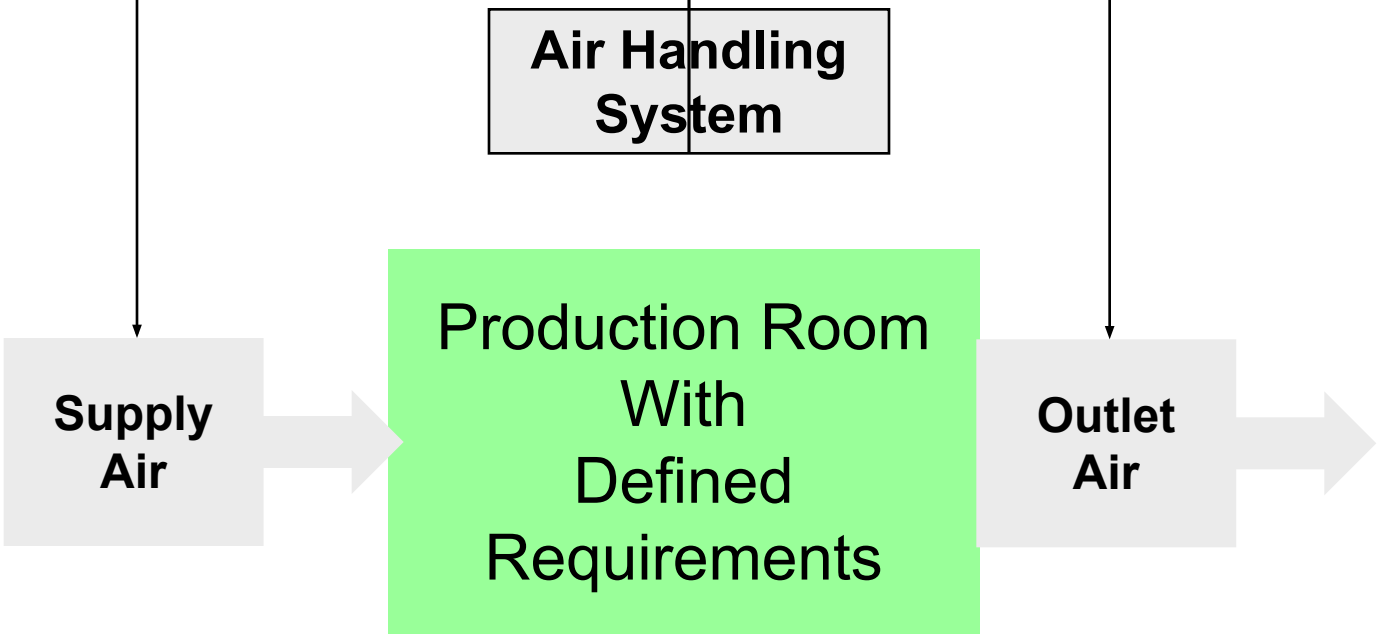
Air Handling Systems

Heating Ventilation and Air Conditioning (HVAC)

