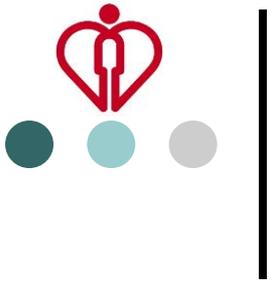


Operating theatre ventilation: *Design Considerations*

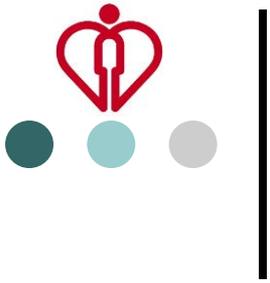
P L Yuen
Senior Manager
Hospital Authority



The Past

The Chinese approach by boiling of vinegar to sterilize a room area

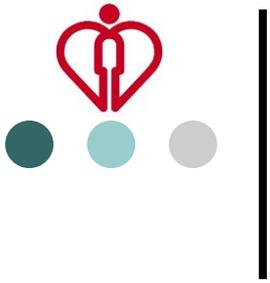




The Past

Still seen during SARS period

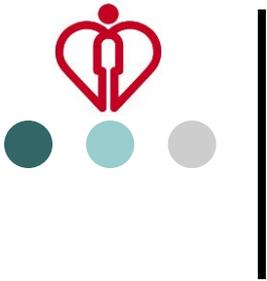




The Past

Using carbonic acid back in 1866 to disinfect the space when performing surgery





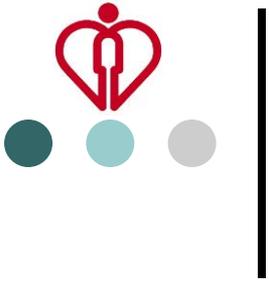
The Evolution

Evolving into modern operating theatre design referring to clean room requirements for the pharmaceutical industry

Federal Standard 209D classification based on the number of particles 0.5µm per cubic foot of air

Class	Max. number of particles/cubic ft				
	0.1µm	0.2µm	0.3µm	0.5µm	5µm
1	35	7.5	3	1	NA
10	350	75	30	10	NA
100	NA	750	300	100	NA
1 000	NA	NA	NA	1 000	7
10 000	NA	NA	NA	10 000	70
100 000	NA	NA	NA	100 000	700





