

Indoor
Temperature, &
Relative Humidity



ICU Rooms for
Covid



Guidance for
Hospital AC
Technicians

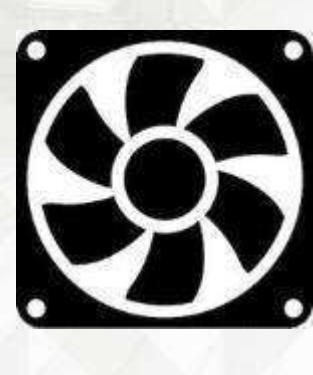


Patient Rooms
for Covid
Isolation

Portable Air
Cleaners

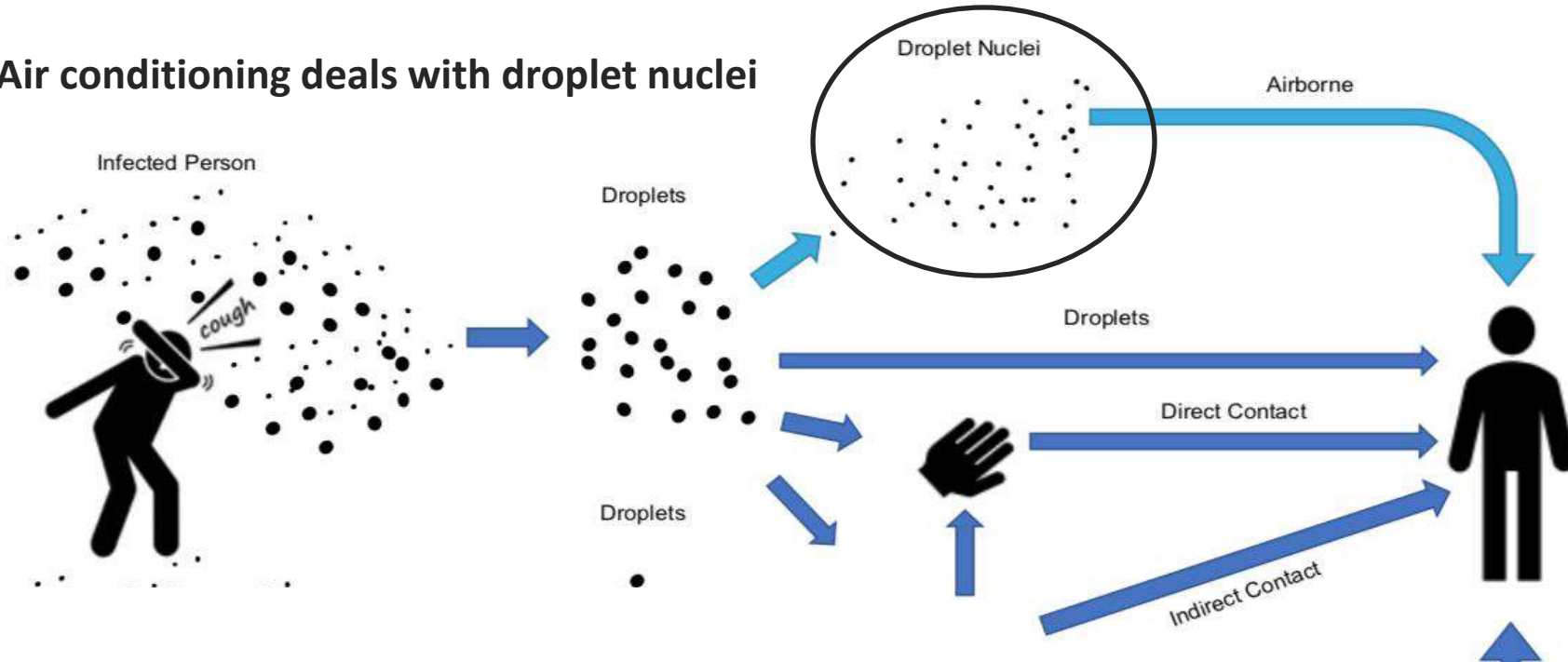


Treatment of
Exhaust Air



COVID-19 TRANSMISSION ROUTES

Air conditioning deals with droplet nuclei



Is the Virus Air-Borne & can it spread thru Air-con?



