credit compliance*
  - *Charging facilities for low-emitting vehicles include electric, Compressed Natural Gas (CNG), bio-diesel, etc.*

Documentation Required

Option 1A: Electric Vehicles:

1. Parking layouts highlighting the location of preferred parking spaces with electric charging facilities for electric vehicles.
2. Purchase invoice of the electric vehicles provided in the project.
3. Calculations indicating the total number of occupants catered through electric vehicles in the project, in percentage.
4. Calculations indicating the number of building occupants catered through electric vehicles/ CNG-powered vehicles in the project to the total number of building occupants, in percentage.
5. Photographs showing electric vehicles and electric charging facilities with signages, provided in the project.

Option 1B: CNG-powered Vehicles:

1. Parking layouts highlighting the location of preferred parking spaces for CNG-powered vehicles.
2. Site vicinity map (with scale) highlighting the location of CNG filling station within 5 km distance (by road) from the project campus entrance.
3. Purchase invoice of the CNG-powered vehicles provided in the project.
4. Calculations indicating the total number of occupants catered through CNG- powered vehicles in the project, in percentage.
5. Photographs showing CNG-powered vehicles and preferred parking spaces with signages provided for CNG-powered vehicles.

Heat Island Reduction, non-roof

SSP Credit 6

Point(s):1

Intent:

Minimise heat island effect so as to reduce negative impact on micro-climate

Compliance options:

❖ **Option 1: non-roof Impervious Areas**

Provide one or combination of the following, for at least 50% of exposed non-roof impervious areas within the project site:

- Shade from existing tree cover/ newly planted saplings within 5 to 8 years of planting
- Open grid pavers or grass pavers
- Hardscape materials (including pavers) with SRI of at least 29 (and not higher than 64) Points are awarded as below:

Notes:

- *Non-roof impervious areas include, but not limited to, footpaths, pathways, roads, driveways, uncovered surface parking, and other impervious areas.*
- *Trees / Saplings shall be in place at the time of occupancy.*
- *SRI values of reflectance materials shall be as per ASTM Standards.*
- *SRI materials that are certified by IGBC under Green Product Certification Programme or by a third party agency approved by IGBC, can be used by the project to show compliance.*
- *Exposed non-roof area need not include utility areas such as areas covered with DG sets, transformer, STP etc.,*

❖ **Option 2: Covered Parking**

Provide at least 50% of the parking spaces under cover.

Notes:

- *'Parking spaces under cover' here refers to structured covered parking.*
- *The exposed roof of the parking shall meet 'Heat Island Effect - Roof' criteria*

Documentation Required

Option 1: Non-roof Impervious Areas

1. Narrative describing the strategies to reduce heat island effect from non-roof areas.
2. Site drawing highlighting the non-roof impervious (hardscape) areas and the areas covered with shade from tree cover within 5 years, (and/ or) open grid pavers, including grass pavers (and/ or) hardscape materials with SRI of atleast 29 (and not higher than 64).
3. Calculations indicating the area covered with shade from tree cover, (and/ or) open grid pavers, including grass pavers (and/ or) hardscape materials with SRI of atleast 29 (and not higher than 64) to the total exposed non-roof impervious area, in percentage.
4. List of the existing trees/ plant species which can mature into fully grown up trees for shading, within the next 5years.
5. Purchase invoice/ Payment receipt of the reflective materials, if sourced.
6. Manufacturer letters/ brochures indicating the Solar Reflective Index (SRI) of the reflective materials.
7. Photographs showing the measures implemented to reduce heat island effect from non-roof areas.

Option 2: Covered Parking

1. Narrative describing the strategies to reduce heat island effect from non-roof areas.
2. Calculations indicating the total number of parking spaces provided under cover to the total number of parking spaces, in percentage.
3. Parking layouts highlighting the parking areas under cover.
4. Photographs showing the measures to reduce heat island effect from non- roof areas**.**

Heat Island Reduction, Roof

SSP Credit 7

Point(s):1

Intent:

Minimise heat island effect so as to reduce negative impact on micro-climate.

Compliance options:

❖ **Option 1: High Reflective Materials**

Use material with a high solar reflective index to cover at least 75% of the exposed roof area, including covered parking.

Note:

- *Material with high solar reflectance index (SRI) include white / light colored broken China mosaic tiles or white cement tiles or other high reflective materials / coatings.*

Minimum Solar Reflective Index (SRI) values for different roof types are provided below:

Roof Type	Slope	Minimum SRI value	Maximum SRI value
Low-sloped roof	≤ 2:12	78	-
Steep-sloped roof	≥2:12	29	64

(OR)

❖ **Option 2: Vegetation**

Provide vegetation to cover at least 50% of the exposed roof area, including covered parking. Points are awarded as below:

(OR)

❖ **Option 3: Combination of High Reflective Materials and Vegetation**

Install combination of materials with high solar reflective index and vegetation to cover at least 75% of the exposed roof area, including covered parking.

Points are awarded as below:

Notes:

- *All roof areas, including podium, covered surface parking and utility blocks, which are exposed to the sky (at and above ground level) shall be considered for this credit calculation.*
- *Exposed roof area need not include equipment platforms, areas covered with solar photovoltaic & solar water heaters, skylights, water body, driveways, pathways, roads, play areas etc.,*
- *Artificial vegetation shall not be considered*
- *SRI values of high reflectance materials shall be as per ASTM Standards. Broken China mosaic tiles are exempted from showing SRI value.*
- *SRI materials that are certified by IGBC under Green Product Certification Programme or by a third party agency approved by IGBC, can be used by the project to show compliance.*
- *Pavers installed over basement shall have SRI of at least 29 (and not higher than 64).*

Documentation Required:

Option 1: High Reflective Materials

1. Narrative describing the strategies implemented to reduce heat island effect from roof areas.
2. Roof area calculations indicating the total area covered with high reflective roof materials to the total exposed roof area (excluding service & utility areas), in percentage.
3. Roof plans highlighting the area covered with high reflective roof materials.
4. Purchase invoice/ Payment receipt of the high reflective roof materials sourced for the project.
5. Manufacturer letters/ brochures indicating the Solar Reflective Index (SRI) of high reflective roof materials used in the project.
6. Photographs showing the measures to reduce heat island effect from roof areas.

Option 2: Vegetation

1. Narrative describing the strategies implemented to reduce heat island effect from roof areas.
2. Roof area calculations indicating the total area covered with vegetation to the total exposed roof area (excluding service & utility areas), in percentage.
3. Roof plans highlighting the area covered with vegetation in the project.
4. Declaration letter from the owner/ developer stating that the vegetated areas on the roof surfaces will be retained for life.
5. Photographs showing the measures to reduce heat island effect from roof areas.

Option 3: Combination of High Reflective Materials and Vegetation

1. Narrative describing the strategies implemented to reduce heat island effect from roof areas.
2. Roof area calculations indicating the area covered with high reflective roof materials and vegetation to the total exposed roof area (excluding service & utility areas), in percentage.
3. Roof plans highlighting the area covered with high reflective materials and / or vegetation installed in the project.
4. Declaration letter from the owner/ developer stating that the vegetated areas on the roof surfaces will be retained for life.
5. Purchase invoice/ Payment receipt of the high reflective roof materials sourced for the project.
6. Manufacturer letters/ brochures indicating the Solar Reflective Index (SRI) of high reflective roof materials used in the project.
7. Photographs showing the measures to reduce heat island effect from roof areas.

Outdoor Light Pollution Reduction

SSP Credit 8

Point(s):1

Intent

Reduce light pollution to increase night sky access and enhance the nocturnal environment

Compliance options:

- **Option 1: Prescriptive Approach**
  - **Upward Lighting:**

    Design exterior lighting such that no external light fixture emits more than 5% of the total initial designed fixture Lumens, at an angle of 90 degrees or higher from nadir (straight down).

    (AND)

  - **Lighting Power Density:**

    The lighting power density should be reduced by 30% for building facades and exterior areas vis-à-vis the ASHRAE Standard 90.1-2010 baselines, Section 9.4.3 - Exterior Building Lighting Power (tradable & non-tradable surfaces).

  Notes:

  - *Total initial designed fixture Lumens shall be based on the sum total of all fixtures installed on site.*
  - *Classify the project under one of the lighting zones, as defined in ASHRAE Standard 90.1-2010, and follow all the requirements of the respective zone. The justification shall be provided for the selected lighting zone.*
  - *Exterior light fixtures that are certified by IGBC under Green Product Certification Programme or by a third party agency approved by IGBC can be used by the project to show compliance*

- **Option 2: Simulation Approach**
  - **Upward Lighting:**

    Design exterior lighting such that all site and building-mounted luminaires produce a maximum initial illuminance values, as defined in ASHRAE Standard 90.1-2010.

    (AND)

  - **Lighting Power Density:**

    The lighting power densit should be reduced by 30% for building facades and exterior areas vis-à-vis the ASHRAE Standard 90.1-2010 baselines, Section 9.4.3 - Exterior Building Lighting Power (tradable & non-tradable surfaces).

Notes:

- *Classify the project under one of the lighting zones, as defined in ASHRAE Standard*
- *90.1-2010, and follow all the requirements of the respective zone. The justification shall be provided for the selected lighting zone.*
- *Exterior light fixtures that are certified by IGBC under Green Product Certification Programme or by a third party agency approved by IGBC can be used by the project to show compliance.*

LZ1: Dark (Developed Areas of national Parks, State Parks, Forest Land and Rural Areas)

Design exterior lighting so that all site and building-mounted luminaires produce a maximum initial illuminance value no greater than 0.01 horizontal and vertical footcandles (0.1 horizontal and vertical Lux) at the site boundary and beyond. Document that 0% of the total initial designed fixture Lumens (sum total of all fixtures on site) are emitted at an angle of 90 degrees or higher from nadir (straight down).

LZ2: Low (Areas predominantly consisting of residential zones, neighborhood business districts, light industrial areas with limited night time use and residential mixed-use areas)

Design exterior lighting so that all site and building-mounted luminaires produce a maximum initial illuminance value no greater than 0.1 horizontal and vertical footcandles (1.0 horizontal and vertical Lux) at the site boundary and no greater than 0.01 horizontal footcandles (0.1 horizontal Lux) 10 feet (3 meters) beyond the site boundary. Document that no more than 2% of the total initial designed fixture Lumens (sum total of all fixtures on site) are emitted at an angle of 90 degrees or higher from nadir (straight down)

LZ3: Medium (All other areas not included in LZ1, LZ2 or LZ4, such as commercial/ industrial, and high-density residential)

Design exterior lighting so that all site and building-mounted luminaires produce a maximum initial illuminance value no greater than 0.2 horizontal and vertical footcandles (2.0 horizontal and vertical Lux) at the site boundary and no greater than 0.01 horizontal footcandles (0.1 horizontal Lux) 15 feet (4.5 meters) beyond the site. Document that no more than 5% of the total initial designed fixture Lumens (sum total of all fixtures on site) are emitted at an angle of 90 degrees or higher from nadir (straight down).

LZ4: High14 (High-activity commercial districts in major metropolitan areas)

Design exterior lighting so that all site and building-mounted luminaires produce a maximum initial illuminance value no greater than 0.6 horizontal and vertical footcandles (6.5 horizontal and vertical Lux) at the site boundary and no greater than 0.01 horizontal footcandles (0.1 horizontal Lux) 15 feet (4.5 meters) beyond the site. Document that no more than 10% of the total initial designed fixture Lumens (sum total of all fixtures on site) are emitted at an angle of 90 degrees or higher from nadir (straight down).

LZ2, LZ3 and LZ4: For site boundaries that abut public rights-of-way, light trespass requirements may be met relative to the curb line instead of the site boundary.

For All Zones

Illuminance generated from a single luminaire placed at the intersection of a private vehicular driveway and public roadway accessing the site is allowed to use the centerline of the public roadway as the site boundary for a length of 2 times the driveway width centered on the centerline of the driveway

Documentation Required

Option 1: Prescriptive Approach

1. Narrative describing the strategies implemented for outdoor light pollution reduction and exterior LPD.
2. Calculations indicating upward lighting for each typical lighting fixture. The calculations shall include the lighting fixture type, quality, total lumens, upward lumens and upward lighting percentage.
3. LPD calculations, along with the list of the exterior lighting fixtures (with make & model) proposed in the project.
4. Site drawing highlighting the exterior lighting fixtures.
5. Photographs showing the typical exterior lighting fixtures.

Option 2: Simulation Approach

1. Narrative describing the strategies implemented for outdoor light pollution reduction and exterior LPD.
2. Site drawing highlighting the exterior lighting fixtures.
3. Simulation report showing compliance with outdoor light pollution reduction criteria. The report should include the list of lighting fixtures (with make & model), photometric data and LDP calculations.
4. Photographs showing the typical exterior lighting fixtures.

Universal Design

SSP Credit 9

Point(s):1

Intent:

Ensure that the building design caters to differently abled and senior citizens

Compliance options:

Design the building / campus to provide the following, as applicable, for differently abled and senior citizens in accordance with the guidelines of the National Building Code (NBC) of India 2005.

- Appropriately designed preferred car park spaces having an easy access to the main entrance or closer to the lift lobby.

  (Provide at least one car park space for the first 100 car park spaces and one additional for every 250 car park spaces thereafter or as defined by local byelaw).
- Easy access to the main entrance of the building.
- Non-slippery ramps, with handrails on at least one side (as applicable).
- Braille and audio assistance in lifts for visually impaired people.
- Seating area near lift lobbies.
- Uniformity in floor level for hindrance-free movement in common areas & exterior areas.
- Restrooms (toilets) in common areas designed for differently abled people.

  Restrooms (toilets) in common areas designed for differently abled people. (Provide at least one restroom in the building or as defined by the local byelaw, in an easily accessible location)
- Main walkways / pathways with adequate width in exterior areas.
- Visual warning signage in common areas & exterior areas

Documentation Required

1. Narrative describing the measures implemented in the building for differently abled people and senior citizens.
2. Calculations indicating the total number of preferred car park spaces (for differently abled people and senior citizens) to the total number of car park spaces.
3. Calculations indicating the total number of rest rooms (toilets) provided in the common areas (for differently abled people and senior citizens) to the total number of building occupants.
4. Drawings highlighting the measures implemented for differently abled people and senior citizens.
5. Photographs showing all the measures implemented.
6. Manufacturer brochures for the measures implemented, as applicable.

Basic Facilities for Construction Workforce

SSP Credit 10

Point(s):1

Intent:

Promote welfare of the construction workforce by providing safe and healthy work conditions.

Compliance options:

Provide basic facilities for construction workforce to exceed the guidelines of 'The Building and other Construction Workers Act, 1996 & Rules, 1998'.

- Adequate housing to meet or exceed local / labour byelaw requirement.
- Sanitary facilities:

  Provide at least 3 toilet seats & 3 urinals for the first 100 workers and one additional toilet seat & urinal for every 100 workers thereafter (or) as defined by local / labour byelaw.

  (The sanitary measures should be provided separately for men and women).
- First-aid and emergency facilities.
- Adequate drinking water facilities.
- Personal protective equipment (by owner / contractor).
- Dust suppression measures.
- Adequate illumination levels in construction work areas.
- Site emergency alarm.
- Day care/ crèche facility for workers' children.

  (Only if, more than 50 female building workers are employed full time)

  Note:

  - *The project can consider 'Constructional Practices and Safety Guidelines' from National Building Code (NBC) of India 2005, Part 7 - Constructional Practices and Safety*

Documentation Required

1. Narrative describing the basic facilities provided in the project for construction workforce.
2. Calculations indicating the total number of construction workers and thetotal number of toilet seats & urinals provided in the project, for men and women.
3. Drawings highlighting the basic facilities provided for construction workforce.
4. Extract of the construction contract agreement highlighting the facilities provided.
5. Photographs showing the measures implemented.

Innovation In Design Process

Innovation in Design Process

ID Credit 1

Intent:

Provide design teams and projects an opportunity to be awarded points for innovative design & performance in healthcare buildings not specifically addressed by the IGBC Green Healthcare Buildings rating system and / or exemplary performance above the requirements set by the IGBC Green Healthcare Buildings rating system.

Compliance options:

- **Credit 1.1: Innovation & Design Process**
  - **Option 1: Innovation**

    Identify the intent of proposed innovation credit, proposed requirement for compliance, and proposed documentation to demonstrate compliance, and the design approach used to meet the required measures.

    (or)
  - **Option 2: exemplary performance**

    The project is eligible for exemplary performance, if the design and / or construction measures greatly exceed the credit requirements of the IGBC Green Healthcare Buildings rating system.
- **Credit 1.2: Innovation & Design Process**

  Same as credit 1.1
- **Credit 1.3: Innovation & Design Process**

  Same as credit 1.1
- **Credit 1.4: Innovation & Design Process**

  Same as credit 1.1

  Notes:
  - *As a general rule, points for exemplary performance are awarded for doubling the credit requirements and / or achieving the next incremental percentage threshold.*
  - *Eligibility criteria for various credits in the IGBC Green Healthcare Buildings rating system are defined in respective credits.*

  General Notes:

  The project shall also meet the following criteria for achieving an Innovation point:
  - *Quantitative performance improvements (comparing a baseline and design case).*
  - *Strategy must be significantly better than standard sustainable design practices.*
  - *Measures must be voluntary. Measures that are mandated by the local byelaws and not addressed in the rating system are not eligible for Innovation.*
  - *Measures should be implemented both in interior and common areas, as applicable.*

Exhibit A - List of Base Credits eligible for Exemplary Performance	
Indoor Air Quality	
IEQ Credit 1.1	Healing Architecture- Day lit Spaces Option 1: > 90% of the patient area with natural daylight Option 2: > 75% of the regularly occupied area with natural daylight
IEQ Credit 1.2	Healing Architecture- Connectivity with nature Option 1: > 75% of the patient area with natural daylight Option 2: > 75% of the regularly occupied area with natural daylight
IEQ Credit 1.3	Healing Architecture- Green Open Spaces More than 60% of the project area (excluding the building footprint) is covered with green open spaces.
IEQ Credit 1.4	Healing Architecture- Healing Garden More than 50% of the green open spaces are designed as patient centric healing garden
Sanitation health and hygiene	
SH Credit 5	Automated Solid Waste Management System Install automatic waste collection systems for handling more than 75% of bio-medical waste
SH Credit 6	Organic Waste Management Install an on-site waste treatment system for handling at least 90% of the organic (kitchen, landscape) waste generated in the facility.
Energy Efficiency	
EE Credit 2	Enhanced Energy Performance: New and existing building >30%
EE Credit 3	On-site Renewable Energy: Option 1 New and existing building >6% Option 2 New and existing building >24
EE Credit 4	Off-site Renewable Energy: > 75% (RECs)
Water Conservation	
WC Credit 1	Rainwater Harvesting, Roof & Non-roof (as defined in credit)
WC Credit 2	Water Efficient Plumbing Fixtures: > 28%
WC Credit 3	Landscape Design: No Turf (and) > 60% Drought Tolerant Species
WC Credit 5	Wastewater Treatment and Reuse: > 95% (Reuse)
Site Selection and Planning	
SSP Credit 6	Heat Island Reduction: Option 1: > Non Roof: > 75% (Non-roof Impervious Areas) Option 2: > Covered Parking > 100%
SSP Credit 7	Heat Island Reduction, Roof: > 95% (Vegetation)
Building Materials and Resources	
BMR Credit 1	Sustainable Building Materials Materials with Recycled Content: > 20% Local Materials: > 30% Wood based Materials: > 75%

IGBC Accredited Professional

ID Credit 2

Intent:

Support and encourage involvement of IGBC Accredited Professional in green building projects, so as to integrate appropriate design measures and streamline the certification process.

Compliance options:

At least one principal participant of the project team shall be an IGBC Accredited Professional.

Documentation Required

Copy of IGBC AP Certificate of one of the project team members

Annexures

IGBC's Green Guidelines for Fast Track and Emergency Facilities for Treating COVID-19 Patients

August 2020

Table of Contents

1. Layout
2. Site Selection for Greenfield Facility
3. Modular Structures for Temporary Facilities
4. Hygiene Practices
5. Ventilation Parameters
6. Energy Efficiency
7. Water Conservation
8. Waste Management
9. Interior Furnishings
10. Facilities for Health Workforce

Layout

Layout and design of the temporary COVID facilities plays significant role in avoiding the spread of infections within the facility. They are meant for managing only COVID positive tested individuals. Proper zoning is required for the patients having mild and severe symptoms and healthcare work force to avoid cross infection.

The layout design should cater to the requirements of the following categories of patients and have separate zone for each of these categories.

Level 1 (Quarantine Facilities)

The temporary COVID facility to provide care for symptomatic COVID patients who have only mild symptoms and do not require Oxygen or Mechanical Ventilation support.

Level 2 (Isolation Facilities)

The level 2 zone should have Oxygen Therapy for the needy patients who require oxygen support, but not in need of intensive care. This zone should have Isolation facilities and oxygen supply for treating the patients.

Level 3 (Critical Care Facilities)

This zone should have intensive Care (ICU Area) facilities with mechanical ventilators for the patients.

The layout design should facilitate unidirectional movement patients in each zone and health care workers offering treatment to patients to avoid cross infection within the facilities.

