

# HVAC

# HVAC

## Objective

Our objective is to design an efficient, reliable, and sustainable HVAC system for office spaces that ensures optimal indoor air quality, comfort, and energy efficiency. The design will focus on maintaining appropriate temperature, humidity, and ventilation levels while adhering to all relevant building codes and standards. Additionally, the system will incorporate innovative technologies to reduce energy consumption and operational costs, while providing flexibility for future modifications and expansions.

## Definitions of Units and Constants

International System of Units (SI) is used unless otherwise noted. Abbreviation used are as specified in 3. Abbreviations.

Sl.No	Abbreviations	Description
1	HVAC	Heating, Ventilating and Air-conditioning
2	MLE	Master List Of Equipment's
3	AHU	Air Handling Unit
4	ASHRAE	American Society for Heating, Refrigeration and Air-conditioning Engineers
5	ISHRAE	Indian Society of Heating, Refrigerating and Air-Conditioning Engineers
6	DBT °C	Dry Bulb temperature in degree Celsius
7	WBT °C	Wet Bulb temperature in degree Celsius
8	RH %	Relative Humidity in Percentage
9	CHW	Chilled Water
10	AMC	Annual Maintenance Cost
11	INR	Indian Rupee
12	TR	Tons of Refrigeration
13	CMH	Cubic Meter per Hour
14	CFM	Cubic Feet per Minute
15	VRF	Variable Refrigerant Flow
16	CHW	Chilled Water
17	KWh	Kilo watt hour
18	DX	Direct Expansion

# HVAC

## Scope Matrix

S.No	Particulars	Landlord Scope	Design Scope	Remarks
1	Chiller	✓		
2	Chilled water pipe Riser pipe	✓		
3	Air Handling Units (AHU)	✓		
4	AHU Valve packages	✓		
5	BTU Meter	✓		
6	MERV 13 Filter for AHU	✓		
7	UV Lamps for AHU	✓		
8	Supply Air Plenum		✓	
9	AHU Room Fire Dampers		✓	
10	Supply air ducting (within AHU Room)		✓	
11	Sound Attenuator (within AHU Room)		✓	
12	Starter Panel for AHU	✓		

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## Scope Matrix

S.No	Particulars	Landlord Scope	Design Scope	Remarks
13	Electrical cabling from AHU starter panel to AHU motor	✓		
14	AHU Room floor drain point & condensate pipe with insulation	✓		
15	AHU Wall Acoustic Insulation		✓	
16	Fresh air for AHU Room	✓		
17	VAV for Fresh air		✓	
18	Low side Ducting and Air Terminals		✓	
19	Lift lobby air-conditioning	✓		The lowside works have already been completed by the builder, and a duct tap-off has been provided outside the lobby. The connection from the main supply air duct to the tap-off point will be taken into account.
20	Staircase pressurization	✓		
21	Lift lobby pressurization	✓		
22	Electrical Room Air-conditioning		✓	
23	Space Provision to mount ODU (Terrace, Balcony, etc...)	✓		
24	Kitchen Ventilation		✓	
25	Roof Under-deck Insulation		✓	

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## Design Consideration :

### Design and Efficiency Standards

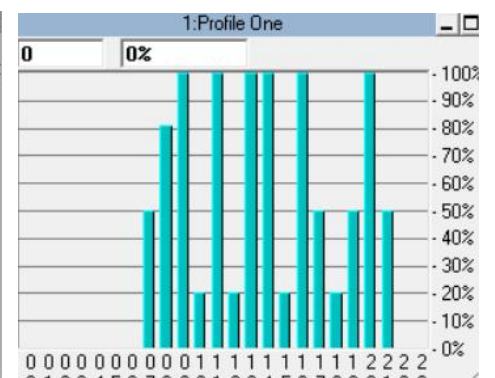
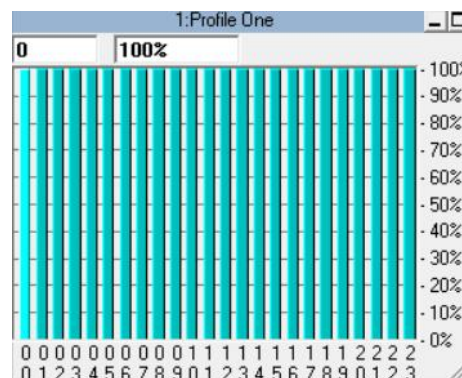
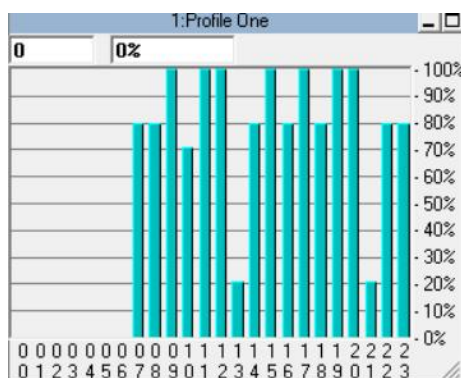
Sl.No	Design	Standards
1	Energy standards for buildings except low -rise residential Buildings	ASHRAE 90.1
2	Outdoor Air calculation	ASHRAE 62.1
3	Duct Construction	SMACNA
4	Galvanized Steel Sheet	IS 277
5	Fire Sealant	BS 476 Part 20 and UL 1479
6	Green building certification	LEED V4 (ID+C) Interior Design and Construction

### Outdoor Design Conditions - Bengaluru

Sl.No	Season - Occurring Month	DBT (°C)	WBT (°C)	RH (%)
1	Summer - April	35.5	20.4	26.0
2	Monsoon - September	30.1	21.1	46.4
3	Winter - December	28.5	17.2	33.5

**Note :** The weather data is considered based on ASHRAE 2021 Bengaluru, India's weather data, which is the nearest weather station from the facility.


### Operational Schedule



All HVAC System equipment's and components will be selected / sized based on this schedule.

