SBS4113 Architecture & Buildings

http://ibse.hk/SBS4113/

Lecture : Introduction to building services I - Ventilation and Air Conditioning Services

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Cheung's Old web site: http://www.ad.arch.hku.hk/~kpcheung/index.html

Web site jointly developed with *Dr Hui : http://www.ad.arch.hku.hk/research/BEER/

Heating, Ventilating, and Air-conditioning Systems

Priority :

Safety [structural, fire, accident prevention] ,

Health : Good hygiene of water supply, soil and waste drainage, rain water drainage [good indoor air quality- good IAQ, little Electromagnetic effect, reasonable daylight, greening,],

Comfort [Reasonable comfort : temperature, humidity, noise versus quietness] ,

Sustainable building & Sustainable world [Energy saving, Energy efficient, Low carbon building]

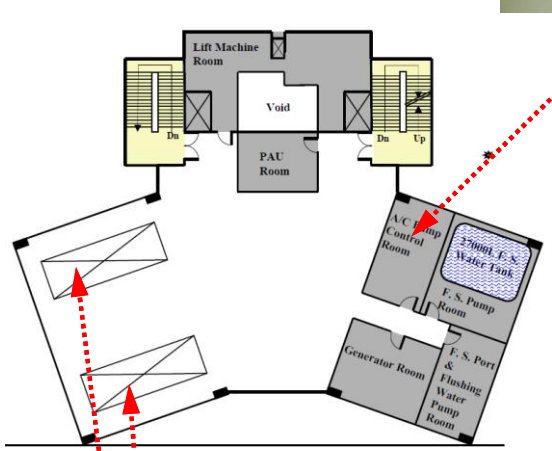
Chilled water pump on Roof
(image : http://poet.lbl.gov/tour/sf/pumps.html)

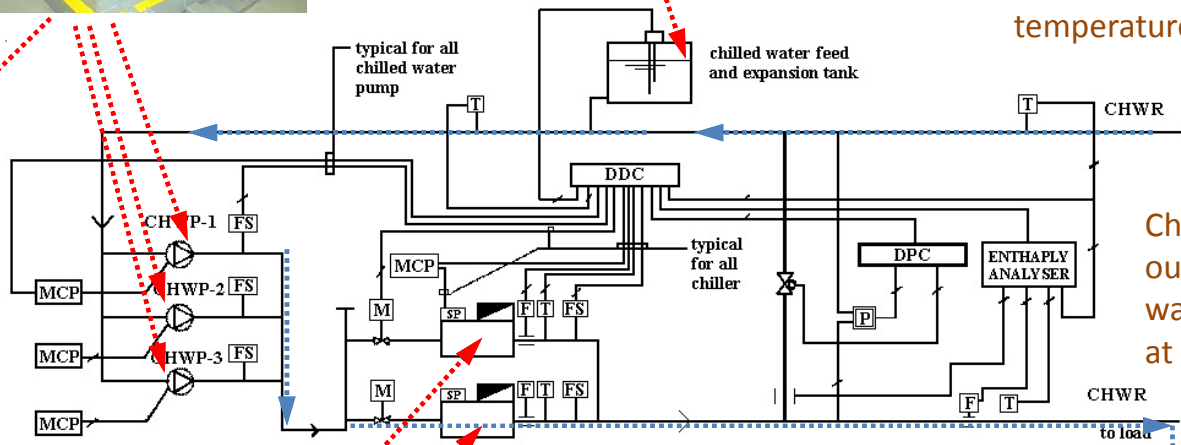
Roof pneumatic booster unit supplies potable water to 9/F and above, Including the feed-and-expansion tank of the chilled water system of the central air conditioning system

