

# Starting an Eye Hospital with Minimum Real estate

Dr M Kumaran

MBBS,MS,DNB,MRCOphth

Kumaran Eye Speciality Center

Chennai

# Mandatory Requirements

- Building plan approval
- Mandatory Licenses
- Minimum area required ??
- Scope of services
- Set back Area



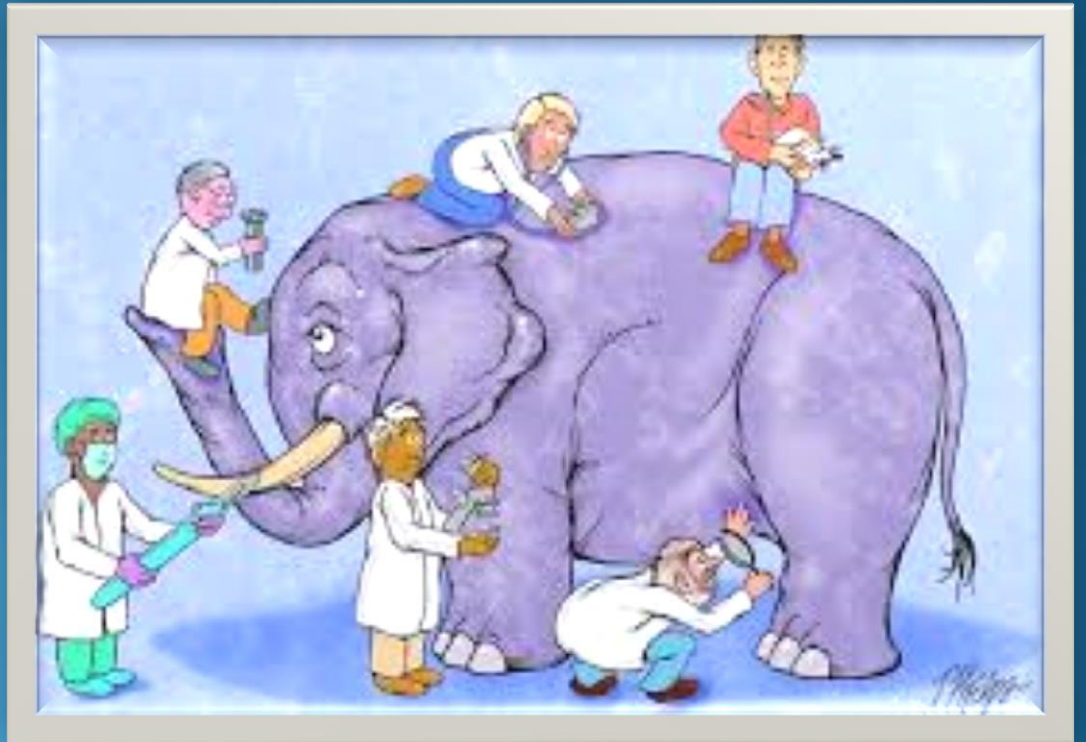
# Principles to be taken into consideration while planning an Eye Care set up (physical / architecture)

- Location, No:of patients seen
- Zone wise distribution
- Space allocation/ Instrumentation
- Ventilation & temperature control- HVAC
- **Differently Abled friendly**
- Emergency /Fire exit
- **Rest Rooms**



# Principles to be taken into consideration while planning (physical / architecture)

- Multidisciplinary approach
- Whom to get involved ?





# Whom to get involved ?



## Yourself

- Anaesthetist
- Architect / Structural Engineers / Interior Designers
- HVAC engineers
- Electrical Engineers (Raw power/ Emergency power supply)
- Biomedical engineers
- Paramedical Staff
- Fire Safety Personals
- Bio-Medical waste disposal management

# Evolution of Modern- eye hospital

- **Engineering Approach-** Technology centred & puts people to fit it
- **Ergonomic Approach-** Puts people first and fits technology around them.

# Approach to Planning

Engineering design-  
Technology Centered



Ergonomic design-  
People Centered

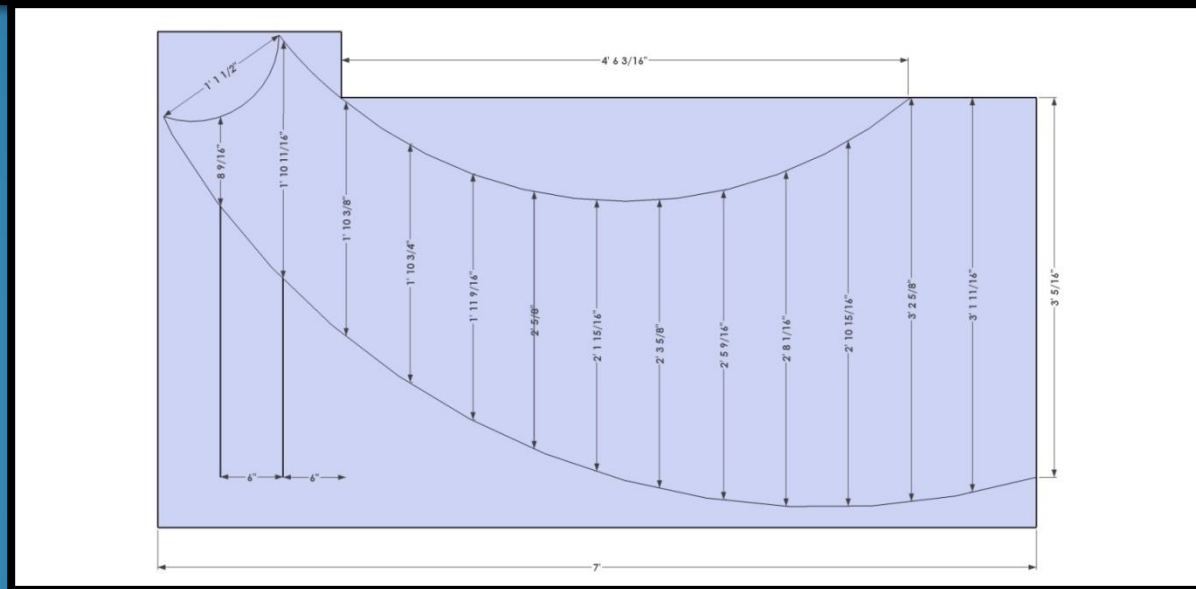
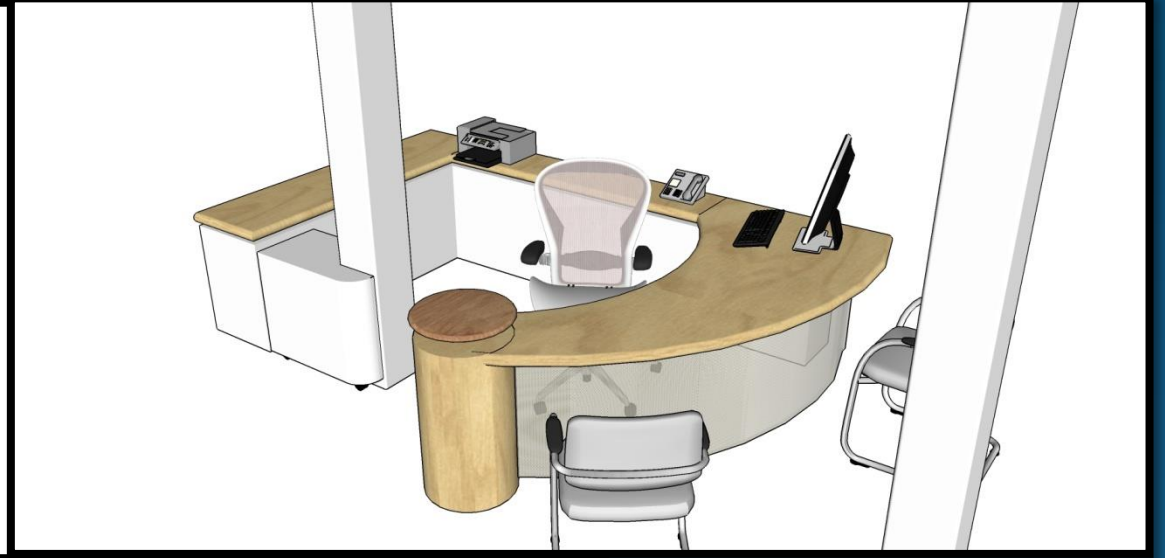
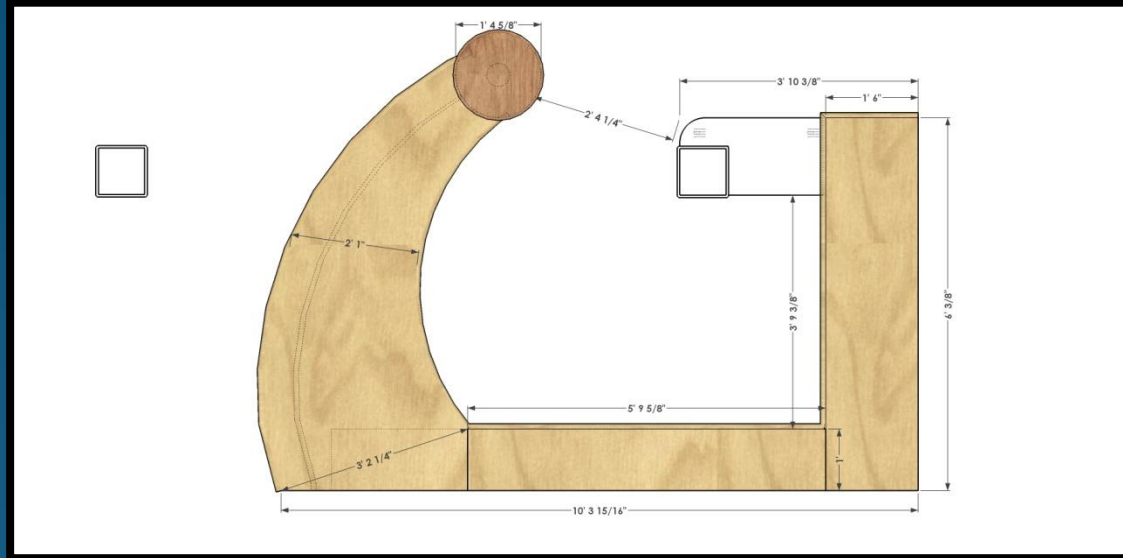


# Approach to Planning

- How are we planning to put in a table to suit both the doctor and the patient?



# Approach to Planning





# Finally..



# Points to be considered while planning an Eye Care set up

- Present and future needs .
- Volume of Patients-OPD & Surgical Volume
- Rest rooms
- Plumbing/Water needs of Staff/Patients
- Zoning in the Hospital
- Parking /Security
- Electrical- Raw/Backup power /Fluctuations/Medical instruments

# Hospital Zoning

- Parking
- Out-Patient Area
- Surgical Area
- Inpatient Area
- Investigative areas
- Staff Rest area
- Laundry



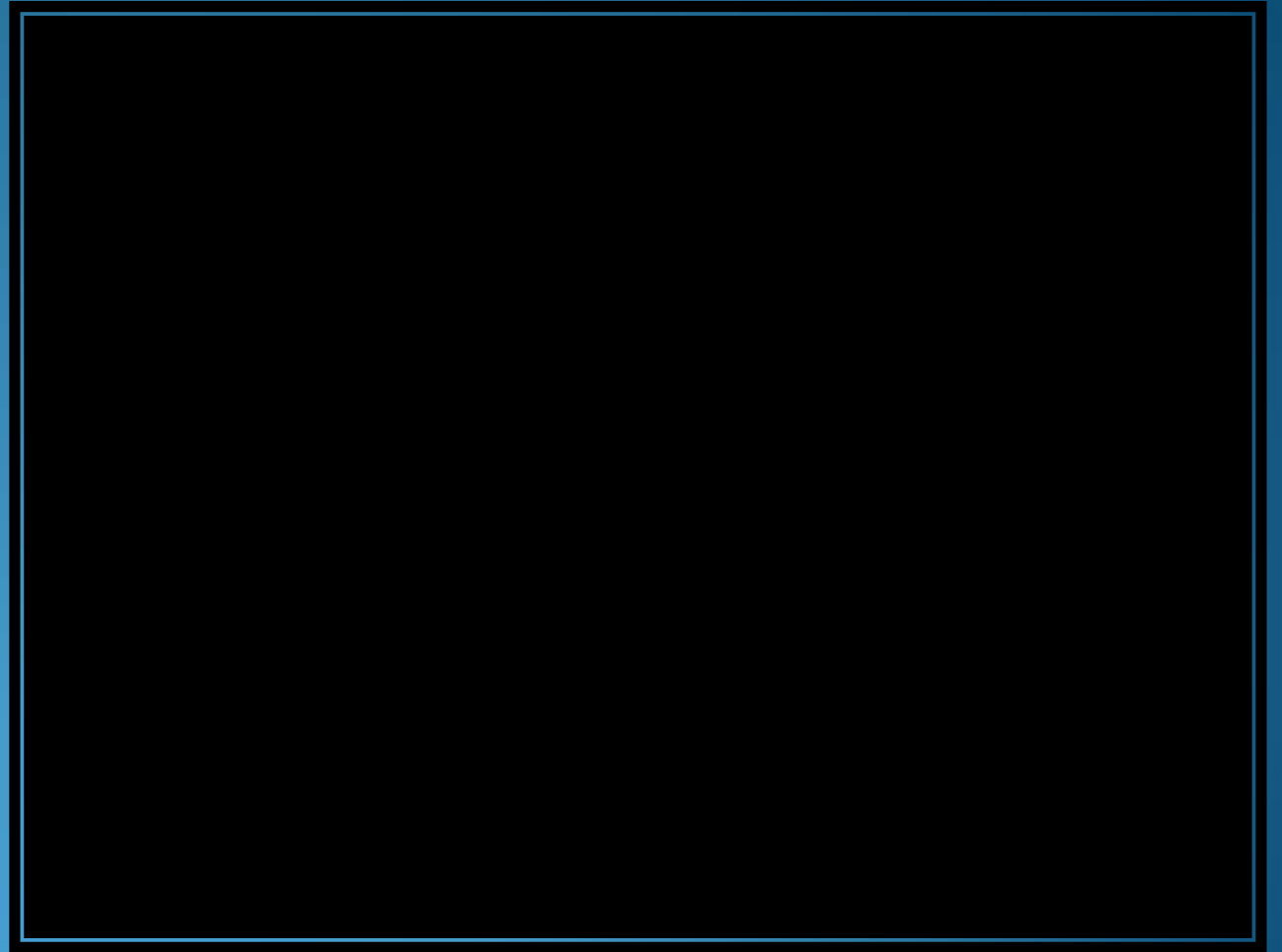
# Key Areas in an Eye Hospital

- Optical Area Display
- Pharmacy
- Out-Patient Area / Doctor chambers
- Operation Room
- Recovery Room
- In-Patient Room
- Counselling Room