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## Outdoor Design Conditions - Bengaluru

 BENGALURU, INDIA (WMO: 432950)

Lat:12.967N Long:77.583E Elev:921 StdP: 90.74 Time zone:5.50 (IND) Period:94-19 WBAN:99999

Annual Heating, Humidification, and Ventilation Design Conditions															
Coldest Month	Heating DB		Humidification DP/MCDB and HR						Coldest month WS/MCDB				MCWS/PCWD to 99.6% DB		WSF
			99.6%			99%			0.4%		1%				
	99.6%	99%	DP	HR	MCDB	DP	HR	MCDB	WS	MCDB	WS	MCDB	MCWS	PCWD	
12	15.5	16.2	1.6	4.7	28.6	3.9	5.6	27.8	4.4	20.4	4.0	21.3	1.1	90	0.226
Annual Cooling, Dehumidification, and Enthalpy Design Conditions															
Hottest Month	Hottest Month DB Range	Cooling DB/MCWB						Evaporation WB/MCDB						MCWS/PCWD to 0.4% DB	
		0.4%		1%		2%		0.4%		1%		2%			
		DB	MCWB	DB	MCWB	DB	MCWB	WB	MCDB	WB	MCDB	WB	MCDB	MCWS	PCWD
4	10.3	34.3	20.0	33.6	19.9	32.7	19.9	23.7	29.1	23.2	28.6	22.8	28.0	1.3	90
Dehumidification DP/MCDB and HR															
0.4%		1%		2%		0.4%		1%		2%		Extreme Max WB			
DP	HR	MCDB	DP	HR	MCDB	DP	HR	MCDB	Enth	MCDB	Enth	MCDB	Enth	MCDB	
22.3	19.0	25.7	21.8	18.4	25.2	21.4	18.0	24.8	76.3	29.2	74.3	28.8	72.7	28.1	28.3
Extreme Annual Design Conditions															
Extreme Annual WS			Extreme Annual Temperature				n-Year Return Period Values of Extreme Temperature								
			Mean		Standard deviation		n=5 years		n=10 years		n=20 years		n=50 years		
1%	2.5%	5%	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	
5.1	4.3	3.6	DB	13.7	36.1	0.9	1.0	13.0	36.8	12.5	37.3	12.0	37.9	11.4	38.6
			WB	10.7	25.5	1.0	1.2	10.0	26.4	9.4	27.0	8.8	27.7	8.1	28.6
Monthly Climatic Design Conditions															
			Annual	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Temperatures, Degree-Days and Degree-Hours	DBAvg		24.4	22.1	24.2	26.7	27.9	27.0	24.9	23.9	23.7	24.0	23.8	22.6	21.6
	DBStd		2.26	1.15	1.49	1.53	1.46	1.58	1.28	0.99	0.92	0.99	1.12	1.21	1.19
	HDD10.0		0	0	0	0	0	0	0	0	0	0	0	0	0
	HDD18.3		0	0	0	0	0	0	0	0	0	0	0	0	0
	CDD10.0		5244	376	398	518	538	527	446	431	426	421	427	377	361
	CDD18.3		2202	117	164	260	288	268	196	173	167	171	169	127	102
	CDH23.3		15677	659	1334	2654	3092	2547	1256	804	722	881	817	508	403
	CDH26.7		5149	90	453	1210	1438	1078	323	124	83	142	132	49	25
Wind	WSAvg		1.5	1.3	1.2	1.1	1.1	1.5	2.5	2.5	2.1	1.5	1.0	1.1	1.2
Precipitation	PrecAvg		1013	2	6	13	55	120	95	110	146	215	166	57	20
	PrecMax		1641	23	58	101	324	242	228	286	387	517	606	236	119
	PrecMin		646	0	0	0	0	1	7	18	45	33	3	1	0
	PrecStd		221	5	13	24	60	50	58	71	83	115	103	55	27
Monthly Design Dry Bulb and Mean Coincident Wet Bulb Temperatures	0.4%	DB	29.7	33.1	34.7	35.5	35.0	32.4	30.0	29.5	30.1	30.1	29.2	28.5	
		MCWB	17.2	17.4	18.4	20.4	21.0	22.5	21.2	21.4	21.1	19.5	18.4	17.2	
	2%	DB	28.6	31.6	33.8	34.6	33.9	30.7	29.0	28.4	29.1	29.0	28.0	27.4	
		MCWB	17.1	17.4	18.4	20.2	21.3	22.3	21.5	21.5	21.0	19.9	18.8	17.5	
	5%	DB	27.7	30.5	33.0	33.8	32.9	29.6	28.1	27.6	28.3	28.1	27.1	26.5	
		MCWB	16.9	17.2	18.4	20.1	21.6	22.0	21.3	21.3	21.0	20.3	19.1	17.5	
	10%	DB	26.8	29.5	32.1	32.8	31.7	28.6	27.1	26.8	27.4	27.3	26.2	25.7	
		MCWB	16.8	17.2	18.1	20.3	21.8	21.8	21.2	21.2	21.0	20.5	19.0	17.5	

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## Indoor Design Conditions

S.No	Space Description	Type of Conditioning	Construction Description		Remarks
			Indoor Temperature (°C)	RH (%)	
1	Office space	Comfort Air Conditioning	23 +2/-1		Considered as per the client input.
2	Meeting rooms & Huddle rooms	Comfort Air Conditioning	23 +2/-1		
3	Cafe	Comfort Air Conditioning	23 +2/-1		
4	Comms Room	DX PAC Air Conditioning	22 +/- 1	50 +/- 5%	Considered as per the client input
5	Wiring Closet room	VRF Ductable Air Conditioning	22 +/- 1		
6	UPS & Battery room	VRF Ductable Air Conditioning	22 +/- 2		

## Building Envelope Properties

S.No	Envelope Type	Construction Description	Thickness (mm)	Overall Heat Transfer Coefficient (W/Sq.m.K)	Shading Coefficient (SC)	Remarks
1	External Wall	-	230	2.070	-	Considered as per architectural layout
2	External Glazing	Double Glaze	-	1.67	0.22	As per the input received from the Builder through Builder input questionnaire
3	Roof	-	275	1.12	-	Included 19mm thick Nitrile rubber underdeck insulation

## Lighting Loads

- Lighting Load for all spaces 4.842 W/m2 (0.45 W/Sq.ft)

## Occupancy

- Occupancy shall be considered based on architectural layout.

