REVISED GUIDELINES FOR AIR CONDITIONING IN OPERATION THEATRES
Air Conditioning In OT

A. The air conditioning requirements for Operation Theater in a HCO have been deliberated at length with manufacturers, engineers, technical committee members and other stakeholders and the following guidelines have been finalized.

B. For this purpose operation theaters have been divided into groups:

1. **Super specialty OT**: Super specialty OT means operation theatres for Neurosciences, Orthopedics (Joint Replacement), Cardiothoracic and Transplant Surgery (Renal, Liver etc).

2. **General OT**: This includes operation theatres for Ophthalmology, District hospital OTs, FRU OT and all other basic surgical disciplines.

   **Daycare centre**: Day surgery is the admission of selected patients to hospital for a planned surgical procedure, returning home on the same day, would fall under the category of general OT.

C. The following basic assumptions have been kept in view:

- Occupancy: Standard occupancy of 5-8 persons at any given point of time inside the OT is considered.
- Equipment Load: Standard equipment load of 5-7 kW considered per OT
- Ambient temperature & humidity at each location to be considered while designing the system.
OT Construction:

a) Paint- antibacterial, anti-fungal
b) OT door – automatic/ Hermetically Sealed/Touch free (preferable)
c) General Lights – Clean room lights
d) Provision of safety against static charge.
e) Separate power circuit for equipment like C-arm
f) Flooring – seamless, incl skirting, should not be of porous stone as it absorbs moisture and could be a source of bio-burden.
REQUIREMENTS – Super Specialty OT

1. Air Changes Per Hour:
   - Minimum total air changes should be 25 based on international guidelines although the same will vary with biological load and the location.
   - The fresh air component of the air change is required to be minimum 4 air changes (ie 16%) out of total minimum 25 air changes.
   - If HCO chooses to have 100% fresh air system than appropriate energy saving devices like heat recovery wheel, run around pipes etc should be installed.

2. Air Velocity: The vertical down flow of air coming out of the diffusers should be able to carry bacteria carrying particle load away from the operating table. The airflow needs to be unidirectional and downwards on the OT table. The air velocity recommended as per the international and national guidelines is 90-120 FPM at the Grille/ Diffuser level.

3. Positive Pressure: There is a requirement to maintain positive pressure differential between OT and adjoining areas to prevent outside air entry into OT. The minimum positive pressure recommended is 15 Pascal (0.05 inches of water) as per ISO 14644 Clean Room Standard.

4. Air handling in the OT including air Quality: Air is supplied through Terminal HEPA filters in the ceiling. The minimum size of the filtration area should be 8’ x 6’ to cover the entire OT table and surgical team. The minimum supply air volume to the OT (in CFM) should be compliant with the desired minimum air change. Air quality at the supply i.e. at grille level should be Class 100/ ISO Class 5 (at rest condition).

   Note: Class 100 means a cubic foot of air should not have more than 100 particles measuring more than 0.5 microns or larger.
5. **Air Filtration:** The AHU must be an air purification unit and air filtration unit. There must be two sets of washable flange type pre filters of capacity 10 microns and 5 microns with aluminum/ SS 304 frame within the AHU. The necessary service panels to be provided for servicing the filters, motors & blowers. HEPA filters of efficiency 99.97% down to 0.3 microns or higher efficiency are to be provided in the OT and not in the AHU.

6. **Temp & RH for Super-specialty OT:** it should be maintained 21 C +/- 3 C (except for Ortho for Joints replacement as 18 C +0 & -2 C) with corresponding relative humidity between 40 to 60% though the ideal RH is considered to be 55%. Appropriate devices to monitor and display these conditions inside the OT may be installed.
REQUIREMENTS – General OT

1. Air Change Per Hour:
   - Minimum total air changes should be 20 based on international guidelines although the same will vary with biological load and the location.
   - The fresh air component of the air change is required to be minimum 4 air changes (ie 16%) out of total minimum 20 air changes.

2. Air Velocity: should be same as per previous guide.

3. Positive Pressure: There is a requirement to maintain positive pressure differential between OT and adjoining areas to prevent outside air entry into OT. The minimum positive pressure recommended is 15 Pascal (0.05 inches of water).

4. **Air handling/Filtration**: should be same as previous. *When not possible, the OTs should be well ventilated with 2 filtrations (pre and microvee filters should be in position at the AHU).*

5. Temperature and Humidity: The temperature should be maintained at 21°C +/- 3 Deg C inside the OT all the time with corresponding relative humidity between 40 to 60%. Appropriate devices to monitor and display these conditions inside the OT may be installed.
Design considerations for Planning New Operation Theatres

- The AHU of each OT should be dedicated one and should not be linked to air conditioning of any other area for all OT constructed.

- During the non functional hours AHU blower will be operational round the clock (may be without temperature control). Variable frequency devices (VFD) may be used to conserve energy.

- Window & split A/c should not be used in any type of OT because they are pure re circulating units and have convenient pockets for microbial growth which cannot be sealed.

- The flooring, walls and ceiling should be non porous, smooth, seamless without corners (coving) and should be easily cleanable repeatedly. The material should be chosen accordingly. Hermetic sealing of the doors is recommended.

- Validation of system to be done as per ISO 14664 standards and should include:
  - Temperature and Humidity check
  - Air particulate count
  - Air Change Rate Calculation
  - Air velocity at outlet of terminal filtration unit /filters
  - Pressure Differential levels of the OT wrt ambient / adjoining areas
  - Validation of HEPA Filters by appropriate tests like DOP etc; repeat after 6 months in case HEPA found healthy.

- Maintenance of the system: It is recommended that periodic preventive maintenance be carried out in terms of cleaning of pre filters at the interval of 15 days. Preventive maintenance of all the parts is carried out as per manufacturer recommendations.
References