The airborne infected droplet nuclei are easily respirable & go deep into the lungs. ***But it is believed that the infectivity of this nuclei is low.*** This is not the transmission mode as per W.H.O & ICMR. That's why air-conditioning can be used with precautions

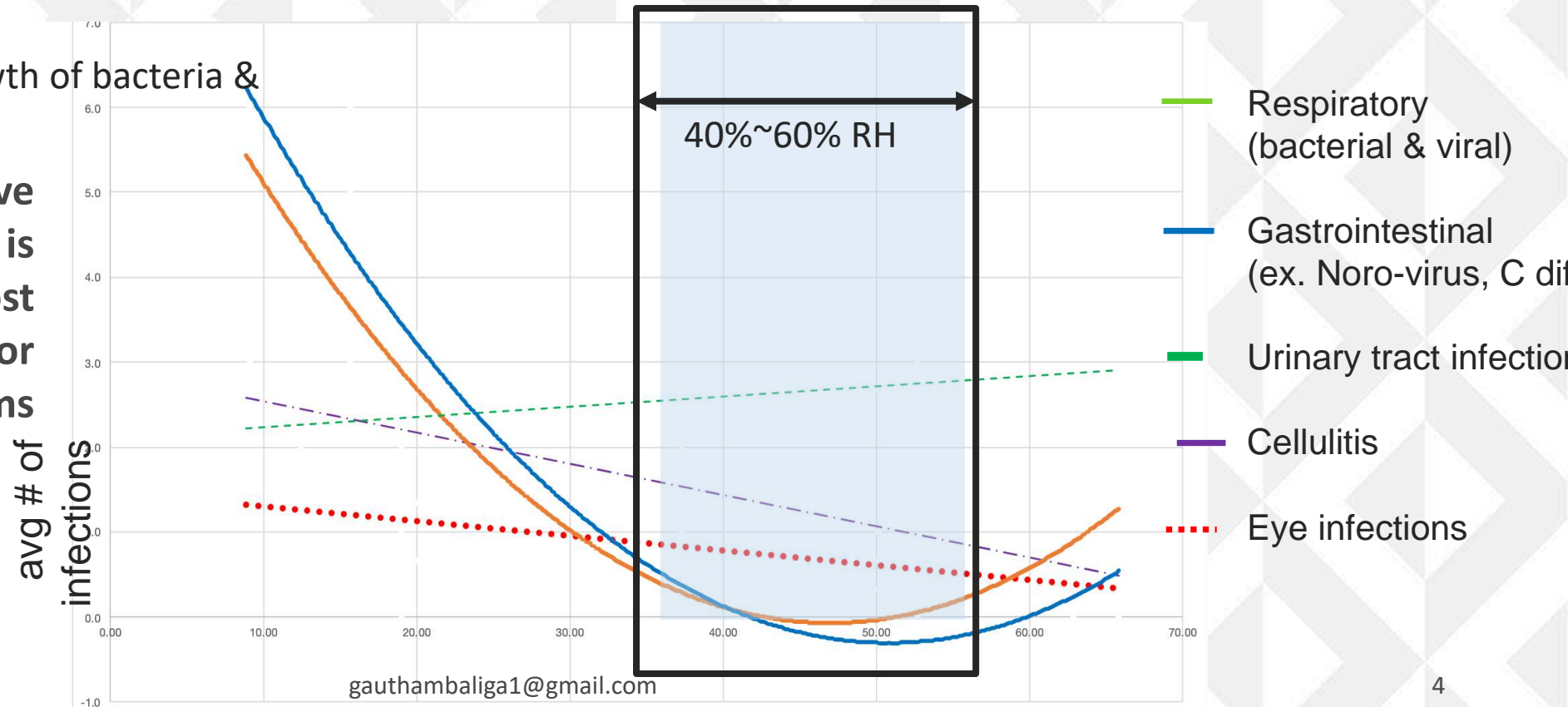
We have to reduce chance of air borne infection by dilution through ventilation [fresh air in system] and filtration

Relative Humidity

Researchers have found that low humidity (below 40%) helps the virulence & growth of virus & bacteria.