A recommended layout design for a 75-bed temporary COVID facility is given below:

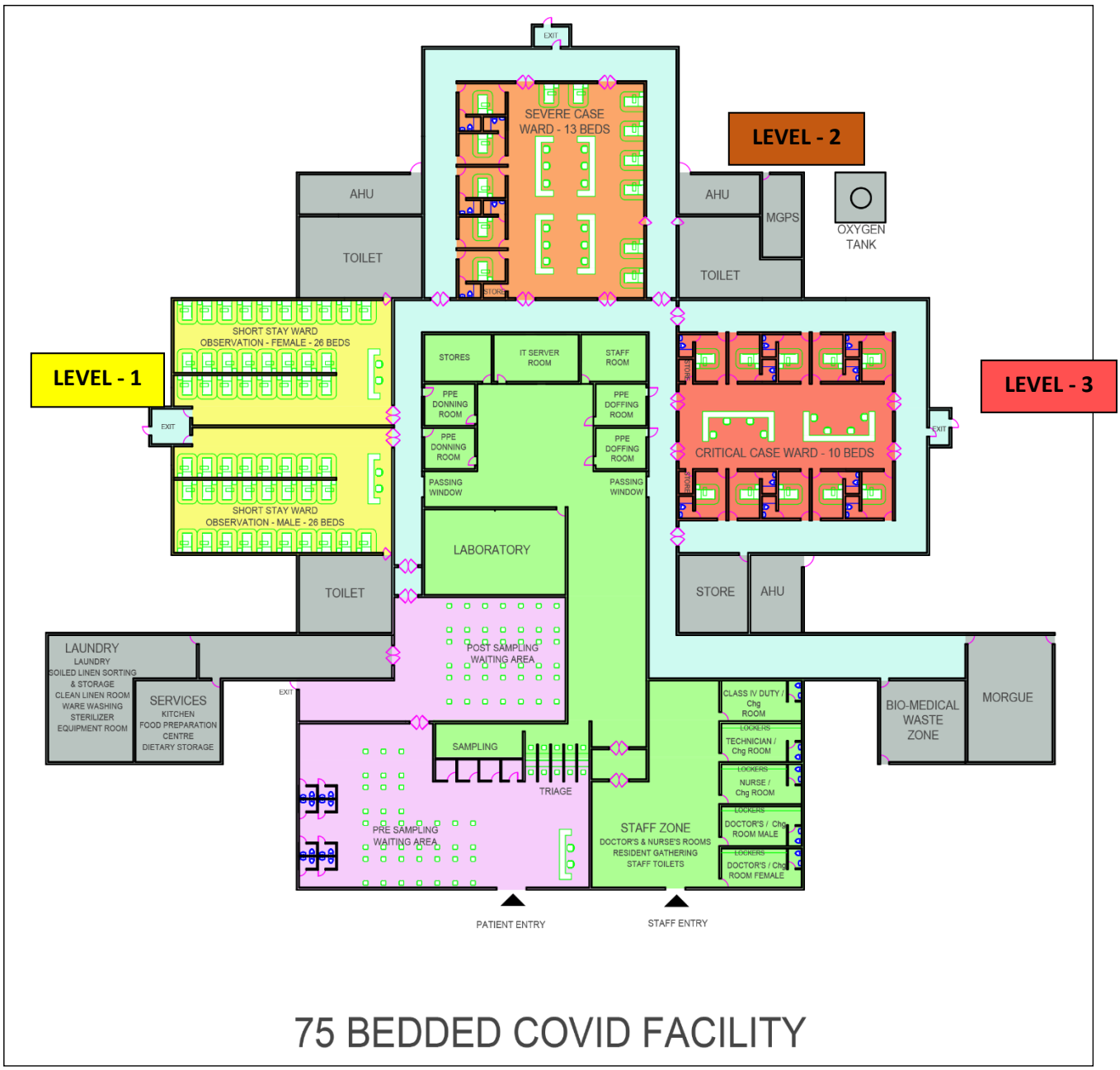


Figure 1: Basic layout of COVID Centre

Staff Area	Triage/ sampling/ waiting area
Level - 1 area	Level – 2 area
Level – 3 area	Service areas

The COVID facility layout is recommended to have two separate area, for patients and

the healthcare workforce. Further the area for patients shall be divided into three zones i.e. Mild (Quaratine), Moderate (Isolation) and Critical (ICU) areas according to the medical conditions of the patients.

The layout design shall accommodate following facilities:

Patients and Visitors:

- **Entry with biocontainment unit**

  Separate entrance should be provided for the entry of patient and the visitors. The sanitisation points should be provided at the entrance so as to ensure that people are disinfected before entering the facility. The entrance should be spacious enough to avoid overcrowding. Appropriate measures should be taken to check Mask and the temperature of all the patients and visitors before entering the facility.

- **Reception**

  The information desk with the designated authority should be located in the reception area. The receptionist shall provide appropriate information to the patients and guide them to the concerned areas such as waiting room, sampling room and wards. The receptionist should also communicate regularly to the staff on patient flow to avoid confusion/mishaps.

- **Triage area**

  Triage is the preliminary area where patients are screened & tested for the virus. Triage is divided into two distinctive zones: a zone for staff and a high-risk zone for patients. A distance of 1 m between staff and patients is required. Double fencing or a Plexiglas barrier can be used for separation. Separate handwashing points (soap and water)/ Sanitizer are required for patients and staff.

- **Waiting room**

  The waiting room should be spacious and to be provided with adequate seating areas. Seating areas should be provided with minimum distance of 6ft to maintain social distancing. The waiting area shall be provided with good ventilation. The seating areas should be cleaned and disinfected regularly to avoid infection spread.

- **Sampling room**

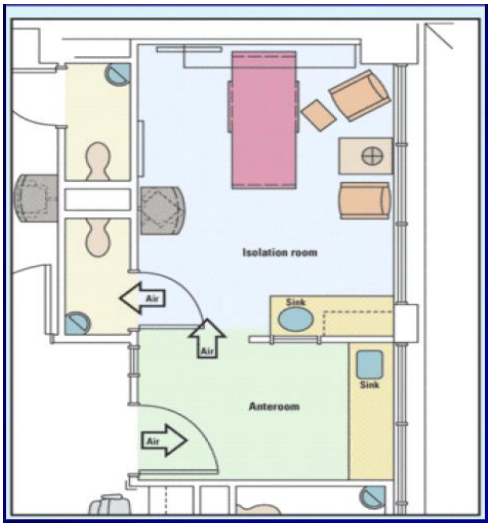
  The samples from symptomatic and asymptomatic patients are collected here and sent for testing. Provide multiple booths for collecting samples. The sampling areas should be air conditioned or ventilated as per recommendations on the Chart Room Design for Air Conditioning & Ventilation Summary: Item 5, Laboratory, General indicated in chapter – Ventilation Parameters. Each booth should be properly labelled to avoid mistakes and allow proper flow of the patients

- **Wards**

  The wards shall be provided in three zones including mild, moderate and critical areas according to the medical conditions of the patients. The beds in wards should be placed with a distance of 6 feet.

  Details of Indoor air Quality is explained in ventilation parameters. Fabric ducts can be used, which are fast & flexible to erect.

  Use of transparent partition between the patients' bed and the nursing station to enable visual contact with patients and regular monitoring of patients.



Typical Layout of Isolation Room

Moderate and severe areas should be properly equipped with the required medical gases supplied through manifold room by pipeline.

Dedicated area for Oxygen plant and storing of medical gases need to be located near Level 2 and Level 3 zones.

- **Washrooms**

  Dedicated washrooms for the patients and staff should be provided. Regular sanitisation and cleaning of washrooms is required. Adequate facilities such as hand wash area, showers, water closets and tissues should be provided. The toilet fixtures as far as possible preferably be touch free/sensor based.

- **Discharge room**

  Patients who have been recovered and tested negative are directed to the discharge room. The area should be provided with good ventilation and required facilities such as washrooms, handwashing points etc.

- **Pharmacy**

  A designated area for pharmacy should be provided within the facility where required medicines and personal protective items can be stored.

- **Morgue**

  A dedicated area away from the patient and staff areas should be provided to keep the dead bodies. This area should be highly restricted for any entry and isolated from other areas of the facility.

Healthcare Workforce

- **Entrance for staff**

  Separate entrance for staff shall be provided. Regular screening of staff entering the facility is required to monitor the temperature and avoid infection spread. The staff entry should be provided within the visibility of reception area such that the authorities would ensure only authorized people are entering the facility. It is recommended to provide sanitization points at the entrance.

- **Changing/ Retiring Rooms**

  Adequate male and female changing rooms should be provided in the facility. Consider installing locker facility for staff members to store their personal items. This area will also cater to retiring facilities for Staff during their prolong stay.

- **Disinfection room**

  Disinfectant chambers should be provided through which staff need to pass through before coming in and going out from premises.

- **Donning & Doffing Area**

  Donning area – This is the designated area for healthcare workforce to put on their personal protective equipment (PPE) such as gown, mask, eye protection and gloves before entering to the patient zone.

  Doffing Area – In this area, healthcare workforce would remove the PPE kits after treating the patients.

  The Donning and Doffing Area should be physically isolated. Doffing area is likely to be a highly contaminated zone and it cannot be mixed with any other activity. While the Donning areas should be located near the patient area and the Doffing areas should be located nearest to the exit from the patient area for the staff.

- **Passing Window**

  To avoid unnecessary movement and mixing of the staff, provide double door passing window at the entrance to the COVID Area. Items like Medicines, Food, Linen, etc. can be passed through the passing window and can be received by the staff working inside the COVID Area without the Pharmacy/ Laundry/ F&B staff having to enter the COVID Area. Similarly, all items to be passed out of the COVID Area can be sent out through the double door passing window eliminating the need for any COVID Staff to come out of the area.

- **Doctor rooms & Nurse stations**

  Designated rooms for doctors and nurse stations should be provided to perform their other duties when they are not working directly with patients. Nurse stations are recommended to be provided at every level of layout in the facility to regularly monitor the patients.

- **Laboratory**

  A dedicated area should be provided for laboratory for testing the collected samples. This area should be restricted for any entry other than the authorized hospital staff.

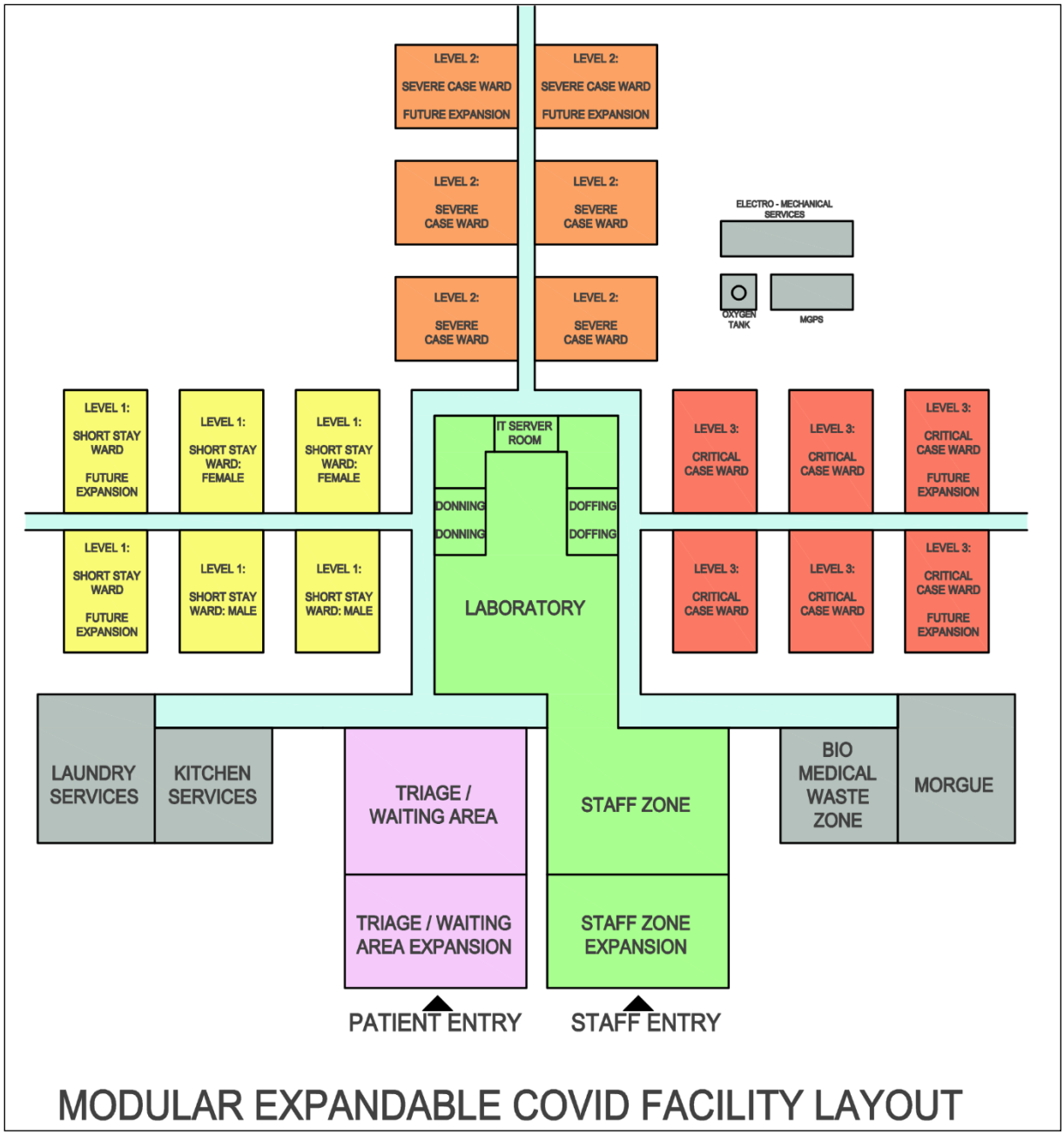
- **Hand washing points**

  Multiple sanitisation points have to be provided at all levels of the layout in the facility for better hygiene of the healthcare workforce.

- **IT Server Room**

  Provide IT systems in the facility to capture all patient data in digital format rather than having it is paper form. A designated room for IT server shall be provided in staff zone. The data can be accessed by senior staff/ doctors outside the COVID areas as well and treatment protocols can be modified accordingly. Also, a video calling facility shall be provided in wards for the patients to commute with their family members as they are restricted to meet physically. This would also facilitate patients to feel better psychologically.

  The facility should also have modular expandable facility depending upon the requirement. Each level can be expanded by adding the modular facilities without compromising on the design for avoiding cross infection.



1.0 Site Selection for Greenfield Facility

- ❖ The site selected for temporary facilities preferably should be near to an existing hospital
- ❖ Ideally the site should not be close to residential and commercial zones.

2.0 Mobile/ Modular Structures for Temporary Facilities

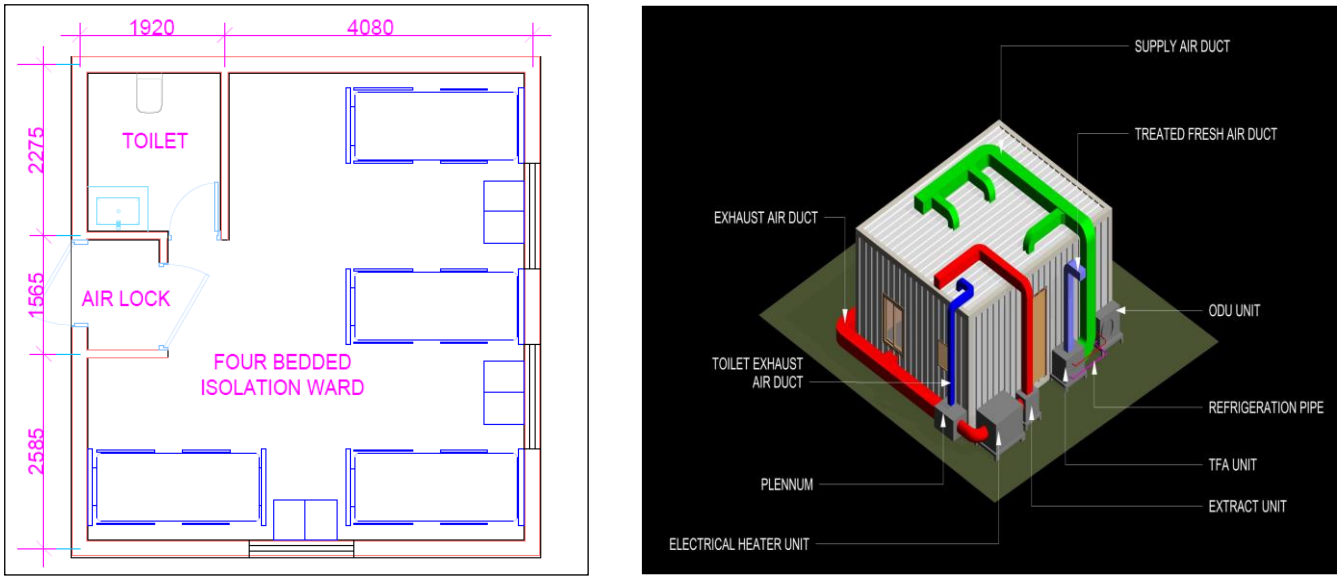
Temporary structures need to be built with minimum possible time and the best of medical facilities. Site work and construction should be planned simultaneously to

reduce time.

- Explore the possibility of using mobile modular structures
- Mobile structures can be installed in any open area available or as an extension to the existing facility
    - Railway Yards, Hospital Vicinity - Parking Lot, Auditoriums, Shopping Mall, Hostels, Colleges, etc.
- Modular structures are constructed using prefabricated materials and assembled at the site.
- All the required infrastructure facilities in the modular structures need to be installed
    - Electrical – main utility power, individual unit level cabling, lights, electric points including 6A & 15A switches
        - All the points to be checked for polarity and continuity
    - Plumbing – water supply plumbing lines, drainage to sewer, plumbing fixtures
        - All the water supplied should be potable water to avoid any infections
    - Ventilation – Ducts to deliver & remove air, HEPA filtration, wet scrubber, fans in the individual units, exhaust fans, UV portable disinfectant

- Other facilities to be provided in the individual modular unit include
    - Clinical wash hand basin
    - Suitable extract fan
    - Transfer grille to en suite door
    - En suite facility
    - Doors to be fully glazed, with integral privacy blinds, to allow staff

- observation and patients views out.



Typical Container Unit

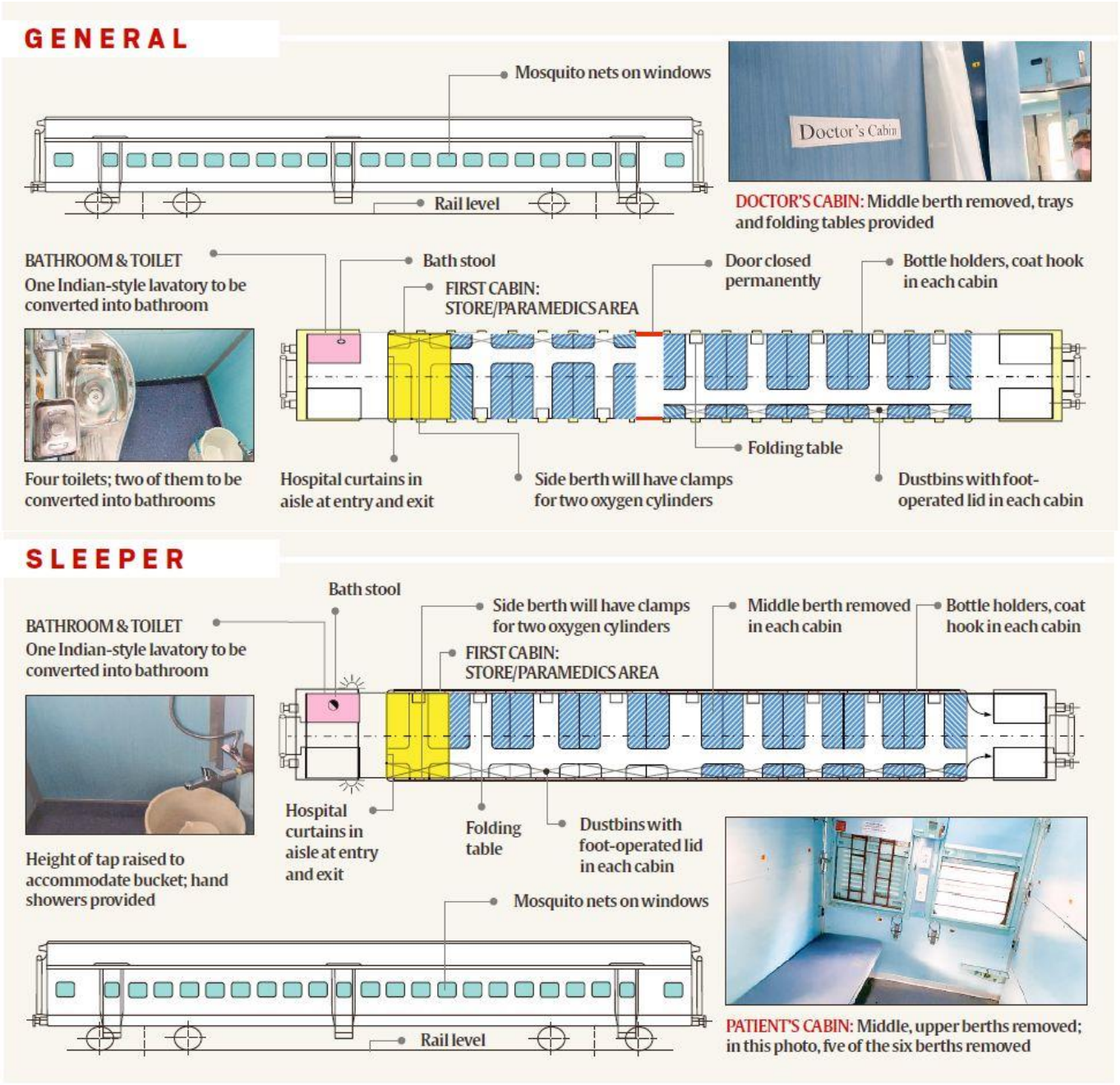
Railway Coaches:

The Ministry of Railways has taken several initiatives in developing railway coaches as temporary COVID care facilities to meet demand of increase in number of infected people across the country. The coaches are used for treating mild cases that can be clinically assigned to the COVID care facilities as per guidelines issued by the Ministry of Health.

