

HVAC CALCULATION NOTES

Prepared by: Samir Dekko - M Eng.

I. HVAC SYSTEMS

The cooling system of the Podium floors will be supplied from a chillers plant located on the roof (8 chillers where 6 chillers are cooling only (2 pipes) and two chillers are specified with recovery (4 pipes) for the heating of HWSTs in the project).

Refer to the Annex Folder “Chillers selections”.

The cooling load was calculated with HAP software Version-5.1 (**Refer to Annex Folder “HAP for Podium floors”**).

A-FCUs and AHUs

Total FCUs and AHUs load: **3876 kw**

Additional load for kitchen condensers **228Kw**

B- FAHU ON ROOF

Total FAHUs load: **1,115kw**

Therefore, total load = $3876 + 228 + 1115 = 5,219\text{kW}$ (**1,483 TR**).

Taking 10 % safety factor, we select 8 chillers

CH-1: cooling only chillers each one should have a capacity of $705\text{kW} = \mathbf{200\ TR}$

1. Cooling Water Pumps

The pump head calculations are made by calculating the most critical path pipe pressure losses including all accessories and adding to it the static pressure (for open systems), outlet pressure and the equipment and components pressure drops such as coils and control valves.

Refer to the Annex Folder “Chilled and Heating circulating pumps selections”.

A- CHWPP-01(Chilled Water Primary Pump)

a- Flow

For the 8 chillers, we have 8 duty pumps & 1 standby pump. (9 Total)

Individual chiller Flow = **30.0 L/s** = 108m³/hr

b- Head

- Pipes: (1Pa/m = 0.01 ft H₂O/100 ft)

Pipes length = 180 ft (14": 1.5ft/100ft) $\Rightarrow$ pressure drop = 3.0 ft

$\Rightarrow$ Total pressure drop = **3.0 ft**

- Chillers:

-Pressure drop in chillers = 6.5 m = **22.0 ft**

-Air Separator:

-Pressure drop in air separator = **4.5 ft**

5. Fresh Air Handling Units

The Treated Fresh air system is provided for each space according to ASHRAE 62.1-2013 recommendation with respect of the air balancing between adjacent spaces. Refer to Annex Folder "Fresh Air & Exhaust Calculation".

A- Fresh Air Handling Units (FAHU) Cooling/Heating Loads

FAHU-LR-1

The total fresh air required is 6,783 l/s (14,375cfm), and exhaust air is 5,250 l/s (11,125cfm) the FAHU is to treat 100% fresh air with energy recovery wheel.

We designed for Evaporation WB/Mean Coincident Dry-Bulb instead of Cooling DB/MCWB, since it has a higher enthalpy content of $h=48$ vs 39.4 BTU/lb. The selected WB/MCDB parameters are exceeded 0.4% of the year (ref *ASHRAE 2017 Fundamentals climatic data*).

Outside design conditions (0.4% for WB & MCDB): DB = 38.2°C (**101.5°F**) (point 1)
WB= 28.9°C (**84.0°F**)
RH = 48.9%
 $h = 48.0$ Btu/lb dry air

Inside conditions:

DB = 22°C (71.6°F) (point 3)
RH = 50%
WB= 16°C (60.8°F)

Taking into consideration that the FAHU is provided with a **heat recovery wheel**, to save energy in the system:

We select a wheel with a **67% efficiency** (Refer to appendix for wheel software calculation)

Resulting conditions **Recovery Wheel**: DB = 27.3°C (**81.1°F**) (point 2)

WB= 20.7°C (69.2°F)

RH = 55.3%

$h_1 = 33.3$ BTU/lb

specific volume $v_1 = 13.9\text{ft}^3/\text{lb}_{\text{air}}$

humidity ratio $w_1 = 0.0127$ lb_{water}/lb_{air}