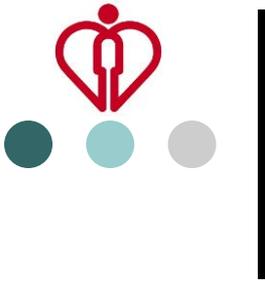
The Ventilation Functions

Control space temperature and humidity

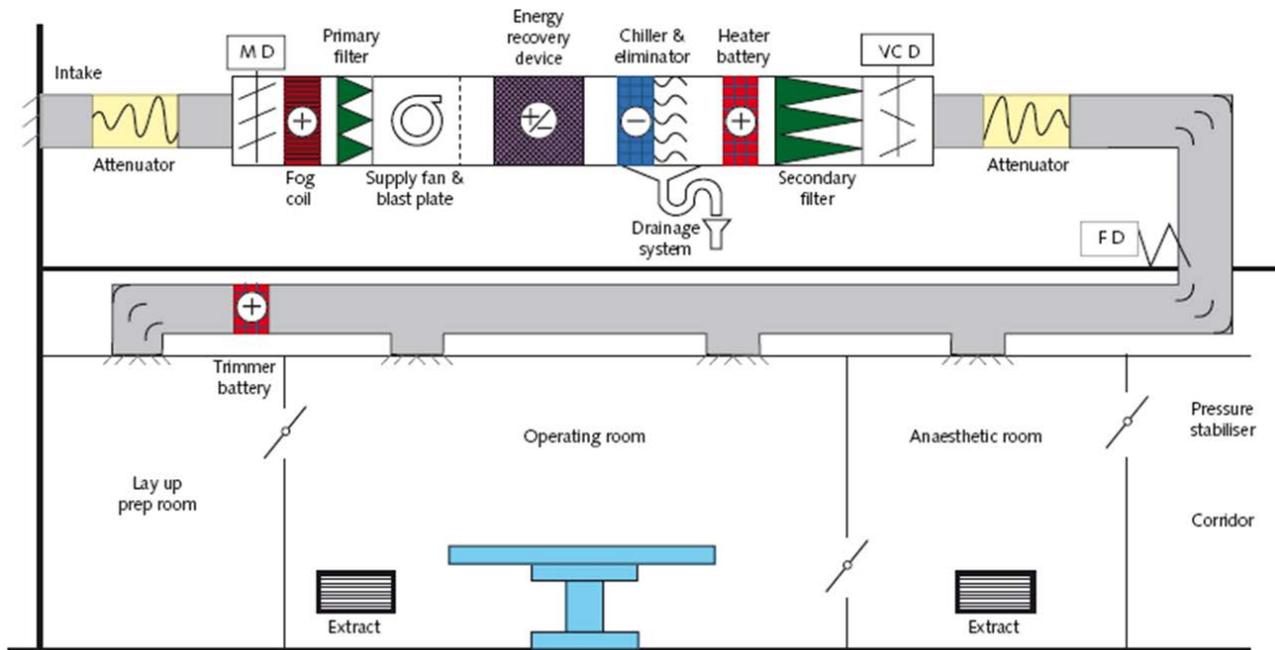
Remove and dilute waste anaesthetic gas

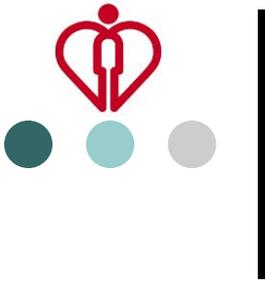
Avoid airborne bacterial contamination

Minimize transfer of airborne bacteria from less clean to cleaner area



Control Space Temperature and Humidity

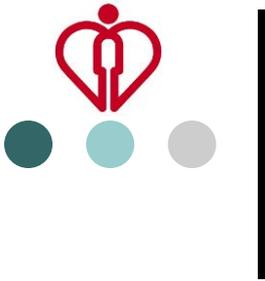




Remove and Dilute Waste Anaesthetic Gas

Greater than 15 air change per hour

ACH	Minutes required for a removal efficiency of:		
	90%	99%	99.9%
1	138	276	414
2	69	138	207
3	46	92	138
4	35	69	104
5	28	55	83
6	23	46	69
7	20	39	59
8	17	35	52
9	15	31	46
10	14	28	41
11	13	25	38
12	12	23	35
13	11	21	32
14	10	20	30
15	9	18	28
16	9	17	26
17	8	16	24
18	8	15	23
19	7	15	22
20	7	14	21
25	6	11	17
30	5	9	14
35	4	8	12
40	3	7	10
45	3	6	9
50	3	6	8

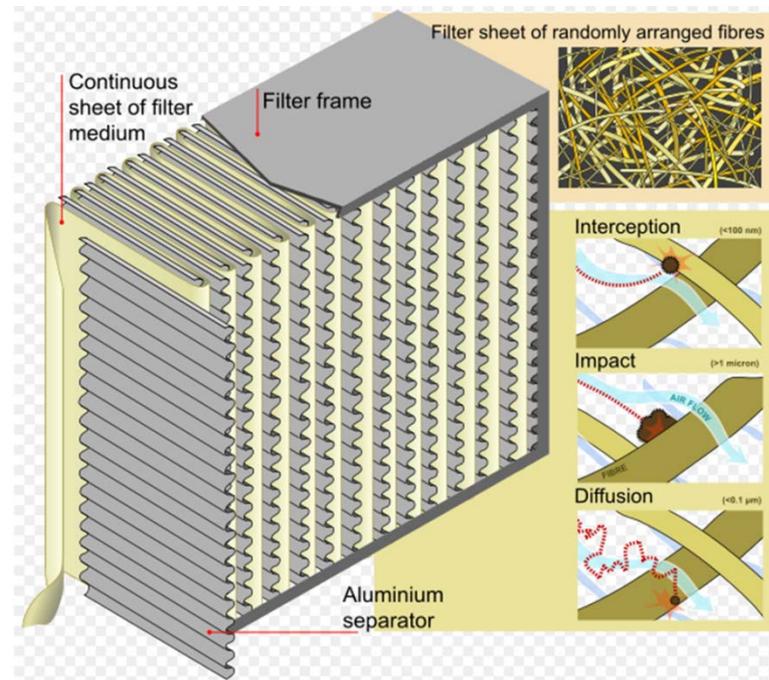
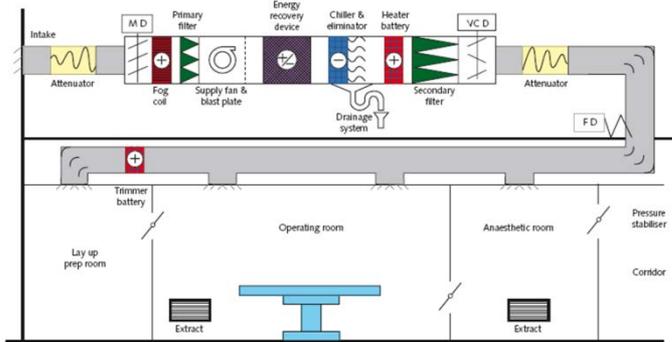