Coaches have been converted into six to eight bays or cabins for patients and toilets are converted to bathrooms. The coaches have been provided with oxygen cylinders and power plug sockets for medical equipment.

For more details on railway coaches, please refer to 'Guidance document on appropriate suspect/confirmed cases of COVID-l9' issued by Ministry of Health & Family welfare and Ministry of Railways developed document on 'COVID Care coaches of Indian Railways'.

Appended below are schematic of coaches with COVID care facilities:



Railway Coach converted to COVID Care Centre

3.0 Hygiene Practices

Good hygiene would be the corner stone of combating COVID 19. Considering the various possibilities of spread within the premises, there is a need for significantly enhancing hygiene measures beyond regular practices. Hygiene measures should be adopted at the individual level and specific measures to be implemented at all the spaces and surfaces where in the occupants are likely to come in contact.

The following measures may be considered for implementation of hygiene in hospitals:

- Provide signages/ posters/ floor markings for social distancing
- Sensor based automatic doors from the entrance to all areas
- Use anti-microbial copper on high touch surfaces
    - Door handles, over patient tables, I.V. pole, Monitor pen, Bed liver, visitor chair arms etc.
- Patients/ Health workforce occupied area:
    - Use entryway mats in all the entry and exit points
    - Provide multiple hand wash/sanitisation stations
    - Regularly check temperature and other COVID symptoms
    - Carryout regular surface cleaning and disinfection of materials & equipment with appropriate sanitisers
    - Regularly change linen materials
    - Monitor proper cleaning of plates, cups, glasses and cutlery in cafeteria and kitchen
    - Periodically sanitise high touch surfaces
        - Workstations, door handles/ knobs, handrails, lift doors & buttons

Copper based Door Handles

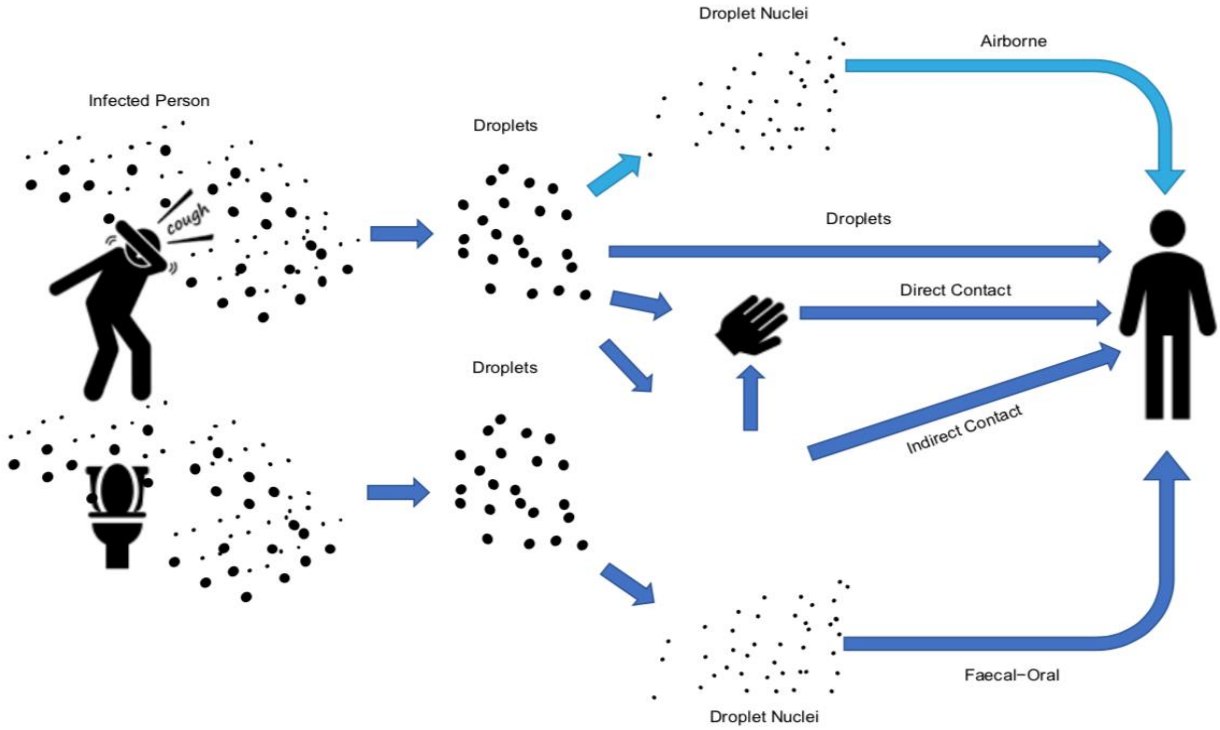
❖ Housekeeping protocols

- Rest Rooms
  - Clean restrooms with GreenPro ecolabelled housekeeping chemicals
  - Hourly cleaning of the high touch surfaces such as door handles / knobs and flush buttons etc.
  - Keep soap solutions/ sanitisers and tissue papers near wash basins
- Mop once in 4 hours all regularly occupied spaces with GreenPro/ equivalent ecolabelled cleaning chemicals or soap water.

4.0 Ventilation Parameters

There is growing evidence that there is likelihood of spread of the disease through the air-conditioning and ventilation systems thus needing extreme care to detail to ensure these systems, which are indispensable, while providing comfort should mitigate rather than propagate the spread of the disease.

The sketch below shows there are several transmission routes for the COVID-19 virus:



WHO reported exposure mechanisms of COVID 19 SARS CoV-2 droplets

The infectious droplets from infected person's cough or respiration come in a spectrum of sizes. The bigger droplets, typically larger than 5μ traverse some distance and subsequently settle down on nearby surfaces or floors or may be even directly respired by nearby people.

The smaller droplets which are <5μ float around in the air for longer times, even hours. Depending on the relative humidity of the surrounding air and the velocity of ejection from the cough, these droplets desiccate into smaller particles called 'Droplet Nuclei' aerosols. These aerosols travel considerable distances from the infected person. The HVAC systems need to primarily contend with the aerosolized droplet nuclei.

In simplified terms the infection equation can be expressed as:

Infection Rate = Viral Concentration x Exposure Time.

The HVAC systems will need to ensure that the viral concentration is substantially reduced so that the chance of airborne infection is diminished.

To achieve dilution of not only viral concentration, but also the other airborne pathogens, the HVAC system design will have to work around the following aspects:

i. *Makeup fresh air*

ii. *Passive filtration* using media filters

iii. *Air p*urification using UVGI [Ultra Violet Germicidal Irradiation]

iv. *Air distribution* of displacement to ensure that virus laden air is quickly replaced in the zone with clean air. The virus laden air is led away out of harm's way.

Apart from dilution of pathogens, the other parameters that need to be controlled are:

v. *Room pressure gradient*

vi. *Relative humidity*

vii. *Temperature*

viii. *Exhaust*

The other important aspect is how to deal with the used air or exhaust air. This is especially true when dealing with all infected patient areas viz. triage, quarantine and critical when dealing with ICUs, isolation rooms and patient area washrooms. We shall thus be discussing at length with this parameter.

ix. Energy Efficiency

HVAC systems consume a lot of energy and mostly work 24x7. It is important that we avoid profligate designs and adopt energy efficiency as an important parameter:

Ensure to choose environment friendly options for the various components of the HVAC systems wherever possible.

As detailed elsewhere in the document, there will be **Level 1, Level 2 or Level 3** facilities and these may have access to varied resources and affordability.

Finally, there are **converted facilities.** These are functioning hospitals and nursing homes which are converted to COVID hospitals.

For providing comfort and also sweeping out pathogens in the healthcare facilities, Natural ventilation, Mechanical ventilation, Air conditioning with unitary equipment viz. wall units/ window air conditioners or cassettes or with AHU systems with filtration are the options and the costs increase in the same order.

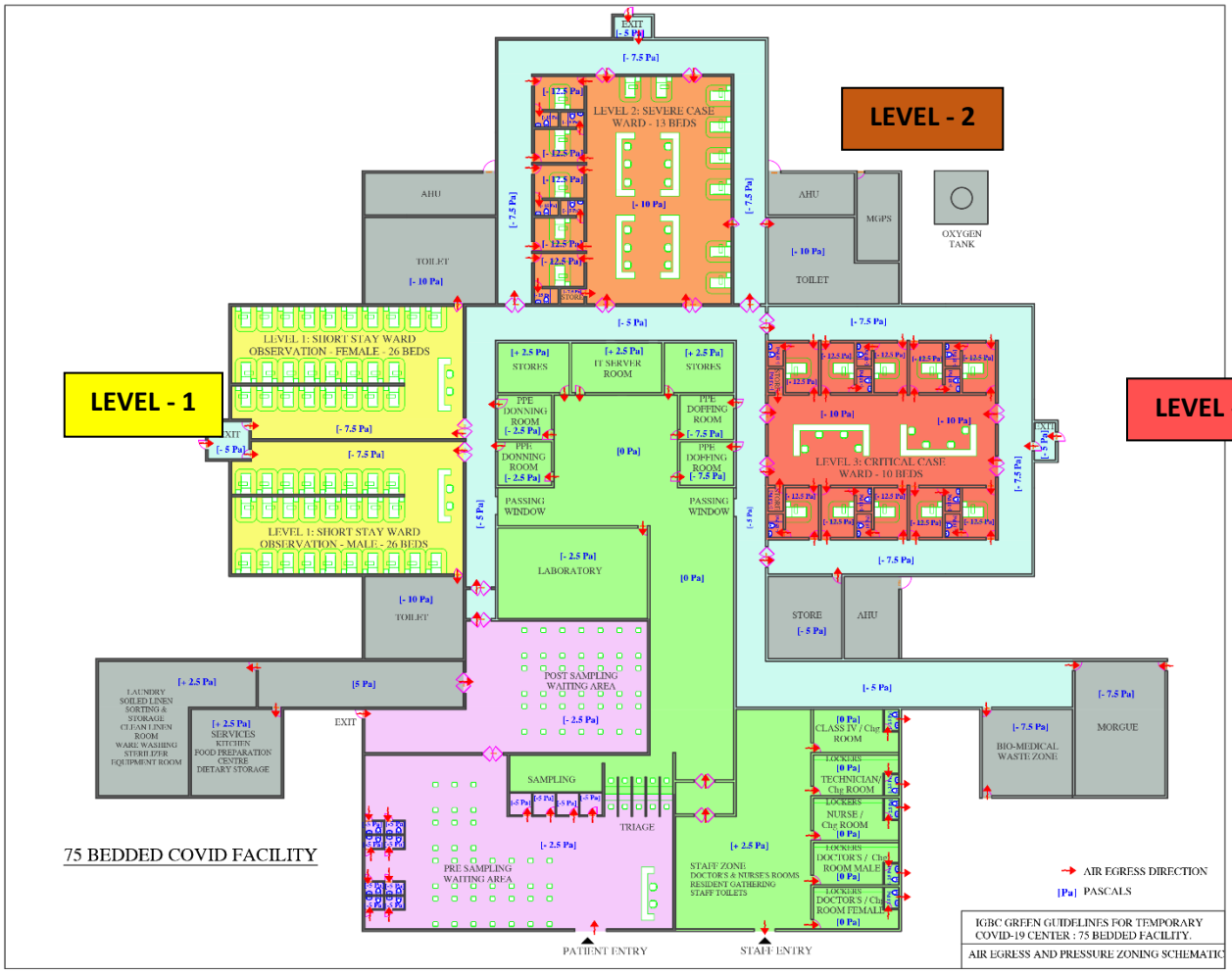
The room design options for the various areas are color coded in the recommendations as follows:

Air conditioning with AHUs: These systems incorporate the necessary air filtration and are the only option for critical areas viz. isolation rooms and ICUs. It is also the preferred option for quarantine and triage. The AHUs can induct fresh air & also create the necessary pressure gradients. Though it can be a good option for the other areas needing air conditioning, the economy of using the same has to be evaluated.

Air conditioning with Unitary Equipment (viz. wall units/ window air conditioners or cassettes) is an economical option where mechanical ventilation cannot provide necessary comfort. But the shortcoming of providing such systems is that the requisite air filtration is not there and there is no provision of fresh air. These systems can be used in quarantine, triage, patient waiting areas, doctors' and nurses' rooms provide separate provision for inducting fresh air is made and room pressure gradient where necessary is provided by exhaust modules where necessary.

Mechanical Ventilation is an option where the climate is favorable but natural ventilation is not practical in terms of availability of the necessary cross ventilation. Mechanical ventilation is acceptable in certain areas viz. quarantine, triage, and areas like resident gathering / activity / dining and physical therapy rooms. In service areas viz. wash, janitor room, store rooms mechanical ventilation is a practical option.

Natural Ventilation depends on favorable climate conditions (e.g. no risk of heat stress, no air pollution). Natural ventilation also depends on cross ventilation and convection principles and the facility will need to have the required attributes to make this a feasible option



Air Egress & Pressure Zoning Schematic

Recommended Design Parameters

IGBC recommends the following parameters while designing the HVAC systems for the various zones in COVID Care facilities.

IGBC Green Guidelines for Temporary COVID-19 Facilities: Room Design for Air-conditioning &Ventilation: Summary													
							Acceptable Options for Air conditioning & Ventilation						
Serial No.	Room Type	Temperature F [C]	Relative Humidity %	Room Pressure w.r.t surroundings	Min. Fresh air ach	Min. Recirculation air ach	Only AHU	Unitary AC + Fresh Air/Exhaust Modules	Mechanical Ventilation	Natural Ventilation	Remarks # 1	Remarks # 2
1	Intensive Care Unit	70F~75F [21~24]	40~70%	> (-) 2.5Pa	12	Nil	Only AHU	Unitary AC + Fresh Air/Exhaust Modules acceptable for converted hospitals only	N/A	N/A		
		Filtration					MERV7 + MERV14 for AHU	Coarse Filters of AC units and (MERV7 + MERV14) for Fresh Air Module	N/A	N/A	H13 HEPA/Chemical treatment/Plume for Exhaust for both AHU based & Unitary AC systems	UVGI for Cooling coil for AHU option

Serial No.	Room Type	Temperature F [C]	Relative Humidity %	Room Pressure w.r.t surroundings	Min. Fresh air ach	Min. Recirculation air ach	Only AHU	Unitary AC + Fresh Air/Exhaust Modules	Mechanical Ventilation	Natural Ventilation	Remarks # 1	Remarks # 2
2	Airborne Infectious Isolation (A.I.I.) , also called Negative Isolation Room	70F~75F [21~24]	40~70%	> (-) 2.5Pa	12	Nil	Only AHU	Unitary AC + Fresh Air/Exhaust Modules acceptable for converted hospitals only	N/A	N/A		
		Filtration					MERV7 + MERV14 for AHU	Coarse Filters of AC units and (MERV7 + MERV14) for Fresh Air Module	N/A	N/A	H13 HEPA/Chemical treatment/Plume for Exhaust for both AHU based & Unitary AC systems	UVGI for Cooling coil for AHU
3	Quarantine	70F~75F [21~24]	40~70%	Negative	2	12	AHU	Unitary AC + Fresh Air/Exhaust Modules acceptable for converted hospitals only	Mechanical Ventilation with minimum 12ACH fresh air supply	Natural Ventilation (Supply Air 160Litres/s per person)		
		Filtration					MERV7 + MERV14 for AHU	Coarse Filters of AC units and (MERV7 + MERV14) for Fresh Air Module	(MERV7 + MERV14) for Supply Air	N/A	All exhausts to be to safe place	1. Upper Room UVGI Recommended for all options 2. UVGI for cooling coil for AHU option 3. Duct mounted UVGI for Supply Air for AHU
Serial No.	Room Type	Temperature F [C]	Relative Humidity %	Room Pressure w.r.t surroundings	Min. Fresh air ach	Min. Recirculation air ach	Only AHU	Unitary AC + Fresh Air/Exhaust Modules	Mechanical Ventilation	Natural Ventilation	Remarks # 1	Remarks # 2

4	Triage	70F~75F [21~24]	40~70%	Negative	2	12	AHU	Unitary AC + Fresh Air/Exhaust Modules (for Converted Hospitals only)	Mechanical Ventilation with min 12ACH fresh air supply	Natural Ventilation (Supply Air 160Litres/s per person)		
		Filtration					MERV7 + MERV14 for AHU	Coarse Filters of AC units and (MERV7 + MERV14) for Fresh Air Module	(MERV7 + MERV14) for Fresh Air supply	N/A	All exhausts to be to safe place	1. Upper Room UVGI for all options 2. UVGI for cooling coil for AHU option 3. Duct mounted UVGI for supply air for AHU option.
5	Laboratory, general	70F~75F [21~24]	N/R	Negative	2	6	AHU	Unitary AC + Fresh Air/Exhaust Modules	Mechanical Ventilation with min 12ACH fresh air supply	N/A		
		Filtration					MERV7 for AHU	MERV7 for Fresh Air	MERV7 for fresh Air supply	N/A	All exhausts to be to safe place	UVGI for Cooling coil for AHU opt
Serial No.	Room Type	Temperature F [C]	Relative Humidity %	Room Pressure w.r.t surroundings	Min. Fresh air ach	Min. Recirculation air ach	Only AHU	Unitary AC + Fresh Air/Exhaust Modules	Mechanical Ventilation	Natural Ventilation	Remarks # 1	Remarks # 2

6	Laboratory, glass washing & Laboratory, strilizing	70F~75F [21~24]	N/R	Negative	2	10	AHU	Unitary AC + Fresh Air Modules	Mechanical Ventilation with min 12ACH fresh air supply	N/A		
		Filtration					MERV 7 for AHU	MERV 7 for fresh Air	MERV7 for fresh Air supply	N/A	All exhausts to be to safe place	UVGI for Cooling coil for AHU option
7	Resident Gathering/ Activity/ Dining	70F~75F [21~24]	N/R	N/R	4	4	AHU	Unitary AC + Fresh Air Modules	Mechanical Ventilation with min 12ACH fresh air supply	Natural Ventilation (Supply Air 160Litres/s per person)		
		Filtration					MERV 7 for AHU	MERV 7 for fresh Air	MERV7 for fresh Air supply	N/A	All exhausts to be to safe place	1. Upper Room UVGI Recommended for all options 2. UVGI for cooling coil for AHU option 3.Duct mounted UVGI for supply air for AHU option
Serial No.	Room Type	Temperature F [C]	Relative Humidity %	Room Pressure w.r.t surroundings	Min. Fresh air ach	Min. Recirculation air ach	Only AHU	Unitary AC + Fresh Air/Exhaust Modules	Mechanical Ventilation	Natural Ventilation	Remarks # 1	Remarks # 2

8	Physical Therapy	70F~75F [21~24]	N/R	Negative	2	6	AHU	Unitary AC + Fresh Air Modules	Mechanical Ventilation with min 12ACH fresh air supply	Natural Ventilation (Supply Air 160Litres/s per person)		
		Filtration					MERV 7 for AHU	MERV 7 for fresh Air	MERV7 for fresh Air supply	N/A	All exhausts to be to safe place	1. Upper Room UVGI Recommended for all options 2. UVGI for cooling coil for AHU option 3.Duct mounted UVGI for supply air for AHU option
9	Main Entry External Change Room	70F~75F [21~24]	N/R	Positive	2	12	AHU	Unitary AC + Fresh Air/Exhaust Modules	Mechanical Ventilation (min.12ACH supply)	N/A		
		Filtration					MERV 7 for AHU	MERV7 for fresh Air	MERV 7 for fresh Air	N/A	All exhausts to be to safe place	1. Upper Room UVGI Recommended for all options 2. UVGI for cooling coil for AHU option 3.Duct mounted UVGI for supply air for AHU option
Serial No.	Room Type	Temperature F [C]	Relative Humidity %	Room Pressure w.r.t surroundings	Min. Fresh air ach	Min. Recirculation air ach	Only AHU	Unitary AC + Fresh Air/Exhaust Modules	Mechanical Ventilation	Natural Ventilation	Remarks # 1	Remarks # 2

