

ON JOB TRAINING
AIR CON FOR CENTRALISED AIR-CON SYSTEM

PREPARED BY ONG KEE HOCK CBM PTE LTD

Key Factors Affecting Air-Con Cooling

This table compares the temperature ranges for HVAC efficiency in conventional buildings versus Green Mark-certified buildings.

Description	Conventional Building	Green mark Building
Supply Air Temperature (The value higher these setting indicate weak cooling)	12 - 14 °C (Setting Temp ± 1°C)	16 – 19.5 °C
Return Air Temperature (Too low may suggest poor room heat gain or sensors faults)	24 – 25 °C (Setting Temp + 1°C)	24 – 25 °C
Chilled Water Temperature must be around the range for effective cooling and the Delta T is 6°C.	6 - 7°C	8.5 - 10°C
Condensing Water Temperature (for water-cooled systems) should be maintained below 32 °C and maintain the Delta T is 6°C.	29 - 32 °C	35 - 36 °C

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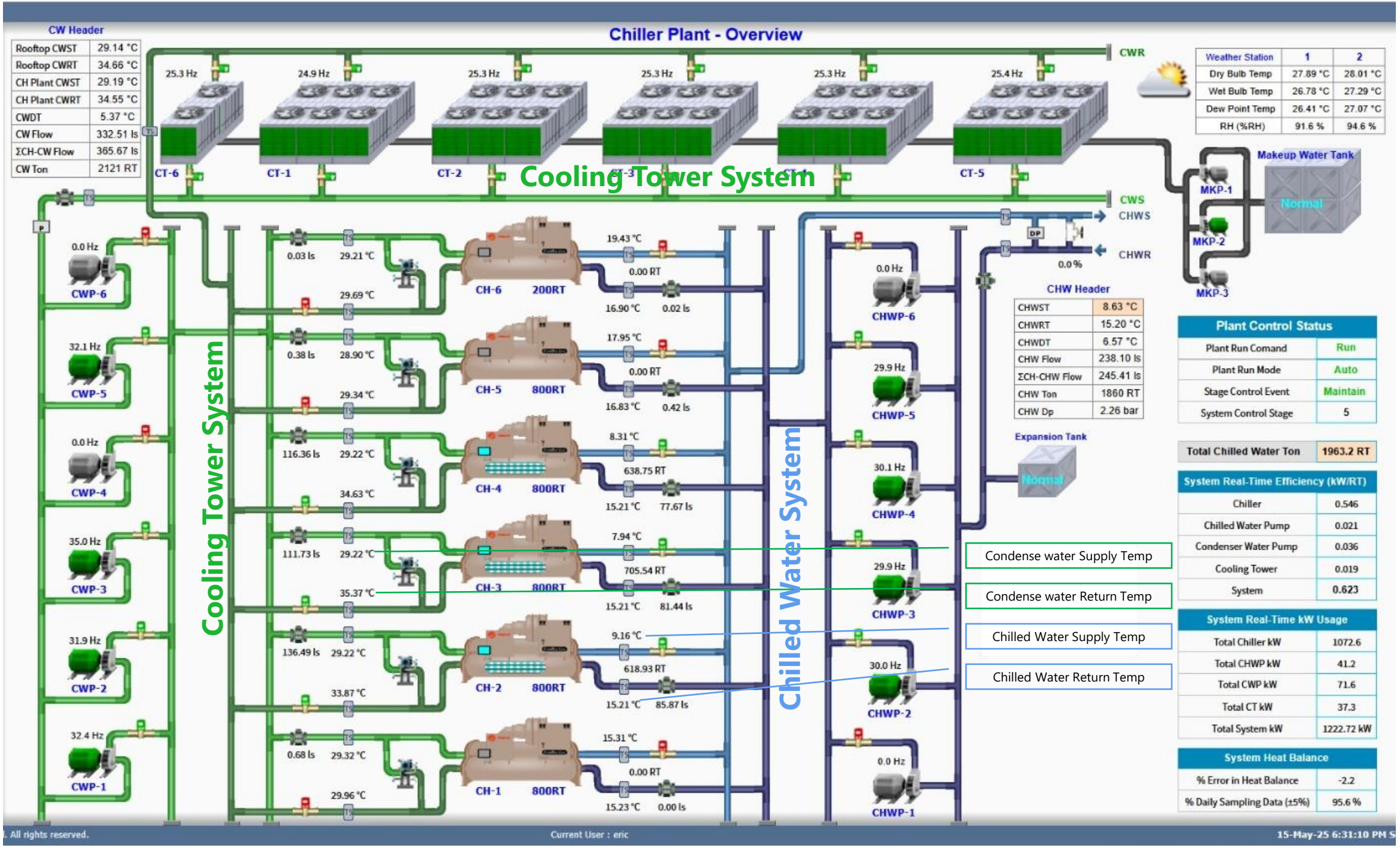
What is the Delta T