Central Chilled water system -Tsui Tsin Tong Building, HKU

http://arch.hku.hk/teaching/intgtech/104.htm

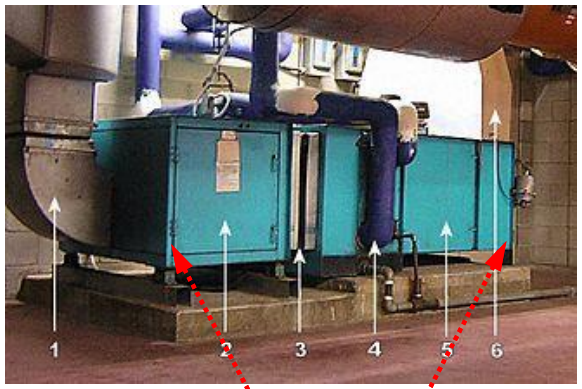
Chilled water returning to chiller at roof -water temperature at 12 degree C





Tsui Tsin Tong Building, HKU, Roof

Chilled water flowing our from chiller - water temperature at 7 degree C



Air Handling unit = AHU

PAU

FCU

AHU

FCU

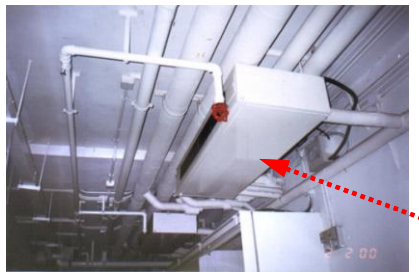
FCU

FCU

FCU

air cooled water chiller on Roof
(image : chistine.ecvv.com)