10	(Entry to COVID Zone) Change Room Donning Area	70F~75F [21~24]	N/R	Positive	2	12	AHU	Unitary AC + Fresh Air/Exhaust Modules	Mechanical Ventilation (min.12ACH supply)	N/A		
		Filtration					MERV 7 for AHU	MERV7for fresh Air	MERV 7 for fresh Air	N/A	All exhausts to be to safe place	1. Upper Room UVGI Recommended for all options 2. UVGI for cooling coil for AHU option 3.Duct mounted UVGI for supply air for AHU option
11	Change Room Doffing Area	70F~75F [21~24]	N/R	Positive	2	12	AHU	Unitary AC + Fresh Air/Exhaust Modules	Mechanical Ventilation (min.12ACH fresh air supply)	N/A		
		Filtration					MERV 7 for AHU	MERV 7 for fresh Air	MERV 7 for fresh Air	N/A	H13 HEPA/Chemical treatment/Plume for Exhaust for both AHU based / Unitary AC systems/ Mechanical Ventilation Systems	1. Upper Room UVGI Recommended for all options 2. UVGI for cooling coil for AHU option 3.Duct mounted UVGI for supply air for AHU option
Serial No.	Room Type	Temperature F [C]	Relative Humidity %	Room Pressure w.r.t surroundings	Min. Fresh air ach	Min. Recirculation air ach	Only AHU	Unitary AC + Fresh Air/Exhaust Modules	Mechanical Ventilation	Natural Ventilation	Remarks # 1	Remarks # 2
12	Doctors' Room, Nurses' Room	70F~75F [21~24]	N/R	Positive	2	6	AHU	Unitary AC + Fresh Air Modules	Mechanical Ventilation (min.12ACH fresh air supply)	N/A		

	INNOVATION IN DESIGN PROCESS											
		Filtration					MERV 7 for AHU	MERV 7 for fresh Air	MERV 7 for fresh Air	N/A	All exhausts to be to safe place	1. UVGI for cooling coil for AHU option 2. Duct mounted UVGI for supply air for AHU option
13	Food Preparation Centre	70F~75F [21~24]	N/R	Negative	2	10	AHU	Unitary AC + Fresh Air/Exhaust Modules	Mechanical Ventilation (min.12ACH fresh air supply)	N/A		
		Filtration					MERV 7 for AHU	MERV 7 for fresh Air	NA	N/A		1. UVGI for cooling coil for AHU option 2. Duct mounted UVGI for supply air for AHU option
Serial No.	Room Type	Temperature F [C]	Relative Humidity %	Room Pressure w.r.t surroundings	Min. Fresh air ach	Min. Recirculation air ach	Only AHU	Unitary AC + Fresh Air/Exhaust Modules	Mechanical Ventilation	Natural Ventilation	Remarks # 1	Remarks # 2
14	Ware washing/ Laundry/ Soiled Linen/Bedpan	N/R	N/R	Negative		10 [exhaust only]	N/A		Mechanical Ventilation (10 ACH Exhaust only)	N/A		

	roon/Janitor's Closet/ Bathroom/ Sterilizer Equip Room	Filtration							MERV7	N/A		
15	Dietary Storage	70F~75F [21~24]	N/R	N/R	2	10	AHU		Mechanical Ventilation (min10 ACH fresh air supply)	N/A		
		Filtration					MERV 7 for AHU		MERV7	N/A		1. UVGI for cooling coil for AHU option
16	Clean Linen room	70F~75F [21~24]	N/R	Positive	2	10	AHU	Unitary AC + Fresh Air/Exhaust Modules	Mechanical Ventilation (10 ACH supply)	N/A		
		Filtration					MERV 7 for AHU	MERV 7 for fresh Air	MERV7 for fresh air	N/A		1. UVGI for cooling coil for AHU option
17	Wash Room	N/R	N/R	Negative		10	N/A	Exhaust Fan only	Exhaust Fan only	N/A		
		Filtration					N/A	N/A	Please refer Remarks#1	N/A	H13 HEPA/Chemical treatment/Plume	

After setting up the system, IGBC recommends complete flush out of the system for about 72 hrs to ensure that all the pollutants including the dust particles and volatile organic compounds (VOCs) are completely flushed out.

Nightingale Hospital project,
UK- COVID section

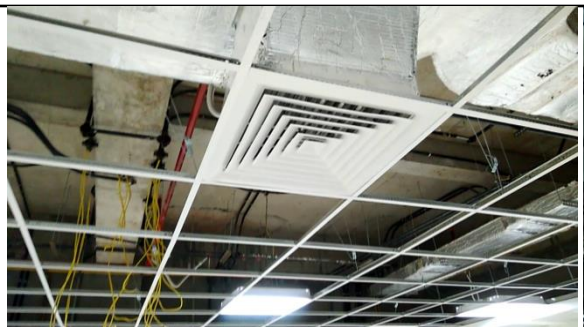
Room Design:

The room design for the various rooms in the hospital are covered here with recommendations on the expectation as per the standard, options where possible in terms of air conditioning with unitary equipment viz. wall units, window air conditioners and cassettes, natural ventilation and mechanical ventilation.

The various areas require temperature and relative humidity settings (where air conditioned), air change rates for fresh air and re circulation, filtration, room pressure differential to prevent cross contamination between areas and air flow patterns to sweep away the pathogens from where they are generated to exhaust points. These concepts, named as 'Parameters' are discussed in greater detail in **Appendix I** and need to be read along with the recommendations given here.

Also, an important aspect of air distribution in the room is that there should not be turbulence. Turbulence vitiates the concept of air patterns as described above and will result in contamination spreading over the place.

The placement of grilles and diffusers and the sizing should be such that there are no air drafts. Typically at occupancy level, air velocities should be around 0.2m/s [ASHRAE 55].




Exposed Metal Ducts

An alternative method is to use Fabric Ducts (as against the normal sheet metal ducts). These fabric ducts can be used for supply as well as exhaust/ return air. These ducts are now available with antimicrobial and fire rating. The fabrics are cleanable in washing machines. As a sustainability initiative, some manufacturers offer fabrics out of recycled polyester

Fabric ducts have a number of air diffusion options which include linear vents, nozzles, orifices, and porous fabrics. These options can be made use of to achieve uniform air flow, necessary air throw and low turbulence. Fabric ducts can be procured and installed in relatively short time.

Recommendations for ventilation in the COVID Facility:

I. Intensive Care Units

Acceptable Options	Only AHU	Unitary AC Units + Fresh Air/ Exhaust Modules (for Converted Hospitals only)

The ASHRAE Standard 170-2017 specifies the following parameters for infectious ICUs:

Temperature F [C]	Relative Humidity %	Room Pressure w.r.t surroundings	Min. Outside air ach	Min. Recirculation air ach
70F~75F [21.1~23.9]	40~70%*	> [-]2.5Pa	Minimum 6**	Nil

Ach # air changes per hour

*ISHRAE COVID 19 document recommends Relative Humidity of 40~70% and this is acceptable as against 40~60% mentioned in ASHRAE Standard 170-2017

**WHO recommends 6~12ach, preferably 12ach. There will not be recirculation of air. ASHRAE Standard 170-2017 allows for recirculation of air if there is HEPA in the return.

Filtration recommended is MERV7 for as first stage & MERV14 or better as second stage for supply air.

The exhaust to atmosphere will have to be with minimum H13 grade HEPA filter (EN1822-1)

For **Converted Facilities** (existing Nursing Homes/ Hospitals being converted into COVID facilities) many of the ICUs are based on local air circulating air conditioning units such as room air conditioners, wall splits & cassettes units. These are not recommended because of various reasons:

i. Maintenance of the units has to be done in the patient area

ii. Filtration is inadequate

iii. There is no provision of fresh air or exhaust.

Till it is practical to go for an upgrade, following steps can be taken to alleviate the inside conditions:

1. Introduce an inline fan for inducting fresh air of minimum 2 air changes per hour. Use two stage filtrations with minimum MERV 7 and MERV14 rated filters.

2. Since directly inducting fresh air into the room can lead to condensation in the room especially during monsoon, make sure that the fresh air is led to the return air grill portion of the air conditioning unit.

The room will need to be kept at a negative pressure of a minimum 2.5Pascals. When the area is under negative pressure, the adjoining room should be maintained at the same level of hygiene as the ICU as air from this area will infiltrate into the ICU. An exhaust unit will be needed to achieve the [-]2.5Pa in the area with respect to the adjoining areas. The exhaust to atmosphere will have to be with H13 or equivalent grade HEPA filter.

II. **Airborne Infectious Isolation [A.I.I.] room** (also called **Negative Isolation Room**]

Acceptable Options	**Only AHU**	**Unitary AC Units + Fresh Air/ Exhaust Modules (for Converted Hospitals only)**

The ASHRAE Standard 170-2017 specifies the following parameters for these isolation rooms:

Temperature F [C]	Relative Humidity %	Room Pressure w.r.t surroundings	Min. Outside air ach	Min. Recirculation air ach

	70F~75F [21~24]	40~70%*	> [-]2.5Pa	12*	Nil

Ach # air changes per hour:

* ISHRAE COVID 19 document recommends Relative Humidity of 40~70% and this is acceptable as against 40~60% mentioned in ASHRAE Standard 170-2017 I

**WHO recommends 6~12ach, preferably 12ach.

There will not be recirculation of air.

Filtration recommended is MERV7 for as first stage & MERV14 or better as second stage for supply air. The exhaust to atmosphere will have to be with minimum H13 grade HEPA filter (EN1822-1).

Additional Recommendation: UVGI for AHU cooling coil will be a useful option to keep the cooling coil & drain pan clean of biofilm.

For **Converted Facilities** (existing Nursing Homes/ Hospitals being converted into COVID facilities) Make-shift Isolation Enclosures may have to be built (Reference: IMA-HBI-ISHRAE covid-19 Guidance Document for Air-conditioning and Ventilation in Healthcare Facilities).

In resource constrained healthcare settings, several COVID-19 patients may be required to be admitted to a single large room. This presents a significant risk to the health care workers as well as a possibility for environmental spread of virus laden particles. For such instances, a make-shift patient isolation enclosure could provide the necessary protection. This could be a temporary makeshift cubicle or tent constructed out of a skeleton structure (of plastic or metal) and plastic sheet or canvas covering. The tent shall be covered on all sides excepting the front, where PVC strip curtains or a similar arrangement can be provided. Arrangements for light and a fan inside the tent can be provided for the comfort of the patient, as necessary. The tent shall be provided with an exhaust blower to extract the air inside the enclosure and exhaust out into the atmosphere after suitable treatment. Exhaust air treatment can be done as mentioned earlier. The exhaust blower shall be so sized that a negative pressure of >2.5Pa is maintained inside the enclosure.

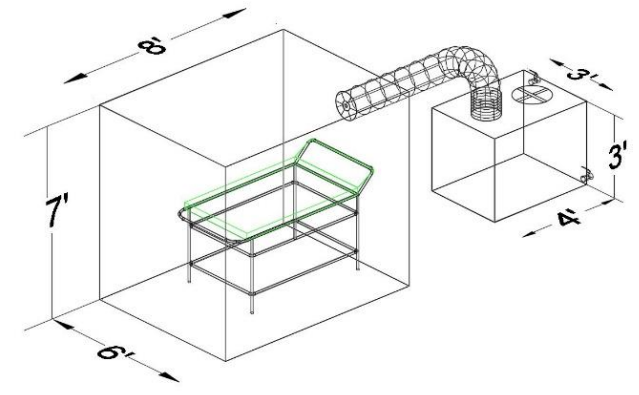


Figure 2: Isolation enclosure with Chemical disinfection for exhaust air. *(Dimensions are only indicative)*

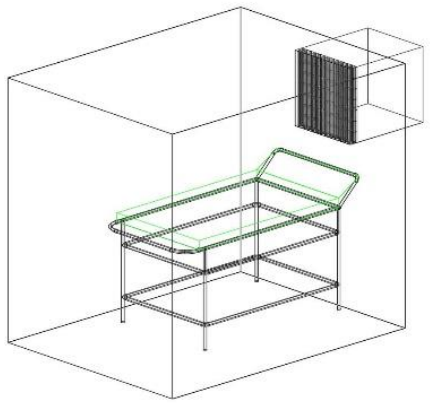


Figure 3: Isolation enclosure with HEPA filtration for exhaust air

Quarantine and Triage

Acceptable Options	AHU	Unitary AC Units + Fresh Air/ Exhaust Modules	Mechanical Ventilation with Filtration	Natural Ventilation

Temperature F [C]	Relative Humidity %	Room Pressure w.r.t surroundings	Min Outside air ach	Min. Recirculation air
70F~75F [21~24]	40~70%	Negative	2	12 ach

Ach # air changes per hour

The ASHRAE Standard 170 recommends that in case of recirculation of air through AHU, there has to be HEPA filter in the return. The filtration in the AHU will be in two stages: MERV7 + MERV14 or better.

In case l**ocal unitary equipment are used viz. wall units, window air conditioners or cassettes** are used, use of fresh air is mandatory. Fresh air has to be introduced towards the return air of the units so that the chance of condensation is reduced. The room exhausts have to be suitably placed to ensure that the exhaust air does not affect thoroughfares or susceptible areas.

These areas may be ***mechanically ventilated***. If this is done, it has to be ensured that a minimum of 12 ach of fresh air is supplied in the room and the pressure relationship is negative with respect to surroundings. Here too, the room exhausts have to be suitably placed to ensure that the exhaust air does not affect thoroughfares or susceptible areas.

In case ***natural ventilation is*** adopted, the WHO recommendation is: Naturally ventilated facilities/areas: the recommended average natural ventilation rate is 160 L/s/patient.

Additional Recommendation: Considering the high viral loads that may be present in these areas, use of ***Upper Room UV Systems*** can be a beneficial addition for air purification.

UVGI for AHU cooling coil for air conditioning with AHU option will keep the cooling coil & drain pan clean of biofilm.

III. Laboratory

Acceptable Options	AHU	Unitary AC Units + Fresh Air/ Exhaust Modules

Recommendation as per ASHRAE Standard 170-2017 is as follows:

Room Type	Temperature F [C]	Relative Humidity %	Room Pressure w.r.t surroundings	Min Outside air ach	Min. Recirculation air
Laboratory, general	70F~75F [21~24]	N/R	Negative	2	6
Laboratory, glass washing	70F~75F [21~24]	N/R	Negative	2	10
Laboratory, sterilizing	70F~75F [21~24]	N/R	Negative	2	10

Ach # air changes per hour

Filtration recommended is MERV7

In case l**ocal unitary equipment are used viz. wall units, window air conditioners or cassettes**, use of fresh air is mandatory. Fresh air has to be introduced towards the return air of the units so that the chance of condensation is reduced. The room exhausts have to be suitably placed to ensure that the exhaust air does not affect thoroughfares or susceptible areas

These areas may be **mechanically ventilated**. If this is done, it has to be ensured that a minimum of 12ach of fresh air is supplied and the pressure relationship is negative with respect to surroundings. The filtration in the fresh air supply AHU will be: MERV7 or better. Here too, the room exhausts have to be suitably placed to ensure that the exhaust air does not affect thoroughfares or susceptible areas.

IV. Resident Gathering/ Activity/ Dining and Physical Therapy Rooms

Recommendation as per ASHRAE Standard 170-2017 is as follows:

Room Type	Temperature F [C]	Relative Humidity %	Room Pressure w.r.t surroundings	Min Outside air ach	Min. Recirculation air
Resident Gathering/ Activity/ Dining	70F~75F [21~24]	N/R	N/R	4	4
Physical Therapy	70F~75F [21~24]	N/R	Negative	2	6

Ach # air changes per hour
For AHU, filtration has to be MERV7
The filtration in the AHU will be MERV7.

In case l**ocal unitary equipment are used viz. wall units, window air conditioners or cassettes** are used, use of fresh air is mandatory. Fresh air has to be introduced towards the return air of the units so that the chance of condensation is reduced. The room exhausts have to be suitably placed to ensure that the exhaust air does not affect thoroughfares or susceptible areas.

These areas may be ***mechanically ventilated***. If this is done, it has to be ensured that a minimum of 12 ach of fresh air is supplied in the room and the pressure relationship is negative with respect to surroundings. Here too, the room exhausts have to be suitably placed to ensure that the exhaust air does not affect thoroughfares or susceptible areas.

In case ***natural ventilation is*** adopted, the WHO recommendation is: Naturally ventilated facilities/areas: the recommended average natural ventilation rate is 160 L/s/patient.

Additional Recommendation: Considering the high viral loads that may be present in these areas due to high occupancy, use of ***Upper Room UV Systems*** can be a beneficial addition for air purification.

UVGI for AHU cooling coil for air conditioning with AHU option will keep the cooling coil & drain pan clean of biofilm.

UVGI in supply air duct for air conditioning with AHU option for air disinfection will further improve the indoor air quality.

V. Entry to COVID Zone External Change Room

Acceptable Options	**AHU**	**Unitary AC Units + Fresh Air/ Exhaust Modules**	**Mechanical Ventilation with Filtration**

Room Type	**Temperature F [C]**	**Relative Humidity %**	**Room Pressure w.r.t surroundings**	**Min Outside air ach**	**Min. Recirculation air**
Main Entry External Change Room	70F~75F [21~24]	N/R	Positive	2	12

Ach # air changes per hour

Filtration with AHU system has to be with MERV7 filters for supply air

In case local unitary equipment are used viz. wall units, window air conditioners or cassettes are used, use of fresh air is mandatory. Fresh air has to be introduced towards the return air of the units so that the chance of condensation is reduced.

These areas may be mechanically ventilated. If this is done, it has to be ensured that a minimum of 12ach of fresh air is supplied in the room. The filtration in the fresh air supply AHU will be: MERV7 or better. The room exhausts have to be suitably placed to ensure that the exhaust air does not affect thoroughfares or susceptible areas

Additional Recommendation: Considering the high viral loads that may be present in these areas, use of Upper Room UV Systems can be a beneficial addition for air purification.

UVGI for AHU cooling coil for air conditioning with AHU option will keep the cooling coil & drain pan clean of biofilm.

UVGI in supply air duct for air conditioning with AHU option for air disinfection will further improve the indoor air quality.

VI. Change Room Suite for PPE Donning and Doffing

Acceptable Options	AHU	Unitary AC Units + Fresh Air/ Exhaust Modules	Mechanical Ventilation with Filtration

In case air conditioned, the following parameters need to be followed:

Room Type	Temperature F [C]	Relative Humidity %	Room Pressure w.r.t surroundings	Min Outside air ach	Min. Recirculation air
Donning Area	70F~75F [21~24]	N/R	Positive	2	12
Doffing Area	70F~75F [21~24]	N/R	Negative	6	Not recommended

Ach # air changes per hour

Filtration with AHU system has to be with MERV7 filters for supply air

The change room area is critical for the safety of the healthcare workers. The donning area has to be clean and the doffing area has a possibility of high viral load.

A diagram showing the recommended air infiltration/ exfiltration direction and pressure gradient to ensure a clean to dirty axis is given below:

The direction of doors should be made note of. This is to ensure that pressure aids in keeping the doors closed

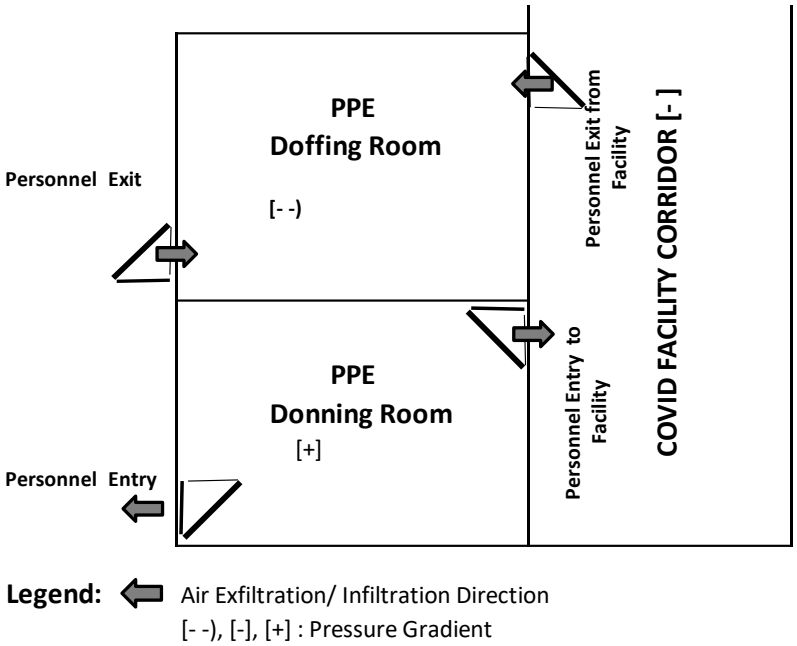


Figure 4: Pressure gradient criteria for change room suite comprising donning and doffing areas

In case l**ocal unitary equipment are used viz. wall units, window air conditioners or cassettes** are used, use of fresh air is mandatory. Fresh air has to be introduced towards the return air of the units so that the chance of condensation is reduced.

These areas may be ***mechanically ventilated***. If this is done, it has to be ensured that a minimum of 12 ach of fresh air is supplied in the room and the pressure relationship is negative with respect to surroundings.