High humidity again leads to growth of bacteria & molds & fungus

Summarised, the relative humidity level of 40%-70% is considered to be the most suitable environment for humans & decreases problems from pathogens.



Temperature

- 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.
- Temperature tends to be a factor that directly affects the comfort of hospital occupants. Healthcare workers in PPE would find it difficult to work in high temperature & so the temperature should be set at highest acceptable temperature form 22C~28C

PORTABLE ROOM AIR CLEANERS

Passive filtration versus Active Filtration

*Passive filtration is with
Traditional Media Filters*

*Active Filtration
Technologies*

ESP

Titanium Dioxide

Cold-Plasma

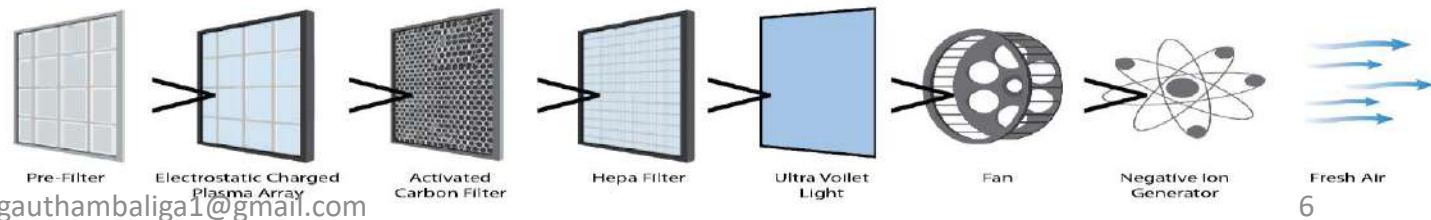
UV

Ionization

Ozonizers

Etc...

*Be aware of active filtration
technologies with regards to
harmful by-products*



- Some of the technologies used are Ionization, Bi-polar ionization, PCO, ESP and ozone generators. Whereas the passive technologies using filters only trap particles, the active technologies use ‘trap & kill’ concept. Here, the dosage of ionization, ESP etc is critical, or else these may harm the inhabitants and may have contra-indications.
- UVGI, if deployed correctly has proven to be useful in inactivating bio-aerosols.
- Passive technologies include HEPA filtration that can remove particles down to 0.1 micrometers or even smaller particles. A Certified H13 certified or equivalent HEPA filter should be installed, to remove viruses that pass through the cleaner.

- It is recommended to select air cleaners with about 3-4 air changes per hour for commercial spaces. **For healthcare spaces 8~10 air changes per hour** may be more appropriate.. The higher the air changes, the better the efficiency of cleaning.

CADR – Number of air changes per hour

Volume of air of room ÷ CADR at medium speed

- Select the machine with the right Air Flow, based on room size and fan speed, to ensure proper filtration and comfort, that includes a desired level of quietness.

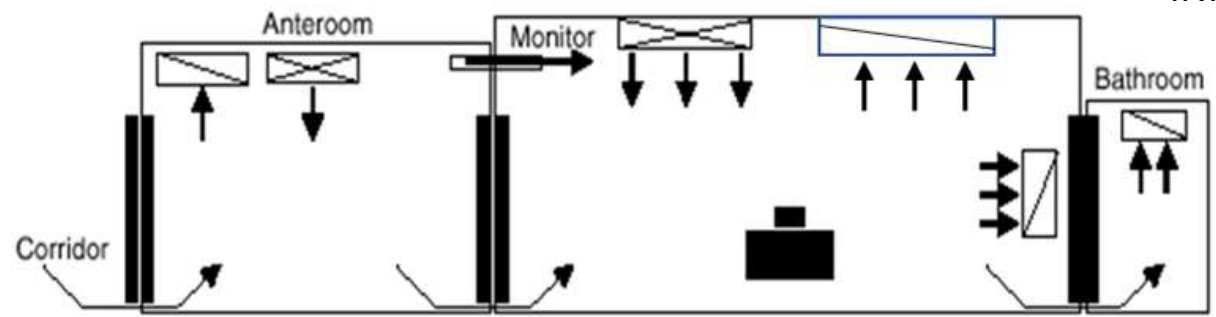
Improvised Negative Isolation Rooms



Basics General Parameters :