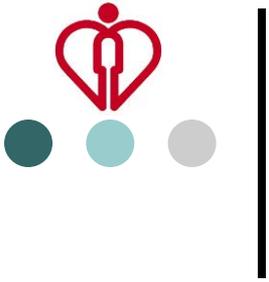
Avoid Airborne Bacterial Contamination

Greater than 15 air change per hour

HEPA filter installation at supply terminal

Positive ventilation at 25 Pascal pressure gradient

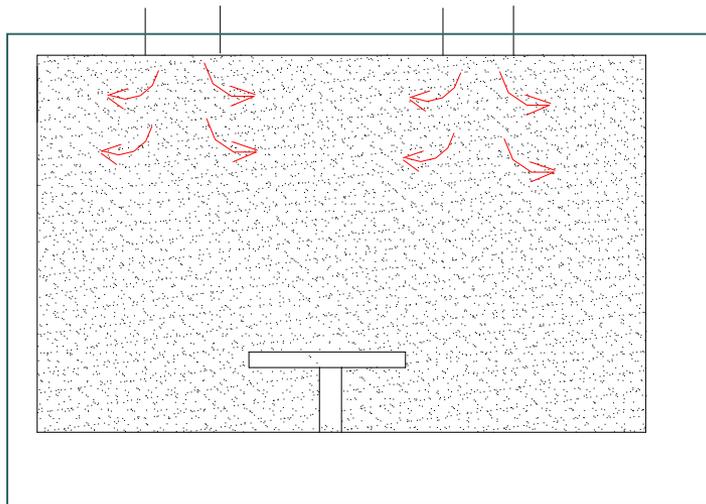




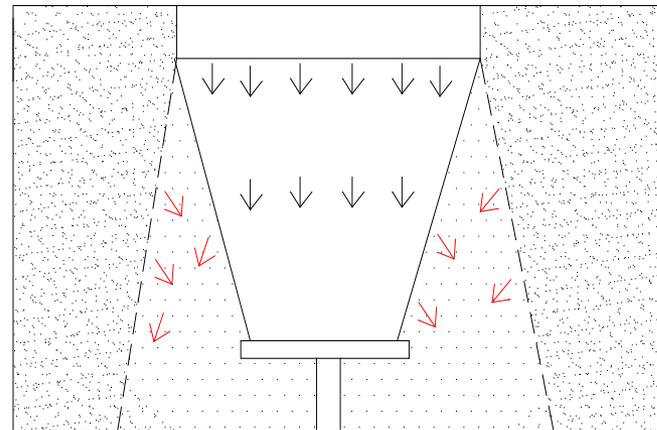
Minimize Transfer of airborne bacteria from less clean to cleaner area

Positive ventilation at 25 Pascal pressure gradient

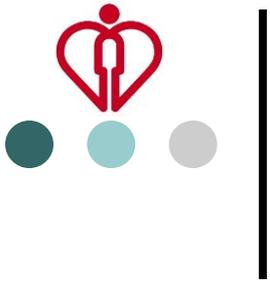
Control air velocity at operating area by installing OT ceiling