Additional Recommendation:

I Considering the high viral loads that may be present in these areas, use of **Upper Room UV Systems** can be a beneficial addition for air purification.

ii. The exhaust air from the doffing area will need to be discharged into atmosphere with minimum H13 grade HEPA filter (EN1822-1).

iii. UVGI for AHU cooling coil for air conditioning with AHU option will keep the cooling coil & drain pan clean of biofilm.

iv. UVGI in supply air duct for air conditioning with AHU option for air disinfection will further improve the indoor air quality

VII. Doctors' and Nurses' Rooms

Acceptable Options	AHU	Unitary AC Units + Fresh Air Modules	Mechanical Ventilation with Filtration

Room Type	Temperature F [C]	Relative Humidity %	Room Pressure w.r.t surroundings	Min Outside air ach	Min. Recirculation air
Doctors' Room	70F~75F [21~24]	N/R	Positive	2	6
Nurses' Room	70F~75F [21~24]	N/R	Positive	2	6

Ach # air changes per hour
Filtration with AHU system has to be with MERV7 filters for supply air

Additional Recommendations:

i. UVGI for AHU cooling coil for air conditioning with AHU option will keep the cooling coil & drain pan clean of biofilm.
ii. UVGI in supply air duct for air conditioning with AHU option for air disinfection will further improve the indoor air quality

In case l**ocal unitary equipment are used viz. wall units, window air conditioners or cassettes** are used, use of fresh air is mandatory. Fresh air has to be introduced towards the return air of the units so that the chance of condensation is reduced.

These areas may be ***mechanically ventilated***. If this is done, it has to be ensured that a minimum of 12ach of fresh air is supplied in the room and the pressure relationship is negative with respect to surroundings.

VIII. Service Areas

The Service Areas need to be mechanically ventilated.

For the food processing area (kitchen), air conditioning may be considered because of heat considerations.

In case of AHU for air conditioning of in the case of mechanical ventilation system, the supply air filtration can be MERV7.

The ventilation requirement and the pressure relationship with adjoining areas is listed below:

Function of Space	Temperature F [C]	Relative Humidity %	Room Pressure w.r.t surroundings	Outside air (min. ACH)	Recirculation air [min, ACH]
Food Preparation Centre	70F~75F [21~24]	N/R	Negative	2	10
Ware washing	N/R	N/R	Negative		10 [exhaust only]
Dietary Storage	70F~75F [21~24]	N/R	N/R	10	Nil
Laundry, general	N/R	N/R	Negative	10	Nil
Soiled linen sorting & storage	N/R	N/R	Negative	10	Nil
Clean Linen room	70F~75F [21~24]	N/R	Positive	2	10
Bedpan room	N/R	N/R	Negative	10	Nil
Bathroom	N/R	N/R	Negative	10	Nil
Janitor's closet	N/R	N/R	Negative	10	Nil
Sterilizer equipment room	N/R	N/R	Negative	10	Nil

Ach # air changes per hour

In case l**ocal unitary equipment are used viz. wall units, window air conditioners or cassettes** (for Food Preparation and Clean Linen Room), use of fresh air is mandatory. Fresh air has to be introduced towards the return air of the units so that the chance of condensation is reduced.

*Additional Recommendation: For air-conditioned space: Food Preparation Centre

i. UVGI for AHU cooling coil for air conditioning with AHU option will keep the cooling coil & drain pan clean of biofilm.

ii. UVGI in supply air duct for air conditioning with AHU option for air disinfection will further improve the indoor air quality

**Additional Recommendation: For air-conditioned space: Dietary Storage & Clean Linen Storage:

i. UVGI for AHU cooling coil for air conditioning with AHU option will keep the cooling coil & drain pan clean of biofilm.

IX. Wash Rooms

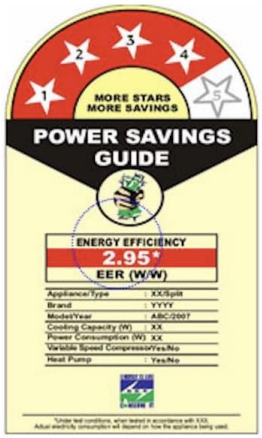
Wash rooms can have high viral load in the exhaust. The exhaust has to be a minimum of 10 air changes. It is necessary to ensure that the exhaust to atmosphere should not get into thoroughfares and occupied areas. If this Is not possible, it should be examined if it can be dispersed high into the air, 3M above the highest point of the building while taking care that this doesn't get into air intakes of adjacent buildings.

If even this is not possible, exhaust air has to be filtered through HEPA filters of minimum grade H13 (EN1822-1) before discharging into atmosphere.

5.0 Energy Efficiency

Healthcare facilities are energy intensive. Good energy management practices can reduce energy consumption to an extent of 30-40%, thereby reducing the operational expenses. Energy efficiency should be achieved without compromising on the quality of health care facilities to the patients.

The following measures may be considered for implementation of energy efficient equipment in the emergency COVID facilities:



- Air Conditioning system
  - Use of CFC free refrigerant HVAC systems
  - Install Halon free fire suppression systems
  - Use unitary air-conditioners with BEE 3-star rating (or) air-conditioners with a COP equivalent to 3.1
- Lighting
  - Use efficient lighting fixtures such as LEDs/CFLs
- Other Equipment
  - Use fans with efficiency equivalent to BEE 3-star rating or more.
  - Install Pumps & Motors in the building with efficiency equivalent to BEE 3-star rating or more.
  - Use efficient hot water systems such as solar hot water systems or BEE star rated geysers

Note: For more details on referring standards for choosing equipment to achieve energy efficiency, please refer to Annexure - III

6.0 Water Conservation

Experts indicate that, COVID 19 is not a waterborne disease. However, while consuming or using water, the associated sanitary fixtures and their surfaces can be a potential source of infection. IGBC recommends the following measures to reduce the spread of infection through sanitary fixtures:

- Fixtures in Existing Buildings & New Buildings
  - Install sensor-based plumbing fixtures for Faucets, water closets & urinals
  - Use sensor-based hand dryers and paper towels in washrooms, kitchen / canteen
  - Use sensor based or foot operated drinking water dispensers
  - Use Long handle (Surgical) faucets which can be operated by elbow in washrooms / kitchen/ dining areas
- Before Starting Operations
  - Carryout chemical cleaning of water storage tanks
  - Carryout flushing of water carrying pipes with clean water

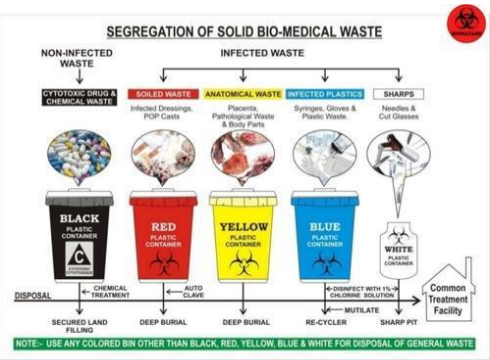
- Check the quality of potable water regularly and take corrective measures

7.0 Waste Management

COVID facilities have to deal with biomedical waste and consumer waste during operations. Since COVID facilities have extensive requirement of personal protective equipment such as masks, gloves, gowns, PPE kits etc., the quantum of waste handled also increases. Furthermore, if the used kits are not disposed off in a proper manner it would lead to further infections and community spread.

Following are the few recommendations to manage waste in the COVID center:

- Install separate bins for waste segregation
  - Dry waste, wet waste, biomedical/hazardous waste.
- Biomedical waste management
  - Provide level wise waste segregation
    - Reference: MoEF- Bio-Medical Waste (Management and Handling) Rules-2016



- Provide centralised waste collection point
  - Locate the area with easy access to disposal
- Instruct housekeeping staff to avoid direct contact to waste while segregating and also during disposal
  - Housekeeping staff to use disposable masks and gloves
  - Install separate storage bins for disposing used masks, gloves and tissue papers

8.0 Interior Furnishings

Interior layout, furnishings and high touch surfaces could be potential sources of infection in the COVID facilities. Following measures are recommended:

- Abundant daylighting in design
- Maintain 6 feet distance in:
  - Arrangement of beds
  - Furniture layouts for workforce
  - Furniture layout in common areas
- Address Colour psychology through appropriate colour selection in the interior wall/surfaces
  - Walls, paintings, linens, bedsheets, curtains etc
- Use materials with recycled content and that are recyclable
- Select materials for interior furnishings that are
  - Antibacterial, Easy to maintain, Resistant to microbial growth, Nonporous and Seamless

9.0 Facilities for Health Workforce

Healthcare workers are the most exposed people and run the risk of high probability of infection. Hazards include direct exposure to the infected patients, long working hours, psychological stress and fatigue. It is recommended to provide following facilities to reduce the infection spread amongst the healthcare workforce:

- Provide adequate kits and protective items for healthcare workforce
  - Masks, PPE kits, Face shields, Gloves, sanitisers
- Provide stress relieving breakout spaces
  - Facilities for mental relaxation
- Provide basic facilities such as bathrooms in donning and doffing area
- Provide dormitories for workforce
- Optimise staff working timings appropriately

References

The IGBC guidelines for emergency COVID healthcare facilities have been developed referring the following recommendations released by various healthcare organizations.

- CDC Guidelines for Environmental Infection Control in Health-Care Facilities
- WHO Minimum requirement for infection prevention and control programmes
- WHO's Severe Acute Respiratory Infections Treatment Centre (SARI)
- ASHRAE 170 & 90.1 Guidelines (American HVAC &R Society)
- COVID19 TATA Isolation Wards – Public document

Appendix – I

Parameters

I. Fresh Air and Re-circulation Air Change Rates

Air change rate represents the number of times the entire volume of air in the room is replaced each hour.

One of the methods to reduce the exposure of the person to the concentration of toxic chemicals and the number of microbes is by providing ventilation i.e. introducing clean fresh air into the area. More number of air changes of ventilation per hour reduces the exposure of the patients and the healthcare workers to the toxic chemicals and microbes.

Similarly, in air conditioning systems, certain quantity of air is recirculated in the space through the air filtration system of the air handling unit. The number of times the air gets churned through the filtration system results in more of the particulate matter and the microbes getting filtered out of the air. This recirculation of air is also expressed in air changes per hour.

The chart given below is from the CDC and it shows the time required for airborne-contaminant removal efficiencies of 99% and 99.9% through air change rates. The chart assumes perfect mixing of the air within the space (i.e., mixing factor = 1). However, perfect mixing usually does not occur. Removal times will be longer in rooms or areas with imperfect mixing or air stagnation.

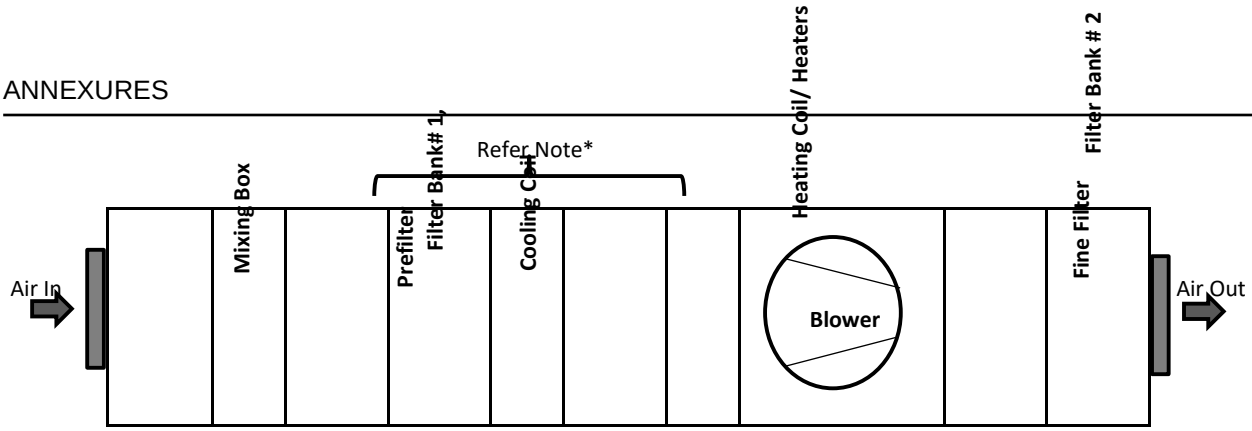
Air changes/hour (ACH) and time required for airborne-contaminant removal efficiencies of 99% and 99.9%*

	Time (mins.) required for removal:	
ACH+ § ¶	99% efficiency	99.9% efficiency
2	138	207
4	69	104
6	46	69
8	35	52
10	28	41
12	23	35
15	18	28
20	14	21
50	6	8

Air Change Efficiency Chart (CDC)

II. Passive filtration using media filters

Filters can effectively trap particulate contaminants, including microbiological pathogens, and remove them from the air passing through them. Various grades of filters can be used to achieve different degrees of cleanliness. In critical care facilities such as in quarantine, triage and ICU, a proper filtration system generally consists of a pre-filter and a final filter in the air handling unit (AHU). The pre-filter should be placed upstream, ahead of the cooling/ heating coil (in the case of air conditioning systems), to remove large particles for a clean heat transfer medium. More importantly, the pre-filter can prolong the life of the final filter placed downstream of the AHU (whether for air conditioning or mechanical ventilation), resulting in a cost-effective operation.



Note* Applicable for air conditioning systems & not for mechanical ventilation

Two Stage Filtration in an Air Handling Unit

Filter Classifications

The ASHRAE Standard 52.2 classifies filters used in HVAC application by their Minimum Efficiency Reporting values (MERV). The standard takes into consideration the fractional efficiencies of filters for particles in the size range of 0.3 to 10 microns.

Standard 52.2 Minimum Efficiency Reporting Value (MERV)	Composite Average Particle Size Efficiency, % in Size Range, µm			Average Arrestance, %
	Range 1 (0.3-1.0)	Range 2 (1.0-3.0)	Range 3 (3.0-10.0)	
1	n/a	n/a	E3 < 20	$A_{avg} < 65$
2	n/a	n/a	E3 < 20	$65 \le A_{avg} < 70$
3	n/a	n/a	E3 < 20	$70 \le A_{avg} < 75$
4	n/a	n/a	E3 < 20	$75 \le A_{avg}$
5	n/a	n/a	20 ≤ E3	n/a
6	n/a	n/a	35 ≤ E3	n/a
7	n/a	n/a	50 ≤ E3	n/a
8	n/a	$20 \le E_2$	70 ≤ E3	n/a
9	n/a	$35 \le E_2$	75 ≤ E3	n/a
10	n/a	$50 \le E_2$	80 ≤ E3	n/a
11	$20 \le E_1$	$65 \le E_2$	85 ≤ E3	n/a
12	$35 \le E_1$	$80 \le E_2$	90 ≤ E3	n/a
13	$50 \le E_1$	$85 \le E_2$	90 ≤ E3	n/a
14	$75 \le E_1$	$90 \le E_2$	95 ≤ E3	n/a
15	$85 \le E_1$	$90 \le E_2$	95 ≤ E3	n/a
16	$95 \le E_1$	$95 \le E_2$	95 ≤ E3	n/a

Minimum Efficiency Reporting Values (MERVs) and Filter Efficiencies by Particle Size

Air filters of MERV 13 and above have the potential to remove microbes and other particles ranging from 0.3micron to 10.0 micron.

HEPA Filters

High efficiency particulate air (HEPA) filters trap a vast majority of very small particulate contaminants from an air

stream.

This worst case particle size at which the filter efficiency is least is called as the Most Penetrating Particle size (MPPS), and the efficiency of a filter at MPPS is called as the MPPS Efficiency. A HEPA filter would have an overall filtration efficiency of above 99.95% at MPPS. For any other particle size, smaller or larger than the MPPS, the filtration efficiency of the HEPA filter would be greater than its MPPS efficiency. The MPPS of a HEPA filter would most commonly fall between 0.10 to 0.30 microns.

Most viruses, including CoVs, range from 0.004 to 1.0 micron (Goldsmith CS et. al 2004, Ultra-structural characterization of SARS coronavirus). However, viruses are rarely observed as individual particles, but instead are expelled from the body already combined with water, proteins, salts, and other components as large droplets and aerosols. Thus far, SARS-CoV-2 has been observed in aerosolized particles in a spectrum of sizes, including 0.25 to 0.5 micron (Liu Y et. al, 2020. Aerodynamic characteristics and RNA concentration of SARS-CoV-2 aerosol in Wuhan hospitals during COVID-19 outbreak) necessitating high efficiency filtration techniques to reduce the transmission potential of pathogens such as SARSCoV-2,

HEPA & ULPA filters are classified as per their filtration efficiencies at MPPS. The classification chart of ISO 29463 is given below:

Filter Group / Filter Class	Integral value		Local value [ab]	
	Efficiency (%)	Penetration (%)	Efficiency (%)	Penetration (%)
E10	≥ 85	≤ 15	--[c]	--[c]
E11	≥ 95	≤ 5	--[c]	--[c]
E12	≥ 99,5	≤ 0,5	--[c]	--[c]
H13	≥ 99,95	≤ 0,05	≥ 99,75	≤ 0,25
H14	≥ 99,995	≤ 0,005	≥ 99,975	≤ 0,025
U15	≥ 99,999 5	≤ 0,000 5	≥ 99,997 5	≤ 0,002 5
U16	≥ 99,999 95	≤ 0,000 05	≥ 99,999 75	≤ 0,000 25
U17	≥ 99,999 995	≤ 0,000 005	≥ 99,999 9	≤ 0,000 1

[a] See 7.5.2 and EN ISO 29463-4.

[b] Local penetration values lower than those given in the table may be agreed between supplier and purchaser.

[c] Group E filters (Classes E10, E11 and E12) cannot and shall not be leak tested for classification purposes.

NOTE ISO 29463-1:2017 developed by ISO/TC 142 includes a classification system for high efficiency air filters according to their filtration performance (efficiency or penetration) similar to EN 1822-1. Table A.1 gives a by-side comparison of the classification in EN 1822-1 and ISO 29463-1:2017.

Classification of EPA, HEPA and ULPA Filters

E series: EPA# Efficient Particulate Air (Filter); H series: HEPA# High Efficiency Particulate Air (filter); U series: ULPA# Ultra Low Particulate Air (filter)

III. Air purification using UVGI [Ultra Violet Germicidal Irradiation]

In HVAC systems, UVGI is being increasingly used for surface sterilization (for cooling coils and condensate drain pans) and as a supplement to filters for air purification.

UVC Germicidal Ultraviolet wavelength (254nm) is effective in impacting the DNA structure and RNA of a micro-organism thereby inhibiting reproduction. Micro-organisms such as mold, bacteria & viruses will be destroyed with the required concentrations of germicidal irradiation.

All viruses and almost all bacteria (excluding spores) are vulnerable to moderate levels of UVGI exposure, but the magnitude of the effect is species-dependent.

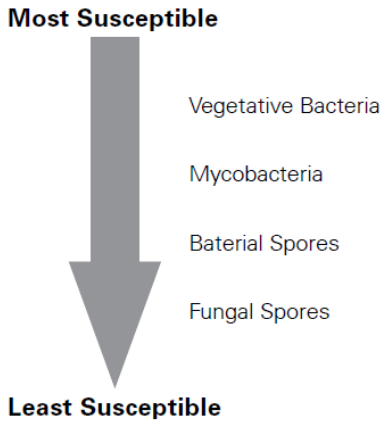
Out of the ultraviolet spectrum, it is the UV-C that has the maximum capability to destroy the microorganisms.

There are a number of factors to be considered that affect the deployment of UVC

- **Residence time**: Greater the exposure time (contact time between the contaminant and the UV source) results in more UV energy being delivered to the contaminant resulting in a greater Kill Rate.
- **Intensity**: Greater intensity results in more UV energy being delivered to the contaminant resulting in a greater Kill Rate
- **Reflection**: Reflection of the UV rays using reflectors and the inside surfaces of the AHU or duct can be a helpful tool to considerably increase the effectiveness of the UV rays produced.
- **Relative Humidity**: affects the susceptibility of microorganisms in the AHU as well as the duct where it is used. The susceptibility factor for the viruses was higher at 55% RH than that at 85% RH, possibly because under high RH (Tseng et al.: Inactivation of virus-containing aerosols by ultraviolet germicidal irradiation, Aerosol Sci Technol 2005). Microbial susceptibility to UVGI—may increase or decrease, depending on the organism.
- **Temperature:** Temperature affects the UV output of the lamp. Temperatures inside the AHU & duct can be below 13.3C [56F] and the output would be lower than 50% of the full output.

(Refer ASHRAE 2012 Systems and Equipment Handbook, Chapter 17 for further details)

Another consideration for the lamp selection is the lamp fouling factor when it is covered with dust. There is an advantage of locating the lamps downstream of high efficiency filters to protect them from dust accumulation. Otherwise, the lamps will need to be cleaned from time to time.
A point to note is that UVC can disinfect a pathogen only if it can reach it either directly or through reflection. In general, reducing the total number of pathogens reduces the risk of transmission.



Susceptibility of Microorganisms to UGVI
Reference: ASHRAE (2008c)

UVGI is being used as an engineering control to interrupt the transmission of pathogenic organisms, such as Mycobacterium tuberculosis (TB), influenza viruses (including COVID 19 virus), mold, and possible bioterrorism agents (Brickner 2003; CDC 2002, 2005; General Services Administration 2003).

Fungal spores are larger than most bacteria and are more resistant to UVGI than most bacteria. For spores, UV-C exposure is postulated to result in the formation of lethal photoactive products [Memarzadeh et al, American Journal

of Infection Control, June 2010] For removal of spores, high efficiency air filtration, viz. MERV14 or superior, would be a better choice. Using a combination of UVGI and high efficiency filters can be an effective solution is certain situations.