Delta T (ΔT) for Condense Water Temp:
Represents the difference between the temperature of the condense water entering condense coil (supply temperature) and the temperature of the condense water leaving the cooling coil (return temperature).

Delta T (ΔT) for CHW Temp:
Represents the difference between the temperature of the chilled water entering a cooling coil (supply temperature) and the temperature of the chilled water leaving the cooling coil (return temperature).

Low Delta T:
A situation where the actual ΔT is lower than the design ΔT. This can be caused by various factors like oversized equipment, scaling of coils, or improper hydronic balancing. Low ΔT can lead to inefficiencies and increased energy consumption.

High Delta T:
A situation where the actual ΔT is higher than the design ΔT. This can indicate that the cooling coils are not adequately transferring heat, potentially due to fouling or reduced airflow.


Chiller Plant - Overview
CW Header
Rooftop CWST 29.14 °C
Rooftop CWRT 34.66 °C
CH Plant CWST 29.19 °C
CH Plant CWRT 34.55 °C
CWDT 5.37 °C
CW Flow 332.51 ls
ΣCH-CW Flow 365.67 ls
CW Ton 2121 RT
Cooling Tower System
CT-6
CT-1
CT-2
CT-3
CT-4
CT-5
25.3 Hz
24.9 Hz
25.3 Hz
25.3 Hz
25.3 Hz
25.4 Hz
CWR
CWS
CHWS
CHWR
Weather Station 1 2
Dry Bulb Temp 27.89 °C 28.01 °C
Wet Bulb Temp 26.78 °C 27.29 °C
Dew Point Temp 26.41 °C 27.07 °C
RH (%RH) 91.6 % 94.6 %
Makeup Water Tank
Normal
MKP-1
MKP-2
MKP-3
CWP-6
CWP-5
CWP-4
CWP-3
CWP-2
CWP-1
0.0 Hz
32.1 Hz
0.0 Hz
35.0 Hz
31.9 Hz
32.4 Hz
Cooling Tower System
0.03 ls
29.21 °C
29.69 °C
0.38 ls
28.90 °C
29.34 °C
116.36 ls
29.22 °C
34.63 °C
111.73 ls
29.22 °C
35.37 °C
136.49 ls
29.22 °C
33.87 °C
0.68 ls
29.32 °C
29.96 °C
CH-6 200RT
CH-5 800RT
CH-4 800RT
CH-3 800RT
CH-2 800RT
CH-1 800RT
19.43 °C
0.00 RT
16.90 °C
0.02 ls
17.95 °C
0.00 RT
16.83 °C
0.42 ls
8.31 °C
638.75 RT
15.21 °C
77.67 ls
7.94 °C
705.54 RT
15.21 °C
81.44 ls
9.16 °C
618.93 RT
15.21 °C
85.87 ls
15.31 °C
0.00 RT
15.23 °C
0.00 ls
Chilled Water System
CHWP-6
CHWP-5
CHWP-4
CHWP-3
CHWP-2
CHWP-1
0.0 Hz
29.9 Hz
30.1 Hz
29.9 Hz
30.0 Hz
0.0 Hz
DP
0.0 %
CHW Header
CHWST 8.63 °C
CHWRT 15.20 °C
CHWDT 6.57 °C
CHW Flow 238.10 ls
ΣCH-CHW Flow 245.41 ls
CHW Ton 1860 RT
CHW Dp 2.26 bar
Expansion Tank
Normal
Condense water Supply Temp
Condense water Return Temp
Chilled Water Supply Temp
Chilled Water Return Temp
Plant Control Status
Plant Run Comand Run
Plant Run Mode Auto
Stage Control Event Maintain
System Control Stage 5
Total Chilled Water Ton 1963.2 RT
System Real-Time Efficiency (kW/RT)
Chiller 0.546
Chilled Water Pump 0.021
Condenser Water Pump 0.036
Cooling Tower 0.019
System 0.623
System Real-Time kW Usage
Total Chiller kW 1072.6
Total CHWP kW 41.2
Total CWP kW 71.6
Total CT kW 37.3
Total System kW 1222.72 kW
System Heat Balance
% Error in Heat Balance -2.2
% Daily Sampling Data (±5%) 95.6 %
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ADJUSTING AIR-CON PERFORMANCE