Ceiling diffusers, Mixing Flow



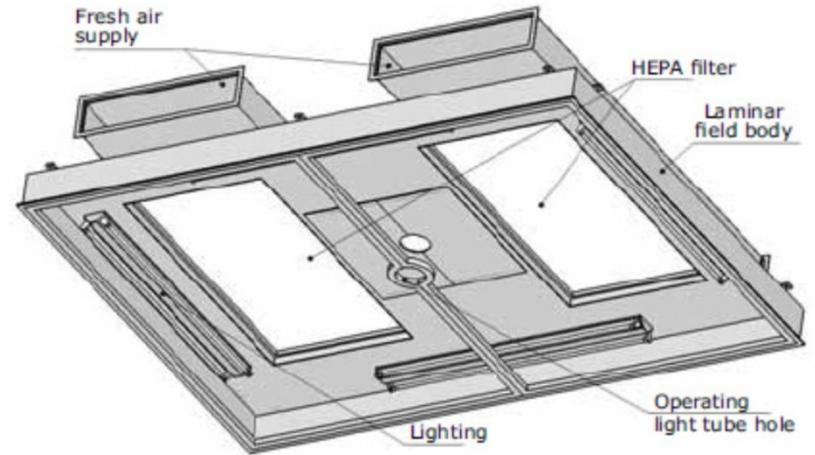
O.T. Ceiling, Laminar Flow outlet

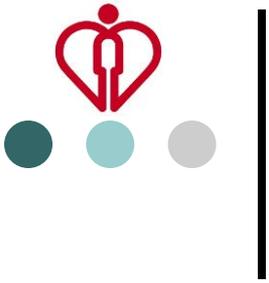


Laminar OT Ceiling

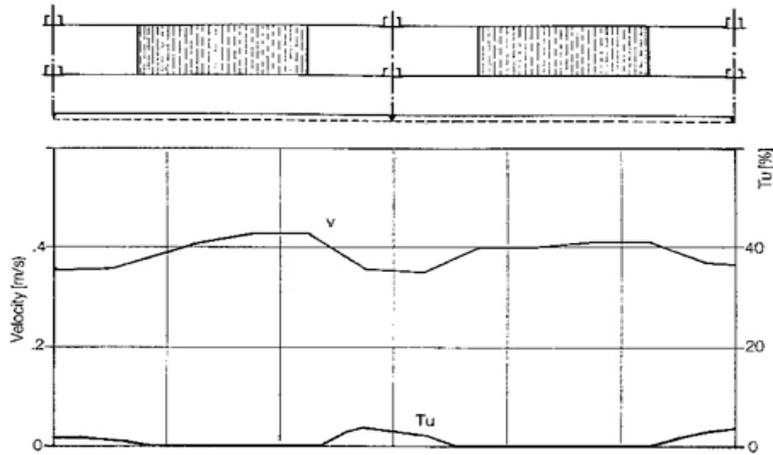


OT Ceiling

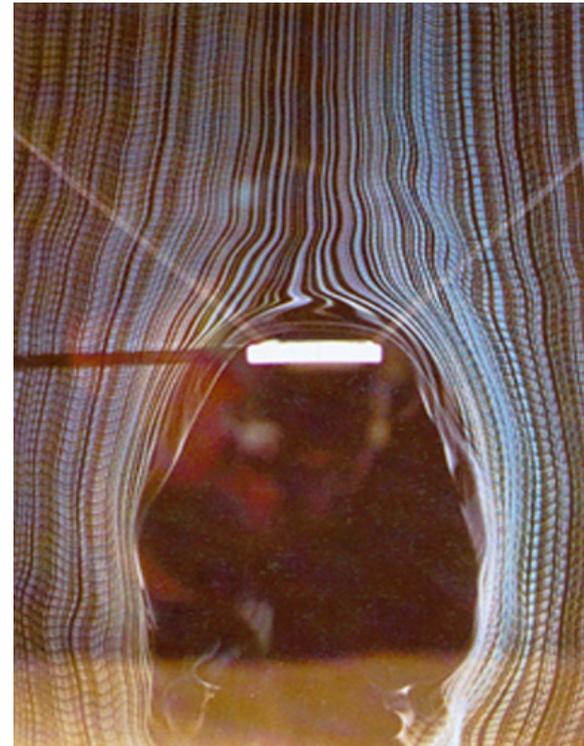




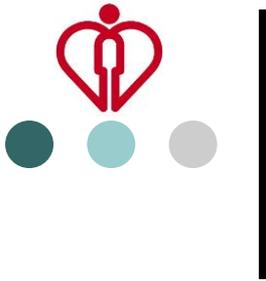
Laminar OT Ceiling



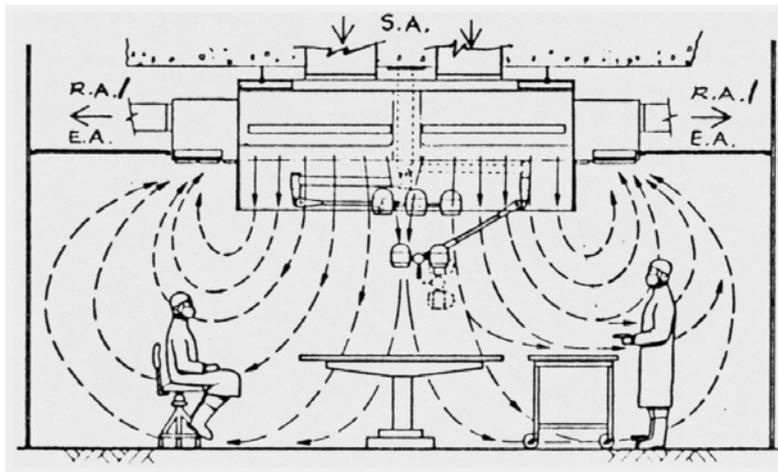
One piece outlet framework



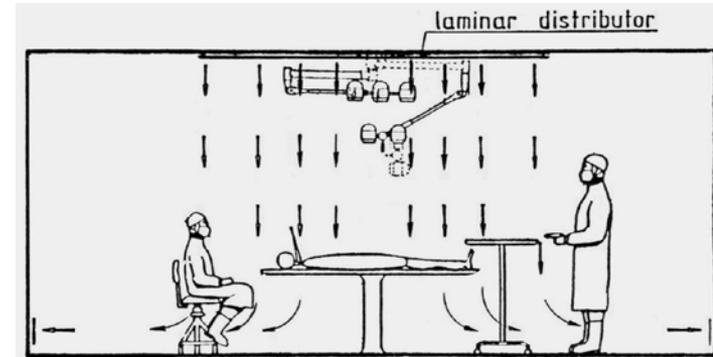
Laminar Flow



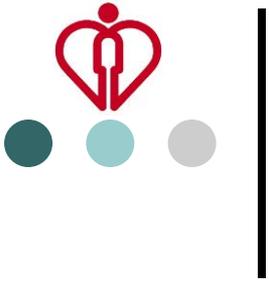
Ventilation Exhaust Location



Arrangement that should be avoided



Suggested arrangement



Ventilation Testing & Commissioning