# Out-Patient Area

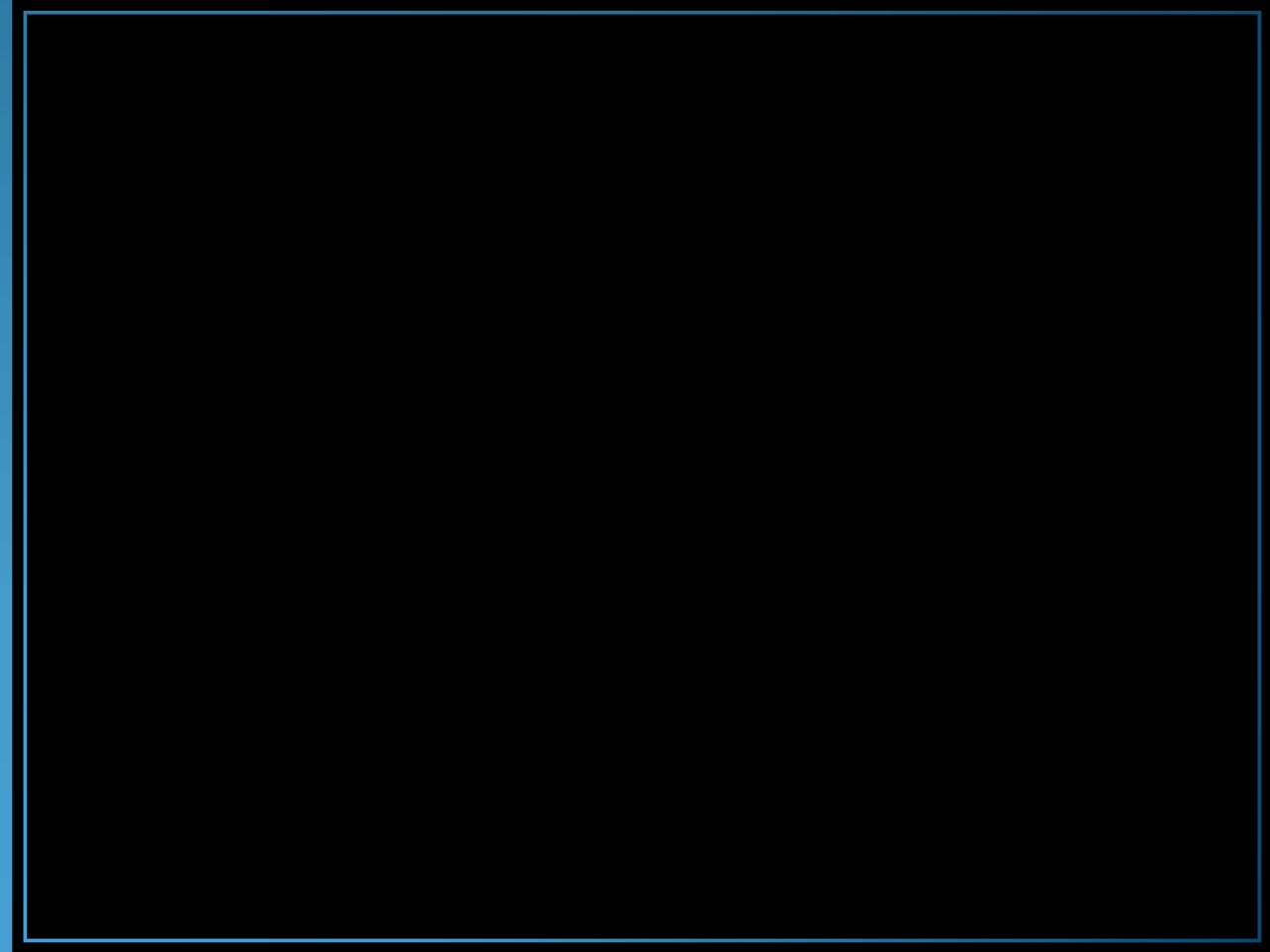
- Front desk
- Reception
- Consultation rooms
- Optometry Cubicles
- Emergency Room
- Nurse station
- Patient education display





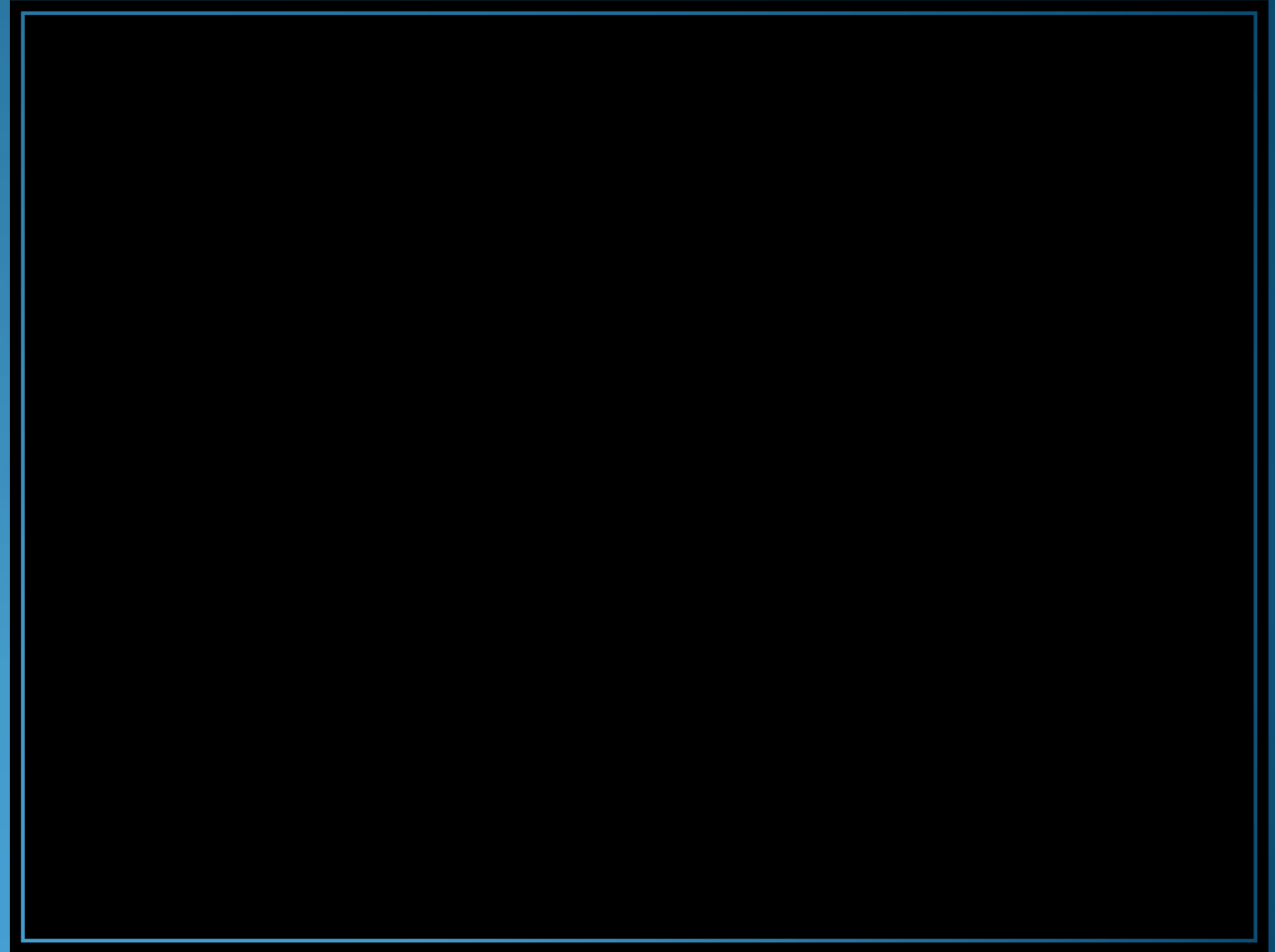
# Optical Area Display

- Maximum display
- At the entrance to attract customers
- Cater to all clients



# KESC- Investigation Arena

- Single speciality/Comprehensive investigations
- Cluster approach for instruments
- Power back up



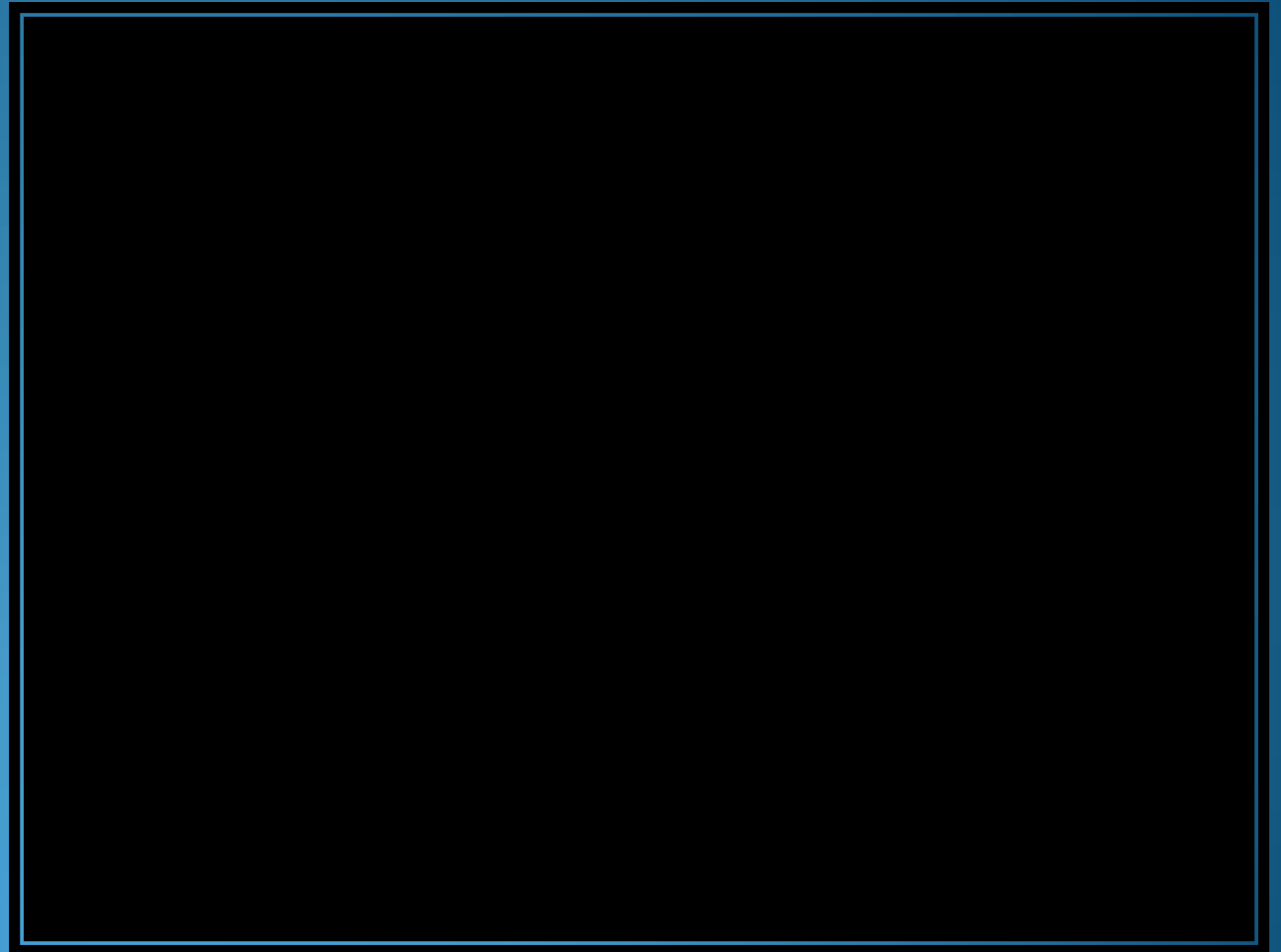
# Operating room

## Civil-Standard Requirements

- Minimum 260 sq feet of main OT area
- Height of OT :9-10 feet
- Seamless surface
- Adequate Separate entry/exit for sterile and unsterile things
- Hermetically sealed doors
- Lighting