- IF NOT COLD ENOUGH:
  - Check supply/return air temperature difference (ideal: ~10°C). Eg. If supply air temperature is 14°C, the return air temperature should be around 24 - 25°C.
  - Increase fan speed for more airflow.
  - Clean clogged filters or chemical cleaning the coils.
  - Faulty Thermostat or Sensor – Incorrect readings can cause no cooling due to actuator is not functioning.

WHAT HAPPEN THE CLOGGED COOLING COIL

1. REDUCED AIRFLOW

- DUST, DIRT, OR DEBRIS ON THE COOLING COIL RESTRICTS AIR FROM PASSING THROUGH.
- **RESULT**: ROOMS COOL SLOWLY OR UNEVENLY; THE SYSTEM RUNS LONGER THAN USUAL.

2. DECREASED COOLING EFFICIENCY

- THE COIL CAN'T ABSORB ENOUGH HEAT FROM THE AIR DUE TO THE CLOG.
- **RESULT**: THE SYSTEM STRUGGLES TO MAINTAIN THE DESIRED TEMPERATURE, INCREASING ENERGY CONSUMPTION.

SOLUTION FOR THE CLOGGED COOLING COIL

- CLEAN THE COIL USING A SOFT BRUSH, VACUUM, OR A SPECIALIZED COIL CLEANER.
- SCHEDULE REGULAR MAINTENANCE TO PREVENT FUTURE CLOGS.

SOLUTION FOR THE CLOGGED COOLING COIL

Before - Cooling coil dirty & Chocked. Air Flow: Avg airflow 0.0m/s to 1.1m/s	After - Cooling coil after chemical cleaning. Air flow: Avg airflow1.6m/s to 1.8m/s
	

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ADJUSTING AIR-CON PERFORMANCE

- IF TOO COLD:
  - Thermostat Set Too Low – The temperature setting may be lower than necessary.
  - Faulty Thermostat or Sensor – Incorrect readings can cause overcooling.
  - Actuator Jam Open – The chilled water valve may be stuck in the open position, allowing continuous cooling.
  - Chilled Water Flow Too High – Improper balancing may cause excess chilled water through the coil.
  - Fan Speed Too High – High airflow may lead to overcooling of the space.
  - Poor Control Logic – Control system not responding correctly to temperature changes.

CALIBRATING TEMPERATURE VIA BMS SYSTEM

- ACCESS AHU OR FCU CONTROL SCREEN IN BMS.
- CHECK SETPOINT VS. ACTUAL SUPPLY AIR TEMPERATURE.
- ADJUST SETPOINT
- ENSURE TEMPERATURE SENSOR CALIBRATION IS CORRECT:
  1. Use a handheld thermometer to verify.
  2. Apply offset correction if deviation exceeds ±2°C.