Chilled water pipes

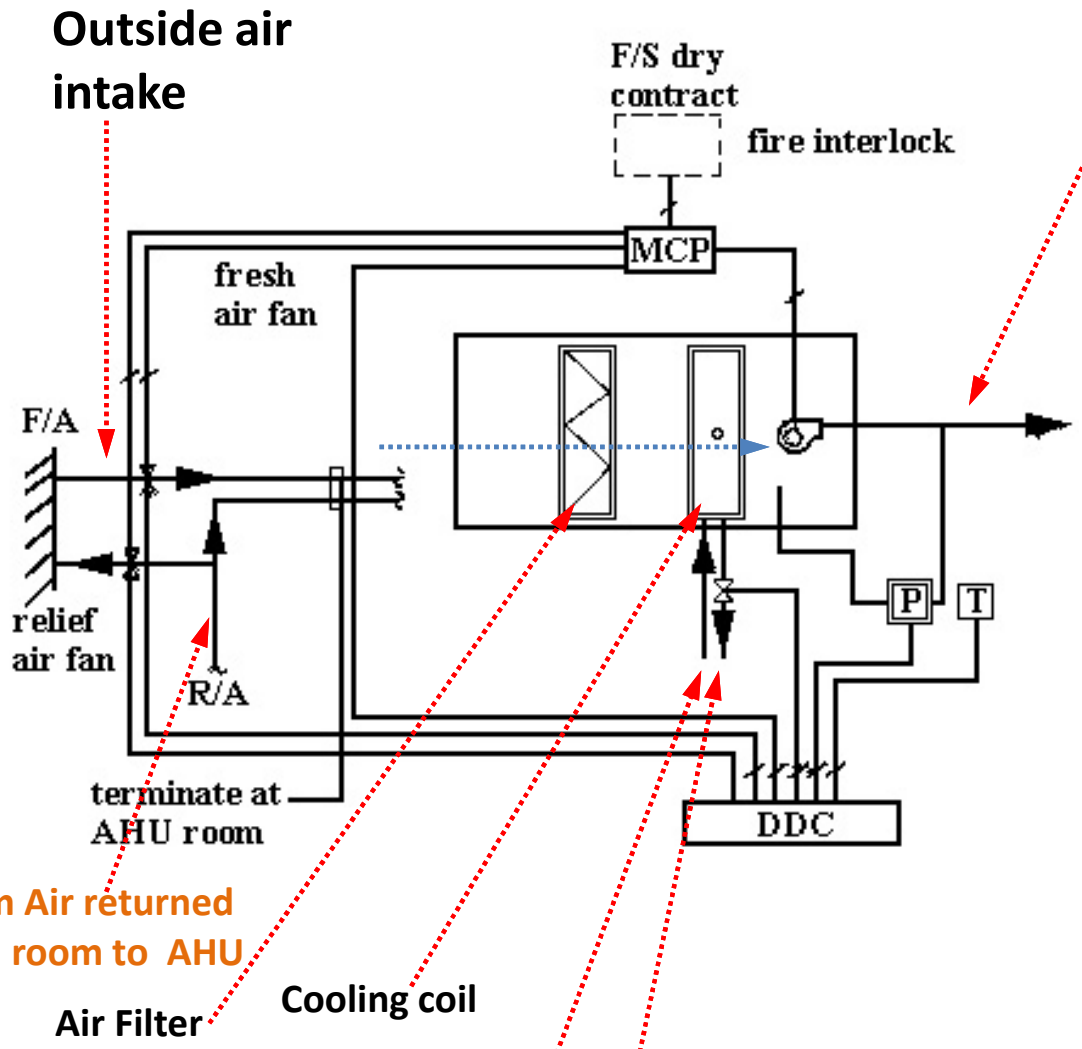


Fan coil unit = FCU

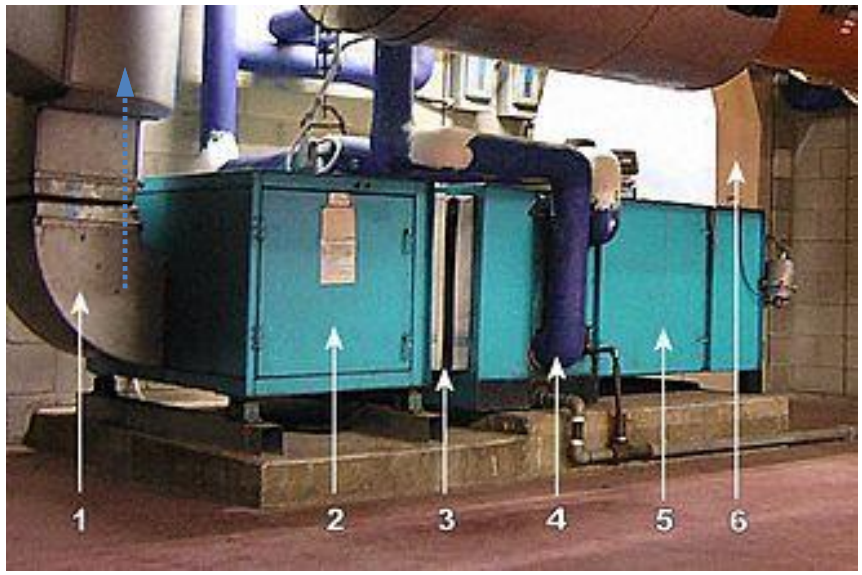
http://arch.hku.hk/~kpcheung/new2001/ac/#0401

Air handling unit control strategy-Tsui Tsin Tong Building, HKU

http://arch.hku.hk/teaching/intgtech/105.htm



Supply air duct [conditioned air inside]