Part 2: Components

Air Handling Systems

Purpose of an air handling system



Air Handling Systems

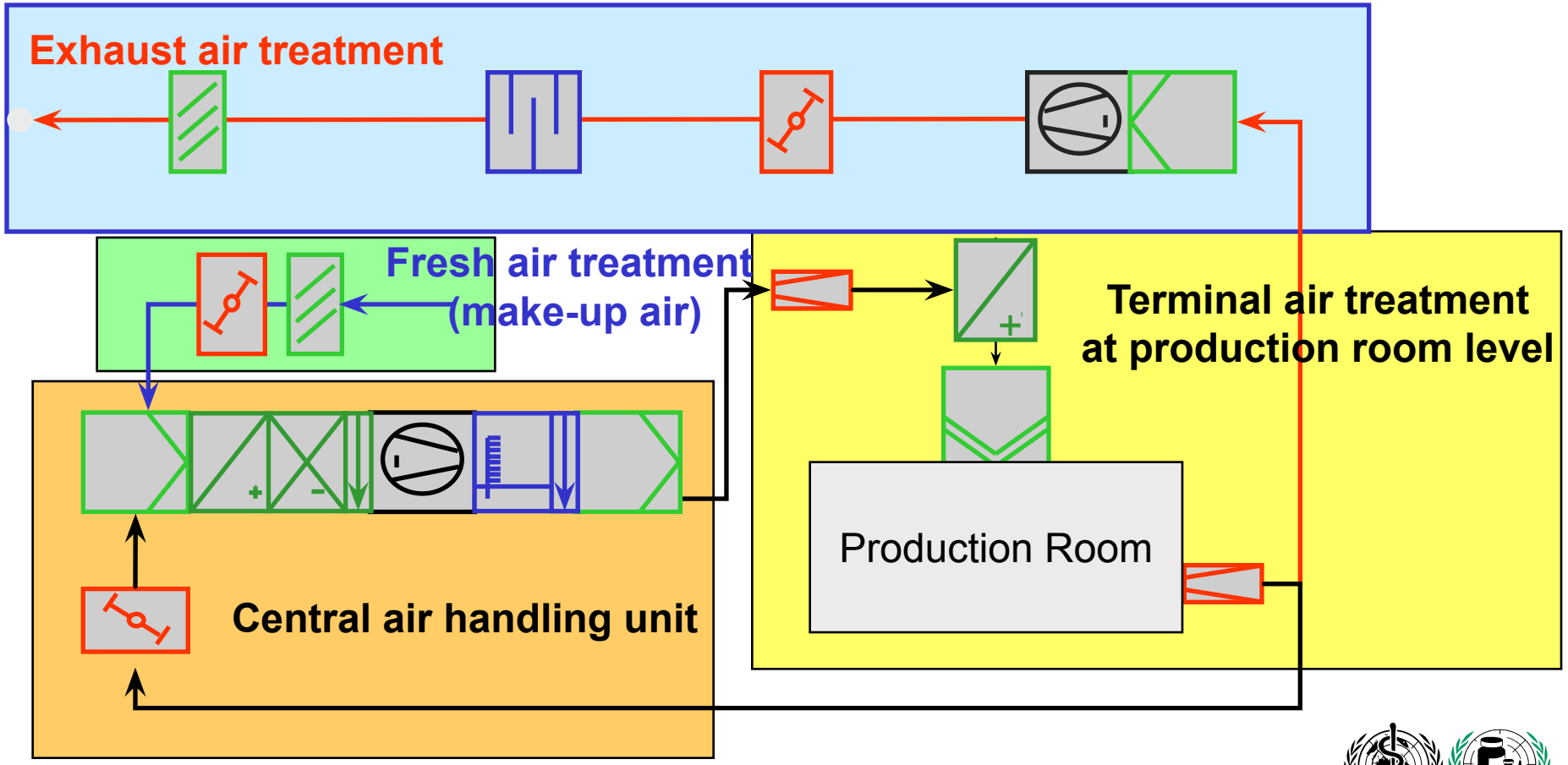
Objectives

In the following slides, we will study the components of air handling systems in order to:

1. become familiar with the components
2. know their functions
3. become aware of possible problems

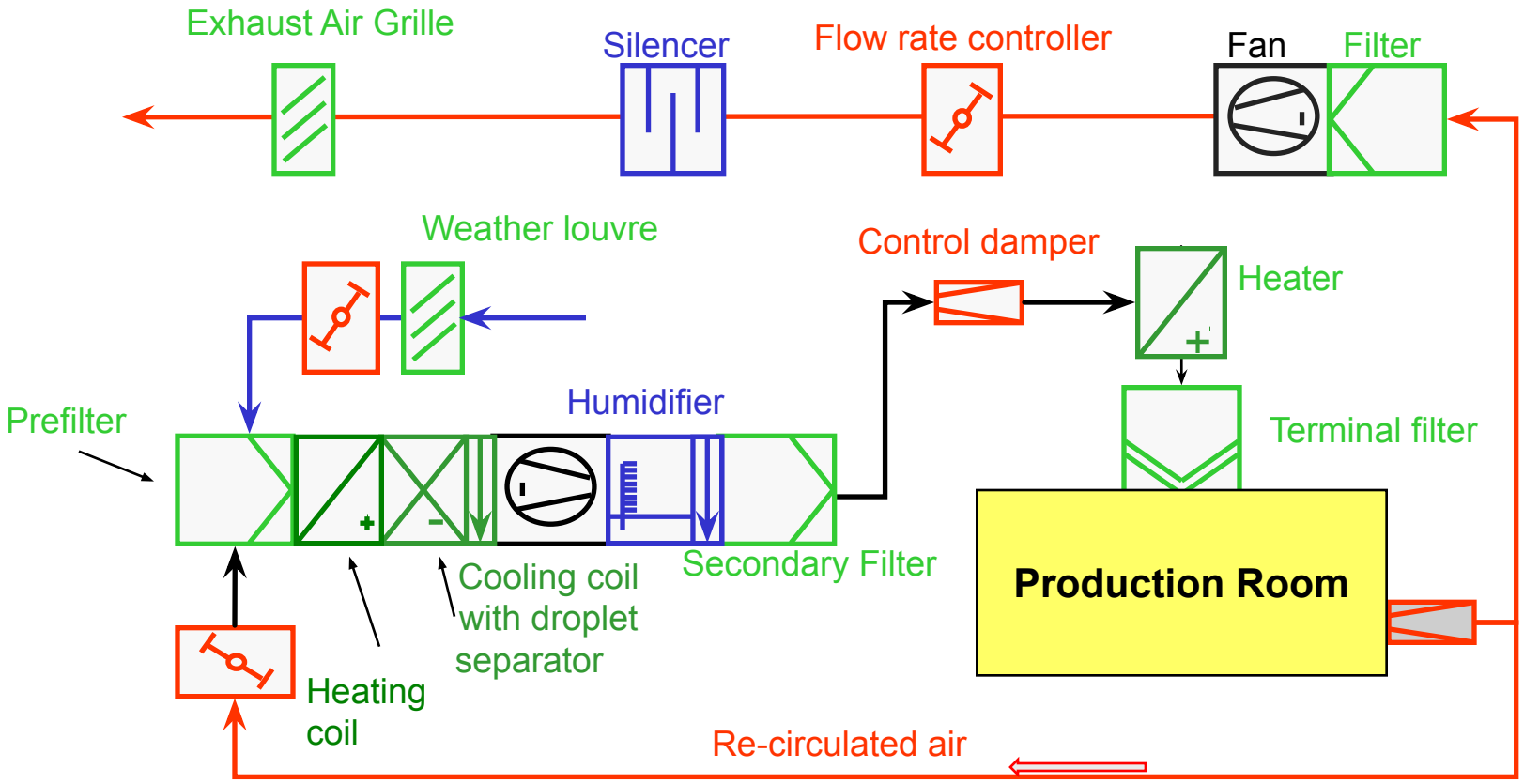
Air Handling Systems

Main subsystems



Air Handling Systems

Overview components



Air Handling Systems

Components (1)