- *Do No Harm*
- *System Arrangement Should Protect Workers*
- *System Arrangement Should Protect Other Patients*
- *Airflow from Clean to Less Clean*

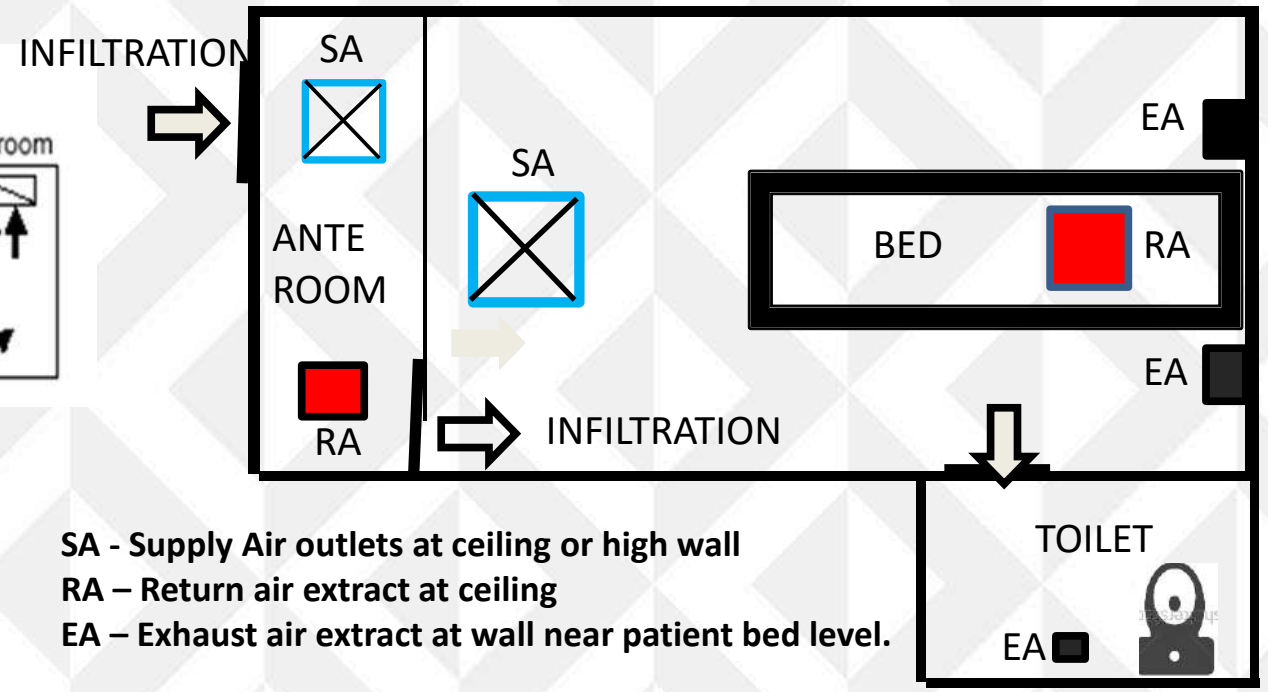
A.I.I. Room Airflow Schematic



Convert the room into a non-re-circulatory system (100% once through system).

Make sure that the AHU has provision to receive adequate outdoor air supply. Check that fresh air is sourced from a clean area

Independent exhaust blower shall be provided to extract the room air and exhaust out into the atmosphere, preferably, after suitable “exhaust air treatment”.



SA - Supply Air outlets at ceiling or high wall
 RA – Return air extract at ceiling
 EA – Exhaust air extract at wall near patient bed level.

A negative pressure of minimum 2.5Pa (preferably >5 Pa) is to be achieved in the room .

The supply air quantity shall be such that it will provide a minimum of 12 air changes per hour.