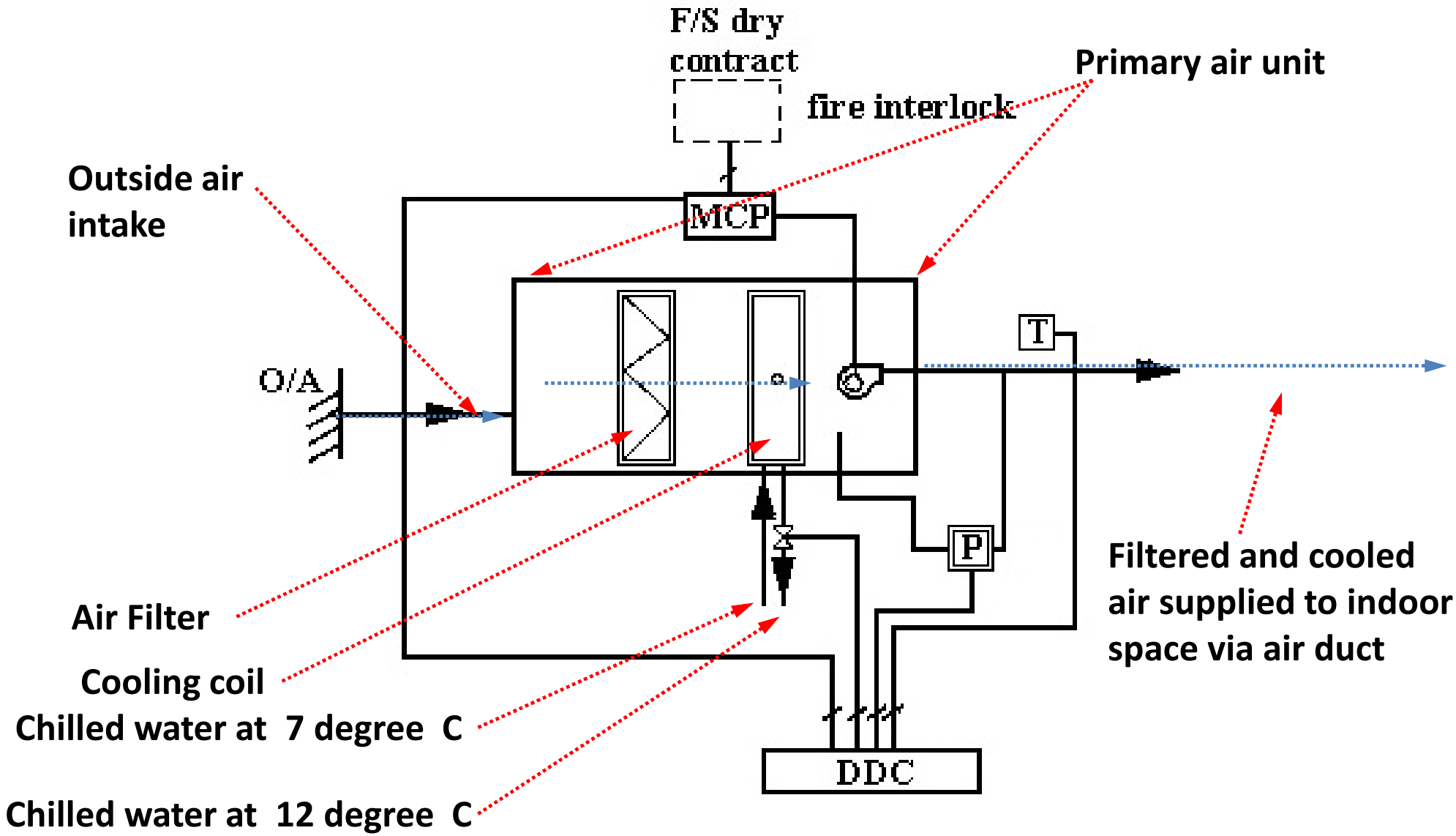
An Air handling unit is used for heating and cooling of air in a central location