• Weather louvre	To prevent insects, leaves, dirt and rain from entering
• Silencer	To reduce noise caused by air circulation
• Flow rate controller	Automated adjustment of volume of air (night and day, pressure control)
• Control damper	Fixed adjustment of volume of air

Air Handling Systems

Components (2)

• Heating unit	To heat the air to the proper temperature
• Cooling unit /dehumidifier	To cool the air to the required temperature or to remove moisture from the air
• Humidifier	To bring the air to the proper humidity, if too low
• Filters	To eliminate particles of pre-determined dimensions and/or micro-organisms
• Ducts	To transport the air

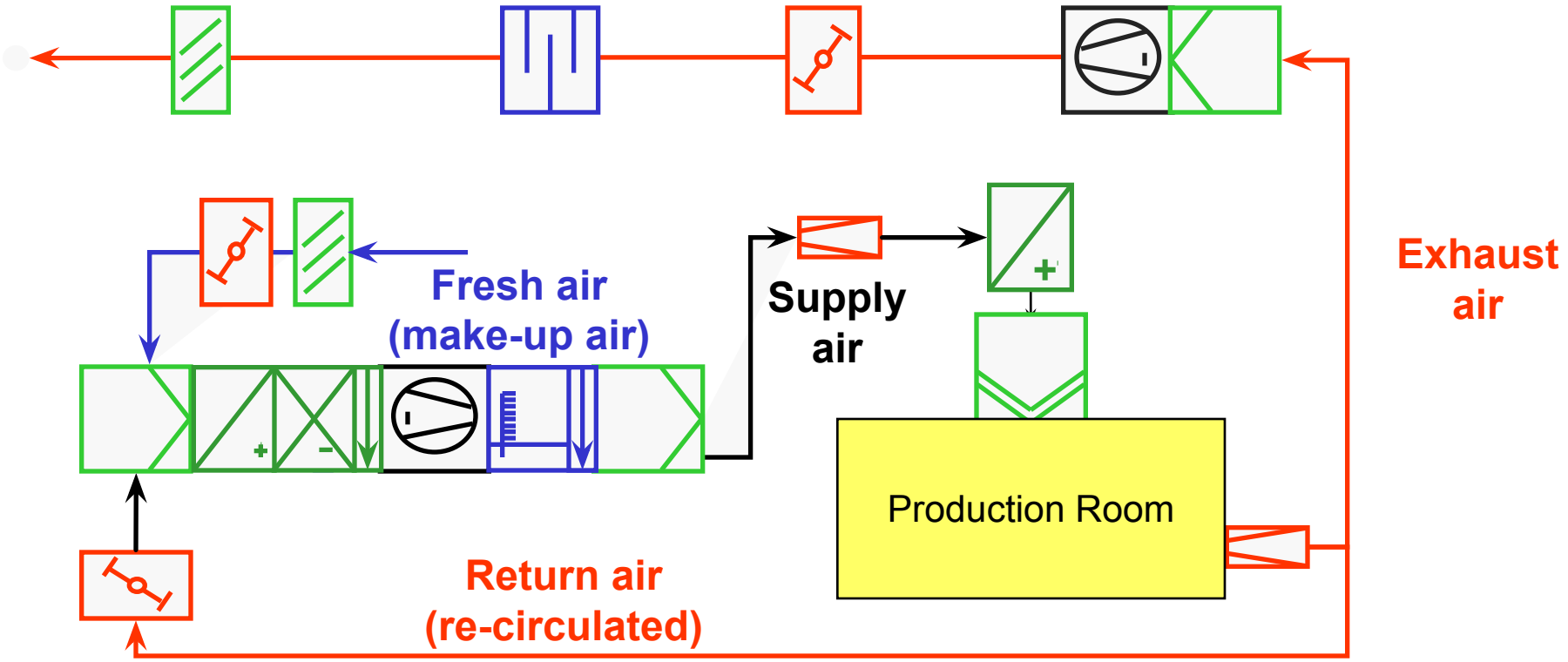
Air Handling Systems

Problems with components

• Flow rate controller	Blocked
• Control damper	Poorly adjusted, bad pressure differential system
• Humidifier	Bad water/steam quality/poor drainage
• Cooling battery	No elimination of condensed water/poor drainage
• Filters	Incorrect retention rate/damaged/badly installed
• Ducts	Inappropriate material/internal insulator leaking