## Fresh air considerations

S.No	Space Use Type	Outdoor Air Requirements as per ASHRAE 62.1 Requirement L/s/person	Outdoor Air Requirements as per ASHRAE 62.1 Requirement (L/s/m <sup>2</sup> )	Outdoor Air considered for the project including 30% additional Fresh air as per the LEED L/s/person	Outdoor Air considered for the project including 30% additional Fresh air as per the LEED L/s/m <sup>2</sup>
1	Open office	2.5	0.30	3.3	0.39
2	Meeting Room	2.5	0.30	3.3	0.39
3	Open Collab Space	2.5	0.30	3.3	0.39
4	Cafe & Dining	3.8	0.9	4.9	1.17

## Equipment Load Considerations:

### Critical Room Equipment Load

S.No	Floor	Space	Load Considered	Total Equipment Load (kW)	Heat Dissipation (%)	Heat Dissipation Load (kW)
1	3	Wiring Closet	2 Racks – 1.5 kW Each	3.0	100 %	3.0
2	5,6,9 & 10	Wiring Closet	5 Racks – 1.5 kW Each	7.5	100 %	7.5
3	5	Comms Room	16.517 kW Load + 15.0 KW Additional Load as per client input	31.517	100 %	31.517
4	5 & 8	UPS Room	315 kVA	252	6 %	15.12
5	5 & 8	Battery Room	315 kVA	252	3 %	7.56

### Other spaces

S.No	Space Name	Equipment Considered	Equipment Load (kW)
1	Open office	Laptop with double monitor heat dissipation	120 W
2	Meeting Room	TV / Monitor	500 W
3	Pantry, Cafe & Dining	Coffee vending Machine & Oven	1500 W
4	Print Room	Copier Machine / Printer	730 W
5	Pantry	Snack Vending Machine	55 W



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## Base Building Existing HVAC Provision

The base building has already been equipped with all high-side related equipment, including water-cooled chillers, air-cooled chillers, pumps, chilled water piping, associated valve packages, and air handling units (AHUs) with EC fans installed in each AHU room. Additionally, treated fresh air fans are connected to the return chilled water pipe, featuring two rows of chilled water coils, along with lift lobby and staircase pressurization fans. The details of each equipment's are listed below for quick reference.

### ❖ Chillers (Trane Make)

- 1 X 350 TR Water cooled chiller
- 1 X 700 TR Water cooled chiller
- 1 X 350 TR Air cooled chiller

### ❖ Cooling Tower (Bell Make)

- 1 X 350 TR
- 1 X 700 TR

### ❖ Pumps (Armstrong Make)

- Primary pumps - 5 Nos (4 working & 1 standby)
- Secondary pumps - 5 Nos (4 working & 1 standby)



### ❖ Lift Lobby pressurization fan

### ❖ Staircase pressurization fan

### ❖ Service Lift Lobby pressurization fan

### ❖ Treated Fresh air fans for the AHU Rooms.

### ❖ Floor mounted AHU with EC Fan, MERV8, 13 Filters & UV Lamp.



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## Heat Load Comparison

### Office area \_ Heat Load Comparison

S.no	Floor	Zone	AHU No	Floor area (Sq.ft)	Assessed cooling Load			Builder Available Capacity		Remarks
					Fresh air (CFM)	TR	Dehumidified CFM	TR	CFM	
1	2	Zone-1	AHU - 1	4680	705	13	9130	-	-	20.0 TR, 10000 CFM Chilled water CSU will be proposed considering the tapp off from the main chilled water header pipe.
2	3	Zone-1	AHU - 1	6485	1230	17	9610	30	12000	Adequate.
3	3	Zone-2	AHU - 2	7115	5790	14	8740	35	14000	<b>AHU Room to be segregated, refer the slide no 61.</b>
4	3	Zone-3	AHU - 3	11290		24	12840	35	14000	
5	4	Zone-1	AHU - 1	8865	1615	21	11390	30	12000	Adequate.
6	4	Zone-2	AHU - 2	11600	3720	18	11870	30	12000	Adequate.
7	4	Zone-3	AHU - 3	7255		21	11086	30	12000	Adequate.
8	5	Zone-1	AHU - 1	8770	1490	21	11610	30	12000	Adequate.
9	5	Zone-2	AHU - 2	10655	3250	18	11330	30	12000	Adequate.
10	5	Zone-3	AHU - 3	7515		21	11570	30	12000	Adequate.
11	6	Zone-1	AHU - 1	9490	1300	22	11760	30	12000	Adequate.
12	6	Zone-2	AHU - 2	12220	2270	30	20370	30	12000	Adequate (2 No's)
13	6	Zone-3	AHU - 3							
14	6	Zone-4	Cafe	2660	820	3.6	1260	-	-	The AC units are selected based on the Townhall setup as the load is higher considering the café setup
			Townhall		2610	6.03	1837			
15	7	Zone-1	AHU - 1	8780	1630	21	10860	30	12000	Adequate.
16	7	Zone-2	AHU - 2	11850	3600	19	11920	30	12000	Adequate.
17	7	Zone-3	AHU - 3	7250		21	10842	30	12000	Adequate.

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## Heat Load Comparison:

### Office area \_ Heat Load Comparison

S.no	Floor	Zone	AHU No	Floor area (Sq.ft)	Assessed cooling Load			Builder Available Capacity		Remarks
					Fresh air (CFM)	TR	Dehumidified CFM	TR	CFM	
18	8	Zone-1	AHU - 1	8770	1625	25	11532	30	12000	Adequate.
19	8	Zone-2	AHU - 2	11410	3560	18	11310	30	12000	Adequate.
20	8	Zone-3	AHU - 3	7250		21	11117	30	12000	Adequate.
21	9	Zone-1	AHU - 1	5885	3250	13.2	9850	30	12000	Adequate.
22	9	Zone-2	AHU - 2	13230	1340	30	19510	30	12000	Adequate (2 No's)
23	9	Zone-3	AHU - 3							
24	9	Zone-4	-	5100	1250	8	4045	-	-	Social hub & Well Being area will be aircondiioned by VRF units to avoid the recirculation of odor from cafe AHU to Social Hub & Well-being.
25	10	Zone-1	AHU - 1	8780	1640	21	11470	30	12000	Adequate.
26	10	Zone-2	AHU - 2	11780	3560	19	11900	30	12000	Adequate.
27	10	Zone-3	AHU - 3	7225		21	10560	30	12000	Adequate.
28	11	Zone-1	AHU - 1	8800	1650	29	13860	35	14000	Adequate.
29	11	Zone-2	AHU - 2	10780	3390	25	13710	35	14000	Adequate.
30	11	Zone-3	AHU - 3	8090		29	13960	35	14000	Adequate.