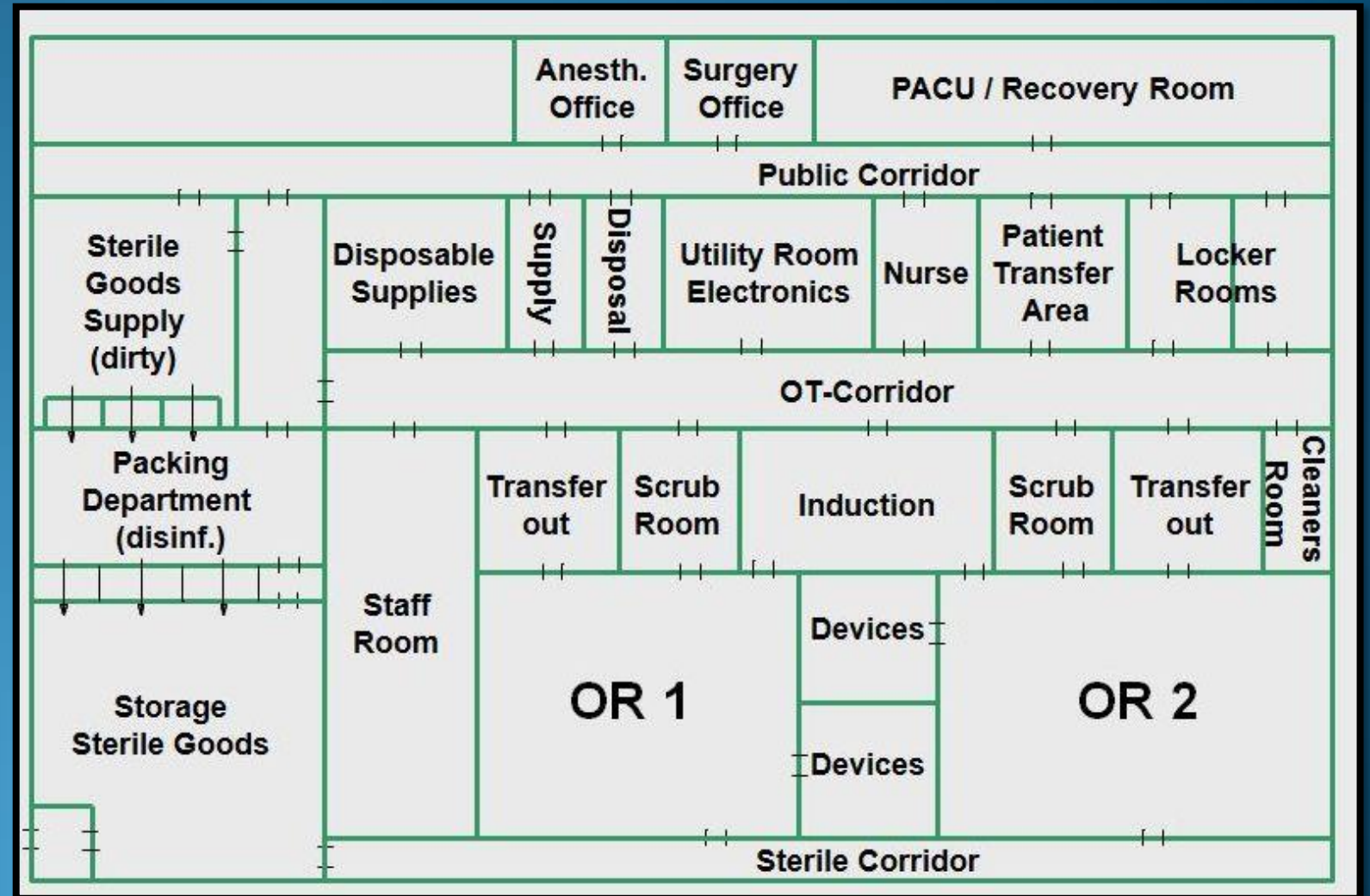
# Zones in an OT complex

- Protective Zone
- Clean Zone
- Aseptic Zone
- Disposal Zone
- Other areas



# Zones in an OT complex

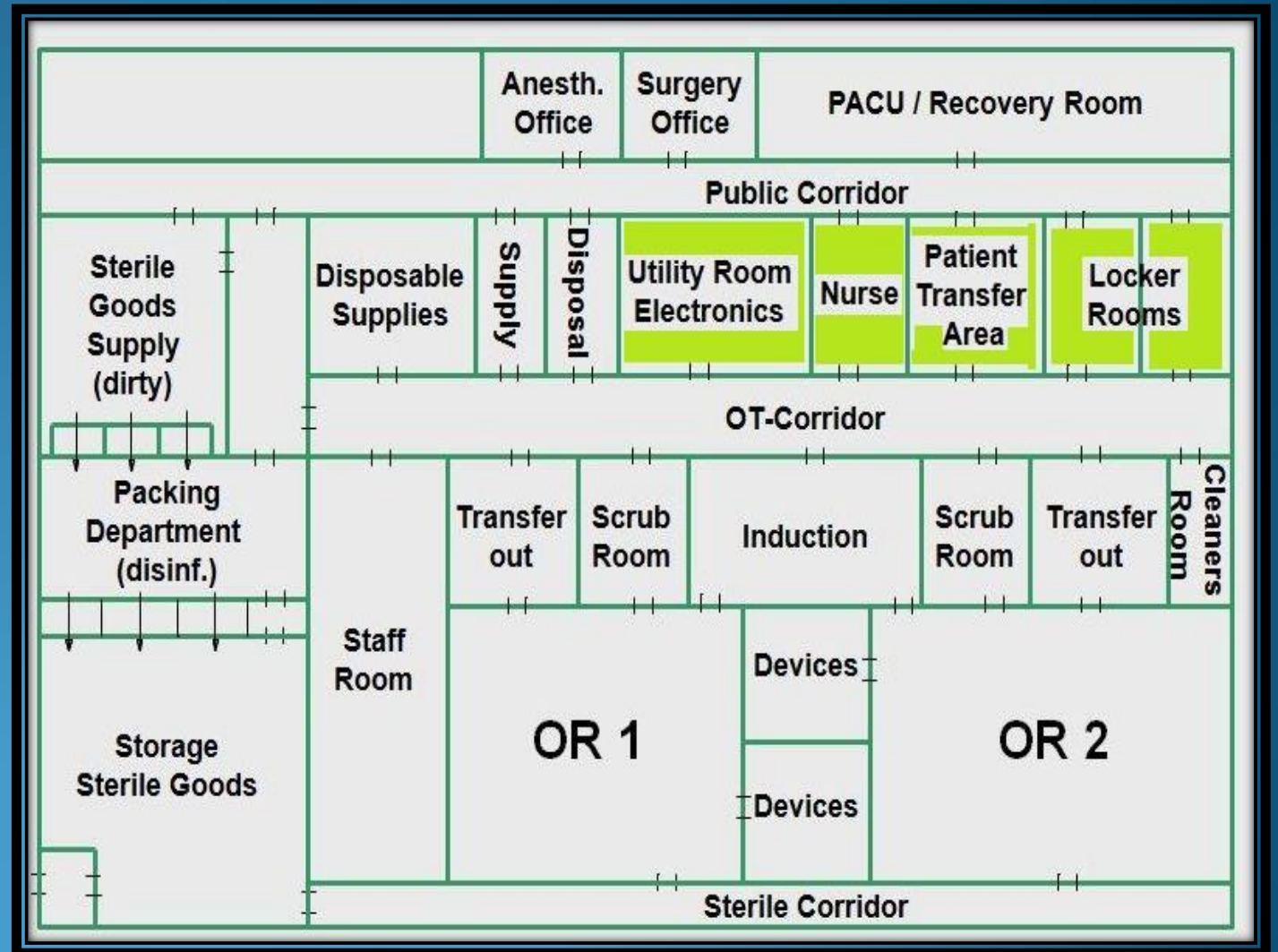
- Protective Zone
- Clean Zone
- Aseptic Zone
- Disposal Zone
- Other areas





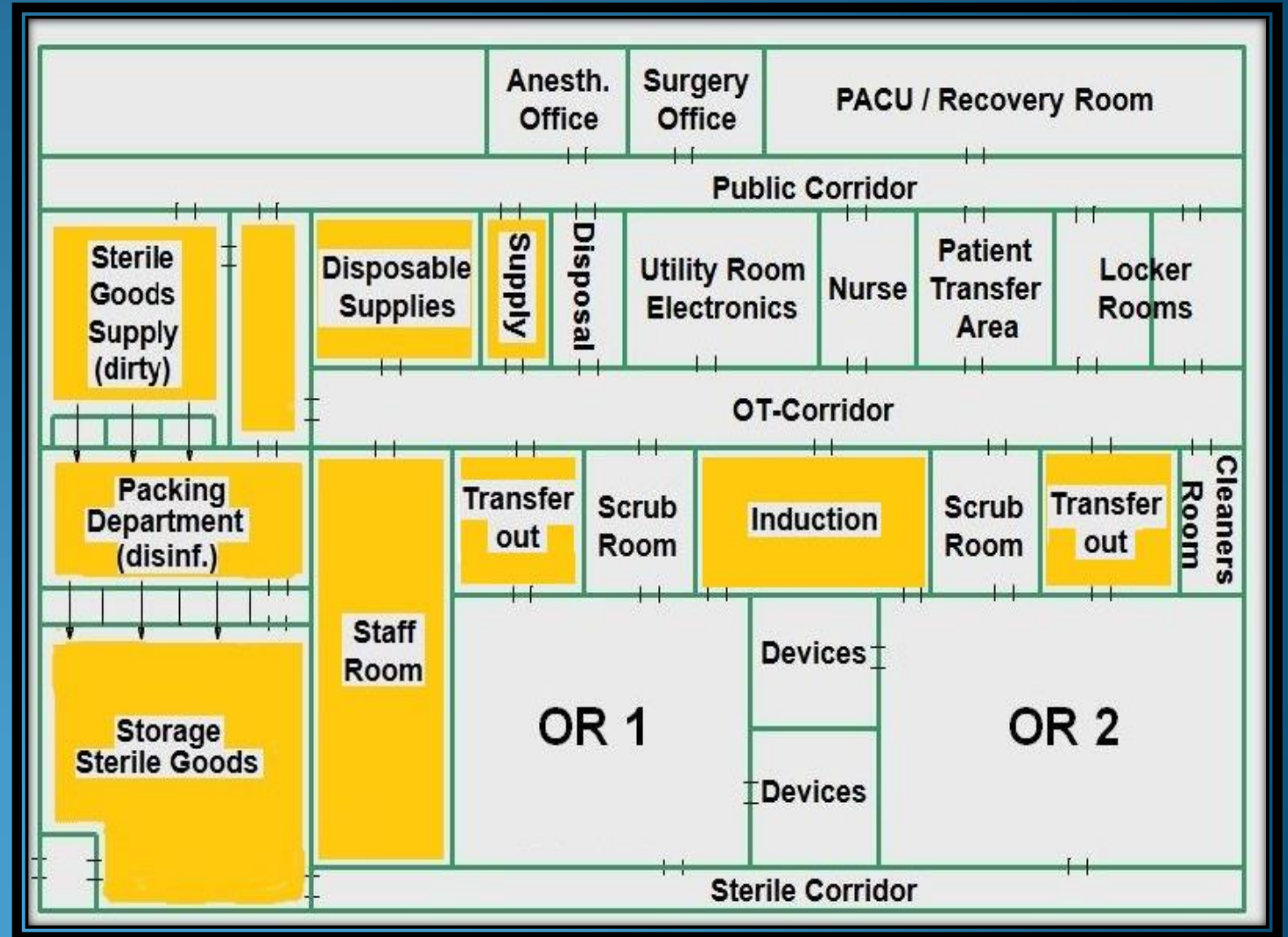
# Protective Zone

- Change rooms
- Transfer bay- patients & equipments
- Rooms for staff
- Stores & records
- Pre & post-operative rooms
- Recovery beds
- Sterile stores