USING TEMPERATURE MEASURING TOOLS

- **RAYTEK GUN (INFRARED):**
  - Aim at surface (e.g., diffuser or pipe)
  - Ideal for non-contact quick checks
  - Avoid shiny or reflective surfaces for accuracy

SWING THERMOMETER:

- Used for **air temperature**
- Hang in airflow path for **5–10 minutes**
- Read once stabilized





USING TEMPERATURE MEASURING TOOLS

DIGITAL THERMOMETER:

- Insert probe into duct or near diffuser
- Wait for stable reading
- Good for Calibration and spot check



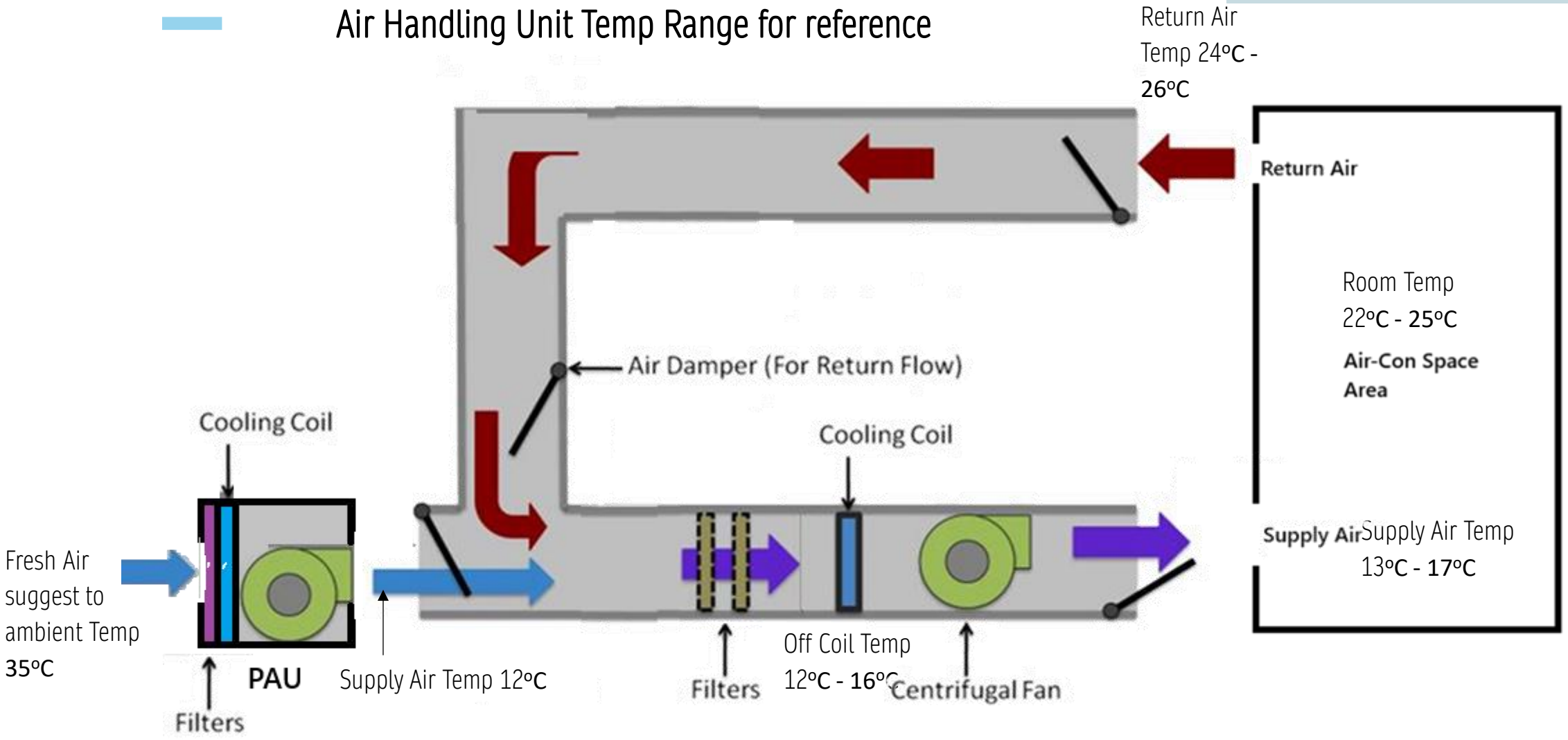
USING TEMPERATURE MEASURING TOOLS

Anemometer

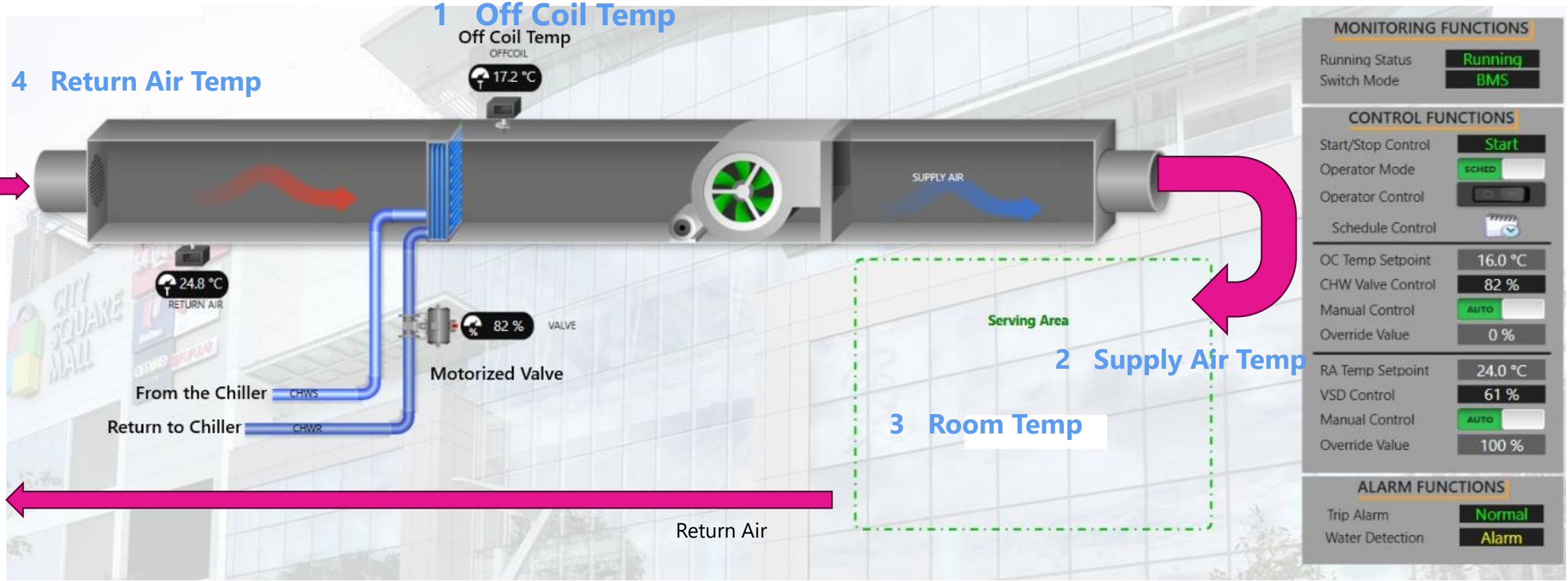
- **Taking Measurements:**
  - Aim the anemometer at the airflow source.
  - The primary display shows **temperature**; the secondary line displays either **air velocity** or **relative humidity**.
- **Data Hold Function:**
  - Press the **HOLD** button to freeze the current reading.
- **Auto Power Off:**
  - The device automatically powers off after **30 minutes** of inactivity.