Source : http://en.wikipedia.org/wiki/HVAC

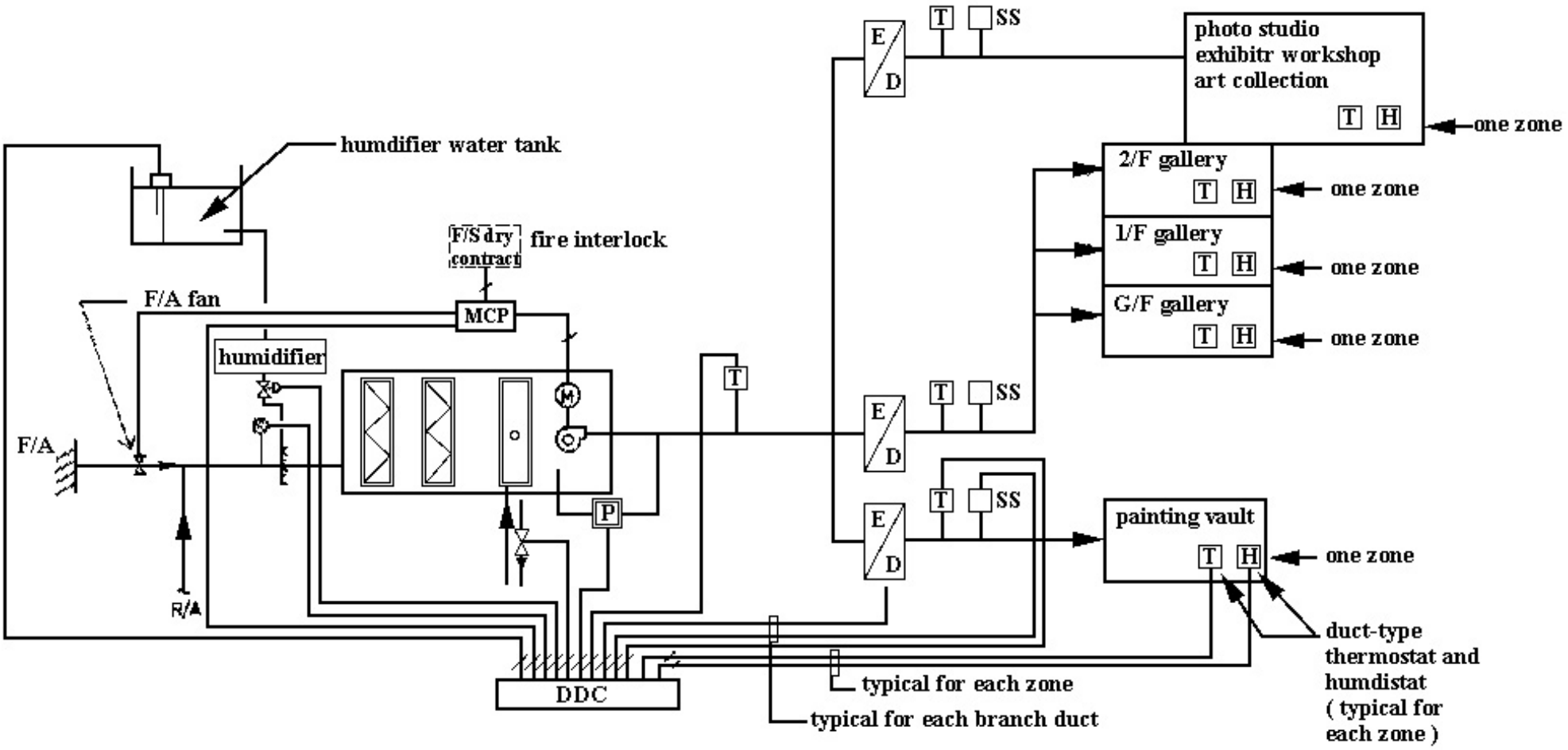
Filtered and cooled air supplied to indoor space via air duct