Air Handling Systems

Air types

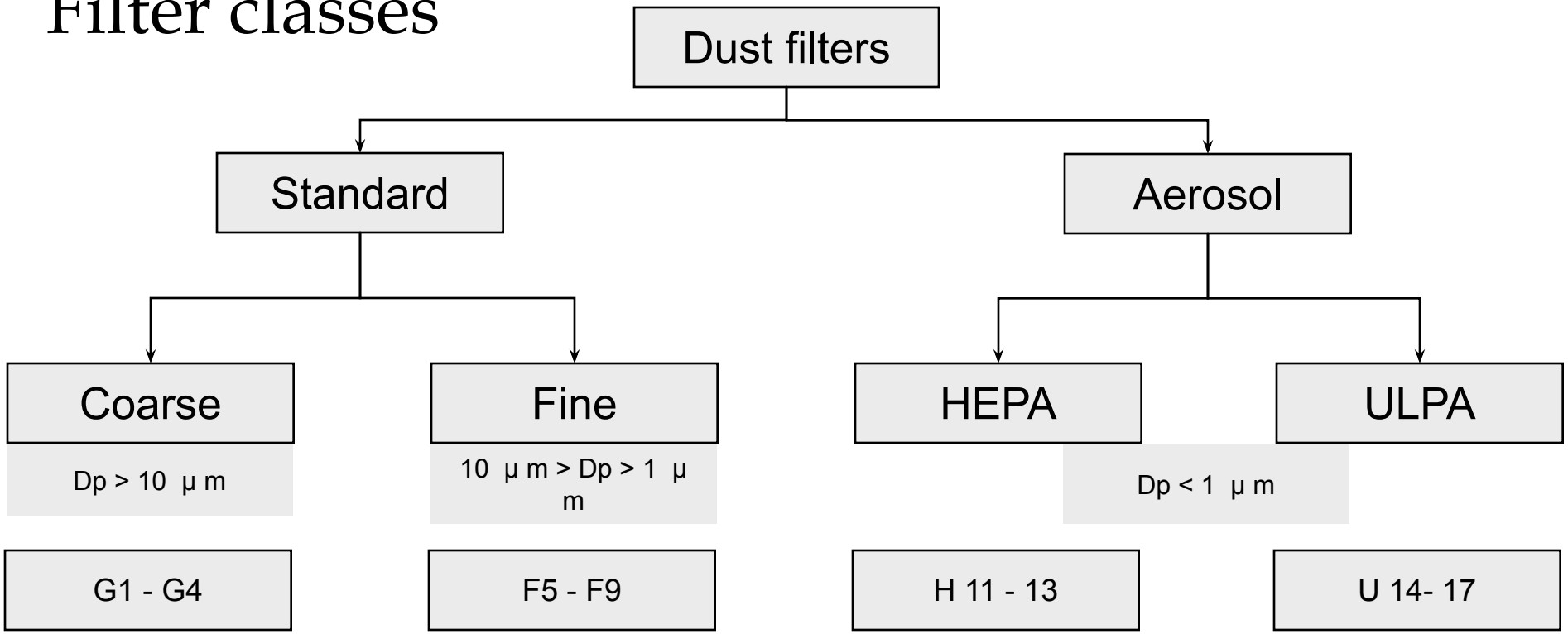


Comparing International Cleanroom Classifications

Particles / m^3 □ 0.5µm	US 209D non-metric	US 209E 1992 metric	EC cGMP Annex I 1997	Germany VDI 2083 1990	UK BS 5295 1989	Japan JIS B 9920 1989	ISO 14644-1
1							
3,5				0		2	2
10		M 1					
35	1	M 1.5		1		3	3
100		M 2					
353	10	M 2.5		2		4	4
1.000		M 3					
3.530	100	M 3.5	A, B A= unidirectional B= turbulent	3	E or F	5	5
10.000		M 4					
35.300	1.000	M 4.5		4	G or H	6	6
100.000		M 5					
353.000	10.000	M 5.5	C	5	J	7	7
1.000.000		M 6					
3.530.000	100.000	M 6.5	D	6	K	8	8
10.000.000		M 7					

Air Handling Systems

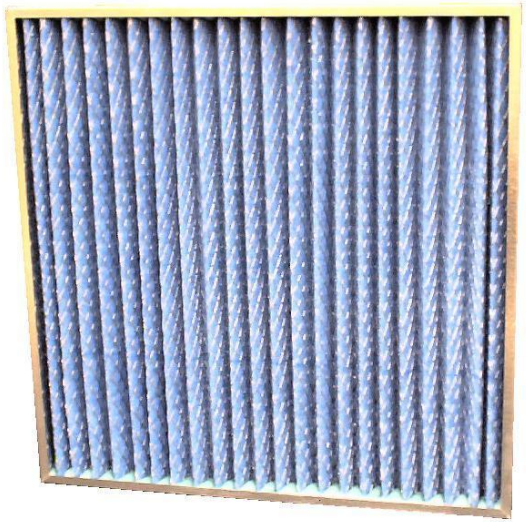
Filter classes



Air Handling Systems

Classification of filters according to their efficiency				
	Average Efficiency Integral Value		Peak Arrestance Local Value	
	Retention in %	Penetration	Efficiency	Penetration
F9	85	0.15		
H11	95	0.05		
H12	99.5	$5x10^{-3}$	97.5	$25x10^{-3}$
H13	99.95	$5x10^{-4}$	99.75	$25x10^{-4}$
U14	99.995	$5x10^{-5}$	99.975	$25x10^{-5}$