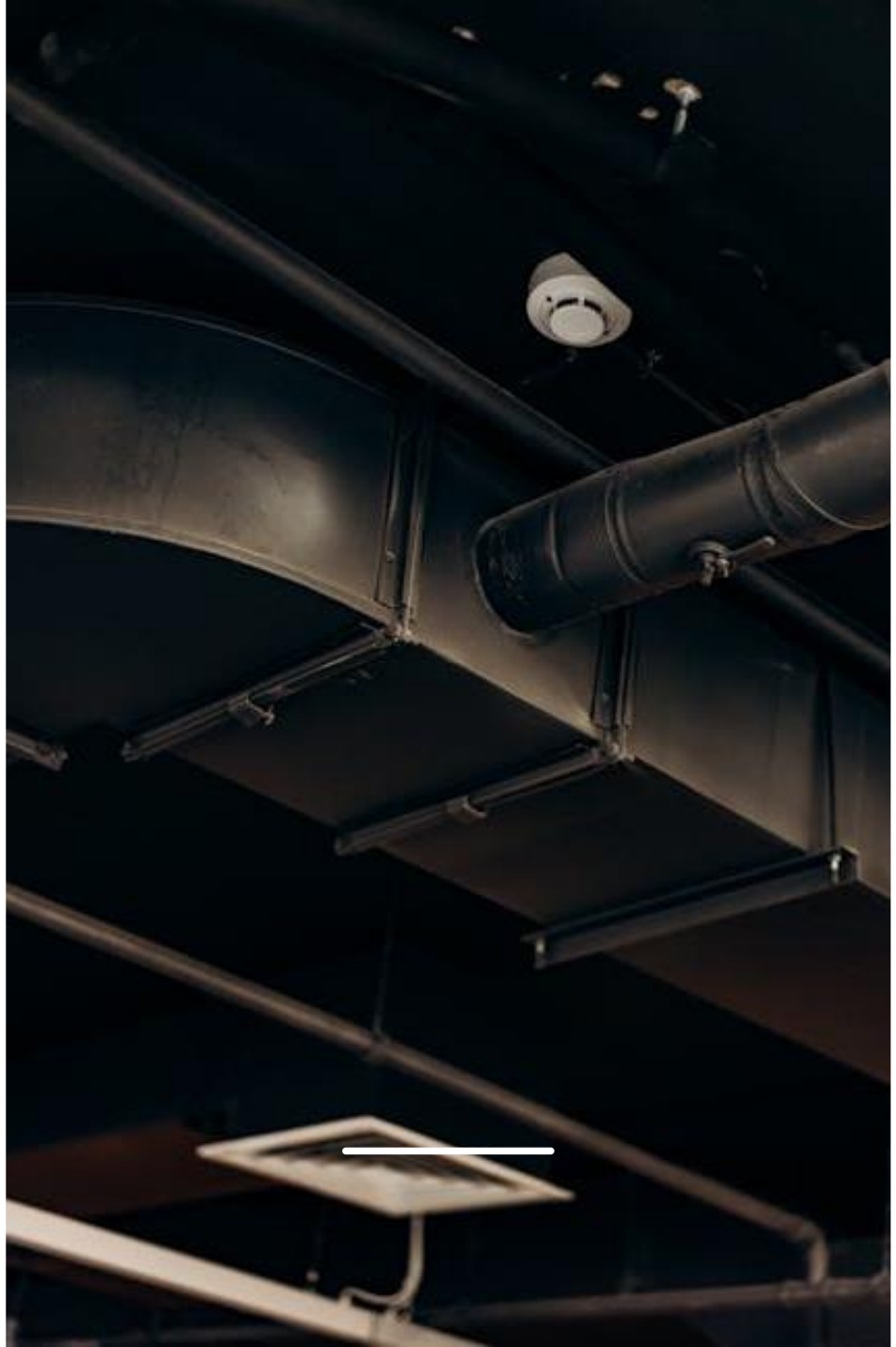
Air Handling Unit Temp Range for reference



The Sensors Location of Handling Unit Schematic Diagram



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1 Off Coil Temperature

OPTIMAL RANGE

To ensure optimal performance of HVAC systems, it is crucial to maintain the off coil temperature within the range of 14 to 16 °C. This temperature threshold helps in maximizing energy efficiency and comfort levels in conditioned spaces. Keeping temperatures outside this range can lead to equipment strain and reduced efficiency, ultimately impacting the overall system performance.