Primary air unit- control strategy-Tsui Tsin Tong Building, HKU

http://arch.hku.hk/teaching/intgtech/105.htm

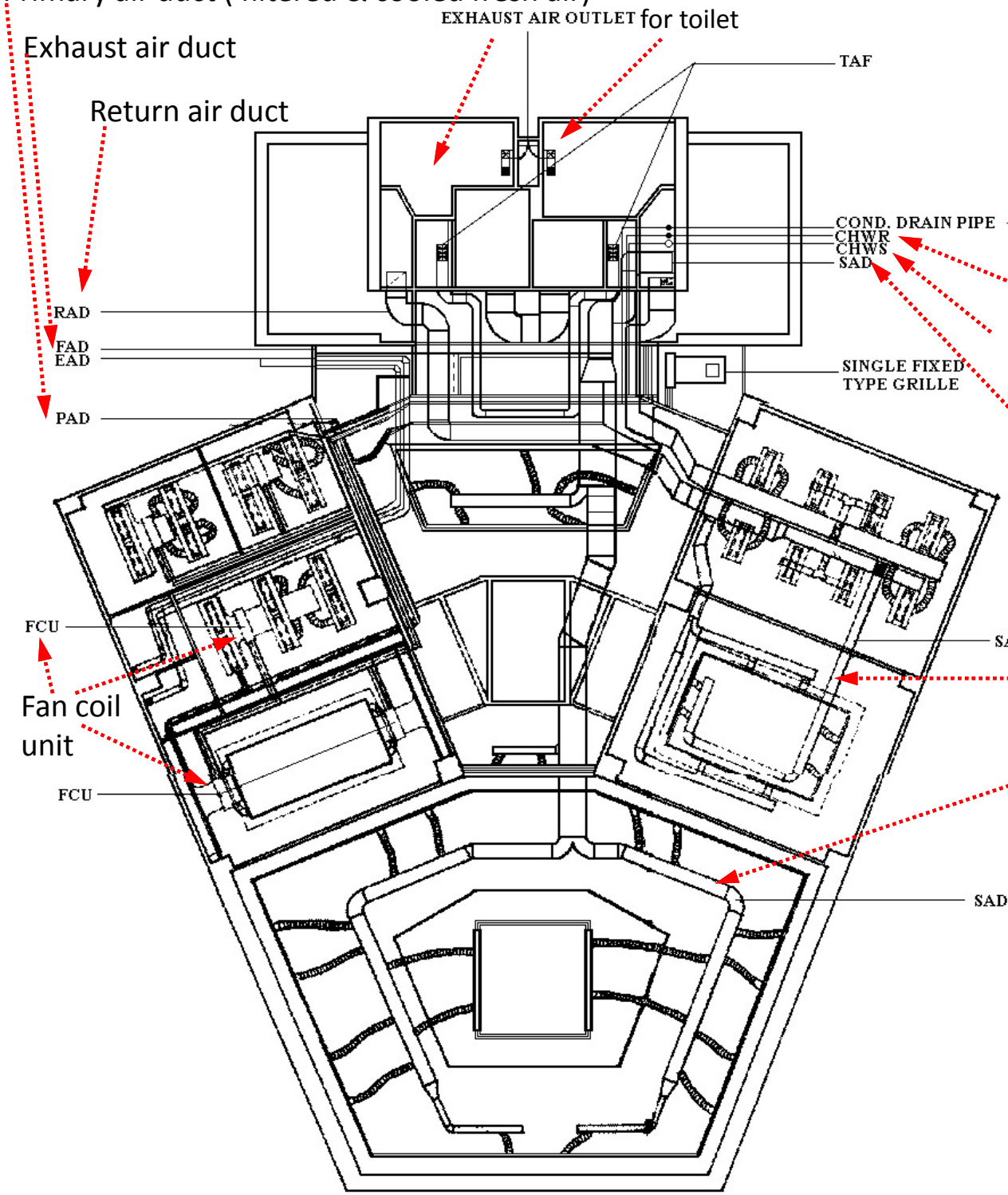


Air handling unit control strategy for art gallery
-Tsui Tsin Tong Building, HKU
-a sophisticated unit to control both temperature and humidity of the art gallery
http://arch.hku.hk/teaching/intgtech/107.htm