CDC guideline addresses UVGI as a supplemental engineering control and are classified as Category II, 'Suggested for implementation and supported by suggestive clinical or epidemiological studies, or a theoretic rationale'

UVGI is used in two formats in the air conditioning systems:

- **In AHUs**: UVGI directed at environmental surfaces can damage microorganisms present or growing on the surface. Lower-intensity UVGI is effective for surface inactivation because irradiation is applied continuously. UVGI from lamps in AHU plenums has been used successfully to inactivate microorganisms present on airstream surfaces such as on cooling coils and drain pans (Menzies et al. 1999, 2003). This helps in keeping the cooling coils and drain pans clean. Since the bio films that normally develop on the heat exchanger surface get eliminated, studies have indicated better heat transfer because of the UVGI radiation.

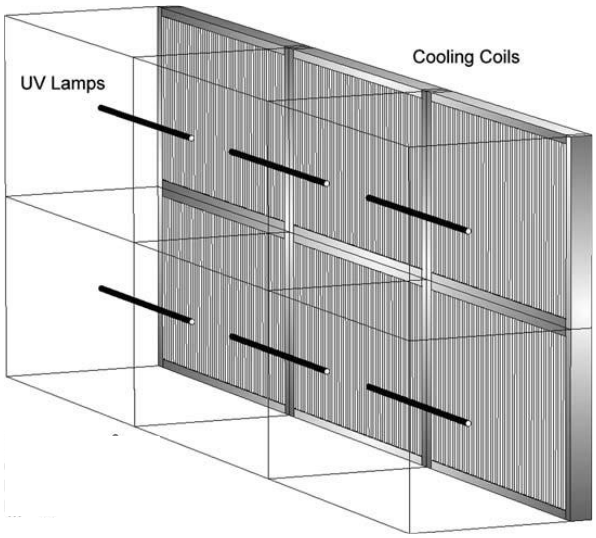
  Menzies et al. found a significant decline in building-related symptoms associated with use of UVGI in AHUs though significant declines in airborne levels of fungi and bacteria as well as endotoxins were not detected in the workplace

- **In Ducts:** UV lamps placed in ductwork have been used to inactivate Mycobacterium species and other microorganisms. The residence time of the microbe under UVGI illumination is an important factor while considering the UVGI lamp design inside the duct. This is achieved by installing the UV lamps parallel to the airflow inside the ducts.

Safety Requirements

Inadvertent exposure to UVC can be dangerous for humans**.** Doors, covers and lamp mounting brackets that give direct access to Ultraviolet (UV) radiation lamp systems shall be equipped with an interlocking mechanism that removes power from the ultraviolet (UV) radiation lamp system when the door is open or cover removed.

Further, polymeric cabinet, structural, and current carrying parts and wiring which are subjected to irradiance from a UV lamp system will need to be shielded from the UVC light or be constructed of a material that is capable of withstanding UVC exposure levels expected in the product without degrading.



UVGI Lamps for irradiating cooling coil [diagram from Ultraviolet Germicidal Irradiation Handbook: Wladyslaw Kowalski, Springer Publication

Multiple UV lamp fixture for installation in ventilation ductwork. [Photograph of Sanuvox from Ultraviolet Germicidal Irradiation Handbook: Wladyslaw Kowalski, Springer Publication

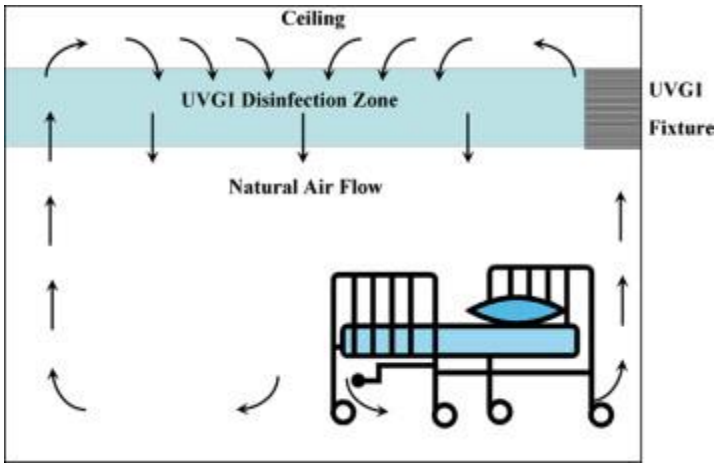
- Apart from air conditioning systems, UVGI lamps can be fitted in rooms to intercept microbes inside the room where they may be generated by occupants, thereby controlling infection at the source. When used in rooms, the systems are called **Upper Room UV systems**.
-

The Upper Room UV systems create a germicidal zone of UV rays. This zone is confined to the upper portion of the room. Air that enters this zone gets disinfected.

Upper air UV disinfection is considered to be the most practical method of airborne infection control in resource limited locations since they are passive (no moving parts), have modest costs, and consume very low energy unlike air conditioning and mechanical ventilation systems which can be prohibitive.

Safety issues associated with Upper Room are addressed in the CDC/NIOSH and recommend REL of 0.006 J/cm2, or 60 J/m2 (at 254 nm) for 8 h of exposure.

The UV reflectance hazards for Upper Room (and Lower Room) systems should not be ignored and care should be taken to ensure there are no highly UV-reflective ceiling paints or materials in locations that may direct reflected UV rays towards the eyes or skin.

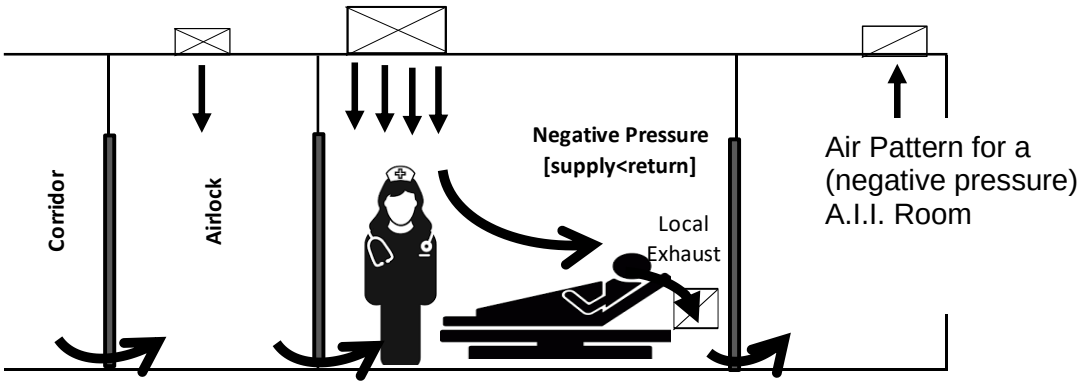


Upper Room UV System: Schematic from ScienceDirect

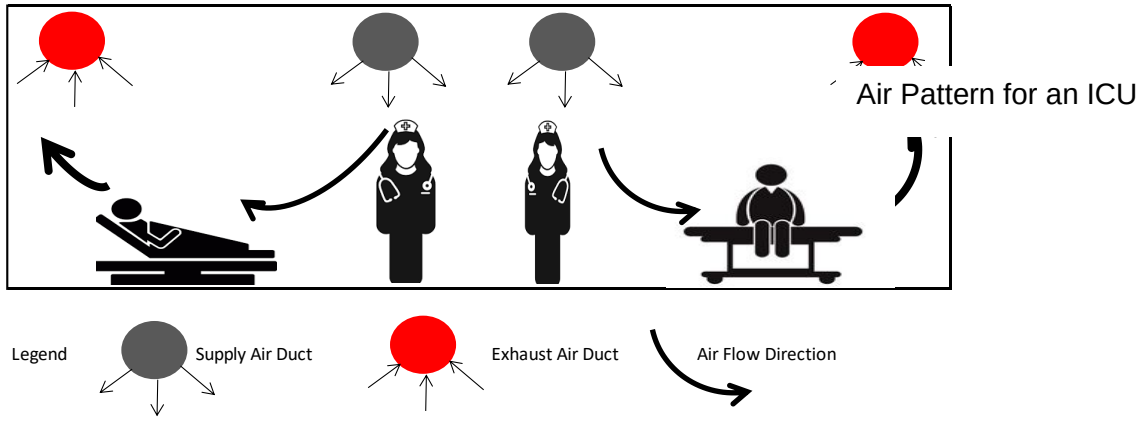
IV. Air Distribution

For infection control, it is not only about air filtration and differential pressure. How the air is introduced into the room and then how it sweeps away the contaminants is important. The supply of air has to reach each part of the space to improve dilution and removal of pollutants from the space .A few examples will make the concept clear.

- In an **Airborne Infectious Isolation [A.I.I.] room** (also called **Negative Isolation Room**], also called the negative isolation room, the people in the outside corridor and the healthcare workers will need to be protected from the patient. The room is thus kept under negative pressure. The healthcare worker should be safe when attending to the patient and the latter's respiration should be directly exhausted. The air pattern shown in the figure does just that. The clean air from the supply air duct comes first on the healthcare worker & thence to the patient and then exhausted from the nearby exhaust grille.



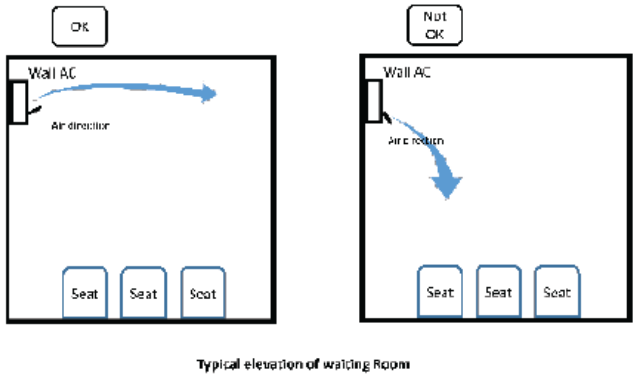
- In **Infectious Intensive Care Unit (ICU)** the air pattern will have to ensure that the aisles have clean air and so do the patients. The respiration from the patients will have viral load which will have to be swept away by the room air directly into the exhaust without mixing in the room air.



- ***Air Patterns for Window , Wall mounted and Cassette split air conditioners***

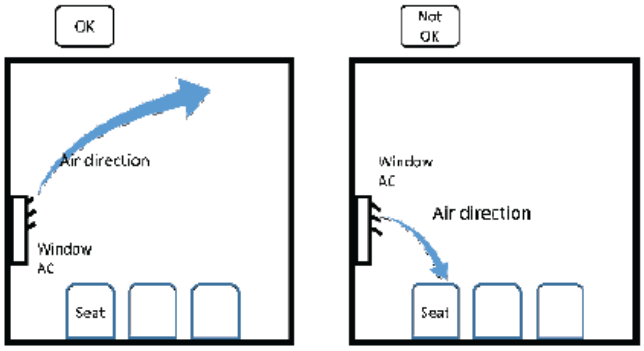
(As recommended in IMA-HBI-ISHRAE COVID-19 Guidance Document for Air-conditioning and Ventilation in Healthcare Facilities).

Considering that the virus spreads through coughing and sneezing by an infected patient, it is important to ensure that the draft of air from the AC unit is not directed to the occupants. It is recommended to direct the supply air into the occupied zone in such a way that a high velocity draft is avoided. Window and wall mount split AC units and cassettes have setting to direct the air flow. Figures are illustrated below for reference.



Typical elevation of waiting Room

Air Pattern for Wall AC Units



Air Pattern for Window AC Units

- The air patterns in rooms dealing with **quarantine and triage in emergency rooms**, need to be from clean to dirty axis as part of design considerations as this will impact transmission of disease.

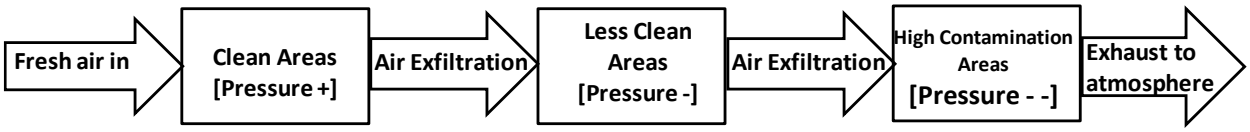
Some Important Points Regarding Air Distribution with Ducted Systems

- False ceiling returns are not acceptable. This is on account of the fact that the plenum above the false ceiling is not cleanable and thus can be a place where pathogens can grow.
- In re-circulatory AHU or ducted split units, the units shall not be shared between different rooms/zones. This is because infection in one room/ zone will get conveyed into the other rooms/zones.

V. Room Pressure Gradient

While the quantity of air distributed to the space and air patterns are important, from an air-quality standpoint, space pressurization is perhaps even more important. The air quantities of supply, return, fresh air and exhaust should be balanced so that air travels from the cleanest spaces to the dirtiest (or highly contaminated areas) spaces.

In COVID healthcare facilities the Admin Areas, Doctors' Rooms and Nursing Stations, Reception Areas may be considered as among the cleaner areas. The triage and quarantine areas have higher levels of contamination. The ICU, isolation rooms, washrooms and change room doffing areas have the highest levels of contamination. Accordingly, the room pressure gradient has to be planned as shown in Figure 17 below



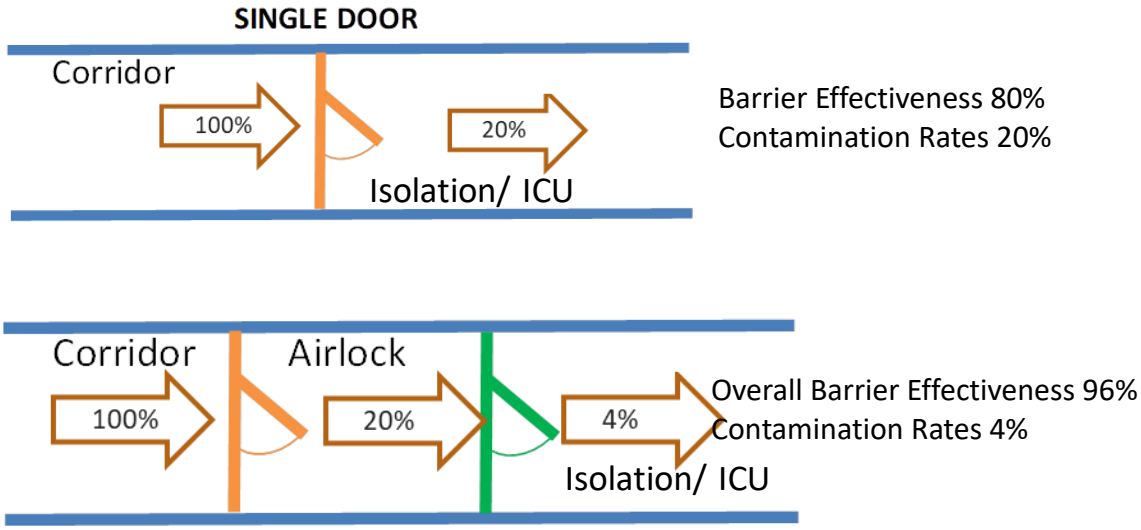
Pressure gradient to achieve air exfiltration from clean to contaminated rooms

The ASHRAE Standard 170-2017 has a recommendation for the pressure gradient for the various rooms in a hospital which indicates whether they should be positive, negative or neutral with respect to the surroundings.

In particular the isolation rooms and ICU will have to be lower than (-) 2.5Pascals compared to the adjoining areas.

Introduction of an airlock (also called ante room) outside these critical rooms (isolation rooms and ICU)d can significantly improve the barrier effectiveness when doors get opened and the pressures equalised.

The illustration below from ASHRAE Design Guide for Cleanrooms makes the concept clear.



Advantage of using airlock for contamination control

VI. Relative Humidity

Moisture in the air is the first arm of defense of our immune system and we now know that our body cannot fight off foreign particles or invaders as adequately when we're in a dry environment. Further, the infectivity of the bacteria too increases with low humidity. Relative humidity of at least 40% is considered the threshold. (Dr. Stephanie Taylor, Presenter, "Optimize Occupant Health, Building Energy Performance and Revenue through Indoor-Air Hydration, ASHRAE).

All microorganisms need water to grow initially. Too much humidity leads to higher levels of dust mites and fungi, two of the worst culprits for indoor allergy sufferers. Mold and fungi are known to exacerbate respiratory conditions such as upper respiratory (nasal and throat) symptoms, cough, wheeze and asthma. Immuno-suppressed or Immuno- compromised patients are at increased risk.

Effect of Humidity on Airborne Transmission of Cough Aerosol

Small particles get generated during the course of coughing and sneezing and to a lesser extent by even talking and breathing. Particle size distributions of coughed materials encompass a broad spectrum of diameters, from very small to large droplets.it is known that most of the viable particles ranging from 0.65 to 3.3µm in the cough-generated aerosols are immediately respirable (K. P. Fennelly et. al "Cough-generated Aerosols of Mycobacterium tuberculosis: A New Method to Study Infectiousness," American Journal of Respiratory and Critical Care Medicine).

While big particles and droplets from cough promptly fall to ground and surfaces, the smaller ones float in the air for a long time. Small particles <5micron (droplet nuclei or residue) are formed from droplets (usually within milliseconds) in the air which shrink in size due to the process of evaporation and desiccation in low humidity and remain suspended in air for several hours.

How humidity affects the virulence of bacteria

Organisms that have been exposed to dry environment have increased virulence and increased rates of antibiotic resistance even in the absence of antibiotics.

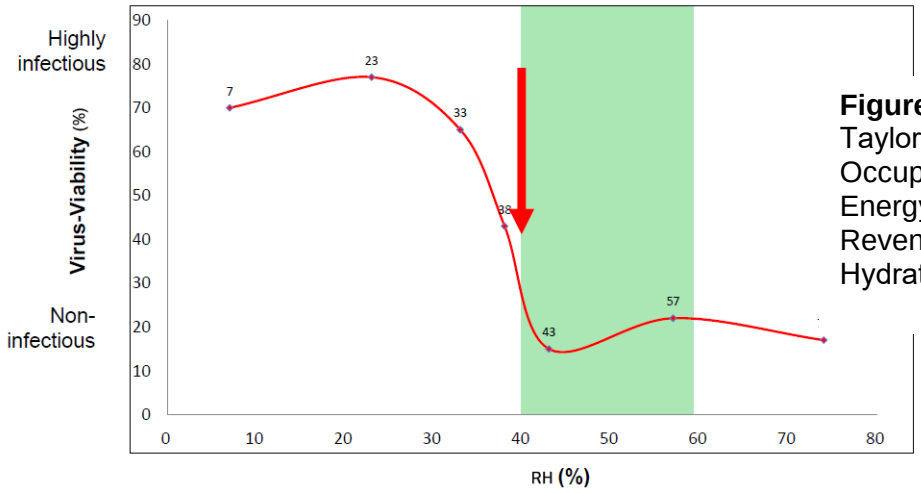


Figure 21: Stephanie Taylor, Presenter, "Optimize Occupant Health, Building Energy Performance and Revenue through Indoor-Air Hydration," ASHRAE

Apart from virus, there is a correlation of humidity with the growth of various pathogens as given in the Sterling chart below [figure20]

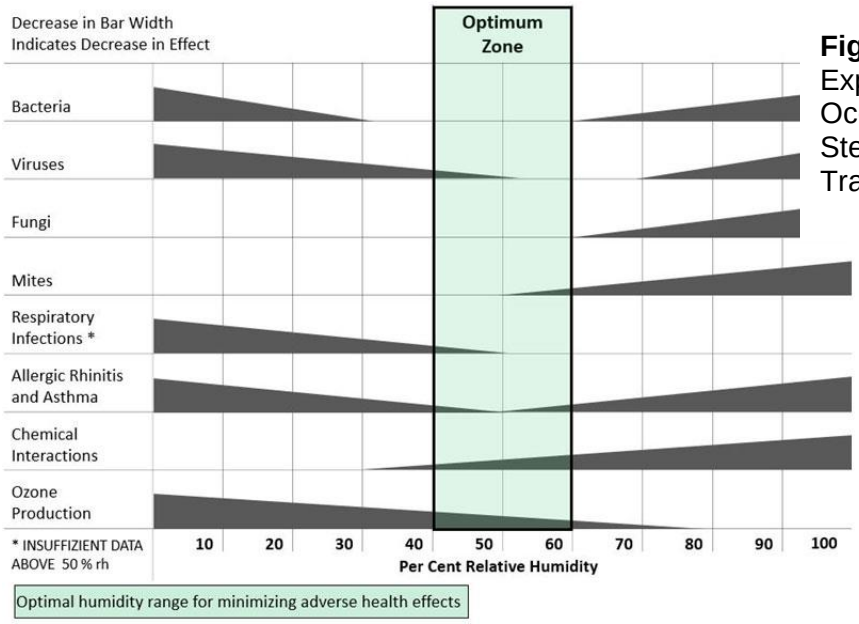


Figure 22: Criteria for Human Exposure to Humidity in Occupied Buildings, E.M. Sterling, 1985 ASHRAE Transactions CH85-13-1

All things considered, the humidity level of 40% ~ 60% is considered to be the most suitable environment for humans & decreases problems from pathogens.

VII. Temperature

(As recommended in IMA-HBI-ISHRAE COVID-19 Guidance Document for Air-conditioning and Ventilation in Healthcare Facilities).