Air Handling Systems



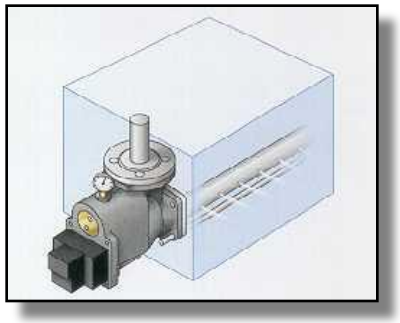
Primary panel filter

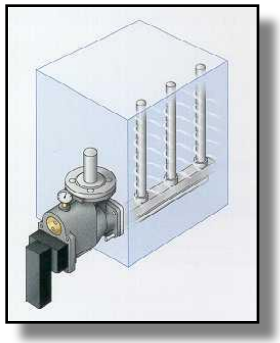
Secondary filter

HEPA or tertiaary filter

Air Handling Systems

Humidifier



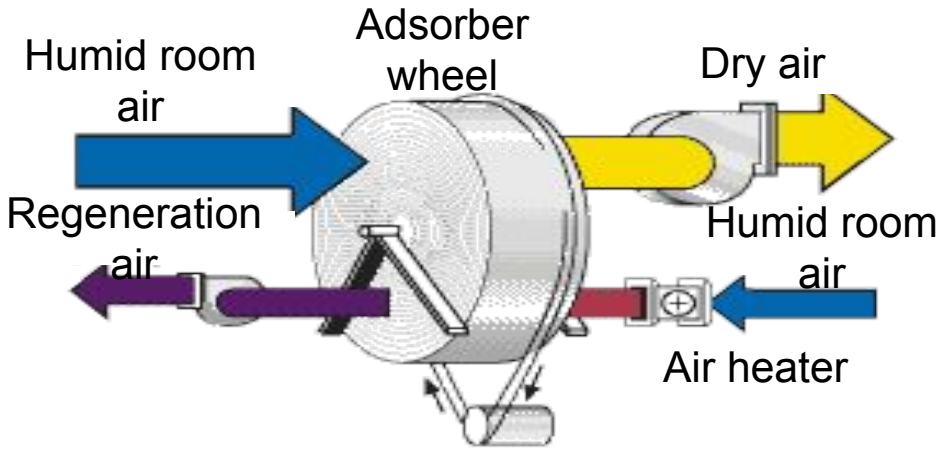


Silencer cooling units

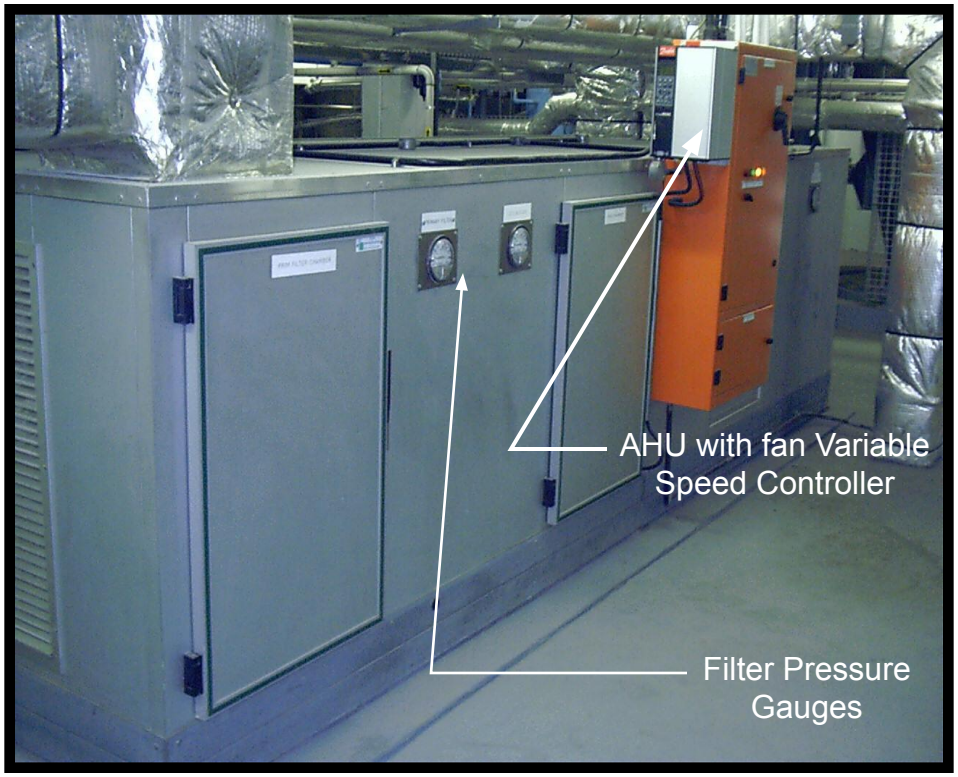
Heating and