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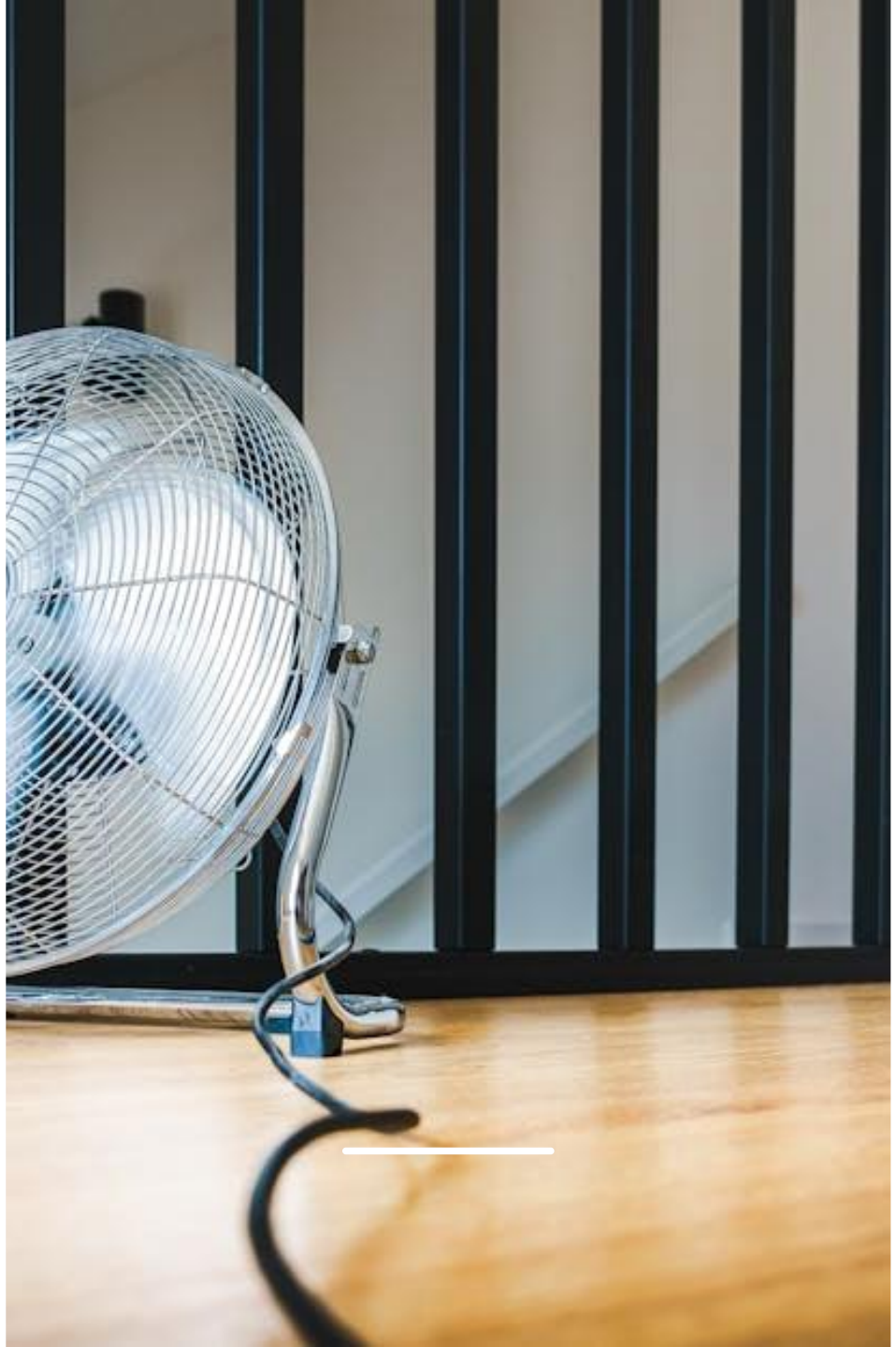