2/F - A/C Layout

http://arch.hku.hk/teaching/intgtech/105.htm

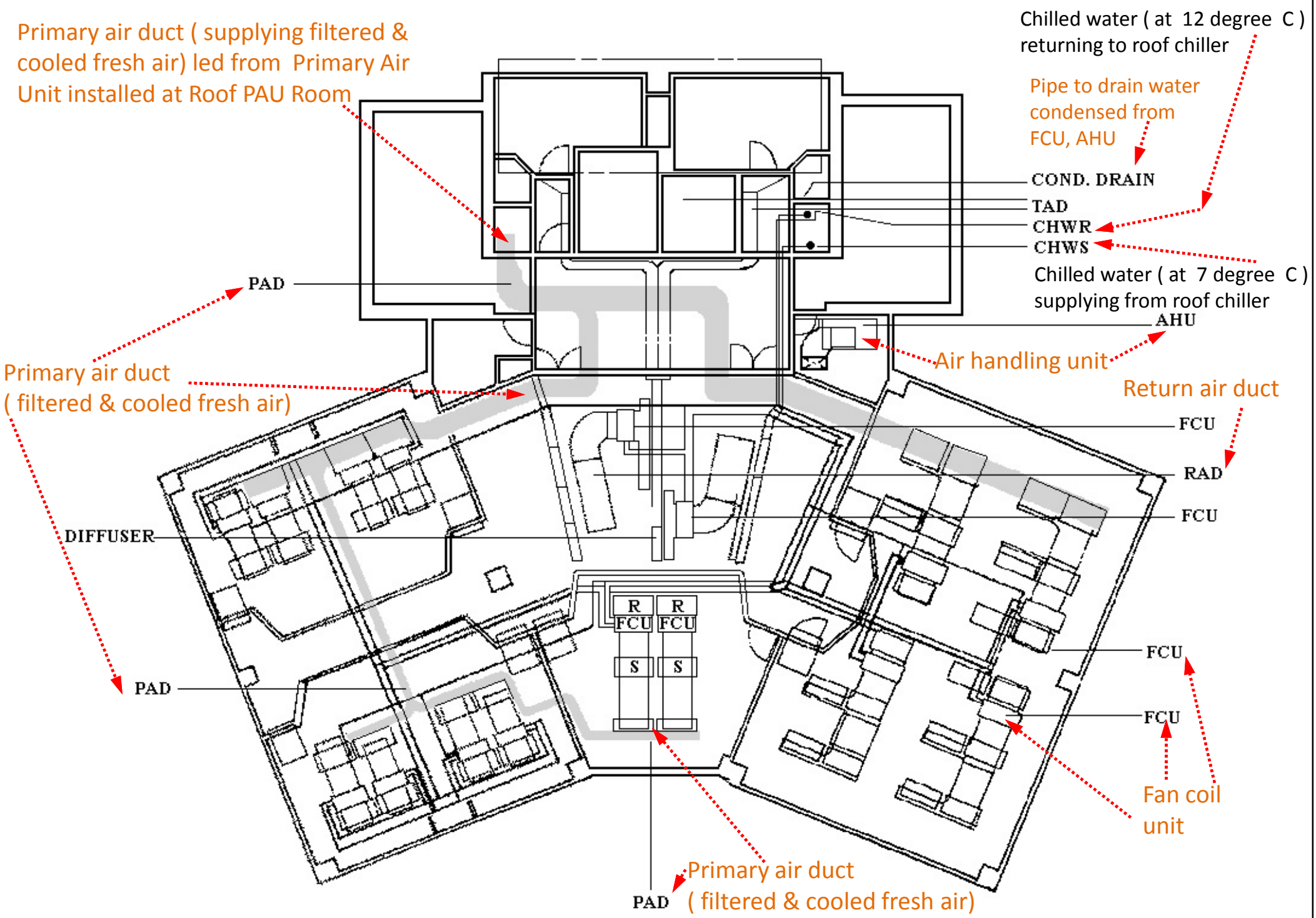


Pipe to drain water condensed from FCU

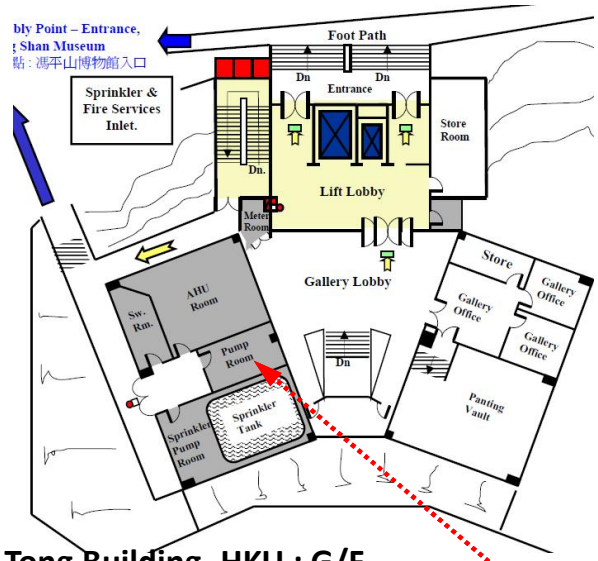
Chilled water (at 12 degree C) returning to roof chiller