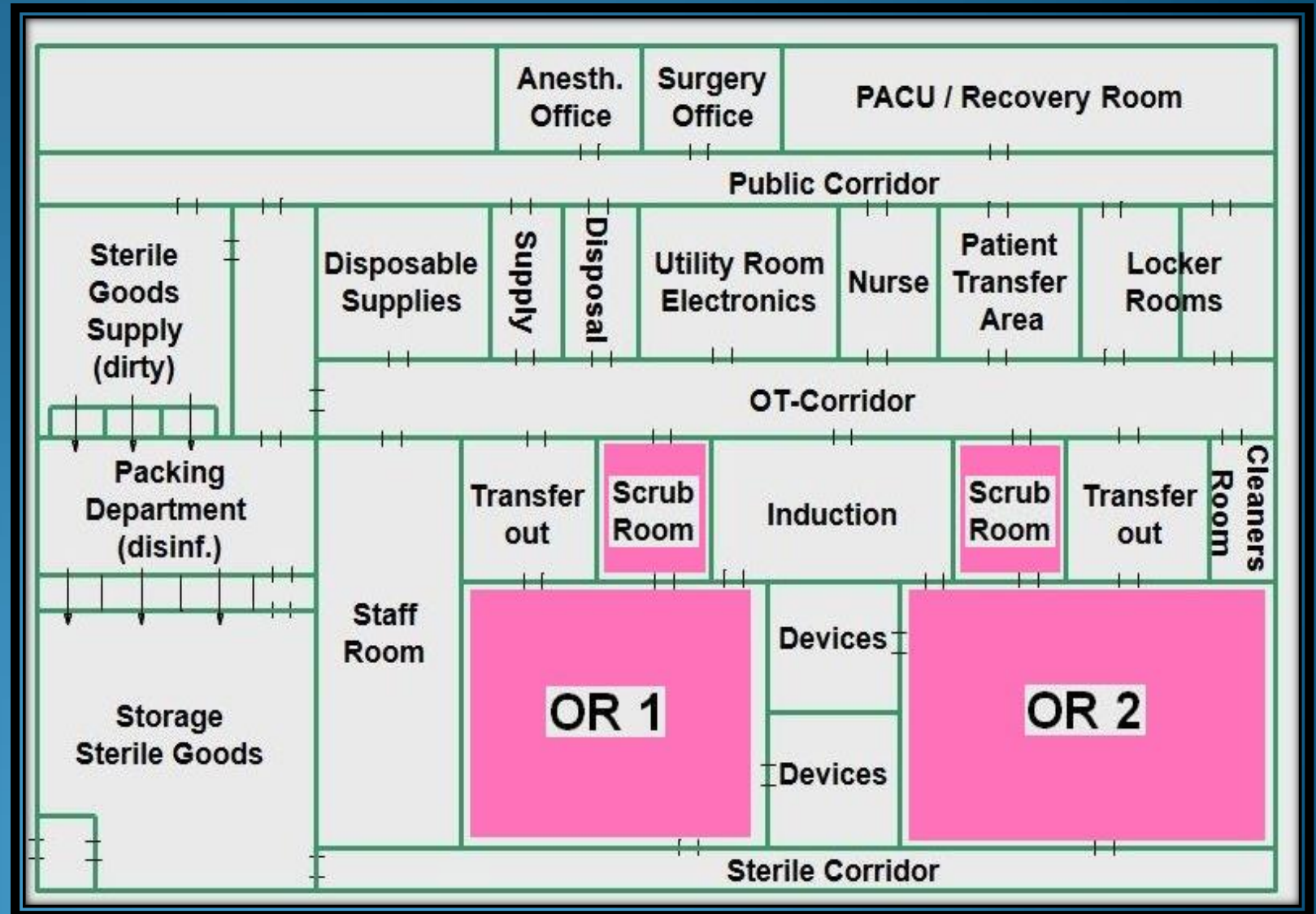
# Clean Zone

- Connects protective zone to aseptic zone and has other areas also like
  - Stores & cleaner room
  - Equipment store room
  - Maintenance workshop
  - Firefighting device room
  - Emergency exits
  - Service room for staff



# Aseptic Zone

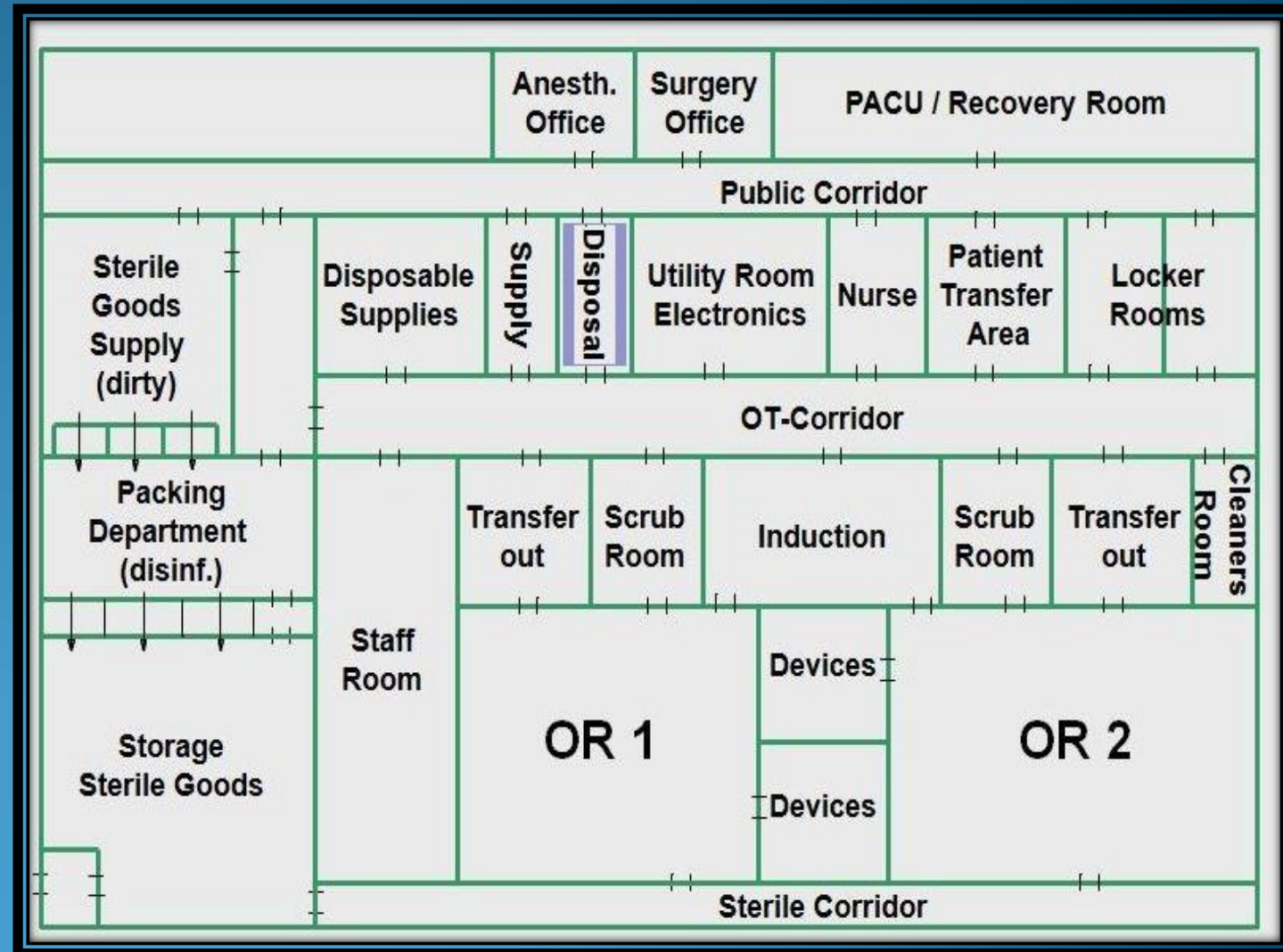
- Operation theatre





# Disposal Area

- Disposal areas from each OR & corridor lead to disposal zone

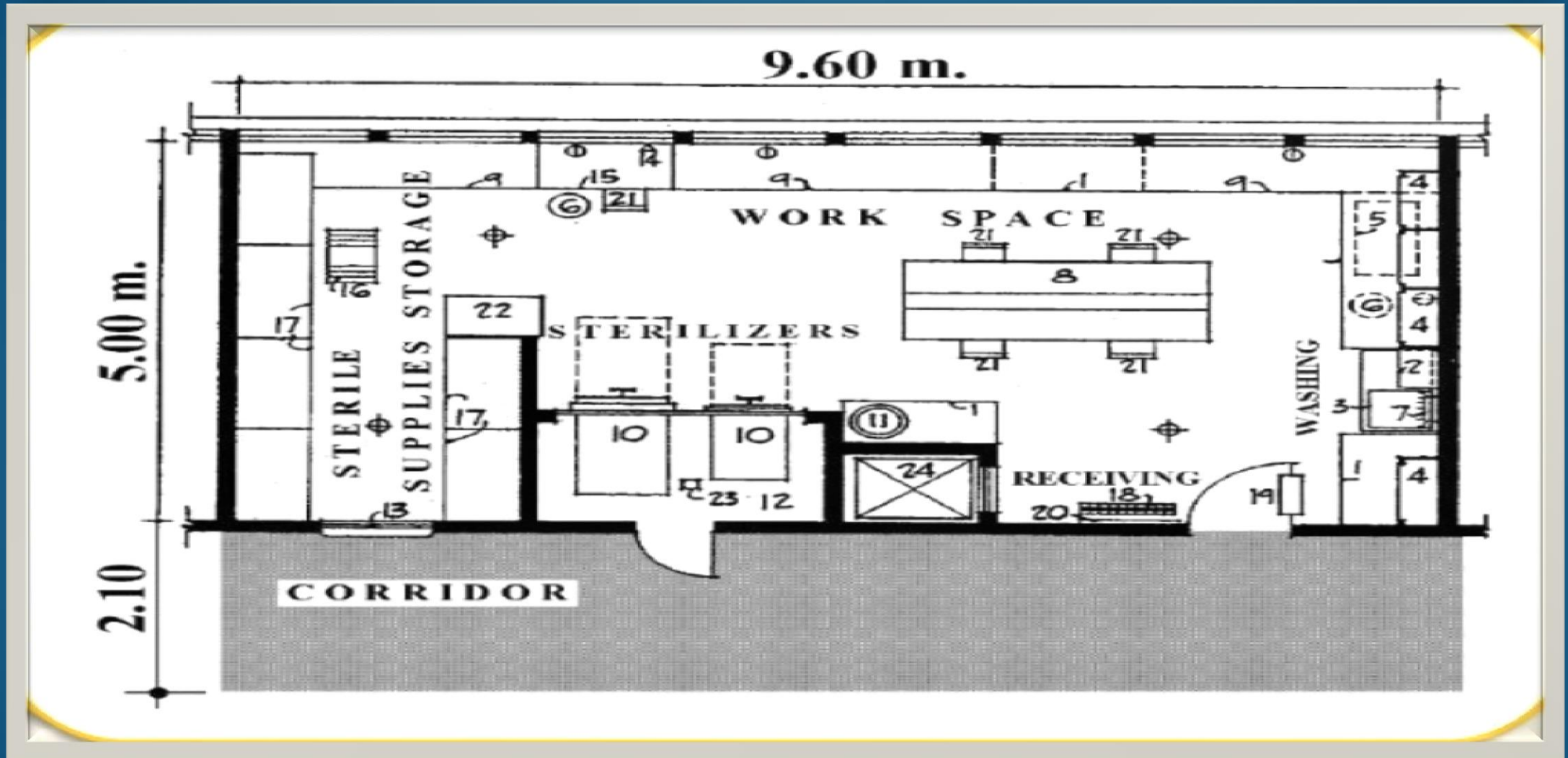


# Other Areas to be considered in OT setup

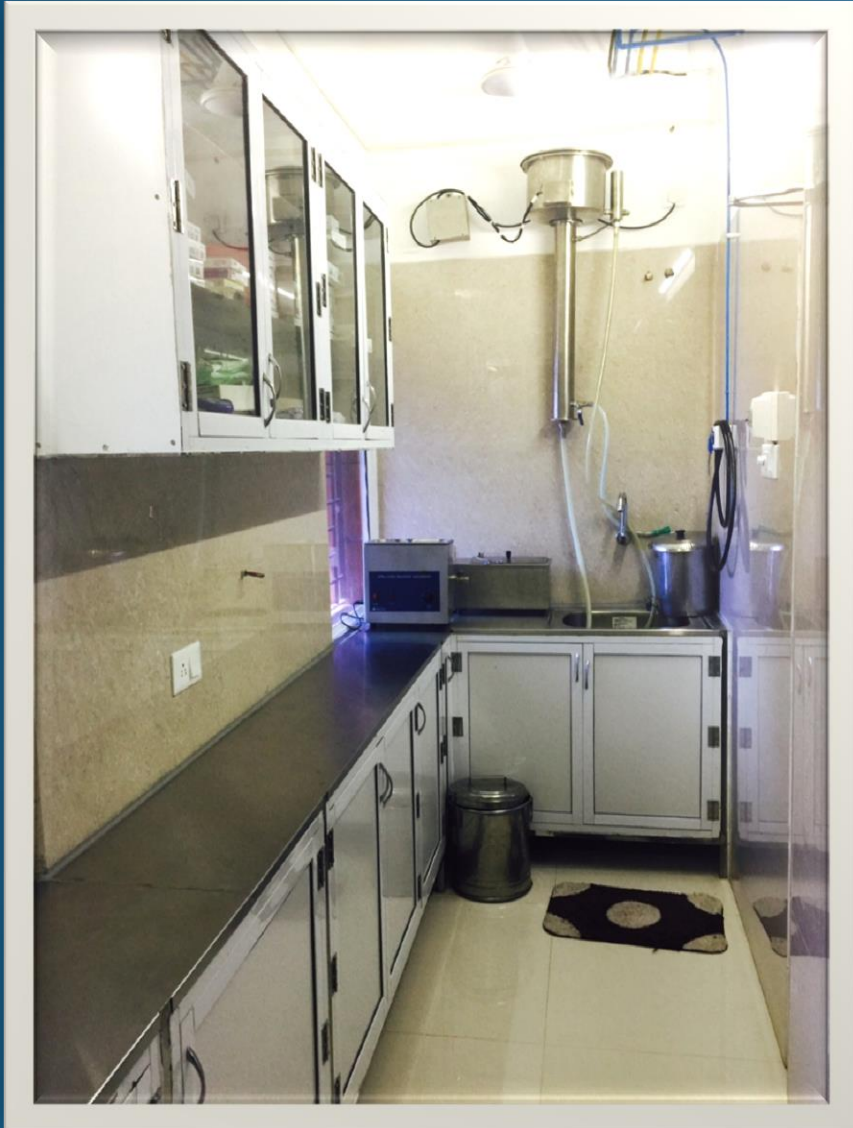
- Pre-operative check in area (Reception)
- Holding area/Induction Area
- Post anesthetic care units /Recovery Rooms
- Staff room & Sanitary facility
- Manifold room
- Store room
- Theatre sterile supply unit (TSSU)