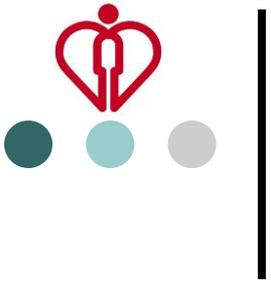
Particle count to achieve class 100 (Federal Standard 209D) or better

Velocity Uniformity Test

Smoke Test

Pressure differential test

BCP Test by end user



Ventilation Testing & Commissioning

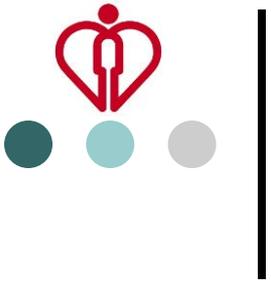


O.T. 6

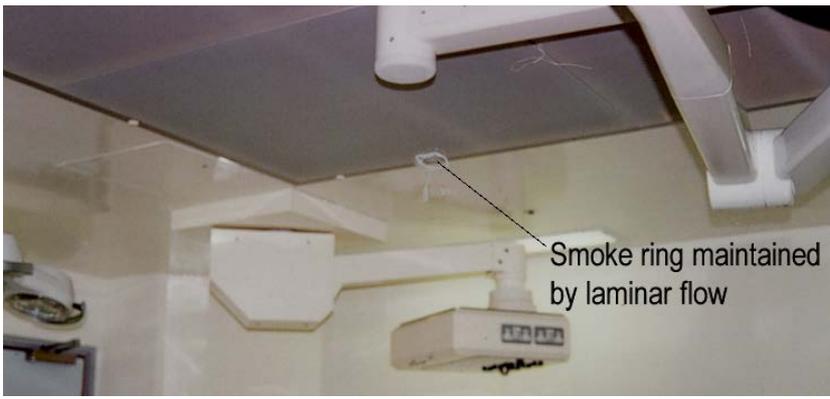


O.T. 8





Ventilation Testing & Commissioning

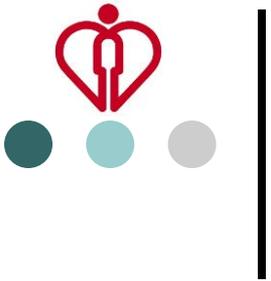


O.T. 7



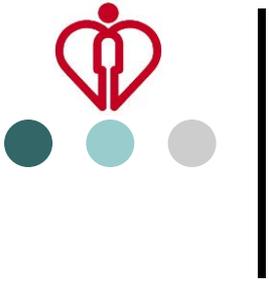
O.T. 3





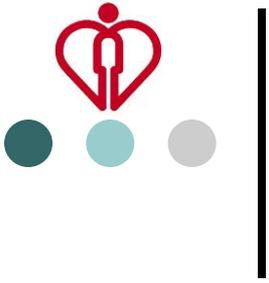
Ventilation Testing & Commissioning





Ventilation Testing & Commissioning





Thank You