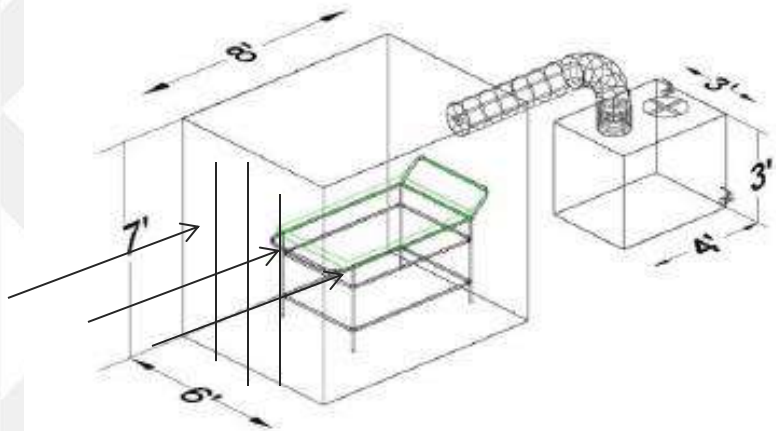
Ref :

- 1) Guidelines for environmental infection control in health care facilities, CDC, 2019.
- 2) HVAC Design Manual for Hospitals & clinics, 2nd edition, ASHRAE, gauthambalga1@gmail.com

The exhaust air is most likely to contain particles carrying a viral load and hence a suitable technique should be deployed to prevent the spread of infections.

- ***Treatment by HEPA filtration minimum of H13 (EN1822-1) filter class or equivalent.***
- Treatment of exhaust air by Chemical disinfection.
- ***When both the methods are not viable, the exhaust air shall be let off into the atmosphere through an upward plume at a height of 3 m above the tallest point of the building.***
- The other two options available for exhaust air treatment being UV irradiation and heating but . Please refer to the document for more details on the same

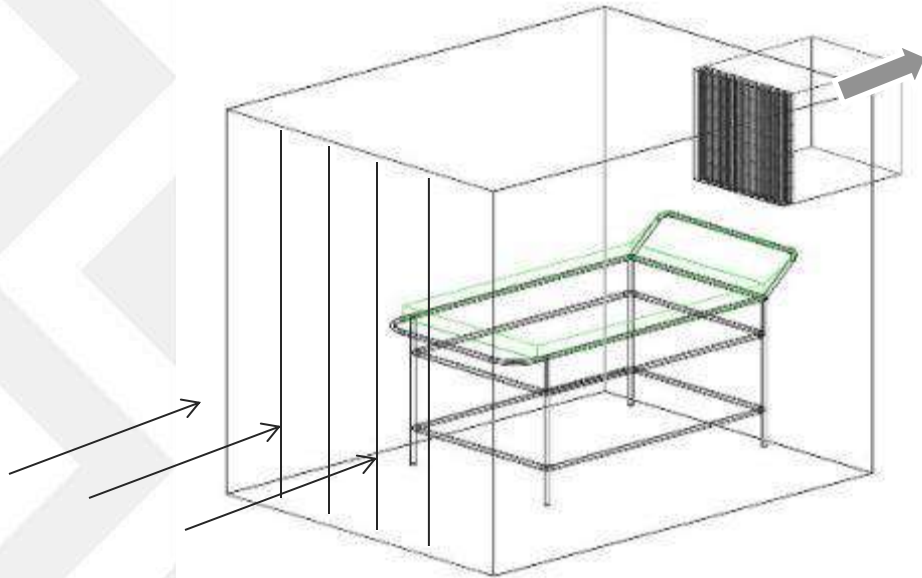
Temporary Isolation Rooms



Isolation enclosure with Chemical disinfection for exhaust air. (Dimensions are only indicative)

- Isolation cabinet is created in an existing air-conditioned ward using temporary partitions. The front will have PVC strips.
- The air is sucked in from the patient ward area through the PVC curtains in the front using exhaust fan to create -2.5 Pa pressure
- Air is exhausted out of the building using fan & discharging 3M above building / aeration tank with a 1% sodium hypochlorite solution to kill the virus

Temporary Isolation Rooms



- Here, the isolation cabinet is created same as in Alternative #1, inside an air-conditioned ward
- The air is sucked in from the patient ward area through the PVC curtains in the front using exhaust fan to create -2.5Pa pressure
- Air is exhausted back into the room using fan & HEPA [min. H13 grade]
- Since the exhaust into the room is thru' HEPA, it is safe for others.