Air Handling Systems

Control damper for air flow

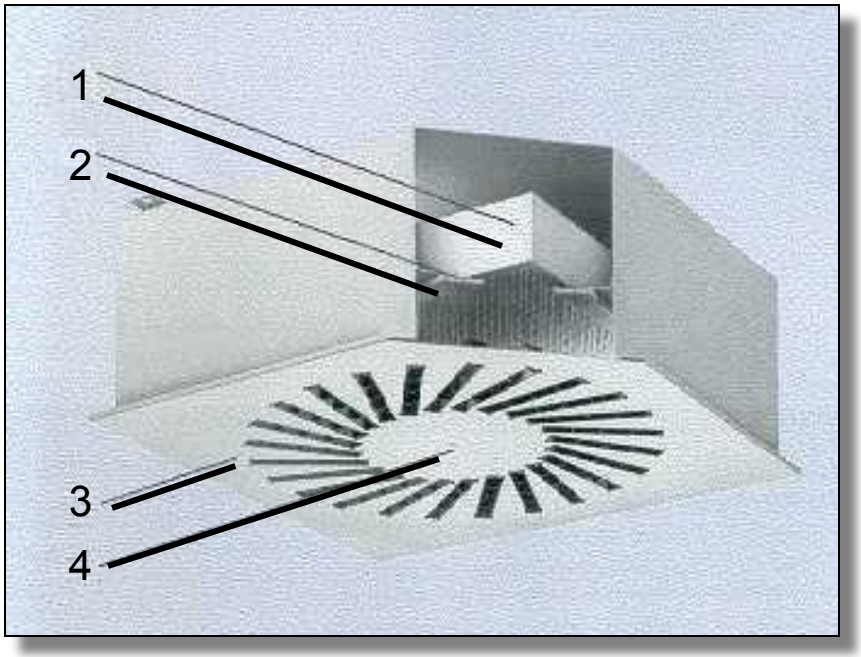


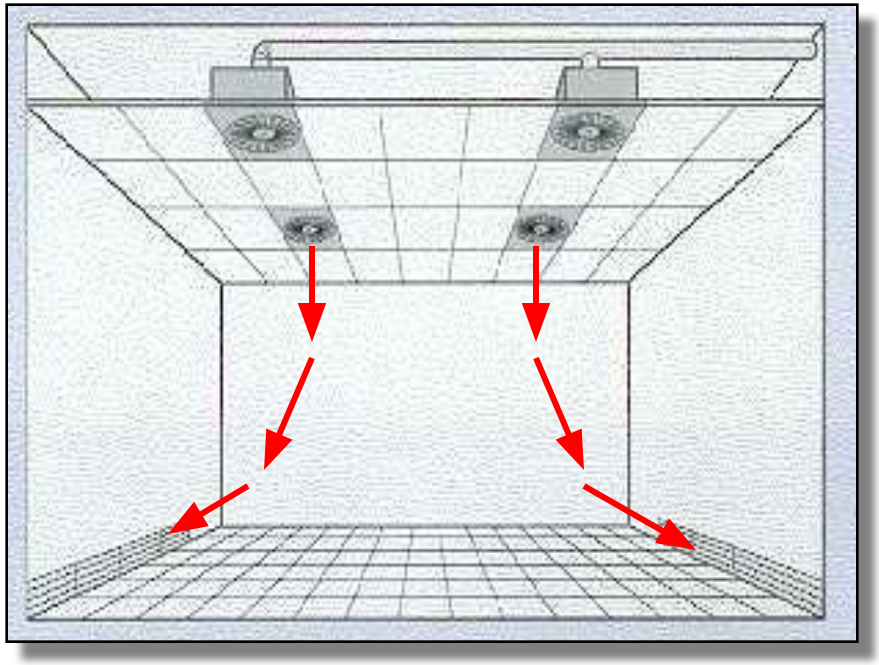
De-humidification



Air handling unit

Air Handling Systems

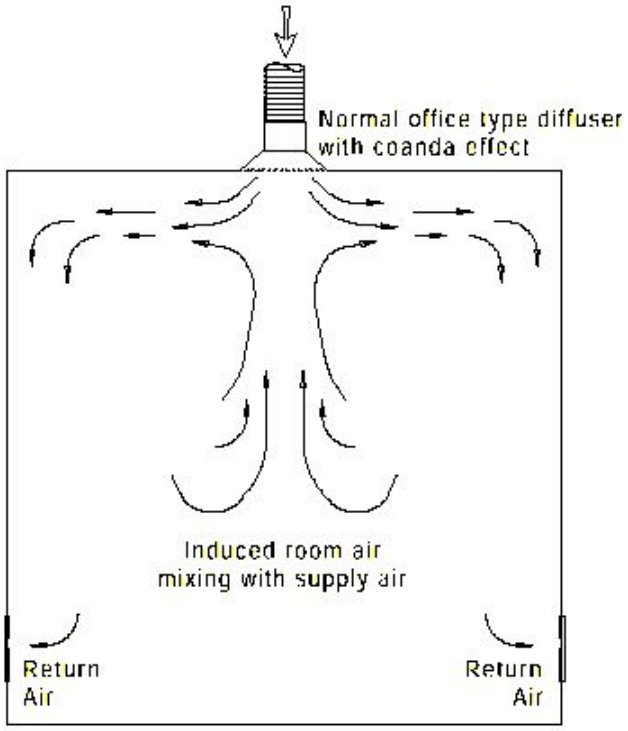


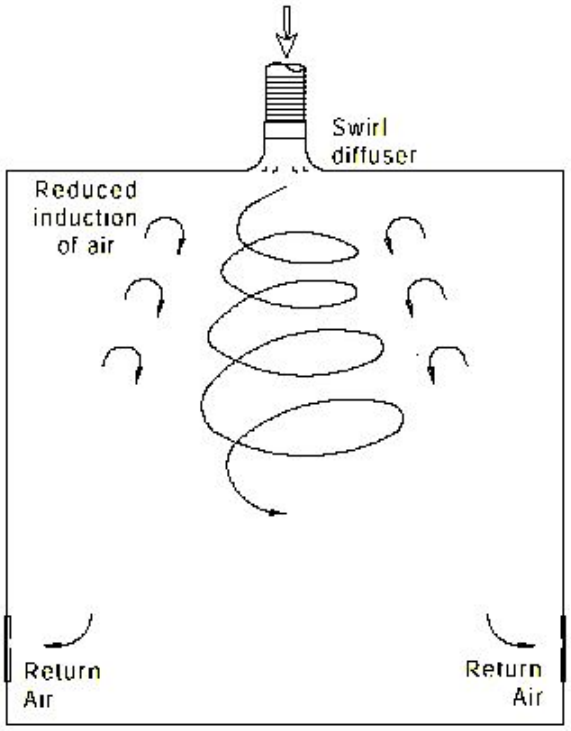


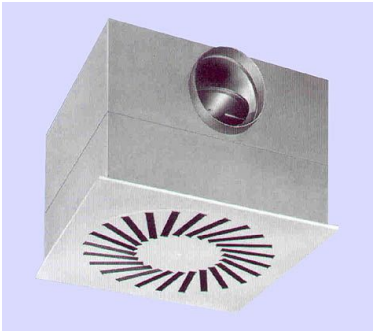