**Note:** The load calculations shown above are based on maintaining a minimum indoor setpoint of 22°C and a treated fresh air supply temperature of 28°C. Once the coil selection data for the treated fresh air unit is received, the calculations will be cross-verified and adjusted accordingly.

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## Heat Load Comparison:

### Critical room \_ AC Load summary & AC unit selection

S.No	Floor level	Zone	Area Sq.ft	Assessed cooling Load		Proposed AC unit capacity
				TR	Dehumidified CFM	
1	5	Comms Room	420	10.3	8314	3 X 7.0 TR (4550 CFM each), Floor mounted DX PAC unit (2 W / 1S.by) and the outdoor unit shall be located in the same floor Balcony. (bottom discharge)
2	3	Wiring Closet	184	1.05	870	2 X 2.5 TR (885 CFM) , VRF Ductable unit (1 W / 1S.by) + Supply from Main AHU and the VRF outdoor unit shall be located in the Balcony.
3	5, 6, 9 & 10	Wiring Closet	205	2.44	1988	2 X 5.4TR (2050 CFM) , VRF Ductable unit (1 W / 1S.by)+ Supply from Main AHU and the VRF outdoor unit shall be located in the Balcony.
4	5 & 8	UPS & Battery Room	409	7.25	5895	3 X 8.0 TR (2825 CFM), VRF Ductable unit (2 W / 1S.by) and the VRF outdoor unit shall be located in the Balcony.

### 24/7 Areas \_ AC Load summary & AC unit selection

S.No	Floor level	Zone	Area Sq.ft	Assessed cooling Load		Proposed AC unit capacity
				TR	Dehumidified CFM	
1	2	Mail Room	80	0.6	156	1 TR 400 CFM, CHW Hiwall unit (W) the tapp off from the main chilled water header pipe. and 1 TR 300 CFM VRF Hiwall unit (S) the VRF Outdoor unit shall be located in the Balcony
2	3	BMS Room	325	0.9	498	2 X 1.6 TR (493 CFM), VRF Cassette unit (1 W / 1S.by) and the outdoor unit shall be located in the Balcony. (AHU supply will be provided).
3	3	Transport Room	290	0.8	435	2 X 1.6 TR (493 CFM), VRF Cassette unit (1 W / 1S.by) and the outdoor unit shall be located in the Balcony(AHU supply will be provided).
4	5	EDP Room	255	0.4	185	2 X 1.0 TR (300 CFM), VRF Cassette unit (1 W / 1S.by) and the outdoor unit shall be located in the Balcony(AHU supply will be provided).

### Dedicated Air conditioning \_ AC Load summary & AC unit selection

S.No	Floor level	Zone	Area Sq.ft	Assessed cooling Load		Proposed AC unit capacity
				TR	Dehumidified CFM	
1	9	Social Hub, Lift lobby, Gaming & WB	5100	8.0	4045	2 X 1.6 TR 493 CFM, VRF Cassette units for Well being & 2 X 5.5 TR 2050 CFM, VRF Ceiling suspended units for Social Hub, Gaming & Lift lobby

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## Option for Night time & Weekend operation

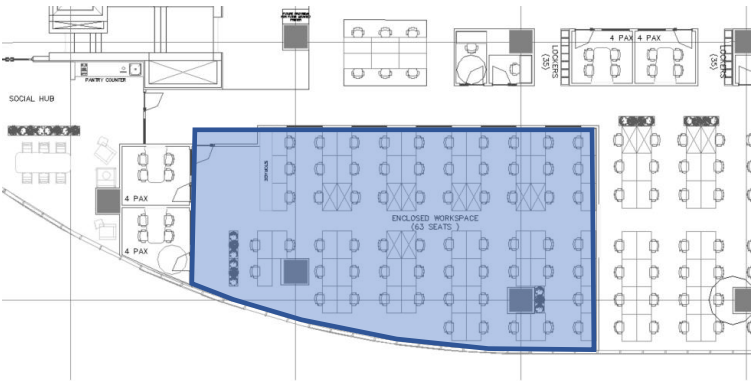
Based on the client's requirements, Four locations have been identified where both air conditioning from the AHU can be provided for daytime operation, and a VRF ceiling-suspended unit can be used for nighttime operation.

Detailed description of the Floor including the area and occupancy is mentioned below for quick reference.

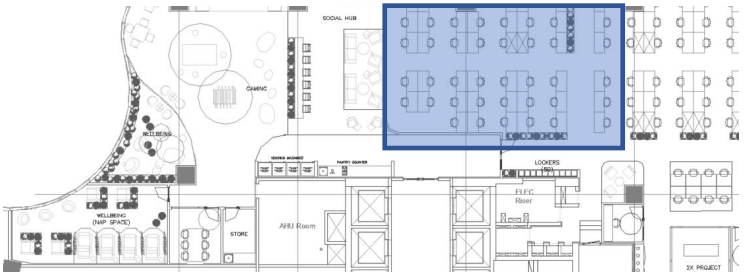
S.no	Floor	Floor area (Sq.ft)	Occupancy (Nos)	Assessed cooling Load			VRF CSU Selection		Remarks
				Fresh air Quantity (CFM)	TR	Dehumidified CFM	TR	CFM	
1	4	2350	63	621	6.7	3710	5.5	2050	2 No's
2	5, 6 & 7	2640	50	555	8.6	4670	6.4	2200	2 No's

The proposed design includes two CSUs on each floor, specified as per the capacity mentioned in the table. These CSUs will be utilized for nighttime and weekend operations, providing an energy-efficient cooling solution.

- **System Configuration:** The supply air from the CSU & AHU will be connected to the Plenum with motorized dampers on both CSU outlets and AHU supply air duct. This integration ensures that the system operates seamlessly during nighttime and weekend periods.
- **Operational Control:** The motorized dampers will be controlled via the Building Management System (BMS). When nighttime or weekend operation is required, the BMS will activate the CSUs and open the motorized dampers, allowing the CSU to supply air through the Plenum and Air distributed through duct. When the CSUs are turned off, the motorized dampers will close, and the AHU supply will automatically resume normal operation.
- **Power and Control Synchronization:** The motorized dampers installed on the duct connected to the CSU will be powered by the VRF CSU. When the CSU turns off, the motorized dampers will close, automatically redirecting the airflow back to the AHU, ensuring continuous airflow during normal operations. The same process will apply to the motorized dampers on the AHU's main duct before this connection.