# Theatre sterile supply unit (TSSU)



# Theatre sterile supply unit (TSSU)



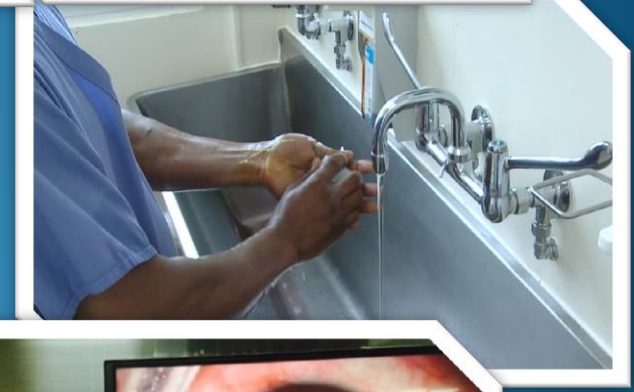


# Autoclave



# Principle points :

## Non-medical





# Principle points

## Non-medical

- Civil- Ceiling, Walls, Floor, Joints & Doors
- **Ventilation**- LAF, AHU, Temperature, Humidity, Air changes & Pressure control
- **Biomedical Waste disposal /Water treatment plant**
- Electrical, General lighting & Plumbing
- Scrub room & Sink
- Change Rooms/ Conveniences
- Emergency Measures

# **Main Operating Room-Principle points-**

## **Non-Medical**

### **CIVIL**



# CIVIL

Granite for walls/floor



Granite for walls/floor



# CIVIL

Walls with PUF paint



SS duct embedded in walls





# CIVIL

Coving with SS

Coving with granite



# CIVIL

Double Leaf Hermetically sealed

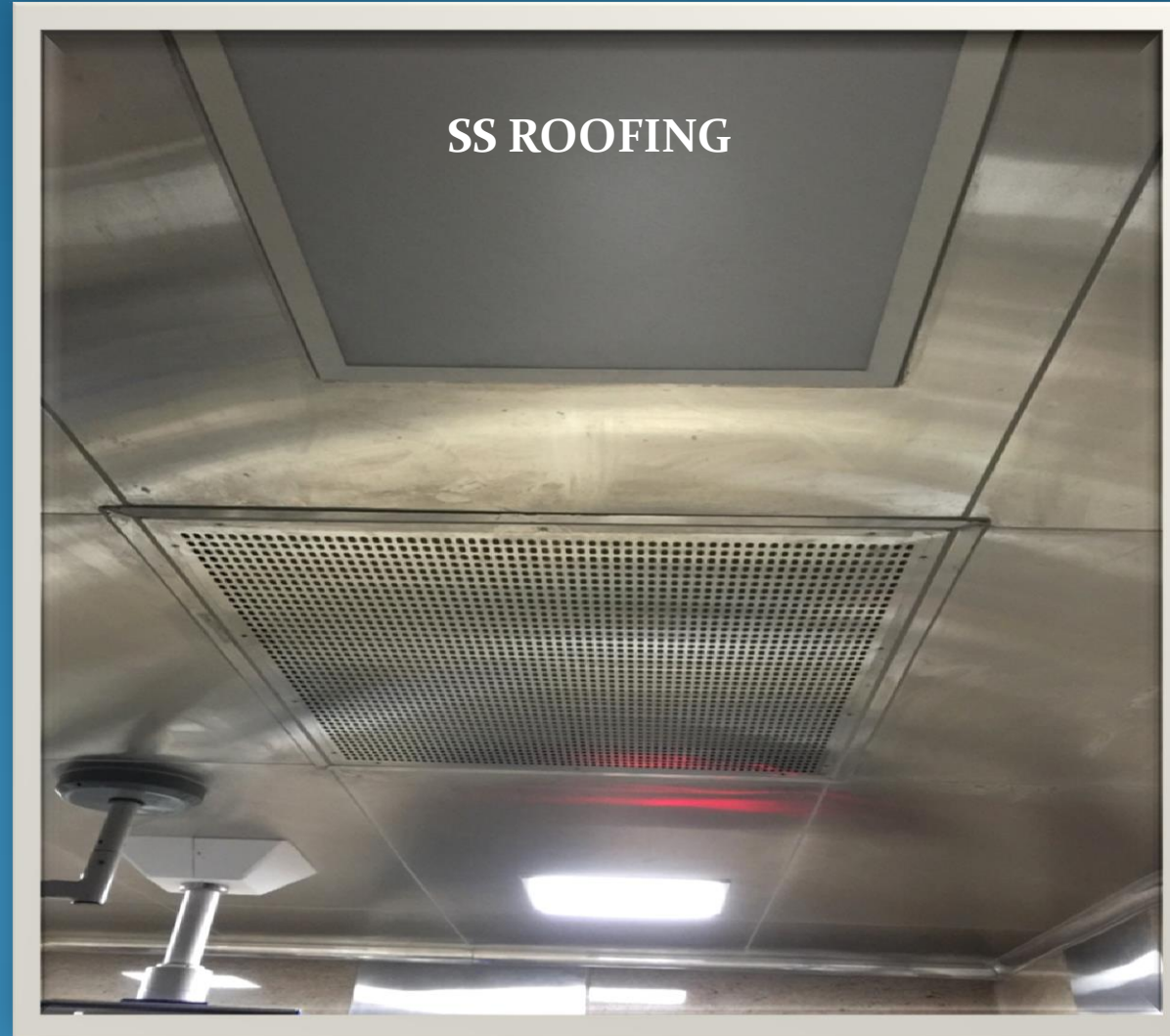


Single Leaf Hermetically sealed





# CIVIL



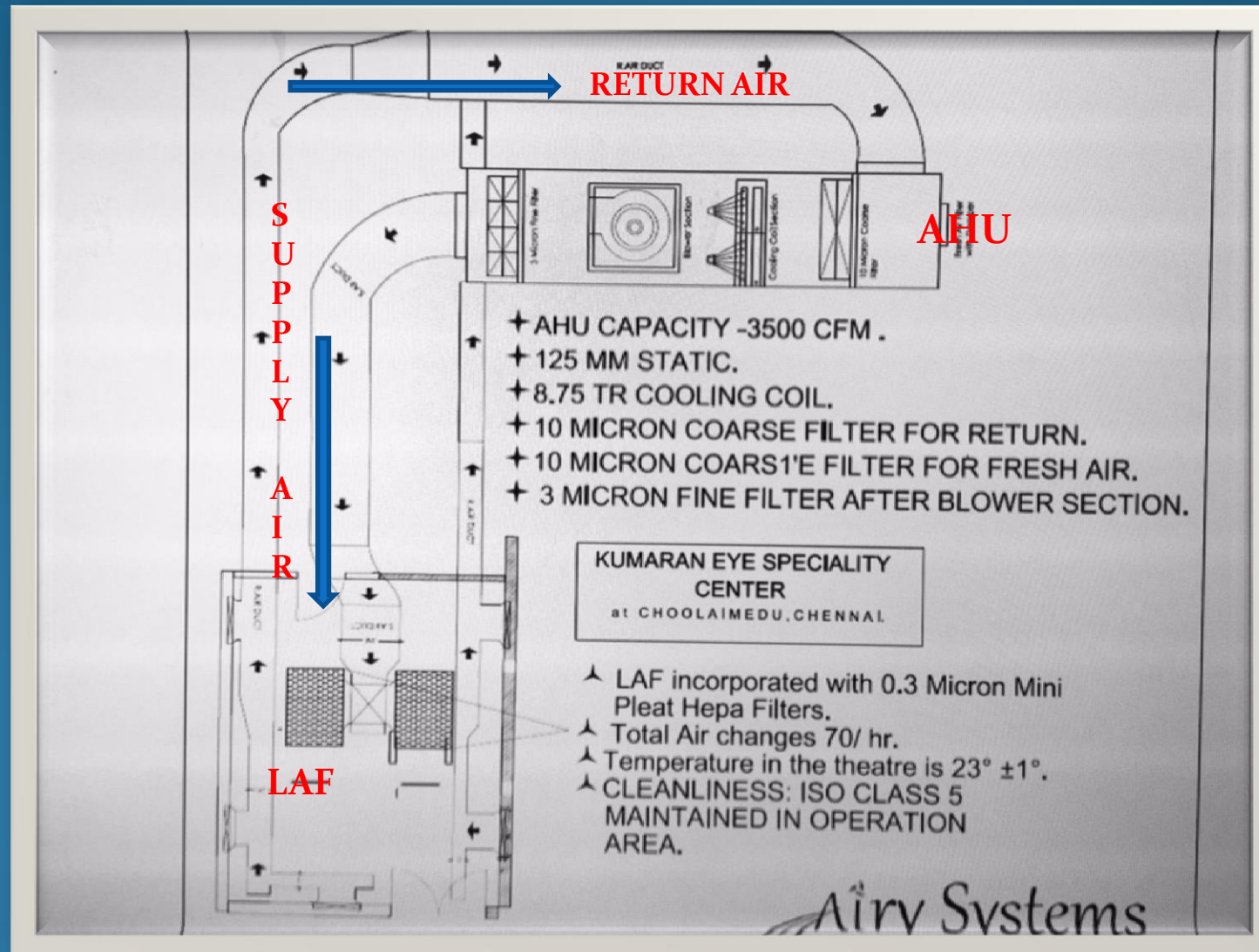
# Main Operating Room-Principle points- Non-Medical- Ventilation



# Ventilation- Standards

- Temperature: 21-23 degree C
- Humidity: 40-60%
- Positive pressure: 2.5 pascals
- Air Velocity: 25-35 fpm
- Air changes: 20/hr, 20% should be fresh air.
- Air quality: ISO class 6/class 1000
- Terminal HEPA filter should extend 1 feet around the operation site

# Ventilation – flow chart



# Ventilation- Components

Air Handling Unit(AHU)



AC Compressor



Laminar Air flow(LAF)





# Air Handling Unit(AHU)





# Principal Points

## Water quality



# ISO WATER QUALITY STANDARDS

**ASIAN ENVIRO LABS** Continuation Sheet . . .

SAMPLE NO: AEL/2016/3494      M/s SNOW WHITE (P) LTD      DATE: 01.02.16

S.No	Parameters	Requirement as per IS 10500-2012	Permissible limit in absence of alternate source	Results
1	Colour(TCU)	5	15	< 5
2	Odour	Agreeable	Agreeable	Agreeable
3	Conductivity	-----	-----	25 µs/cm
4	Turbidity, NTU	1	5	< 0.01
5	pH Value	6.5 to 8.5	-----	7.1
6	Total Dissolved Solids	500 mg/l	2000mg/l	16
7	Total Hardness (as CaCO <sub>3</sub> )	200 mg/l	600mg/l	4
8	Carbonate Hardness (as CaCO <sub>3</sub> )	-----	-----	4
9	Non Carbonate Hardness (as CaCO <sub>3</sub> )	-----	-----	< 1
10	Phenophtenlein Alkalinity (as CaCO <sub>3</sub> )	-----	-----	NIL
11	Total Alkalinity (as CaCO <sub>3</sub> )	200 mg/l	600mg/l	9
12	Calcium (as Ca)	75 mg/l	200mg/l	0.8
13	Magnesium (as Mg)	30 mg/l	100mg/l	0.4
14	Chloride (as Cl)	250 mg/l	1000mg/l	7.9
15	Sulphate (as SO <sub>4</sub> )	200 mg/l	400mg/l	2.4
16	Iron (as Fe)	0.3 mg/l	-----	< 0.01
17	Nitrate (No <sub>3</sub> )	45 mg/l	-----	< 0.1
18	Silica ( as SiO <sub>2</sub> )	-----	-----	< 1

\* Sample not drawn by Asian Enviro Labs  
 \*\* The results shown in the report is valid only to the sample and should not be reproduced in any case unless with a written approval from the company.