1 Filter
2 Tightening frame
3 Register outlet
4 Screw fixation for register

Swirl Type air diffusors with terminal filters

Air Handling Systems





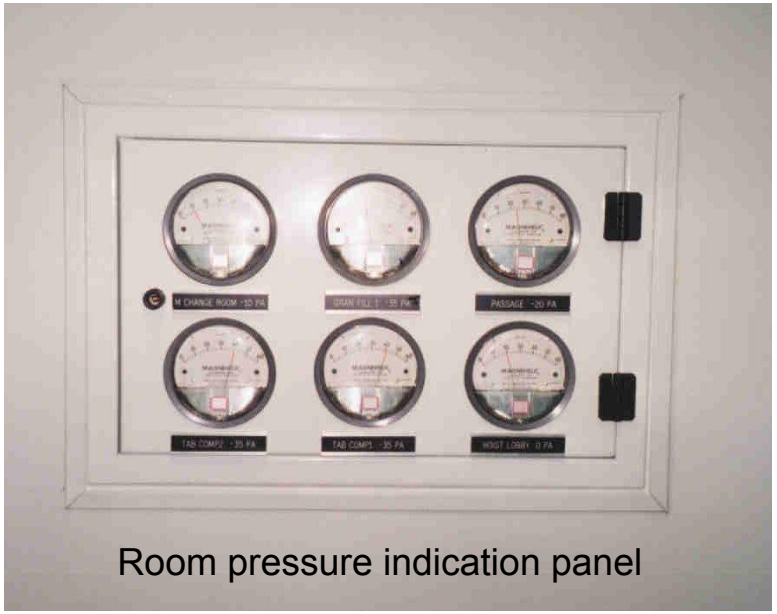


High induction
office type diffusor
(avoid)

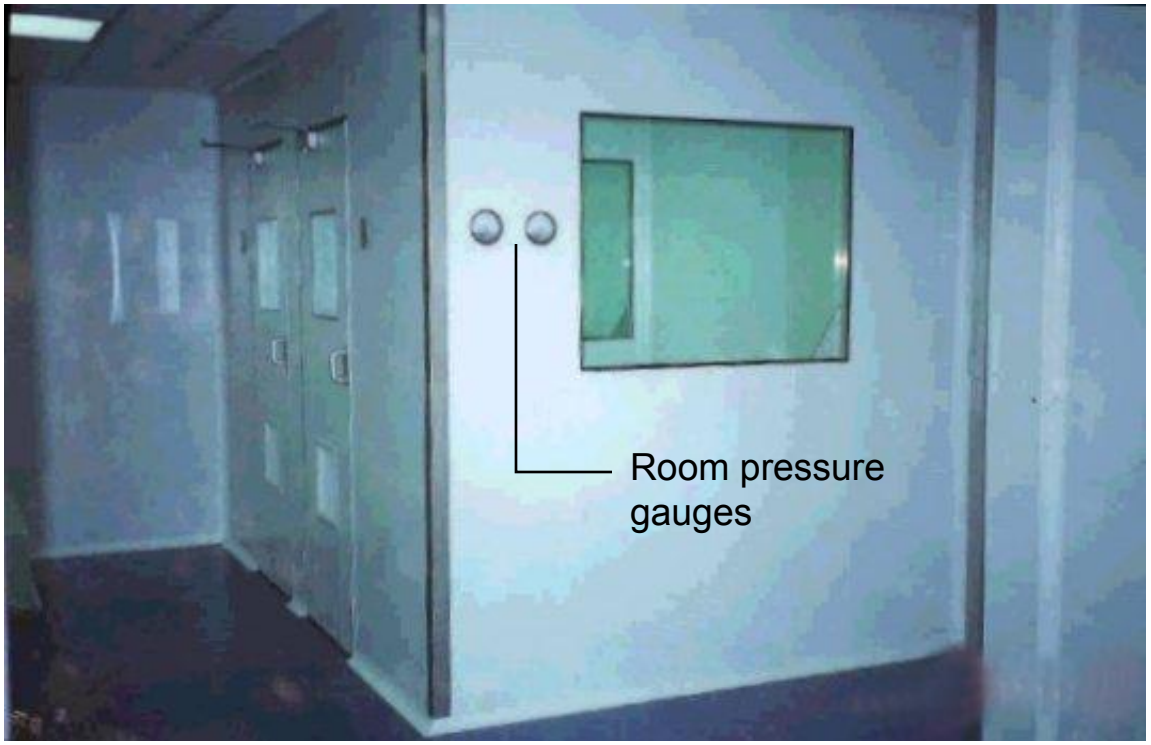
Low induction
swirl diffusor
(preferred)