Dedicated Air conditioning zone in 4th Floor for Night time & Weekend operation.



Dedicated Air conditioning zone in 5th, 6th & 7th Floor for Night time & Weekend operation.

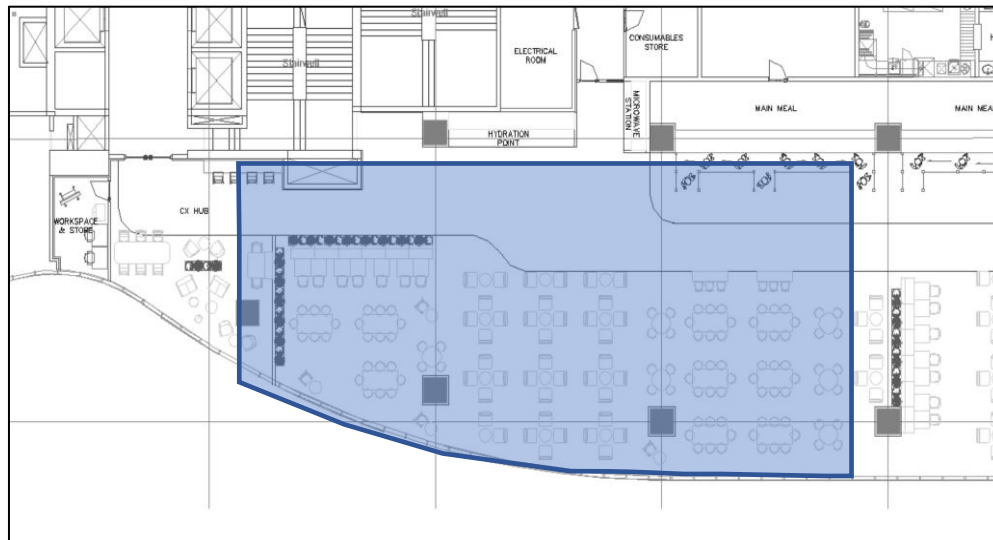
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## Option for Post-office hours & Weekend operation for Cafe

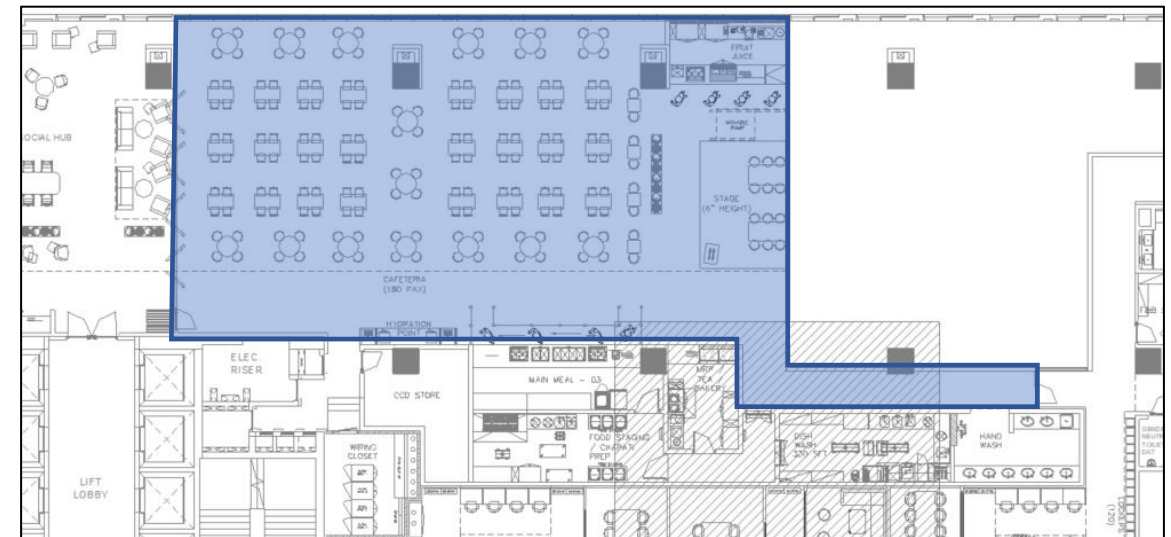
Based on the client's requirements, Cafe need to be airconditioned for post office hours and weekend operations, Insight of the same dedicated VRF cassette unit has been planned.

Detailed description of the Floor area including occupancy is mentioned below for quick reference.

S.no	Floor	Floor area (Sq.ft)	Occupancy (Nos)	Assessed cooling Load			VRF 4W Cassette unit Selection		Remarks
				Fresh air Quantity (CFM)	TR	Dehumidified CFM	TR	CFM	
1	3	5945	159	2860	11.3	4850	3.2	1165	5 No's
2	9	4541	192	3183	13.55	4751	3.2	1165	5 No's



Dedicated Air conditioning zone in 3rd Floor for Night time & Weekend operation.



Dedicated Air conditioning zone in 9th Floor for Night time & Weekend operation.