2 Supply Air Temperature

REQUIRED RANGE

For optimal heating and cooling efficiency, the supply temperature must be maintained between 14 °C to 17 °C. Keeping it within this range enhances performance and comfort levels in the system, ensuring both energy savings and adequate thermal comfort for occupants.

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Room Temperature

IDEAL RANGE

For optimal comfort and efficiency, the recommended indoor temperature should ideally range from 22 °C to 25 °C. Maintaining this temperature in living or working spaces aids productivity and ensures a pleasant environment, striking a balance between warmth and coolness.

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4 Return Air Temperature

ACCEPTABLE RANGE

The return air temperature is critical for HVAC system performance. Ideal temperatures range from 24 °C to 26 °C. Staying within this range helps optimize energy efficiency and ensures comfortable indoor air quality. Deviations outside of these parameters can lead to reduced system efficiency and increased energy consumption, emphasizing the need for regular monitoring.

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Summary Table

This table summarizes the optimal temperature ranges for various settings to enhance HVAC efficiency.

Temperature Type	Optimal Range
Off Coil Temperature	14 - 16 °C
Supply Temperature	14 - 17 °C
Room Temperature	22 - 25 °C
Return Air Temperature	24 - 26 °C

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Applications	Outlet Velocity (m/s)
Broadcasting Studios	1.5 – 2..5
Residences, Hotel Bedrooms, Private Offices	2.5 – 3.75
Theatres, Restaurants	2.5 – 5.0
General Offices, Small Shops	5.0 – 6.25
Department Stores	5..0 - .7.5
Factories	5.0 – 10.0

Recommend Outlet Velocity for Grilles and Registers

THIS TABLE SHOWS THE RECOMMENDED DESIGN OUTLET VELOCITY FOR GRILLES FOR DIFFERENT TYPES OF INDOOR AIR-CON SPACES. PROPER VENTILATION IS IMPORTANT FOR MAINTAINING GOOD AIR QUALITY, COMFORT, AND HEALTH.

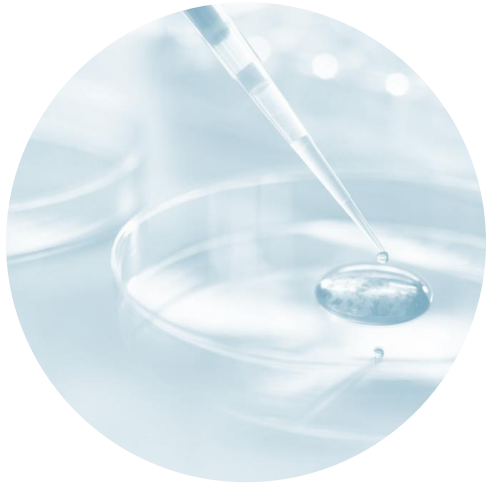
✅ WHY THIS MATTERS:

LOWER VELOCITY (1.5–2.5): USED IN QUIET, LOW-ACTIVITY ROOMS.

MEDIUM VELOCITY (2.5–5.0): NEEDED WHERE PEOPLE GATHER FOR EVENTS OR DINING.

HIGHER VELOCITY (5.0–7.5): REQUIRED FOR LARGE PUBLIC AREAS WITH LOTS OF FOOT TRAFFIC.

BASED ON THESE GUIDELINE TO KEEP INDOOR ENVIRONMENTS SAFE AND COMFORTABLE.



THANK YOU