ANALYZED BY *A. Manikandan*

**ASIAN ENVIRO LABS**

D No. 325/3, Palayam Kall Street, Sola Palayam, Chennai - 600 043, Tamil Nadu.  
 Tel : 91-44-2364 2799 : 2364 2799 : Fax : 91-44-2364 2799

# RO WaterPlant



# Water Quality

## WATER QUALITY AT SOURCE

SAMPLE NO: AEL/2015/2168		M/s SNOW WHITE (P) LTD		DATE: 18.09.15
S.No	Parameters	Requirement as per IS 10500-2012	Permissible limit in absence of alternate source	Results
1	Colour(TCU)	5	15	< 5
2	pH Value	Unobjectable	Unobjectable	7.5
3	Total Dissolved Solids	500 mg/l	1000 mg/l	1355
4	Total Hardness (as CaCO <sub>3</sub> )	500 mg/l	1000 mg/l	724
5	Carbonate Hardness (as CaCO <sub>3</sub> )	500 mg/l	1000 mg/l	388
6	Non Carbonate Hardness	500 mg/l	1000 mg/l	336
7	Phenolphthalein Alkalinity	75 mg/l	100 mg/l	NIL
8	Total Alkalinity	300 mg/l	500 mg/l	388
9	Sulphate (as SO <sub>4</sub> )	200 mg/l	400 mg/l	120
10	Iron (as Fe)	0.3 mg/l	-----	< 0.01
11	Nitrate (No <sub>3</sub> )	45 mg/l	-----	4
12	Silica ( as SiO <sub>2</sub> )	-----	-----	36

\* Sample not drawn by Asan Enviro Labs  
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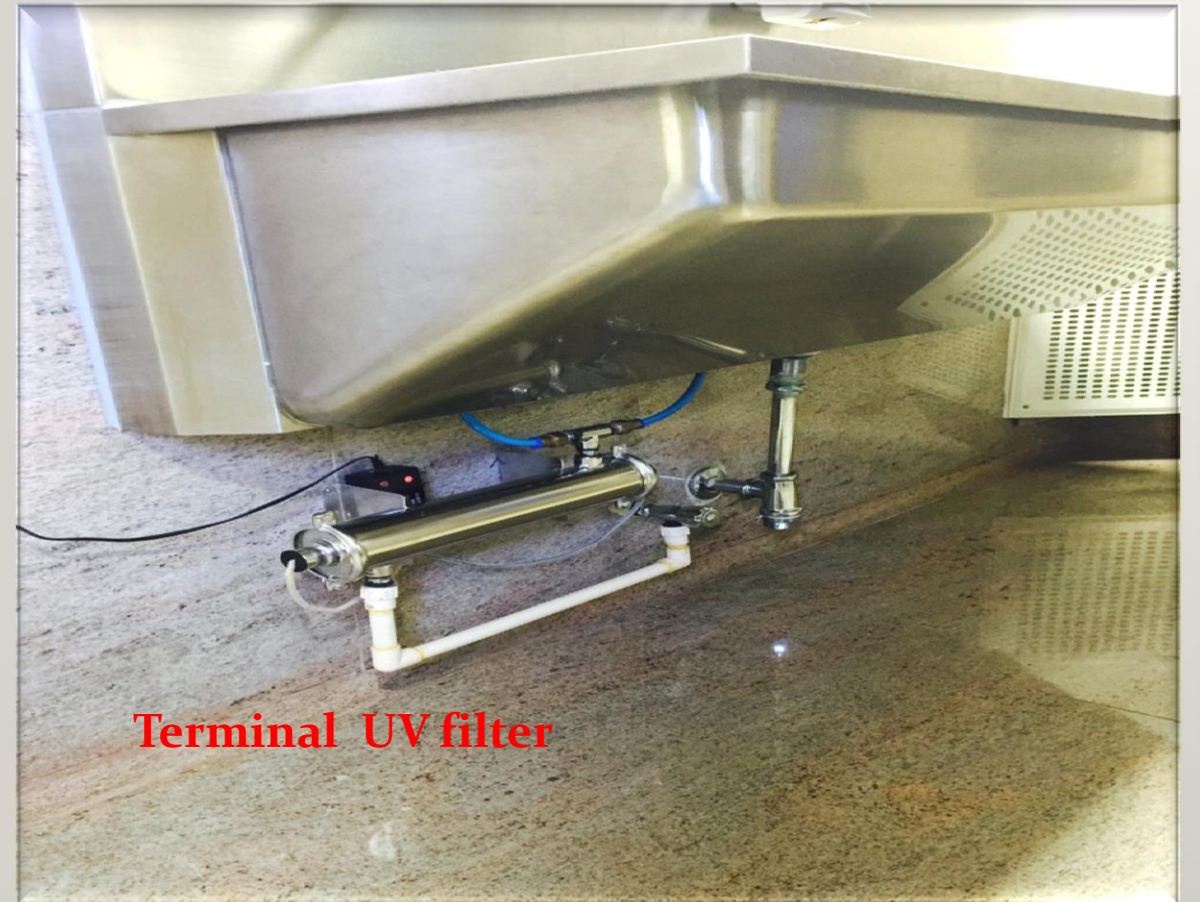
## WATER QUALITY AFTER RO

SAMPLE NO: AEL/2016/3494		M/s SNOW WHITE (P) LTD		DATE: 01.02.16
S.No	Parameters	Requirement as per IS 10500-2012	Permissible limit in absence of alternate source	Results
1	Colour(TCU)	5	15	< 5
2	pH Value	Agreeable	Agreeable	7.1
3	Total Dissolved Solids	500 mg/l	1000 mg/l	16
4	Total Hardness (as CaCO <sub>3</sub> )	500 mg/l	1000 mg/l	4
5	Carbonate Hardness (as CaCO <sub>3</sub> )	500 mg/l	1000 mg/l	4
6	Non Carbonate Hardness (as CaCO <sub>3</sub> )	500 mg/l	1000 mg/l	< 1
7	Phenolphthalein Alkalinity	75 mg/l	100 mg/l	NIL
14	Chloride (as Cl <sup>-</sup> )	250 mg/l	1000 mg/l	7.9
15	Sulphate (as SO <sub>4</sub> )	200 mg/l	400 mg/l	2.4
16	Iron (as Fe)	0.3 mg/l	-----	< 0.01
17	Nitrate (No <sub>3</sub> )	45 mg/l	-----	< 0.1
18	Silica ( as SiO <sub>2</sub> )	-----	-----	< 1

\* Sample not drawn by Asan Enviro Labs  
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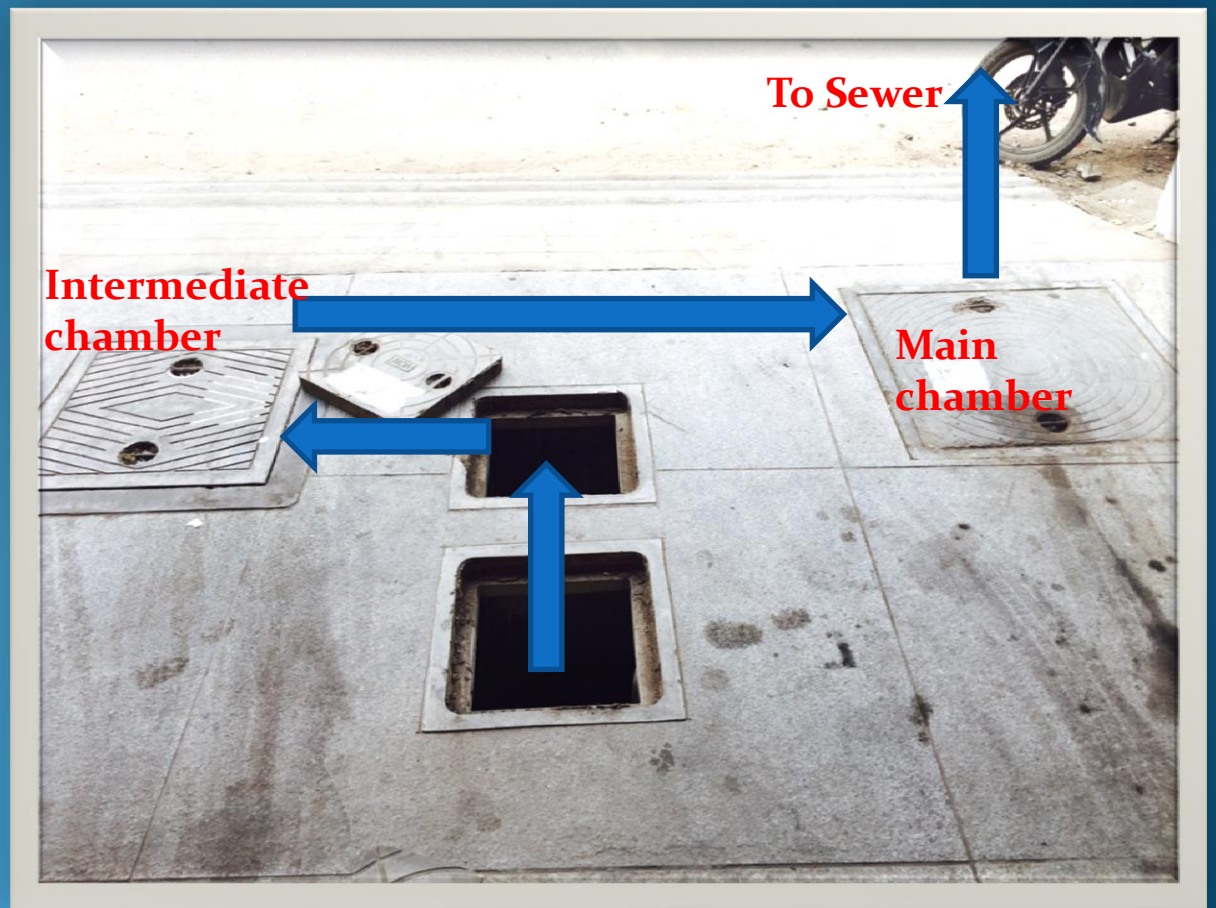
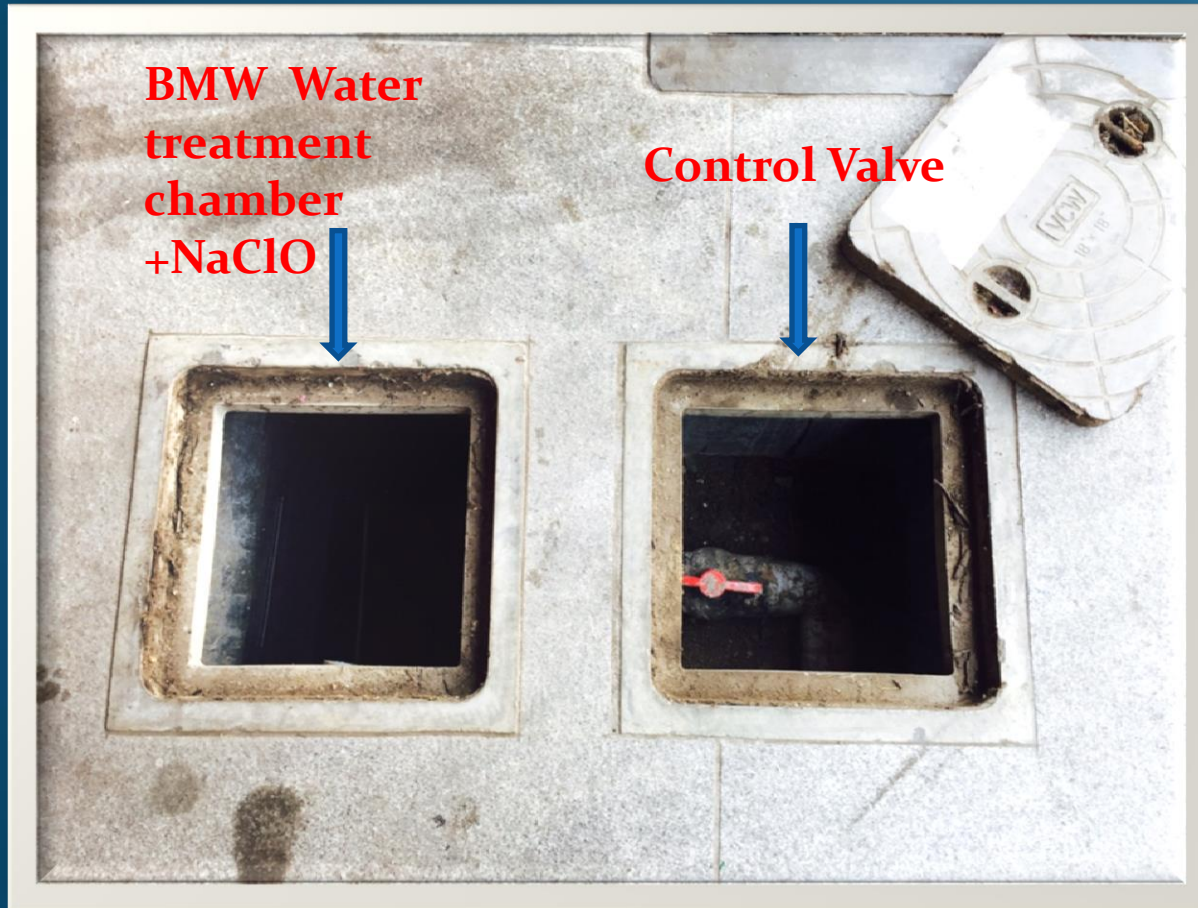
# Water: Scrub Room



Terminal UV filter



# BMW- Water treatment



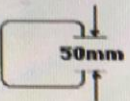
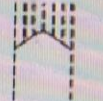
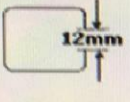
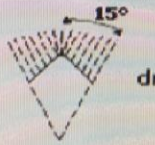
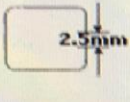
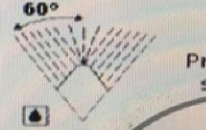
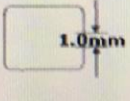

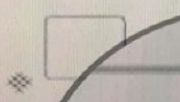
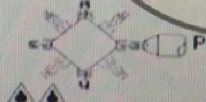
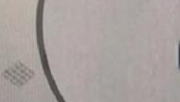
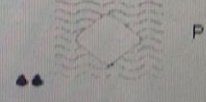
# Principle points- Non-Medical Electrical