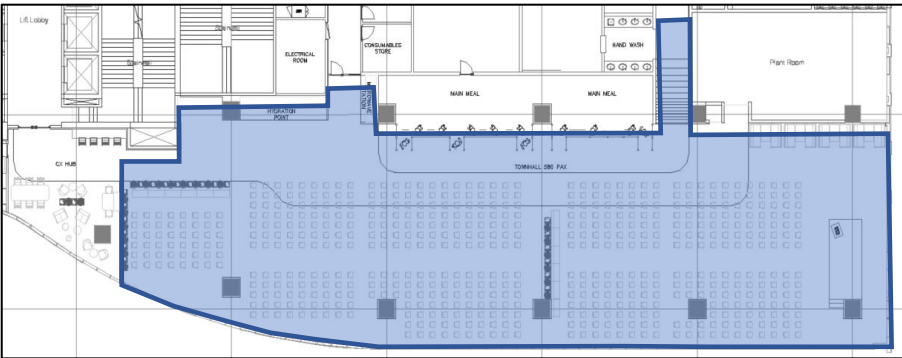
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## Heat Load comparison for the Town Hall setup

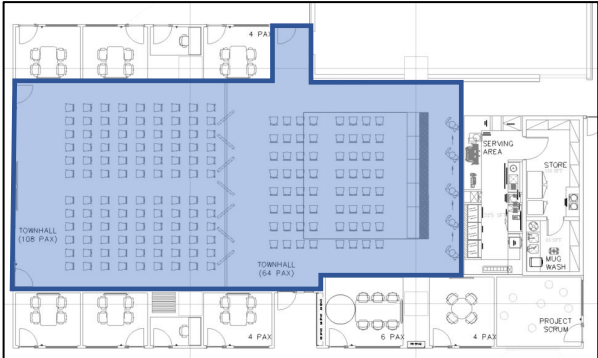
Based on the client's requirements, Cafe can also to be used as Townhall setup, Insight of the same dedicated VRF cassette unit has been planned.

Detailed description of the Floor including the area and occupancy is mentioned below for quick reference.

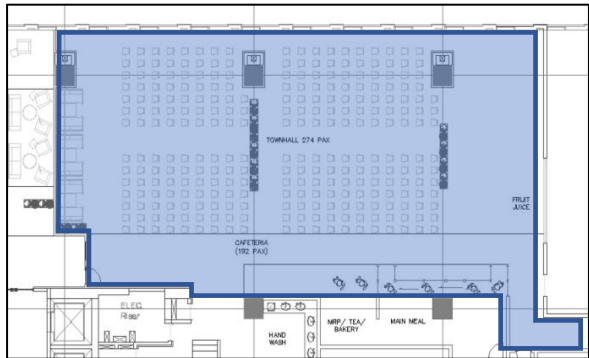
S.no	Floor	Floor area (Sq.ft)	Occupancy Based on Townhall Setup (Nos)	Assessed Cooling Load			Builder Available Capacity		Remarks
				Fresh air Quantity (CFM)	TR	Dehumidified CFM	TR	CFM	
1	3	11185	586	8392	30.3	11469	35	14000	The AHU capacity is adequate to serve both Cafe & Townhall setup.
2	6	3595	172	2610	11.3	3399	-	-	4 X 3.2 TR, 1165 CFM will be considered for Both Cafe & Townhall Setup.
3	9	5084	400	5405	14.2	7580	30	12000	The AHU capacity is adequate to serve both Cafe & Townhall setup.



3rd Floor cafe considered for Townhall Setup



6th Floor cafe considered for Townhall Setup



9th Floor cafe considered for Townhall Setup

# HVAC

## Fresh air requirement and base builder provision

LHS AHU Room (Fresh air Riser shaft)					
Floor	Fresh air provided by Base Builder	Area	Occupants considered including cafe	Fresh air Required including cafe	Remarks
2	812	4680	52	755	-
3	1484	6485	104	1230	-
4	1484	8865	120	1615	-
5	1484	8770	120	1490	-
6	1366	9490	141	1330	-
7	1484	8780	120	1630	-
8	1484	8775	120	1625	-
9	1366	10985	254	4495	Tap off size to be modified to accomodate the Town hall & cafe setup
10	1484	8780	120	1650	-
11	1484	8800	120	1650	-
<b>Total</b>	<b>13932</b>			<b>17470</b>	

Note: In addition to the existing fresh air fan, an additional treated fresh air fan with a capacity of 4000 CFM shall be installed to meet the fresh air requirements as per LEED standards.



# HVAC

## Fresh air requirement and base builder provision

RHS AHU Room (Fresh air Riser shaft)					
Floor	Fresh air provided by Base Builder	Area	Occupants considered including cafe	Fresh air Required including cafe	Remarks
2	-			-	-
3	2955	18400	441	5790	Tap off size to be modified to accomodate the Town hall & cafe setup
4	2955	18850	258	3720	-
5	2955	18170	259	3250	-
6	2723	14890	211	3090	-
7	2955	19100	251	3600	-
8	2955	18655	251	3560	-
9	2723	13230	181	1340	-
10	2955	19000	262	3590	-
11	2955	18870	265	3385	-
<b>Total</b>	<b>26131</b>			<b>31325</b>	

Note: In addition to the existing fresh air fan, an additional treated fresh air fan with a capacity of 4500 CFM shall be installed to meet the fresh air requirements as per LEED standards.

# HVAC

## System Architecture

Air conditioning system architecture for Office area & Cafeteria

S.No	Space Name	CHW AHU	VRF Ductable	VRF Hi-wall
1	Office area	W	-	-
2	3rd Floor - Cafeteria	W	-	-
3	9th Floor - Cafeteria	W	-	-



Floor Mounted AHU

Air conditioning system architecture for Comms, UPS & Battery Room

S.No	Space Name	CHW AHU	DX Floor Mounted PAC unit	VRF Ductable unit	VRF Cassette
1	Comms room		2W + 1S	-	-
2	Wiring Closet	optional	-	1W + 1S	-
3	UPS & Battery room		-	2W + 1S	-
4	BMS, Transport & EDP Room	optional	-	-	1W + 1S



VRF Ductable unit



VRF Fan coil unit



VRF Cassette unit

Ventilation system architecture

S.No	Space Name	Cabinet centrifugal Exhaust fan (Centralized)	Circular inline Booster Exhaust fan	Circular inline Exhaust fan with H2O Sensor & control panel
1	Pantry & Breakout area		✓	-
2	Battery Room	-	-	✓
3	Kitchen vapor Exhaust	-	✓	-


