Temperature tends to be a factor that directly affects the comfort of building or hospital occupants. Comfort temperature **is** generally considered between 24 - 30 °C , after accounting for air velocity, relative humidity and clothing. The study of the transmission of COVID-19 virus in 100 cities of China indicates that high temperature and high humidity significantly reduce the transmission of influenza (Jingyuan Wang, Ke Tang, Kai Fang, and Weifeng Lv, "High Temperature and High Humidity Reduce the Transmission of COVID-19," SSRN Electronic Journal, 9 March 2020, http://dx.doi.org/10.2139/ssrn.3551767.. Studies conducted at various RH levels have shown that using viral culture methods low temperatures (7–8 °C) were optimal for airborne influenza survival, with virus survival decreasing progressively at moderate temperatures (20.5–24 °C) and further decreases at higher (greater than 30 °C) temperatures [5]. As per some recent studies, SARS-CoV-2 has been found highly stable on surfaces for 14 days at 4 °C; one day at37 °C and 30 minutes at 56 °C were needed to inactivate the virus [6].

Though ISHRAE recommends temperature range of 24-30 °C for comfort conditioning, in case the job requires use of special clothing, for example PPE for healthcare staff, temperature lower than 24 °C may be considered to ensure sufficient dissipation of heat released from body through heavier clothing.

VIII. Exhaust Air

Hospital exhausts can have inordinate load of pathogens and we have to be careful where we exhaust the air. The exhaust air must be protected for containment by at least MERV10 grade filters [HVAC Design Manual for Hospitals and Clinics].

The exhaust air from isolation rooms and ICUs is most likely to contain a high viral load and hence a suitable technique should be deployed to prevent the spread of infections. **Treatment of exhaust air can be done preferably by HEPA filtration** (Reference: IMA-HBI-ISHRAE COVID-19 Guidance Document for Air-conditioning and Ventilation in Healthcare Facilities). These HEPA filters shall be a minimum of H13 (EN1822-1) filter class or equivalent.

When not possible, **treatment of exhaust air by Chemical disinfection is acceptable**. When both the methods are not viable, the exhaust air shall be let off into the atmosphere through a high velocity upward plume at a height of 3 m above the tallest point of the building, thereby lowering the viral load concentrations to insignificant levels by dilution. This exhaust discharge shall be well away from other air intake points and populated places.

When HEPA filters are used to treat the exhaust air, it is preferable to install them at the primary point of air extraction in the room and the exhaust blower shall be at the discharge end of the exhaust duct in order to maintain a negative pressure in the exhaust duct.

Chemical disinfection of the exhaust air from COVID-19 patient room can be done by bubbling the exhaust air through a "Diffused air aerator tank" (preferably of non-metallic material) holding a 1% sodium hypochlorite solution [Refer: i European Centre for Disease Prevention and Control, "Disinfection of environments in healthcare and non- healthcare settings potentially contaminated with SARS-CoV-2," Stockholm: ECDC, 2020 ii. World Health Organization, "Collecting, preserving and shipping specimens for the diagnosis of avian influenza A(H5N1) virus infection : guide for field operations," Geneva: World Health Organization, 2006 and iii. Ministry of Health & Family Welfare, Government of India, "COVID 19: Guidelines on disinfection of common public places including offices," Delhi: Government of India, 10th April 2020, https://www.mohfw.gov.in/pdf/Guidelinesondisinfectionofcommonpublicplacesincludingoffices.pdf.]. The

concentration of the solution shall be checked on a regular basis and dosing undertaken based on need. The aeration tank shall be placed in an unpopulated outdoor area and not inside enclosed space. Suitable PPE shall be used while handling the hypochlorite solution and direct contact with skin and eyes shall be avoided. The above chemical inactivation procedure for treatment of exhaust air is suggested based on the available information at this time.

The other two options available for **exhaust air treatment being UV irradiation and heating**. (MER Darnell et al Observed that, an exposure time of 45min at a temperature of 75 °C resulted in complete inactivation of SARS-CoV. Similarly, an UVC (254 nm wavelength) irradiation with an exposure time of 15 minutes at irradiation intensity of 4016 µW/Cm2 resulted in complete inactivation of SARS-CoV. Figure below shows the effect of heat treatment and UV radiation on infectivity of SARS- CoV

Appendix - II

General Notes on Maintenance of HVAC Systems

Location of AC Equipment & Its Servicing

All ac equipment will require servicing from time to time, whether it is to attend to the parts or for cleaning the filters. This puts the unitary equipment viz. wall units, window ac units, ducted splits and cassettes at a disadvantage in areas with contagion as the technicians will be at considerable risk in such areas and servicing with PPE suits can be very inconvenient.

Cleaning of Filters

Filters, whether of re-circulatory AHUs, unitary ac units or of exhaust units, are likely to have high viral load. Cleaning these filters will put the technician to high level of risk. Using filter cleaning booths is advocated. These booths should be located in a designated safe area and the technicians attending to the filter cleaning activity will have to wear appropriate PPE.
Sewage treatment of the cleaning water has to be taken care of.

Disposal of HEPA Filters

The replacement of these filters should be done by trained personnel with the necessary PPE and disposal of these filters shall be done in accordance to “Bio medical waste” regulations.

Cleaning of UVGI Lamps

The UVGI lamps in the ac systems function well only if they are not covered with dust. Maintenance schedule in the facility should include cleaning of these lamps.

Condensate Drain for AC Equipment

This water has to be treated for viral load before discharge into sewage. The condensate drain water should not be recycled for any usage.

Maintenance of All Equipment

All HVAC equipment will be required to be serviced and maintained as per the recommendations of the respective manufacturers.

Appendix - III

Energy Efficiency

The energy consumption of HVAC systems is very high and steps have to be taken to ensure that the installed systems are energy efficient.

New COVID Facilities: healthcare facilities:

Case A - Air-conditioned healthcare facilities:

Design the facility to comply with Energy Conservation Building Code (Revised Version May, 2008) (or) ASHRAE Standard 90.1-2013 (without amendments) through one of the following approaches:

- Option 1 - Performance based approach (Whole building simulation)
- Option 2 - Prescriptive approach

  The total annual energy consumption of the building should not exceed the total base case energy consumption computed, as per ECBC (or) ASHRAE Standard 90.1-2013.

- Option 1 - Performance Based Approach (Whole Building Simulation)
  Demonstrate compliance of the facility performance by whole facility simulation, as per the baselines outlined in ECBC (or) ASHRAE Standard 90.1-2013 (without amendments), Appendix - G. Simulation is to be carried out at comfort temperatures of 24 +/- 2 deg C.

Notes:

- *In cases where lighting systems are yet to be installed, the proposed case LPD during*
- *simulation shall be same as the base case.*
- *Projects that use on-site renewable energy sources (such as solar energy, wind power,*
- *biomass, etc.,) can subtract renewable energy generated from the total annual energy*
- *consumption of the proposed case.*
- *Projects that use solar hot water systems can model the systems in the proposed case, as*
- *against electrical heaters in the base case, to show energy savings.*
- *Projects which have process loads not related to building operations should be considered*
- *during simulation. While reporting, such loads can be excluded from the base case and*
- *proposed case annual energy consumption. The process loads which are excluded shall be*
- *justified with a narrative.*
- *Project with multiple buildings (including projects with common basement) must independently*
- *meet the Minimum Energy Performance criteria for each building.*

- Option 2 - Prescriptive Approach

The project should meet the applicable criteria as established in prescriptive measures of ECBC (or) ASHRAE Standard 90.1-2013 (without amendments).

Case B - Non air-conditioned healthcare facilities: (Prescriptive Approach)

Non air-conditioned facilities are those which are not serviced and will not be serviced in the future, either through central air-conditioned systems or unitary air-conditioners.

- Air-conditioning may be considered for critical areas, not more than 10% of the total regularly occupied area.
- Spaces with unitary air-conditioners shall comply with IEQ Mandatory Requirement 1 - Fresh Air Ventilation, Non air-conditioned buildings criteria

Non air-conditioned buildings shall meet the following prescriptive measures, as applicable:

1) Building Envelope:

The project must ensure that the following building envelope measures meet the baseline criteria as outlined in Annexure - VII

- Solar Heat Gain Coefficient (SHGC) *
- Window Glazing U-value (only if WWR > 40%) **
- Overall Wall Assembly U-value
- Overall Roof Assembly U-value

Notes:

- *For Climatic Zones of India, please refer Annexure - VI.*
- **Low SHGC value can be achieved through chajjas or other sun shading devices or efficient fenestration or a combination of both. For details, refer ECBC section 4.3.3 - Vertical Fenestration, Exception to ECBC 4.3.3.*
- ***Compliance for window glazing U-value should be shown only if Window-to-Wall Ratio (WWR) is more than 40%.*

2) Lighting:

The Lighting Power Density (LPD) in the building interior, exterior and parking areas shall be reduced by minimum 10% over ECBC base case.

Notes:

- *Compliance for the lighting power density shall be shown either through 'Building Area Method'*
- *or 'Space Function Method'. If 'Building Area Method' is considered, compliance for parking*
- *area lighting shall be shown separately.*
- *Exterior areas illuminated by lighting only should be considered for lighting power density*
- *calculations.*
- *The LPD should include power consumption of complete fixture, including lamps and ballasts*

3) Air-conditioning Systems:

Projects having air-conditioners (as per criteria the defined for non air-conditioned buildings), shall consider unitary air-conditioners with BEE 3-star rating (or) air-conditioners with a COP equivalent to 3.1 (EER of 10.58), or more.

4) Heating Systems:

Projects having more than 150 Heating degree days** (HDD18) shall consider heating systems in proposed case to meet a base line COP of 2.5 (EER of 8.53), when heat pumps are installed in the building.

Notes:

- *** Degree day: The difference in temperature between the outdoor mean temperature over 24 hour period and a given base temperature.*
- ***Heating degree day base 18oC, (HDD 18): For any one day, when the mean temperature is less than 18oC, there are as many degree-days as degree centigrade temperature difference between the mean temperature for the day and 18oC.*

Annual heating degree-days (HDDs) are the sum of the degree-days over the calendar year.

5) Fans:

Fans installed in the building shall have an efficiency equivalent to BEE 3-star rating or more.

6) Pumps & Motors:

Pumps & Motors installed in the building shall have an efficiency equivalent to BEE 3-star rating or more.

General Notes:

- *Projects which use on-site renewable energy sources (such as solar energy, wind power, biomass, etc.,) can subtract renewable energy generated from the total energy of the proposed case.*
- *Projects installing solar hot water systems can assume electrical heating in the base case.*
- *Energy efficient materials, products and equipment that are certified by IGBC under Green Product Certification Programme or by a third-party agency approved by IGBC can be used by the project to show compliance*

Existing facilities:

Option 1- EPI Approach

Demonstrate that the annual energy consumption in the facility is within the Energy Performance Index (EPI) limits as mentioned in the table below:

Climatic Zone	EPI range
Warm & Humid	275
Composite	264
Hot & Dry	261
Moderate	247

Source: Implementing Energy Efficiency in Buildings (A report by UNDP, BEE)

Option 2 - Performance Based Approach (Whole Building Simulation)

Demonstrate compliance of the facility performance by whole building simulation, as per the baselines outlined in ECBC (or) ASHRAE Standard 90.1-2010 (without amendments), Appendix- G. Simulation is to be carried out at comfort temperatures of 24 + 2 deg C

Annexure – II

Classification of Spaces in Healthcare Facilities

Administration & Recreational Areas		Patient Areas		Support Areas	
Office areas	Private cabins	Treatment /Observation areas	Consultation/Observation room	Clinical support area	shower room
	Double shared		Patient change cubicle		Staff room
	Open office		Medication/ Treatment Room		Staff station
	Meeting rooms		Play therapy room		Changing room
	Teleconference rooms		ICU		Dirty/Clean utilities
	Cashier's area		X ray room	Food Preparation area	Entry
Reception/Waiting	Waiting area		X ray processing		Trolley Stripping
	Reception		Body Holding room		Washing areas
	Play Areas		Patients Bed room / ward		Cool Room
	Family room		Respiratory Biomedical Workshop		Store
	Ambulance Triage	Surgery Areas	Dental surgery		Preparation
	Triage Cubicle		Operation room		Cooking
Recreational areas	Yoga room/ Meditation room		Clean-up room		Plating/ Tray reperation
	Spa		Discharge lounge	Housekeeping areas	Cleaners Room
	Music room	Laboratory areas	Preparation/ Processing / Serology/ Infection Serology		Disposal Room
	Crèche		Blood Storage/Dispatch		Store General
	Gymnasium		Clean-up/ Sterilization	Bay areas	Linen
	Indoor sports area		IVF/ICSI Laboratory		Handwashing
			Andrology		Blood Collection
			Genetics		Staff Property
		Bay areas	Resuscitation		Wheel chair park
			Recovery		Beverage
			Ultrasound		Trolley
					Blanket warming

For exhaustive list of spaces in healthcare facilities, the projects can refer Indian Health Facility guidelines (http://www.healthdesign.com.au/ihfg/india-v1.2/)

Annexure - III

Ventilation Design Parameters

(Extract from Table 7 : ASHRAE-170

'Ventilation of Health Care')

Sl. No:	Function of Space	Pressure Relationship to Adjacent Areas (n)	Minimum Outdoor ach	Minimum Total ach	All Room Air Exhausted Directly to Outdoors (j)	Air Recirculated by Means of Room Units (a)	Design Relative Humidity (k),%	Design Temperature (l), °F/°C
DIAGnoStIC AnD tReAtMent								
1	Bronchoscopy, sputum collection, and pentamidine administration (n)	Negative	2	12	Yes	No	NR	68–73/20–23
2	Laboratory, general (v)	Negative	2	6	NR	NR	NR	70–75/21–24
3	Laboratory, bacteriology (v)	Negative	2	6	Yes	NR	NR	70–75/21–24
4	Laboratory, biochemistry (v)	Negative	2	6	Yes	NR	NR	70–75/21–24
5	Laboratory, cytology (v)	Negative	2	6	Yes	NR	NR	70–75/21–24
6	Laboratory, glasswashing	Negative	2	10	Yes	NR	NR	NR
7	Laboratory, histology (v)	Negative	2	6	Yes	NR	NR	70–75/21–24
8	Laboratory, microbiology (v)	Negative	2	6	Yes	NR	NR	70–75/21–24
9	Laboratory, nuclear medicine (v)	Negative	2	6	Yes	NR	NR	70–75/21–24
10	Laboratory, pathology (v)	Negative	2	6	Yes	NR	NR	70–75/21–24
11	Trauma room (crisis or shock) ©	Positive	3	15	NR	No	20-60	70–75/21–24
12	Medical/anesthesia gas storage ®	Negative	NR	8	Yes	NR	NR	NR
13	Laser eye room	Positive	3	15	NR	No	20-60	70–75/21–24
14	ER waiting rooms	Negative	2	12	Yes(q)	NR	Max 65	70–75/21–24
15	Triage	Negative	2	12	Yes(q)	NR	Max 60	70–75/21–24
16	ER decontamination	Negative	2	12	Yes	No	NR	NR
17	Radiology waiting rooms	Negative	2	12	Yes (q)(w)	NR	Max 60	70–75/21–24
18	Procedure room (Class A surgery) (o), (d)	Positive	3	15	NR	No	20-60	70–75/21–24
19	Emergency department exam/treatment room (p)	NR	2	6	NR	NR	Max 60	70–75/21–24
IMPAtIent nURSInG								
1	Patient room	NR	2	4 (y)	NR	NR	Max 60	70–75/21–24
2	Nourishment area or room	NR	NR	2	NR	NR	NR	NR
3	Toilet room	Negative	NR	10	Yes	No	NR	NR
4	Newborn nursery suite	NR	2	6	NR	No	30-60	72–78/22–26
5	Protective environment room (t)	Positive	2	12	NR	No	Max 60	70–75/21–24
6	AII room (u)	Negative	2	12	Yes	No	Max 60	70–75/21–24
7	Combination AII/PE room	Positive	2	12	Yes	No	Max 60	70-75/21-24
8	AII anteroom (u)	(e)	NR	10	Yes	No	NR	NR
9	PE anteroom (t)	(e)	NR	10	NR	No	NR	NR
10	Combination AII/PE anteroom	(e)	NR	10	Yes	No	NR	NR

Sl. No:	Function of Space	Pressure Relationship to Adjacent Areas (n)	Minimum Outdoor ach	Minimum Total ach	All Room Air Exhausted Directly to Outdoors (j)	Air Recirculated by Means of Room Units (a)	Design Relative Humidity (k),%	Design Temperature (l), °F/°C
11	Labor/delivery/recovery/ postpartum (LDRP) (s)	NR	2	6	NR	NR	Max 60	70–75/21–24
12	Labor/ delivery/ recovery (LDR) (s)	NR	2	6	NR	NR	Max 60	70–75/21–24
13	Patient Corridor	NR	NR	2	NR	NR	NR	NR
	Nursing facility							
1	Resident room	NR	2	2	NR	NR	NR	70–75/21–24
2	Resident gathering/activity/ dining	NR	4	4	NR	NR	NR	70–75/21–24
3	Resident unit corridor	NR	NR	4	NR	NR	NR	NR
4	Physical therapy	Negative	2	6	NR	NR	NR	70–75/21–24
5	Occupational therapy	NR	2	6	NR	NR	NR	70–75/21–24
6	Bathing room	Negative	NR	10	Yes	No	NR	70–75/21–24
	Radiology (v)							
1	X-ray (diagnostic and treatment)	NR	2	6	NR	NR	Max 60	72–78/22–26
2	X-ray (surgery/critical care and catheterization)	Positive	3	15	NR	No	Max 60	70–75/21–24
3	Darkroom (g)	Negative	2	10	Yes	No	NR	NR
	Diagnostic and treatment							
1	Bronchoscopy, sputum collection, and pentamidine administration (n)	Negative	2	12	Yes	No	NR	68–73/20–23
2	Laboratory, general (v)	Negative	2	6	NR	NR	NR	70–75/21–24
3	Laboratory, bacteriology (v)	Negative	2	6	Yes	NR	NR	70–75/21–24
4	Laboratory, biochemistry (v)	Negative	2	6	Yes	NR	NR	70–75/21–24
5	Laboratory, cytology (v)	Negative	2	6	Yes	NR	NR	70–75/21–24
6	Laboratory, glasswashing	Negative	2	10	Yes	NR	NR	NR
7	Laboratory, histology (v)	Negative	2	6	Yes	NR	NR	70–75/21–24
8	Laboratory, microbiology (v)	Negative	2	6	Yes	NR	NR	70–75/21–24
9	Laboratory, nuclear medicine (v)	Negative	2	6	Yes	NR	NR	70–75/21–24
10	Laboratory, pathology (v)	Negative	2	6	Yes	NR	NR	70–75/21–24
11	Laboratory, serology (v)	Negative	2	6	Yes	NR	NR	70–75/21–24
12	Laboratory, sterilizing	Negative	2	10	Yes	NR	NR	70–75/21–24
13	Laboratory, media transfer (v)	Positive	2	4	NR	NR	NR	70–75/21–24
14	Nonrefrigerated body-holding room (h)	Negative	NR	10	Yes	No	NR	70–75/21–24
15	Autopsy room (n)	Negative	2	12	Yes	No	NR	68–75/20–24

Sl. No:	Function of Space	Pressure Relationship to Adjacent Areas (n)	Minimum Outdoor ach	Minimum Total ach	All Room Air Exhausted Directly to Outdoors (j)	Air Recirculated by Means of Room Units (a)	Design Relative Humidity (k),%	Design Temperature (l), °F/°C
16	Pharmacy (b)	Positive	2	4	NR	NR	NR	NR
17	Examination room	NR	2	6	NR	NR	max 60	70–75/21–24
18	Medication room	NR	2	4	NR	NR	max 60	70–75/21–24
19	Gastrointestinal endoscopy procedure room (x)	NR	2	6	NR	No	20–60	68–73/20–23
20	Endoscope cleaning	Negative	2	10	Yes	No	NR	NR
21	Treatment room (x)	NR	2	6	NR	NR	Max 60	70–75/21–24
22	Hydrotherapy	Negative	2	6	NR	NR	NR	72–80/22–27
23	Physical therapy	Negative	2	6	NR	NR	Max 65	72–80/22–27
24	Dialysis treatment area	NR	2	6	NR	NR	NR	72–78/22–26
25	Dialyzer reprocessing room	Negative	NR	10	Yes	No	NR	NR
26	Nuclear medicine hot lab	Negative	NR	6	Yes	No	NR	70–75/21–24
27	Nuclear medicine treatment room	Negative	2	6	Yes	NR	NR	70–75/21–24
	STERILIZING							
1	Sterilizer equipment room	Negative	NR	10	Yes	No	NR	NR
	CENTRAL MEDICAL AND SURGICAL SUPPLY							
1	Soiled or decontamination room	Negative	2	6	Yes	No	NR	72–78/22–26
2	Clean workroom	Positive	2	4	NR	No	Max 60	72–78/22–26
3	Sterile storage	Positive	2	4	NR	NR	Max 60	72–78/22–26
	SERVICE							
1	Food preparation center (i)	NR	2	10	NR	No	NR	72–78/22–26
2	Warewashing	Negative	NR	10	Yes	No	NR	NR
3	Dietary storage	NR	NR	2	NR	No	NR	72–78/22–26
4	Laundry, general	Negative	2	10	Yes	No	NR	NR
5	Soiled linen sorting and storage	Negative	NR	10	Yes	No	NR	NR
6	Clean linen storage	Positive	NR	2	NR	NR	NR	72–78/22–26
7	Linen and trash chute room	Negative	NR	10	Yes	No	NR	NR
8	Bedpan room	Negative	NR	10	Yes	No	NR	NR
9	Bathroom	Negative	NR	10	Yes	No	NR	72–78/22–26
10	Janitor’s closet	Negative	NR	10	Yes	No	NR	NR
	SUPPORT SPACE							
1	Soiled workroom or soiled holding	Negative	2	10	Yes	No	NR	NR
2	Clean workroom or clean holding	Positive	2	4	NR	NR	NR	NR
3	Hazardous material storage	Negative	2	10	Yes	No	NR	NR