Converting ICUs for COVID

What the ASHRAE STANDARD SAYS:

ASHRAE Standard 170-2015, for ICUs				
Temperature F [C]	Relative Humidity %	Room pressure w.r.t surroundings	Outside air	Recirculation air
Variable range 70F~75F [21.1~23.9]	30% ~ 60%	Positive, Negative or Neutral*	Minimum 2ach	Minimum 6ach

- *Positive pressure and HEPA filters may be preferred in some ICUs for caring for large numbers of immuno-compromised patients.
- Negative pressure for infectious patients [viz. COVID19] & recirculation of air is not preferred
- Ducted Supply & Ducted Return

Option1:

- To convert an existing ICU into a COVID-19 ICU, patient area, firstly convert the room into a non-recirculatory system (100% once through system).
- On an emergency basis, this can be achieved by blanking (blocking) off the return air vents in the COVID-19 patient room. Make sure that the AHU will have provision to receive adequate outdoor air supply.
- Have exhaust fans to create negative pressure as in the isolation room of [- 2.5Pa]
- Treat exhaust air by having HEPA[H13 or better grade]/chemical treatment etc.

Option2:

- Many isolation rooms today have cassettes or hi wall units. This is really not a recommended way of air conditioning the ICUs.
- However, to alleviate the situation, provision of Fresh Air & exhaust is critical
- Ideally, use inline fan with a MERV14 filter or better & guide the fresh air to the cassette / hi wall return [otherwise in monsoon there will be sweating]. Fresh air quantity is defined in the guide document.
- Have exhaust & treat exhaust as in option1

Do's

ADDITIONAL PRECAUTIONS AT HOSPITALS



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- ❑ Compulsorily wear Surgical nose mask, before entering inside the Hospital, & Laboratory sites. Change the mask every six hours or as soon as it becomes wet.
- ❑ All technicians should wear a clean, long-sleeved gown or full body suit, N95 Respirator, gloves, face cover if they need to enter COVID patient's isolation ward or COVID-19 lab. After exit, dispose the used PPE's into the designated in “RED” color bin.

- Slide courtesy Mr.A Madhukar

- Carry a disposable bag of adequate size, to keep the removed/replaced item and disinfect them at suitable location in the hospital premises.
- Barricade the area, while rendering the service to avoid trespassing. For rendering the service outside the conditioned zones such as for chillers, outdoor units, Fresh Air AHUs, cooling towers ensure that the authorities have cleaned and disinfected before the work is started.
- Maintain complete record of the time spent in the premises

Don'ts

ADDITIONAL PRECAUTIONS AT HOSPITALS

- Never board unknown persons in the vehicle.
- Never touch the common items provided at the customer place such as newspaper, common towel, etc.
- Never handle other person's belongings or share food and water from others.
- Never use another person's crash helmet or PPE
- Do not hand over one's mobile phone to another person/colleague.
- Do not share the pen especially for service report signature from customer, instead ask the customer to use their own pen.
- Never enter premises which are marked as isolated or quarantined.

• Slide courtesy Mr.A Madhukar

Don'ts

ADDITIONAL PRECAUTIONS AT HOSPITALS

- Don't come in close contact with the patients and visitors in the hospital site.
- Don't touch bio-hazardous components such as surgical knife, needles and lab equipment's, used cotton and clothes etc.
- Don't use handrails, touch objects such as lift buttons, door handles and fixtures with your bare hands.

HOW TO DISINFECT TOOLS & TACKLES

- First, clean the surfaces, removing any contaminants, dust, or debris. You can do this by wiping them with soap water (or a cleaning spray) and a hand towel. Wash towel with soap water.
- Then apply a surface-appropriate disinfectant. The quickest and easiest way to do this is with the following:
 - a. Disinfecting wipes
 - b. Disinfectant spray
 - c. Isopropyl alcohol
 - d. Hydrogen peroxide

• Slide courtesy Mr.A Madhukar

Filter Cleaning Machines



Filter Cleaning Machine



Automatic Filter Cleaning Machine