I.2: Construction of ISO Class-4 cleanroom in RRCAT

An ISO Class-4 cleanroom has been constructed as shown in Figures I.2.1 and I.2.2, by Construction and Services Division at RRCAT to enhance the efficiency of cavities used in accelerators. The cleanroom is intended for the measurement, high pressure rinsing (HPR), drying, and assembly of niobium superconducting radio frequency (SRF) cavities. The total area of the cleanroom is ~35 m^2, which is divided into five number of rooms as shown in Table I.2.1.

Table I.2.1: Various rooms inside the cleanroom.

Room No.	Name	ISO Class	Size (m^2)
R1	Ante Room	8	1.85 x 1.95 m^2
R2	Growing Area	6	2.55 x 1.85 m^2
R3	Ante Room	6	3.55 x 1.90 m^2
R4	Air Shower	5	1.10 x 1.55 m^2
R5	Assembly and HPR Room	4	4.00 x 3.80 m^2

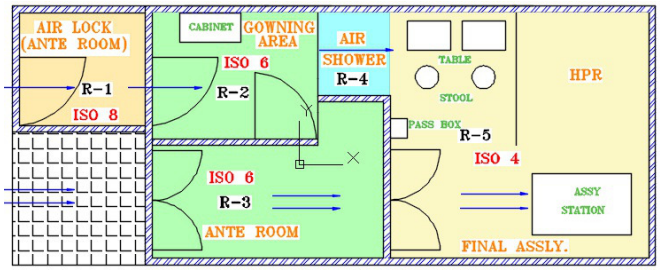

Fig. I.2.1: General layout of the cleanroom.

Fig. I.2.2: Front view of cleanroom.

Table I.2.2: General operating parameters of the cleanroom.

Parameter	value
Temperature	22° ± 2° C
Relative humidity	50% ± 5%
Recovery time	30 minutes
Static charge	All the surfaces meet electrical resistance requirements of 10^6-10^9 Ω
Equipment heat load	20 kW
Pressure differential	Cleaner areas are at higher pressure than adjoining areas to prevent particulate backflow (around 5-10 Pa relative to the outer room/hall)

General operating parameters of the cleanroom are given in Table I.2.2. The cleanroom is equipped with automatic control via facility control and monitoring system (FCMS), which can automatically track and control various parameters, viz., temperature, pressure, humidity, air flow, etc.. Material used for wall panel of cleanroom is 50 mm thick SS 304 sheet on both sides with polyurethane foam (PUF) as infill. The air shower has been provided as an air lock in between the Gowning room (R2) and HPR room (R5) for personnel movement. Dynamic pass box has been provided between R3 and R5 for transfer of equipment/ tools. The arrangement for return air from the cleanroom has been made below the raised floor. The raised floor is provided with ~50 % perforation to ensure return air velocity to be within permissible limits. Anti-static epoxy floor has been provided below raised floor to restrict accumulation of static charge. The cleanroom is equipped with pre-heater, re-heater, humidifier and backward blowers. Automatic fire detection and suppression system has also been installed.

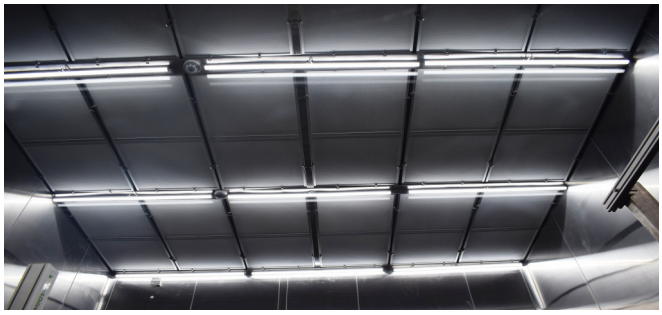

Fig. I.2.3: Maximum filter coverage achieved with plenum type design in ISO class-4 area.

The supply air of the cleanroom is provided from top and the return air is taken from bottom below the raised floor. Two numbers of cleanroom compatible air handling units (AHU) have been provided with variable frequency drive (VFD) having details as shown in Table I.2.3.

Table I.2.3: Details of the AHUs used in cleanroom.

Name of the System	Connected Area	Supply Airflow	Class Condition	Air Changes
AHU - 01	Air Lock, Gowning Area, Ante Room	4907 CFM	ISO-6 and 8	150 ACPH
AHU - 02	Final Assembly, HPR	18941 CFM	ISO-4	500 ACPH

The cleanroom has been designed based on plenum concept to maximize the filter coverage. Terminal HEPA (H-14 as per EN-1822) and ULPA (U15 as per EN-1822) filters have been installed within plenum in series to achieve desired cleanliness. The cleanroom is tested as per ISO-14644 standard.

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