Notes For Table 7.1

a. Except where indicated by a “No” in this column, recirculating room HVAC units (with heating or cooling coils) are acceptable for providing that portion of the minimum total air changes per hour that is permitted by Section 7.1 (subparagraph [a][5]). Because of the cleaning difficulty and potential for buildup of contamination, recirculating room units shall not be used in areas marked “No.” Recirculating devices with HEPA filters shall be permitted in existing facilities as interim, supplemental environmental controls to meet requirements for the control of airborne infectious agents. The design of either portable or fixed systems should prevent stagnation and short circuiting of airflow. The design of such systems shall also allow for easy access for scheduled preventative maintenance and cleaning.

b. Pharmacy compounding areas may have additional air change, differential pressure, and filtering requirements beyond the minimum of this table depending on the type of pharmacy, the regulatory requirements which may include adoption of USP 797), the associated level of risk of the work (see USP [2013] in Informative Appendix B), and the equipment utilized in the spaces

c. The term trauma room as used herein is a first-aid room and/or emergency room used for general initial treatment of accident victims. The operating room within the trauma center that is routinely used for emergency surgery is considered to be an operating room by this standard.

d. Pressure relationships need not be maintained when the room is unoccupied.

e. See Section 7.2 and its subsections for pressure-relationship requirements.

f. This letter is not used in this table.

g. All air need not be exhausted if darkroom equipment has a scavenging exhaust duct attached and meets ventilation standards regarding NIOSH, OSHA, and local employee exposure limits.2, 3

h. A nonrefrigerated body-holding room is applicable only to facilities that do not perform autopsies on-site and use the space for short periods while waiting for the body to be transferred.

i. Minimum total air changes per hour (ach) shall be that required to provide proper makeup air to kitchen exhaust systems as specified in ANSI/ASHRAE Standard 154.4 In some cases, excess exfiltration or infiltration to or from exit corridors compromises the exit corridor restrictions of NFPA 90A,5 the pressure requirements of NFPA 96,6 or the maximum defined in the table. During operation, a reduction to the number of air changes to any extent required for odor control shall be permitted when the space is not in use. (See FGI [2010] in Informative Appendix B.)

j. In some areas with potential contamination and/or odor problems, exhaust air shall be discharged directly to the outdoors and not recirculated to other areas. Individual circumstances may require special consideration for air exhausted to the outdoors. To satisfy exhaust needs, constant replacement air from the outdoors is necessary when the system is in operation.

k. The RH ranges listed are the minimum and/or maximum allowable at any point within the design temperature range required for that space.

l. Systems shall be capable of maintaining the rooms within the range during normal operation. Lower or higher temperature shall be permitted when patients’ comfort and/or medical conditions require those conditions.

m. National Institute for Occupational Safety and Health (NIOSH) criteria documents regarding occupational exposure to waste anesthetic gases and vapors, and control of occupational exposure to nitrous oxide7 indicate a need for both local exhaust (scavenging) systems and general ventilation of the areas in which the respective gases are utilized. Refer to NFPA 99 for other requirements.8

n. If pressure-monitoring device alarms are installed, allowances shall be made to prevent nuisance alarms. Short-term excursions from required pressure relationships shall be allowed while doors are moving or

temporarily open. Simple visual methods such as smoke trail, ball-in-tube, or flutterstrip shall be permitted for verification of airflow direction.

o. Surgeons or surgical procedures may require room temperatures, ventilation rates, humidity ranges, and/or air distribution methods that exceed the minimum indicated ranges.

p. Treatment rooms used for bronchoscopy shall be treated as bronchoscopy rooms. Treatment rooms used for procedures with nitrous oxide shall contain provisions for exhausting anesthetic waste gases.

q. In a recirculating ventilation system, HEPA filters shall be permitted instead of exhausting the air from these spaces to the outdoors provided that the return air passes through the HEPA filters before it is introduced into any other spaces. The entire minimum total air changes per hour of recirculating airflow shall pass through HEPA filters. When these areas are open to larger, nonwaiting spaces, the exhaust air volume shall be calculated based on the seating area of the waiting area. (Note: The intent here is to not require the volume calculation to include a very large space [e.g., an atrium] just because a waiting area opens onto it.)

r. See NFPA 99 for further requirements.8

s. For intermediate care, labor/delivery/recovery rooms, and labor/delivery/recovery/postpartum rooms, four total ach shall be permitted when supplemental heating and/or cooling systems (radiant heating and cooling, baseboard heating, etc.) are used.

t. The protective environment airflow design specifications protect the patient from common environmental airborne infectious microbes (i.e., Aspergillus spores). Recirculation HEPA filters shall be permitted to increase the equivalent room air exchanges; however, the outdoor air changes are still required. Constant-volume airflow is required for consistent ventilation for the protected environment. The pressure relationship to adjacent areas shall remain unchanged if the PE room is utilized as a normal patient room. Rooms with reversible airflow provisions for the purpose of switching between protective environment and AII functions shall not be permitted.

u. The AII room described in this standard shall be used for isolating the airborne spread of infectious diseases, such as measles, varicella, or tuberculosis. Supplemental recirculating devices using HEPA filters shall be permitted in the AII room to increase the equivalent room air exchanges; however, the minimum outdoor air changes of Table 7.1 are still required. AII rooms that are retrofitted from standard patient rooms from which it is impractical to exhaust directly outdoors may be recirculated with air from the AII room, provided that air first passes through a HEPA filter. When the AII room is not utilized for airborne infection isolation, the pressure relationship to adjacent areas, when measured with the door closed, shall remain unchanged and the minimum total air change rate shall be 6 ach. Switching controls for reversible airflow provisions shall not be permitted.

v. When required, appropriate hoods and exhaust devices for the removal of noxious gases or chemical vapors shall be provided in accordance with NFPA 99.8

w. The requirement that all room air is exhausted directly to outdoors applies only to radiology waiting rooms programmed to hold patients who are waiting for chest x-rays for diagnosis of respiratory disease.

x. If the planned space is designated in the organization's operational plan to be utilized for both bronchoscopy and gastrointestinal endoscopy, the design parameters for "bronchoscopy, sputum collection, and pentamidine administration" shall be used.

y. For single-bed patient rooms using Group D diffusers, a minimum of six total ach shall be provided and calculated based on the volume from finished floor to 6 ft (1.83 m) above the floor.

Annexure - IV

Bio-Medical Waste Categories

(Extract from Bio-Medical Waste - Management and Handling Rules, 2016)

Category	Type of Waste	Type of Bag or Container to be used	Treatment and Disposal options
Yellow	(a) Human Anatomical Waste: Human tissues, organs, body parts and fetus below the viability period (as per the Medical Termination of Pregnancy Act 1971,amended from time to time).	Yellow coloured non-chlorinated plastic bags	Incineration or Plasma Pyrolysis or deep burial*
	(b) Animal Anatomical Waste : Experimental animal carcasses, body parts,organs, tissues,including the waste generated from animals used in experiments or testing in veterinary hospitals or colleges or animal houses.		
	(c) Soiled Waste: Items contaminated with blood, body fluids like dressings, plaster casts, cotton swabs and bags containing residual or discarded blood and blood components.		Incineration or Plasma Pyrolysis or deep burial* In absence of above facilities, autoclaving or micro-waving/ hydroclaving followed by shredding or mutilation or combination of sterilization and shredding. Treated waste to be sent for energy recovery.
	(d) Expired or Discarded Medicines: Pharmaceutical waste like antibiotics,cytotoxic drugs including all items contaminated with cytotoxic drugs along with glass or plastic ampoules, vials etc.	Yellow coloured non-chlorinated plastic bags or containers	Expired `cytotoxic drugs and items contaminated with cytotoxic drugs to be returned back to the manufacturer or supplier for incineration at temperature >1200 0C or to common bio-medical waste treatment facility or hazardous waste treatment, storage and disposal facility for incineration at >12000C Or Encapsulation or Plasma Pyrolysis at >12000C.All other discarded medicines shall be either sent back to manufacturer or disposed by incineration.

	(e) Chemical Waste: Chemicals used in production of biological and used or discarded disinfectants.	Yellow coloured containers or non-chlorinated plastic bags	Disposed of by incineration or Plasma Pyrolysis or Encapsulation in hazardous waste treatment, storage and disposal facility.
	(f) Chemical Liquid Waste : Liquid waste generated due to use of chemicals in production of biological and used or discarded disinfectants, Silver X-ray film developing liquid, discarded Formalin, infected secretions, aspirated body fluids, liquid from laboratories and floor washings, cleaning,house-keeping and disinfecting activities etc.	Separate collection system leading to effluent treatment system	After resource recovery, the chemical liquid waste shall be pre-treated before mixing with other wastewater. The combined discharge shall conform to the discharge norms given in Schedule- III.
	(g) Discarded linen, mattresses, beddings contaminated with blood or body fluid.	Non-chlorinated yellow plastic bags or suitable packing material	Non- chlorinated chemical disinfection followed by incineration or Plazma Pyrolysis or for energy recovery. In absence of above facilities, shredding or mutilation or combination of sterilization and shredding. Treated waste to be sent for energy recovery or incineration or Plazma Pyrolysis.
	(h) Microbiology,Biotechnology and other clinical laboratory waste: Blood bags, Laboratory cultures, stocks or specimens of microorganisms, live or attenuated vaccines,human and animal cell cultures used in research, industrial laboratories, production of biological, residual toxins, dishes and devices used for cultures.	Autoclave safe plastic bags or containers	Pre-treat to sterilize with nonchlorinated chemicals on-site as per National AIDS Control Organisation or World Health Organisation guidelines thereafter for Incineration.

Red	Contaminated Waste (Recyclable) (a) Wastes generated from disposable items such as tubing, bottles,intravenous tubes and sets, catheters, urinebags, syringes (without needles and fixed needle syringes) and vaccutainers with their needles cut) and gloves	Red coloured non-chlorinated plastic bags or containers	Autoclaving or micro-waving/ hydroclaving followed by shredding or mutilation or combination of sterilization and shredding. Treated waste to be sent to registered or authorized recyclers or for energy recovery or plastics to diesel or fuel oil or for road making, whichever is possible.Plastic waste should not be sent to landfill sites.
White (Trans-lucent)	Waste sharps including Metals: Needles, syringes with fixed needles, needles from needle tip cutter orburner, scalpels, blades,or any other contaminated sharp object that may cause puncture and cuts. Thisincludes both used,discarded and contaminated metal sharp	Puncture proof, Leak proof, tamper proof containers	Autoclaving or Dry Heat Sterilization followed by shredding or mutilation or encapsulation in metal container or cement concrete; combination of shredding cum autoclaving; and sent for final disposal to iron foundries (having consent to operate from the State Pollution Control Boards or Pollution Control Committees) or sanitary landfill or designated concrete waste sharp pit.
Blue	(a) Glassware: Broken or discarded and contaminated glass including medicine vials and ampoules except those contaminated with cytotoxic wastes.		Disinfection (by soaking the washed glass waste after cleaning with detergent and Sodium Hypochlorite treatment) or through autoclaving or microwaving or hydroclaving and then sent for recycling.
	(b) Metallic Body Implants	Cardboard boxes with blue colored marking	

AnneXURe - V

High-Touch Surfaces

(Extract from Centre for Disease Control & Prevention)

- Bed rails / controls
- Tray table
- IV pole (grab area)
- Call box / button
- Telephone
- Bedside table handle
- Chair
- Room sink
- Room light switch
- Room inner door knob
- Bathroom inner door knob / plate
- Bathroom light switch
- Bathroom handrails by toilet
- Bathroom sink
- Toilet seat
- Toilet flush handle
- Toilet bedpan cleaner

Source- High touch surfaces as defined by Centre for Disease Control & Prevention

Annexure - VI

Washroom Designs

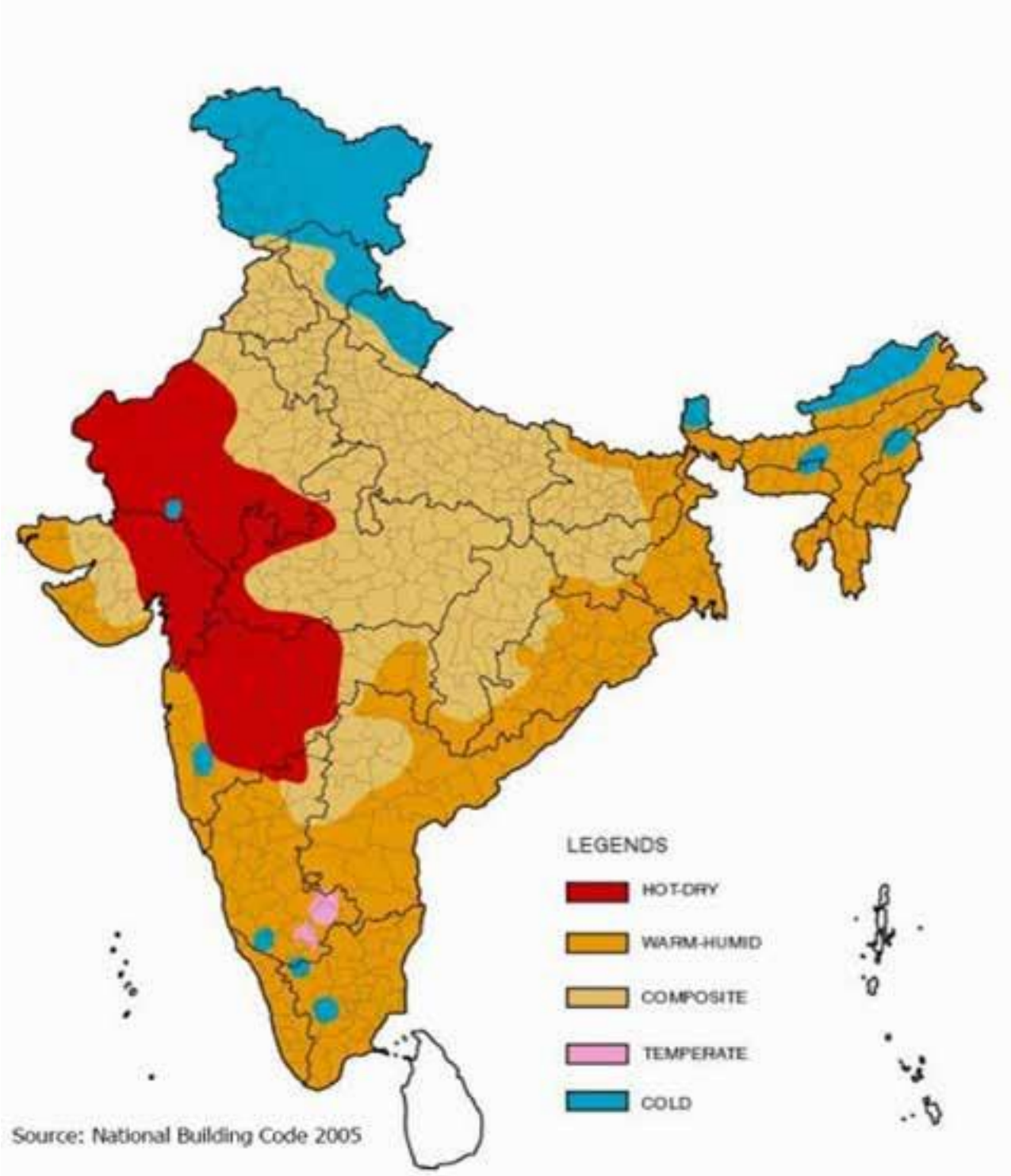
(Extract from National Building Code-2005)

Table 5.7 Sanitation Requirements for Institutional (Medical) occupancy- Hospital

Sno:	Sanitary Unit	Hospitals With indoor Patient Ward	Hospitals With outdoor Patient Wards	
		For Males & females	For Males	For Females
1.	Water Closet (W.C.)	One for every 6 beds or part thereof	One for every 100 persons or part thereof	Two for every 100 persons or part thereof
2.	Ablution taps	One in each W.C.	One in each W.C.	One in each W.C.
2.	Ablution taps	One in each W.C.	One in each W.C.	One in each W.C.
3.	Wash Basins	Two upto 30 bed; add one for every additional 30 beds; or part thereof	One for every 100 persons or part thereof	One for every 100 persons or part thereof.
4.	Baths with Shower	One bath with shower for every 8 beds or part thereof.	--	--
5.	Bed pan washing sink	One for each ward	-	--
6.	Cleaner' Sinks	One for each ward	One per floor minimum	One per floor minimum
7.	Kitchen sinks & dish Washers (where Kitchen is provided)	One for each ward	--	--
8.	Urinals	--	One for every 50 persons or part thereof	--

Annexure - VII

Climate Zone MAP of India


LEGENDS
HOT-DRY
WARM-HUMID
COMPOSITE
TEMPERATE
COLD
Source: National Building Code 2005

Annexure - VIII

EE MR 2 - Minimum Energy Efficiency Baseline Criteria for Building Envelope Measures Under Case 2 - Non AIR-Conditioned Buildings

1) Envelope Measures:

(* For Climatic Zones of India, please refer Annexure - I)

❖ **Fenestration - SHGC value**

Climate Zone *	Maximum SHGC Value	
	WWR ≤ 40%	WWR > 40%
Hot and Dry	0.42	0.36
Warm and Humid	0.42	0.36
Composite	0.42	0.36
Temperate	0.48	0.4
Cold	0.8	0.8

❖ **Glazing U-value**

(Applicable only if Window-to-Wall Ratio WWR > 40%)

Climate Zone *	Maximum U-value (W/m^2K) (WWR > 40%)
Hot and Dry	5.7
Warm and Humid	5.7
Composite	5.7
Temperate	5.7
Cold	5.7

☙ **Wall Assembly U-value**

Climate Zone *	Maximum U-value of the overall wall assembly (W/m^2K)
Hot and Dry	2.5
Warm and Humid	2.5
Composite	2.5
Temperate	2.5
Cold	1.1

☙ **Roof Assembly U-value**

Climate Zone *	Maximum U-value of the overall roof assembly (W/m^2K)
Hot and Dry	1.2
Warm and Humid	1.2
Composite	1.2
Temperate	1.8
Cold	1.2

Annexure - IX

EE Credit 2 Enhanced Energy Efficiency Baseline Criteria for Building Envelope Measures Under Case 2 - Non-AIR Conditioned Building

1) Envelope Measures:

(* For Climatic Zones of India, please refer Annexure - I)

☙ **Fenestration - SHGC value**

Climate Zone *	Maximum SHGC Value	
	WWR ≤ 40%	WWR > 40%
Hot and Dry	0.32	0.27
Warm and Humid	0.32	0.27
Composite	0.32	0.27
Temperate	0.40	0.30
Cold	0.8	0.8

☙ **Glazing U-value**

Climate Zone *	Maximum SHGC Value	
	WWR < 40%	WWR > 40%
Hot and Dry	3.3	2.8
Warm and Humid	3.3	2.8
Composite	3.3	2.8
Temperate	5.7	3.3
Cold	3.3	2.8

☙ **Wall Assembly U-value**

Climate Zone *	Maximum U-value of the overall wall assembly (W/m^2K)
Hot and Dry	1.8
Warm and Humid	1.8
Composite	1.8
Temperate	1.8
Cold	0.8

☙ **Roof Assembly U-value**

Climate Zone *	Maximum U-value of the overall roof assembly (W/m^2K)
Hot and Dry	0.5
Warm and Humid	0.5
Composite	0.5
Temperate	0.75
Cold	0.5

Notes

About CII
(Confederation of Indian Industry)

The Confederation of Indian Industry (CII) works to create and sustain an environment conducive to the development of India, partnering industry, Government, and civil society, through advisory and consultative processes.

CII is a non-government, not-for-profit, industry-led and industry-managed organization, playing a proactive role in India's development process. Founded in 1895, India's premier business association has over 8,000 members, from the private as well as public sectors, including SMEs and MNCs, and an indirect membership of over 2,00,000 enterprises from around 240 national and regional sectoral industry bodies.

With 66 offices, including 9 Centres of Excellence, in India, and 9 overseas offices in Australia, Bahrain, China, Egypt, France, Germany, Singapore, UK, and USA, as well as institutional partnerships with 320 counterpart organizations in 106 countries, CII serves as a reference point for Indian industry and the international business community.

About IGBC
(Indian Green Building Council)

The Indian Green Building Council (IGBC), part of Confederation on Indian Industry (CII) was formed in the year 2001. The vision of the council is 'To enable a sustainable built environment for all and facilitate India to be one of the global leaders in sustainable built environment by 2025'.

The council offers a wide array of services which include developing new green building rating programmes, certification services and green building training programmes. The council also organises Green Building Congress, its annual flagship event on green buildings.

The council is committee-based, member-driven and consensus-focused. All the stakeholders of construction industry comprising of architects, developers, product manufacturers, corporate, government, academia and nodal agencies participate in the council activities through local chapters.

CII
Confederation of Indian Industry

IGBC

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