Air Handling Systems

Regulation of room pressure – pressure differentials concept



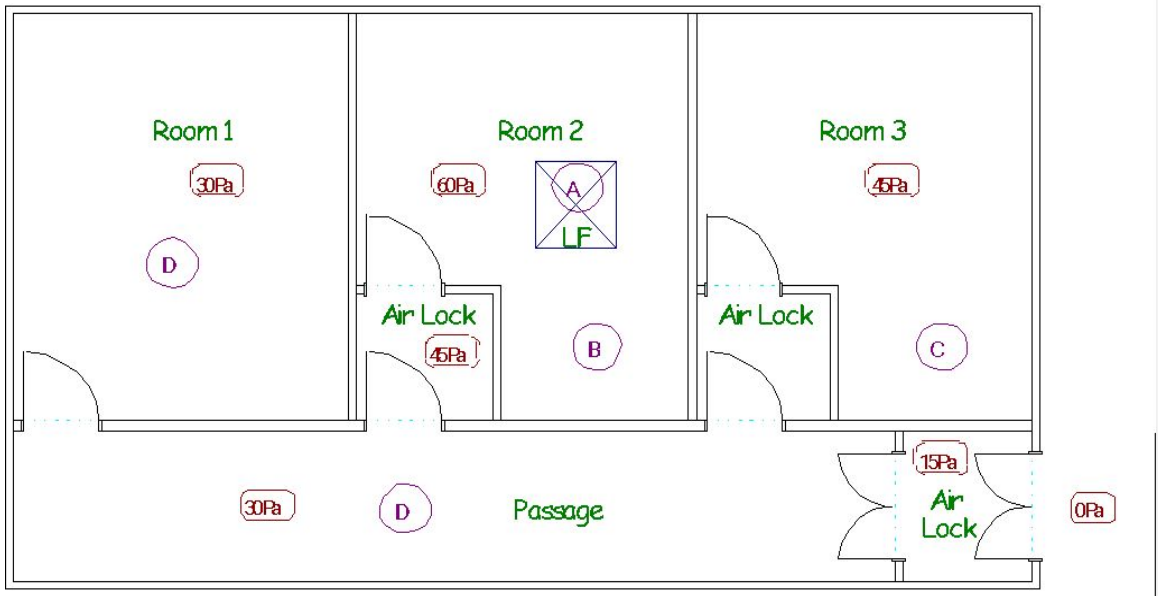
Room pressure indication panel



Annex 1, 17.26

Air Handling Systems

Pressure cascade injectables
Protection from micro-organisms and particles

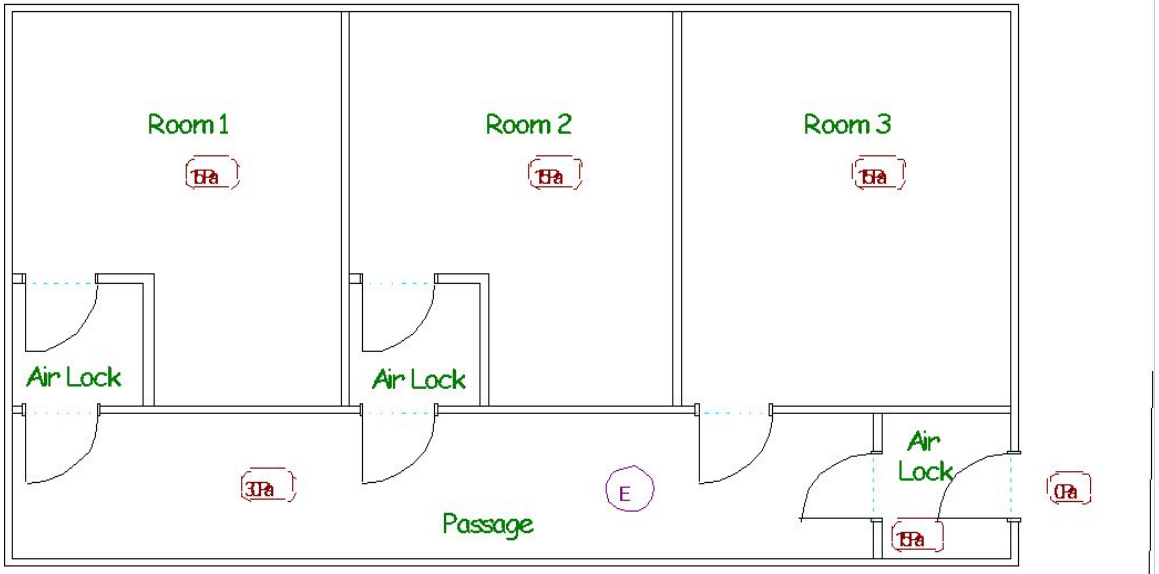


Note : Direction of door opening relative to room pressure

Annex 1, 17.24, 17.25

Air Handling Systems

Pressure cascade solids
Protection from cross-contamination



Note: Direction of door opening relative to room pressure