DX PAC Unit



Inline Fan

# HVAC

## VRF Schematic

3rd, 5th,6th Floor Critical room ODU (W+S) and 8th, 9th,10th Floor Critical room ODU (W)						Terrace	
8th, 9th,10th Floor Critical room ODU (W)	Balcony 					Eleventh Floor	
9th Floor Cafe & Social Hub, WB area ODU	Balcony 	Wiring Closet 				Tenth Floor	
6th & 7th Floor Workstation ODU	Balcony 	Wiring Closet 	Well Being area 	Social Hub 	Cafe 	Ninth Floor	
6th Floor Cafe ODU	Balcony 	UPS & Battery Room 				Eight Floor	
4th & 5th Floor Workstation ODU	Balcony 	Enclosed Office area Night time & Weekend operation 				Seventh Floor	
5th Floor Comms Room PAC ODU	Balcony 	Enclosed Office area Night time & Weekend operation 		Cafe 	Wiring Closet 	Sixth Floor	
5th Floor Comms Room PAC ODU	Balcony 	EDP Room 	Wiring Closet 	UPS & Battery Room 	Comms Room 	Enclosed Office area Night time & Weekend operation 	Fifth Floor
3rd Floor Cafe ODU	Balcony 	Enclosed Office area Night time & Weekend operation 					Fourth Floor
2nd & 3rd Floor BMS, Transport & Mail Room ODU	Balcony 	Transport Room 	BMS Room 	Wiring Closet 	Cafe 		Third Floor
	-	Mail Room 					Second Floor

# HVAC

## Kitchen Ventilation

- The proposed kitchen area will be ventilated using a dedicated floor-mounted exhaust fan with a dry scrubber and an Indirect direct evaporative cooling system for the fresh air intake.
- A two-stage evaporative cooling system is proposed for the fresh air intake, combining both direct and indirect cooling methods. This process draws ambient fresh air from outside, which is first pre-cooled using a heat exchanger with cold water circulated and sprayed around it. The air then passes through a wet evaporative media for additional cooling.
- The capacity of the exhaust fan for the 3rd & 9th floor kitchen shall be 11000 CFM (2 No's) & Fresh air shall be 10000 CFM (2 No's).
- The capacity of the exhaust fan for the 6th floor shall be 1600 CFM.
- However, the builder team needs to identify the location for the exhaust and fresh air fans on the terrace level.

### Note:

- The kitchen exhaust requirements have been determined based on the final kitchen equipment layout. Any revisions to the layout will be incorporated, and the requirements will be updated and finalized accordingly.



**Centrifugal  
Cabinet Fan**



**Scrubber**



**Indirect & Direct  
Evaporative cooling unit**

# HVAC

## Duct Design

Sl.No	Particulars	Data	Remarks
1	Duct standard	SMACNA	
2	Velocity of air flow in Main supply air duct	7.62 m/s	
3	Velocity of Return air in the AHU Return air ducts	5.08 m/s	
4	Rectangular Duct Gauges	Rectangular Duct Width - Gauges <ul style="list-style-type: none"> <li>• 0 to 750 mm - 24 G</li> <li>• 750 mm to 1500 mm - 22 G</li> <li>• 1500 mm to 2250 mm - 20 G</li> <li>• 2250 mm and above - 18 G</li> </ul>	
5	Elliptical Duct Gauges	Elliptical Duct Width - Gauges <ul style="list-style-type: none"> <li>• 0 to 600 mm - 24 G</li> <li>• 600 mm to 900 mm - 22 G</li> <li>• 900 mm to 1200 mm - 20 G</li> <li>• 1200 mm and above - 18 G</li> </ul>	



## Air Terminal Design

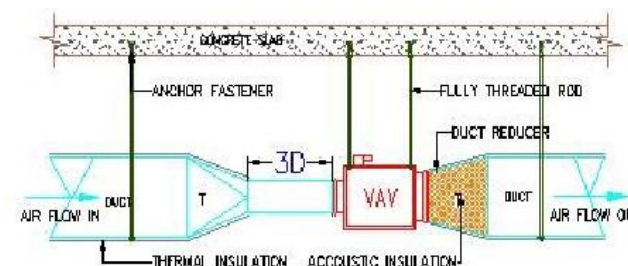
Sl.No	Particulars	Data	Remarks
1	Diffuser	Construction – Aluminum powder coated diffuser Velocity – 2 m/s	
2	Grille	Construction – Aluminum powder coated Grille Velocity – 2.54 m/s	



# HVAC

## Variable Air Volume Boxes

- The VAV box shall be provided for all workstation, meeting room through CHW AHU'S.
- VAV will be provided for each zone.
- Minimum inlet straight duct (3 X inlet dia in mm) shall be provided to ensure streamlined airflow over flow sensors. Refer the detail provided..
- All open office VAV shall have thermostat and IAQ sensor for each zone.
- All closed rooms (Training room, meeting room, seminar room) VAV shall have thermostat.
- All VAV shall be connected to UPS network by electrical vendor.
- VCDs shall be provided for all VAVs.



## Motorized Fire Damper

Sl.no	Particulars	Data	Remarks
1	Type	Motorized fire dampers	
2	Application areas	All fire rated walls: <ul style="list-style-type: none"> <li>• AHU room supply &amp; return</li> <li>• Fire compartment partition walls supply &amp; return</li> </ul>	
3	Control Panel	<ul style="list-style-type: none"> <li>• Each AHU room will have an individual control panel to monitor and integrate each fire damper to the BMS system.</li> <li>• The control panel shall be connected to BMS for monitoring via potential free contacts</li> </ul>	
4	Power supply	<ul style="list-style-type: none"> <li>• UPS power supply shall be considered for Fire dampers</li> </ul>	
5	Certifications	CBRI Certified	

# HVAC

## Thermal & Acoustic Insulation

### Acoustic Insulation:

- 15mm thick Class "1" type, Open cell elastomeric Acoustic insulation with density not less than 140 kg / m<sup>3</sup> with Eco friendly adhesives shall be used.
- First 5-meter length of supply air duct (from plenum) shall be acoustically lined.