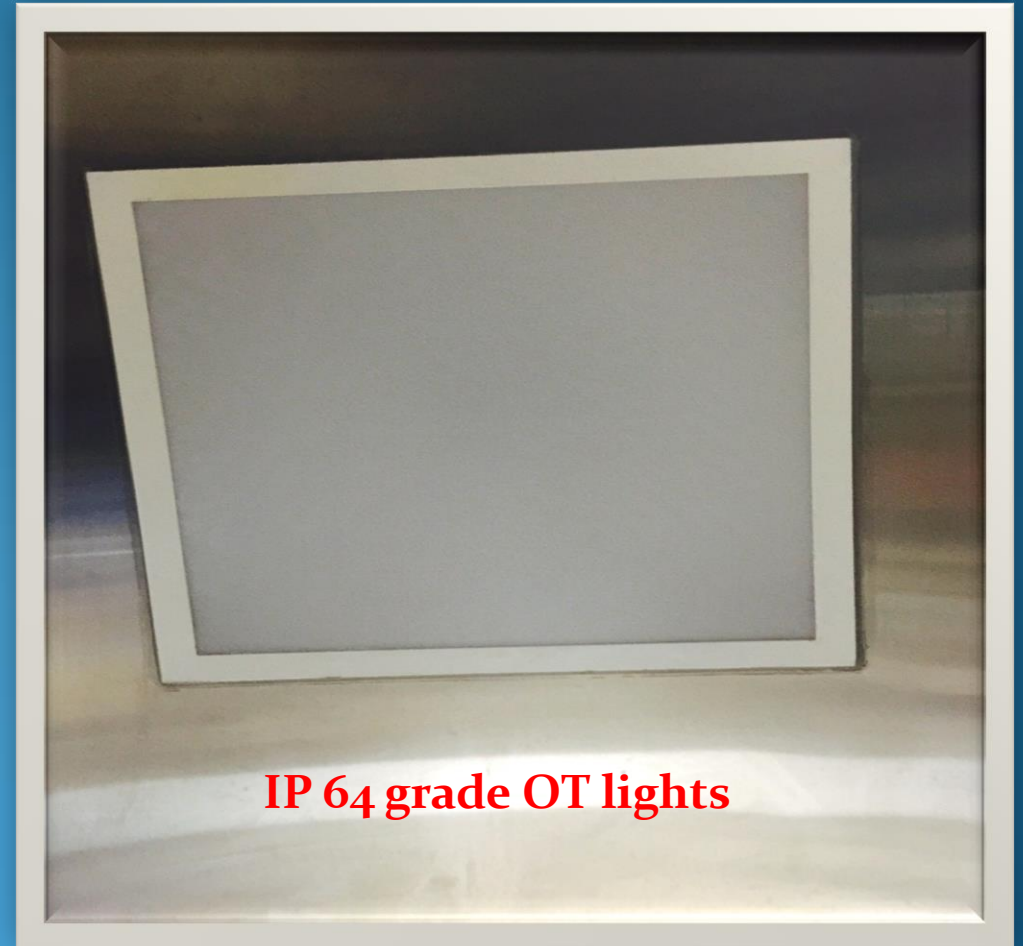
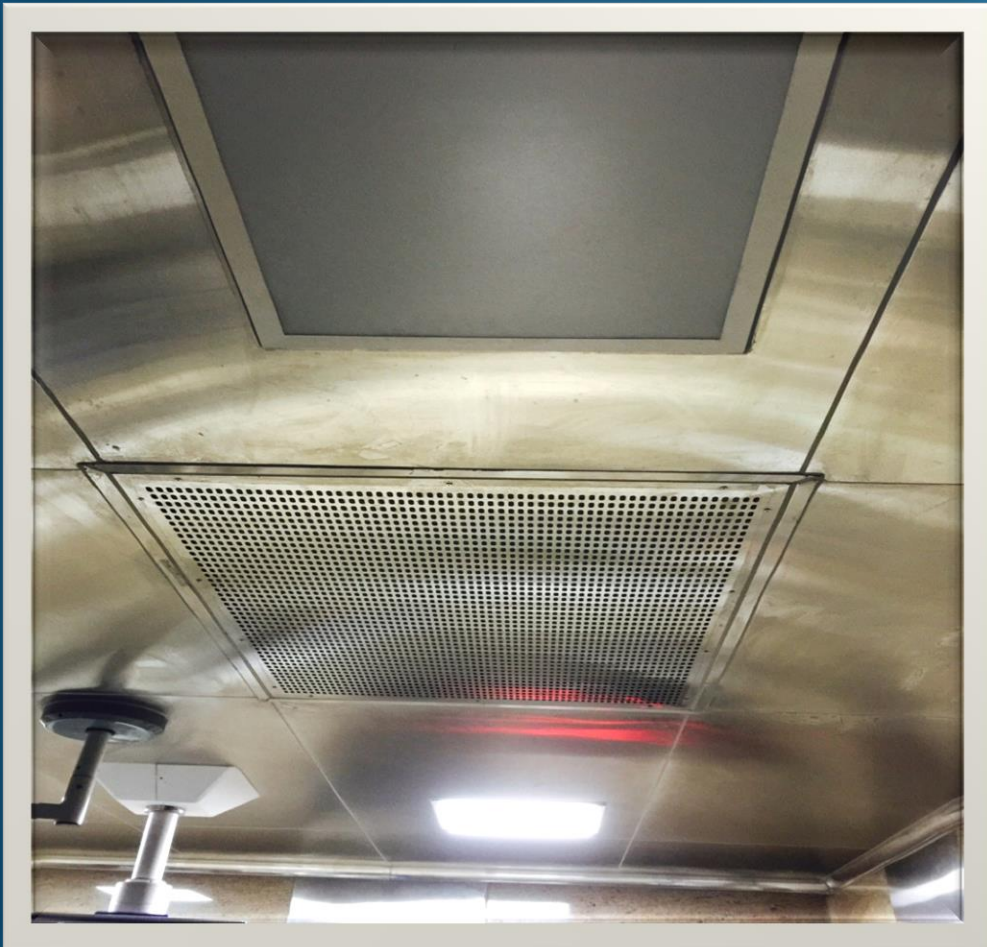
# Electrical

- General lighting
- Surgical Lighting
- Surgical Recording
- Lighting intensity
- Emergency power
- Electrical Load
- Electrical wiring
- Communication

# IP (Ingress protection ) Ratings for lights used in Operation theatres

1st Digit	Protection from solid objects	2nd Digit	Protection from moisture
0	Non protected	0	Non protected
1	 Protected against solid objects greater than 50mm	1	 Protected against dripping water
2	 Protected against solid objects greater than 12mm	2	 Protected against dripping water when tilted up to 15°
3	 Protected against solid objects greater than 2.5mmØ	3	 Protected against spraying water
4	 Protected against solid objects greater than 1.0mmØ	4	 Protected against splashing water
5		5	 Protected against water jets
6	 Dust tight	6	 Protected against heavy seas

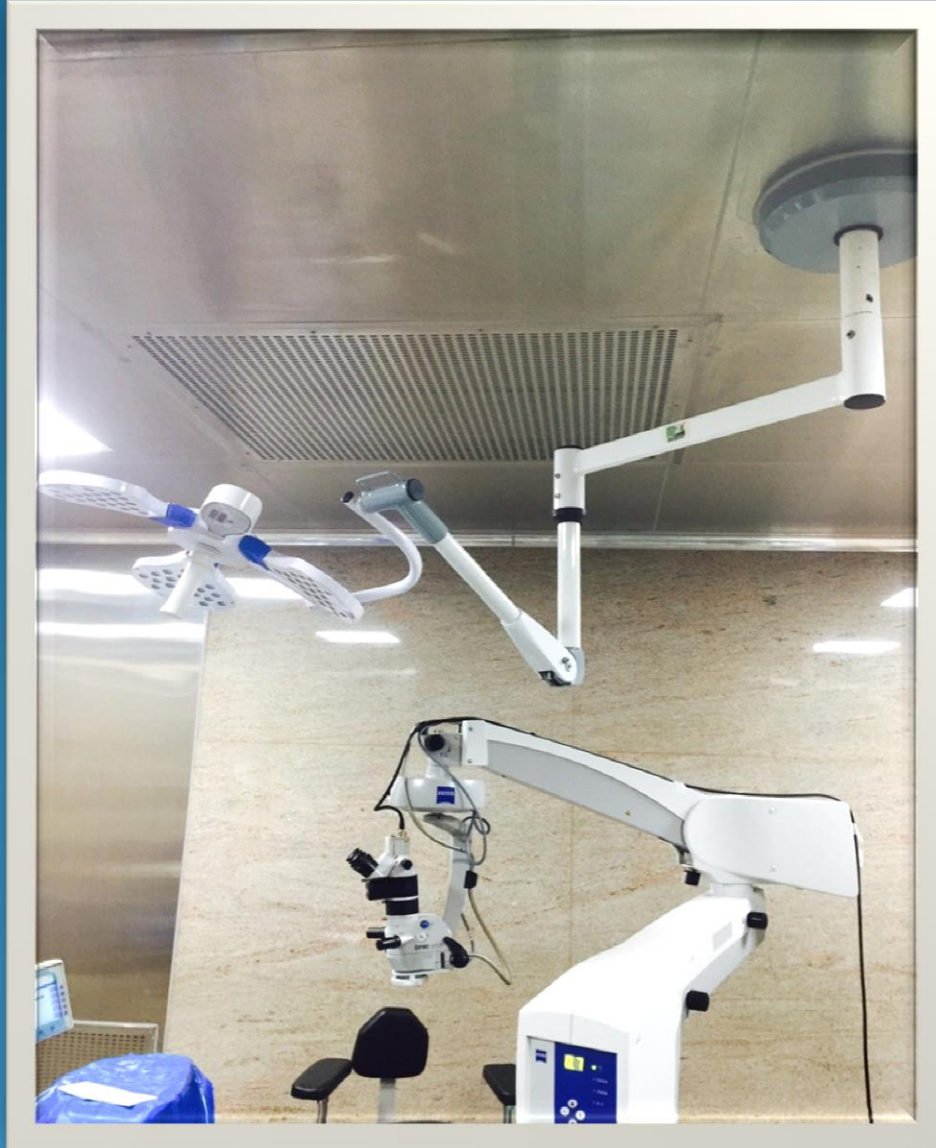
# Electrical: General Lighting



IP 64 grade OT lights

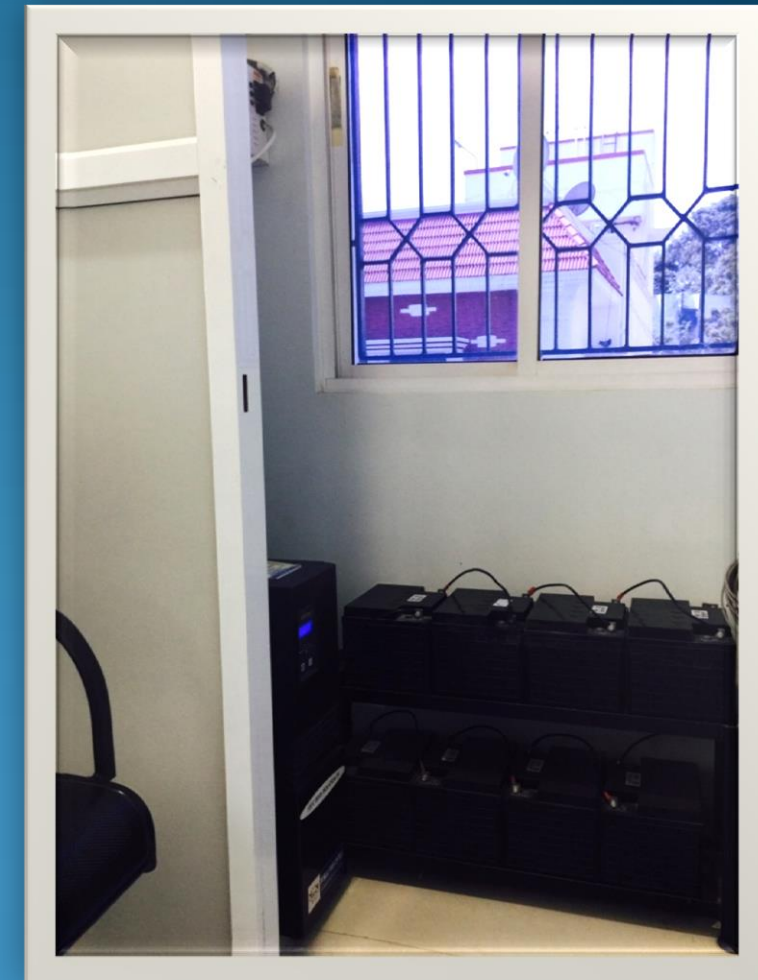


# Electrical-Surgical Lighting





# Electrical-Alternate power sources



# Surgical Recording/Communication Surgeon Panel





# Surgical Recording/Communication: Surgeon Panel



# Surgical Recording/Communication Surgeon Panel





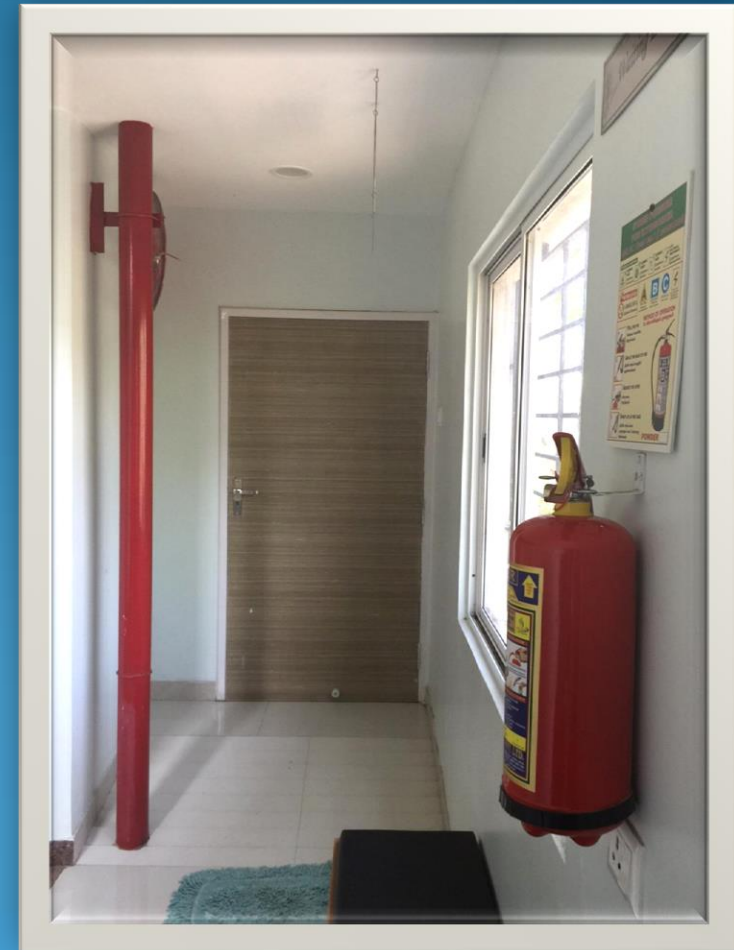
# Electrical Load & Wiring

- Phaco machine+Vit+ Microscope
- Operating Table+Chair
- Boyles+NIBP
- Electrocautery
- Surgeon Panel instruments
- Green Laser
- Heat resistant+ Flame retardant wires
- Anti-rodent and anti-termite wires
- Proper casing for electrical conduit