### Thermal Insulation:

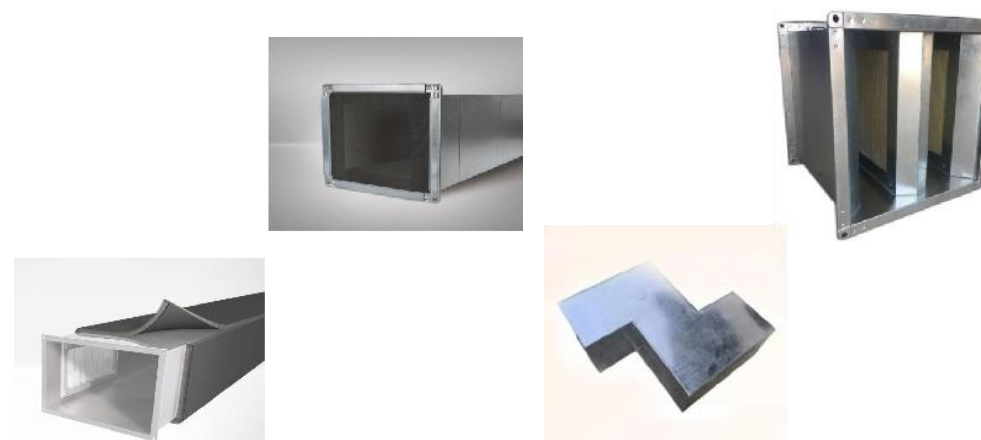
- 9 mm thick closed cell elastomeric insulation of Class 'O' material with density of 40 - 55 kg/cum is used. All the supply & Return air duct (except those acoustically lined) will be thermally insulated and the Eco-friendly adhesives shall be used.

## Sound Attenuators

Sound attenuators shall be installed in both the supply and return air ducts from the AHU room to reduce the noise transmission & to enhance acoustic comfort. The casing will be made of 120 GSM GSS, 20-gauge, with sound-absorbing material and internal baffles. These baffles will be 25 mm thick fiberglass with a density of 48 kg/m<sup>3</sup>, covered with RP tissue and finished with a 24 Gauge perforated GI sheet.

## Cross-talk Attenuators

Cross-talk attenuators will be installed in all enclosed meeting rooms, cabins, and conference rooms to prevent sound transmission between adjacent spaces, ensuring privacy and reducing noise disturbances. The casing will be made of 120 GSM, 24-gauge galvanized sheet steel (GSS), and the entire cross-talk silencers will be acoustically lined with 10mm thick open-cell nitrile rubber insulation.

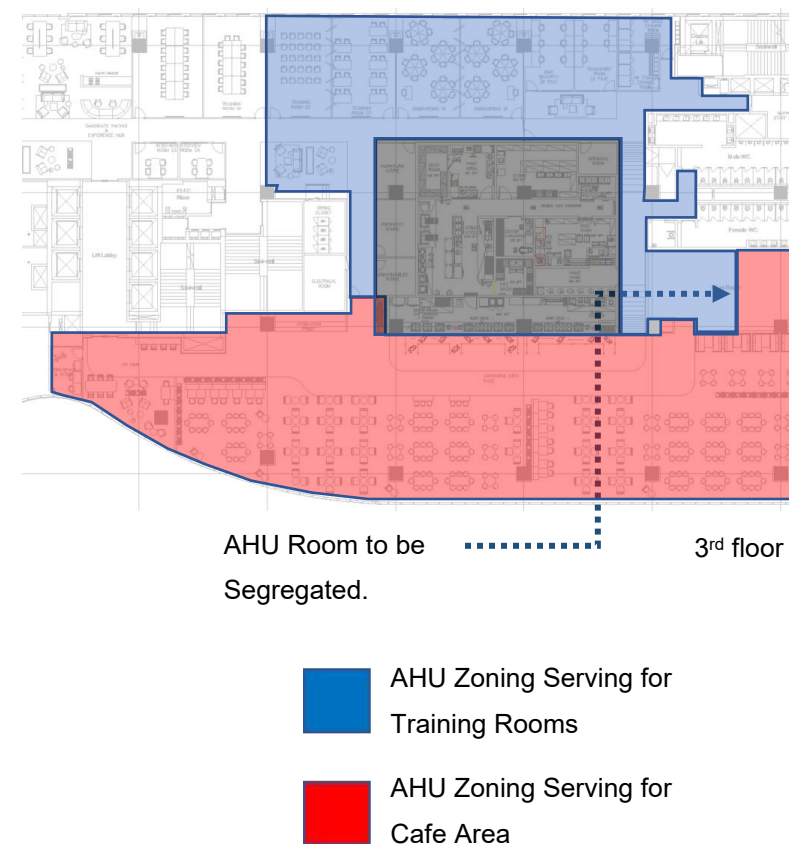


# HVAC

## Observations & Recommendation on the base building infrastructure to accommodate the interior requirements :

Since half of the third floor has been designated for a café, the air conditioning system must also cover this area. The AHU room on the right-hand side (RHS) contains two Air Handling Units (AHUs), with one AHU sufficient to serve the café area while the other AHU can provide cooling for the training rooms located on the upper floor.

In light of this, we recommend segregating the two AHUs within the AHU room by constructing an airtight partition between them. This partition will prevent the re-circulation of odors from the café area into the training rooms, ensuring that the indoor air quality of both spaces is maintained and that no cross-contamination of smells occurs.





# HVAC

## Compliance sheet

Sl.No	Inputs received	Innowell response	Input received & dated
1	24/7 Air conditioning to be considered for BMS, Transport, IT & EDP Room	IT Room is not reflecting in the interior layout, apart from that all other rooms are captured	Natwest   MEP DBR catchup-call on 14.10.2024
2	Dedicated air conditioning for 3 <sup>rd</sup> , 6 <sup>th</sup> & 9 <sup>th</sup> floor cafeteria to be considered for weekend and night operations.	The requirement has been updated in the DBR.	Natwest   MEP DBR catchup-call on 14.10.2024
3	4 <sup>th</sup> floor air conditioning location for the weekend & night time operation to be changed to enclosed WS area.	Noted, the same has been updated in the DBR	Natwest   MEP DBR catchup-call on 14.10.2024
4	Indoor temperature to be maintained 23 -2/+1 Deg C, Based on this the Heat load comparison to be revised.	Noted, the same has been updated in the DBR	Natwest   MEP DBR catchup-call on 14.10.2024
5	Thermal insulation class "o" to be considered.	Noted, the same has been updated in the DBR	Natwest   MEP DBR catchup-call on 14.10.2024
6	Cafeteria Townhall setup to be considered and AC load to be cross checked.	Noted, the same has been updated in the DBR	Natwest   MEP DBR catchup-call on 16.10.2024
7	Indoor Temperature for the critical rooms has been revised based on the client requirement 22 +/- 1 Deg C	Noted, the same has been updated in the DBR	Natwest   MEP DBR catchup-call on 16.10.2024

# Thank you