# Conveniences



# Emergency -Fire





# Manifold, Anesthetic Pendant

PENDANT



MANIFOLD



MEDICAL GAS  
COMPRESSOR+FILTER





# OT VALIDATION

**TRUE AIRE CONCEPTS Private Limited**  
Testing and Certification Services  
Cleanrooms and Mini Environments

14th Avenue, Banu Nagar  
Pudur, Ambattur, Chennai - 600 054  
Ph No. +91 95000 25554  
Fax No. +91 044 2638 4022  
Email: info@trueaire.com  
U29253TN2010PTC0775

## TEST REPORT OF AIR VELOCITY TEST

TEST REPORT REFERENCE: TACPL / AV / 05 B - 1 / 03 Page 1 of 1

CLIENT: M/s. Kumaran Eye Speciality

SITE: Choolaimedu

AREA / EQUIPMENT UNDER TEST: Operation Theater (Opth)

DATE OF TESTING: 05.03.2016

TESTED BY: [Signature] True Air Concepts Pvt. Ltd.

IN THE PRESENCE OF: [Signature]

**Details of Test Equipments Used**  
Vane Type Anemometer of make "KUSAM" make having Serial number 12000050 Calibrated on 24/11/2015 and Calibration Valid up to 24/11/2016 vide calibration certificate No. 2015-16/NCS/663 Dt. 24.11.2016 of M/s. Nagman Instruments & Electronics Pvt. Ltd.

**Results of measurement at the Grille face (Supply Air):**

Location	Grille Ref.	Velocity readings in fpm					Average velocity in fpm	Eff. Filtration Area (Sq. ft.)	Airflow Rate in CFM	Total CFM
		V1	V2	V3	V4	V5				
Operation Theater (Opth)	S-1	177	163	154	159	159	162	11.14	1809	3683
	S-2	177	168	163	168	165	168	11.14	1874	

**Results of measurement at the Grille face (Return Air):**

Location	Grille Ref.	Velocity readings in fpm					Average velocity in fpm	Eff. Filtration Area (Sq. ft.)	Airflow Rate in CFM	Total CFM
		V1	V2	V3	V4	V5				
Operation Theater (Opth)	R-1	189	339	180	247	180	247	3.11	766	323
	R-2	270	185	210	145	173	170	3.11	536	
						170	171	3.11	532	
						242	3.11	751		

**Summary:**

Total Supply	3683	CFM	✓
Total Return	3238	CFM	✓
Room Volume	3121	in Cubic feet	
Total Air Change	71		
Fresh Air Flow	446	✓	14.89 v/h
Fresh Air Flow	9	✓	

for and on behalf of: [Signature] True Air Concepts Pvt. Ltd.

**TRUE AIRE CONCEPTS Private Limited**  
Testing and Certification Services  
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14th Avenue, Banu Nagar  
Pudur, Ambattur, Chennai - 600 054  
Ph No. +91 95000 25554  
Fax No. +91 044 2638 4022  
Email: info@trueaire.com  
U29253TN2010PTC0775

## TEST REPORT OF TEMPERATURE AND RH LEVEL

TEST REPORT REFERENCE: TACPL / TRH / 05 F - 1 / 03 Page 1 of 1

CLIENT: M/s. Kumaran Eye Speciality

SITE: Choolaimedu

AREA / EQUIPMENT UNDER TEST: Operation Theater (Opth)

DATE OF TESTING: 05.03.2016

TESTED BY: [Signature] True Air Concepts Pvt. Ltd.

IN THE PRESENCE OF: [Signature] True Air Concepts Pvt. Ltd.


**Details of equipment used**  
Temperature Humidity Meter of "KUSAM - MECO" make having Serial number 12000061 calibrated on 31.07.2015 and valid up to 31.07.2016 vide calibration certificate No. 2015-16/NCS / 324 dated 31.07.2015 of M/s. Nagman Instruments & Electronics (P) Ltd.

**Temperature and RH Level**

Location	Temperature (deg C)	Humidity (%)
1	23.5	60.8
2	22.6	60.5
3	23.1	60.5
4	22.8	60.5
5	22.4	60.5
6	22.1	60.5
7	22.2	62.3
8	22.5	60.4
9	22.4	60.9
Average Temperature (deg C)	22.62	Average RH

for and on behalf of: [Signature] True Air Concepts Pvt. Ltd.

# OT VALIDATION

  
**TRUE AIRE CONCEPTS Private Limited**  
Testing and Certification Services  
Cleanrooms and Mini Environments

Registered Office :  
No. 3, 14th Avenue, Banu Nagar,  
Pudur, Ambattur, Chennai - 600 052  
Ph No. +91 95000 25554  
Fax 044 2638 4022  
E-mail info@trueaire.com  
CIN U29253TN2010PTC07753

**DIFFERENTIAL PRESSURE TEST**

TEST REPORT REFERENCE: TACPL / DP / 05 E-1 / 03-16 Page 1 of 1

CLIENT: M/s. Kumaran Eye Speciality Centre

SITE: Kumaran Eye Speciality Centre

AREA / EQUIPMENT UNDER TEST: Operation Theatre (Optha) to Corridor

DATE OF TESTING: 05.03.2016

TESTED BY: Mr. Abdul Rasheeth of M/s. True Aire Concepts Pvt. Ltd.

IN THE PRESENCE OF: M/s. Sivakumar of M/s. Airy systems


DETAILS OF EQUIPMENT USED: Differential Manometer of "Waco" make having Serial number 150021 calibrated on 21.01.2016 and valid up to 21.01.2017 vide calibration certificate No. 2015-01-01.2016 of M/s. Nagman Instruments & Co.


Room Name: Pressure in mmWg

Pressure in Pa: 10

For and on behalf of True Aire Concepts Private Limited.

K. Ojha  
Authorised Signatory



  
**TRUE AIRE CONCEPTS Private Limited**  
Testing and Certification Services  
Cleanrooms and Mini Environments

Registered Office :  
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CIN U29253TN2010PTC07753

**FILTER INTEGRITY TEST USING AEROSOL**

TEST REPORT REFERENCE: TACPL / FI / 05 C-1 / 0

CLIENT: M/s. Kumaran Eye Speciality Centre

SITE: Kumaran Eye Speciality Centre

EQUIPMENT/AREA UNDER TEST: Operation Theatre (Optha) to Corridor

DATE OF TESTING: 05.03.2016

TESTED BY: Mr. Abdul Rasheeth of M/s. True Aire Concepts Pvt. Ltd.

IN THE PRESENCE OF: Mr. Sivakumar of M/s. Airy Systems.

**DETAILS OF THE TESTING EQUIPMENT USED**  
"TEC Services, Inc., USA", Model No. PH 5 "Aerosol Photometer" having Serial number 1444 calibrated on 06.05.2015 and valid up to 06.05.2016 vide Calibration certificate No. TEC5/TAC of M/s. Gulati Enterprises, Bangalore.  
2. Laskin Nozzle PAO generator.


**FILTER INTEGRITY TEST PROCEDURE**  
The filter under test is challenged with an aerosol produced by mixing the output of the Laskin nozzle PAO generator with ambient air resulting in an upstream aerosol PAO concentration of around 10 mcg / lit. The compressed air pressure is maintained at 20 psi. The test is conducted at the operating air flow volume of the equipment under test. 100% and 0% settings are done on the photometer for the relevant aerosol and the filter is scanned for leaks. The maximum allowable leak is 0.000%.

Results of measurement at the Hepa Filter


Location	Filter Ref	Upstream concentration mic.gms/lit	Upstream concentration	Leakage %	Test Result
Operation Theater (Optha)	F1	24		0.000%	Passed
	F2	24		0.000%	Passed

For and on behalf of True Aire Concepts Private Limited.

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# OT VALIDATION



**TRUE AIRE CONCEPTS**  
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U29253TN2010PTC07753

## REPORT OF PARTICLE COUNT TEST

TEST REPORT REFERENCE	ACPL / LPC / 05 A - 1 / 03-16
CLIENT	M/s. Kumaran Eye Speciality Centre
SITE	Medu
AREA / EQUIPMENT UNDER TEST	Concepts
DATE OF TESTING	
TESTED BY	
IN THE PRESENCE OF	Mr. Sivakumar - Air Systems
CLASS LEVEL TESTED FOR	ISO Class 5 for 0.3 micrometer & 0.5 micrometer particles in "At Rest" condition as per ISO 14644-1.
DETAILS OF PARTICLE COUNTER USED	Airborne Particle Counter of make "METONE, USA" Model 3313 bearing SI.No.020701027 with certification No.01/03/2016 issued on to provide Calibration certificate for Model 3313, issued by Gulati Enterprises, Bangalore.

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### 0.3microns

COMPILATION OF DATA AND CALCULATIONS					
Location Ref.	Particles per CuM for 0.3 Micrometer Particles				
	1	2	3	4	
OT1 F-1	686	446	485	346	
OT1 F-2	519	350	727	489	658

Average  
Particles  
per CuM

=

524

### 0.5microns


Location Ref.	Particles per CuM for 0.5 Micrometer Particles				
	1	2	3	4	
OT1 F-1	0	0	0	0	
OT1 F-2	0	0	0	0	

7

+

0

*Required is only class 6 & below*  
*(ie 1 CF of air. < 1000)*  
*measurly 20.5%*



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Continuation Sheet

ANNEXURE TO THE PARTICLE COUNT TEST REPORT TACPL / LPC / OS A - 1 / 03-16										Page 2 of 2		
Location	No. Of Locations	T - Factor	0.3 micrometer particulate concentration				Ref Value	0.5 micrometer particulate concentration				Ref Value
			Mean	SD	SE	95% UCL	0.3 mic	Mean	SD	SE	95% UCL	0.5 mic
OT1 F-1	5	2.1	524	144	65	660	10200	7	16	7	22	3520
OT1 F-2	5	2.1	549	148	66	688	10200	0	0	0	0	3520

STUDENT'S "T" FACTOR FOR 95% UCL

Y	2	3
6.3		

ISO-14644

Number	0.3 mic	0.5 mic	1 mic
ISO class 1			
ISO class 2	10	4	
ISO class 3	102	35	
ISO class 4	1020	352	8
ISO class 5	10200	3520	83
ISO class 6	102000	35200	83
ISO class 7		352000	83
ISO class 8		3520000	83
ISO class 9		35200000	83

For and on behalf of

Abbreviation

SD = Standard deviation

SE = Standard Error

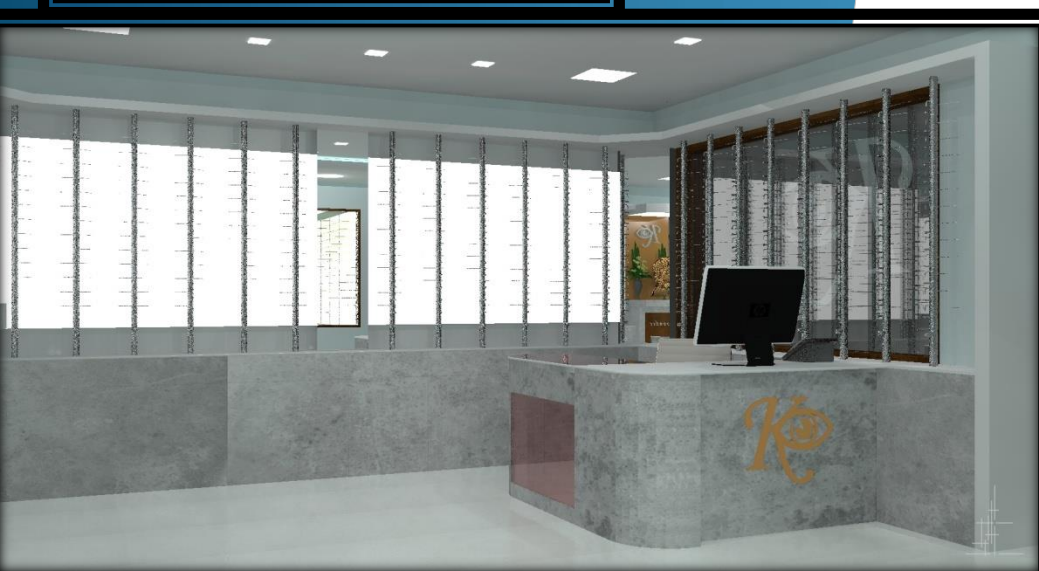
UCL = Upper concentration Limit

Formulae:-

SE = SD / SQUARE ROOT(No. of Location)

95% UCL = Mean + ( T.Factor x SE )







**Finally**  
Thank you