Chilled water (at 7 degree C) supplying from roof chiller

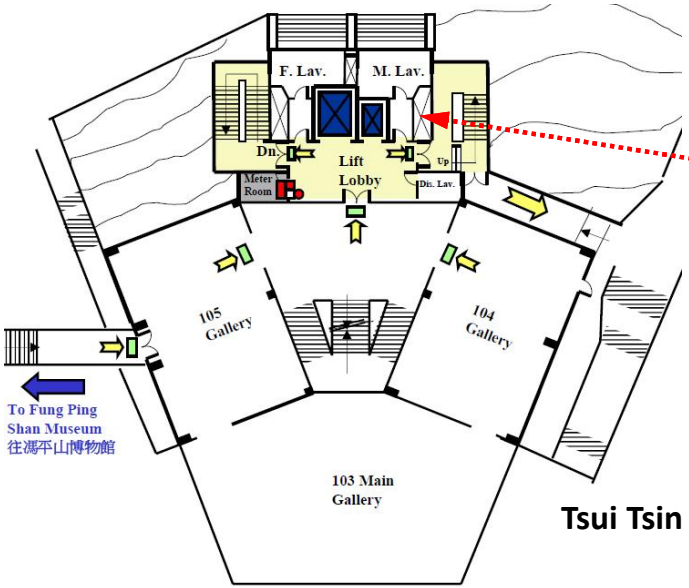
5/F - A/C Layout http://arch.hku.hk/teaching/intgtech/105.htm



Air-conditioning Services



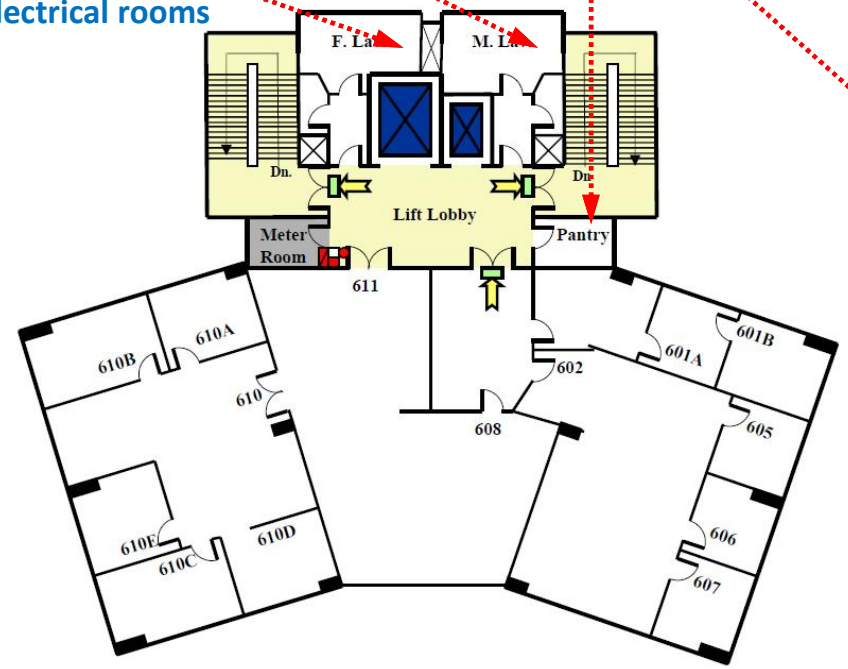
Tsui Tsin Tong Building, HKU : G/F



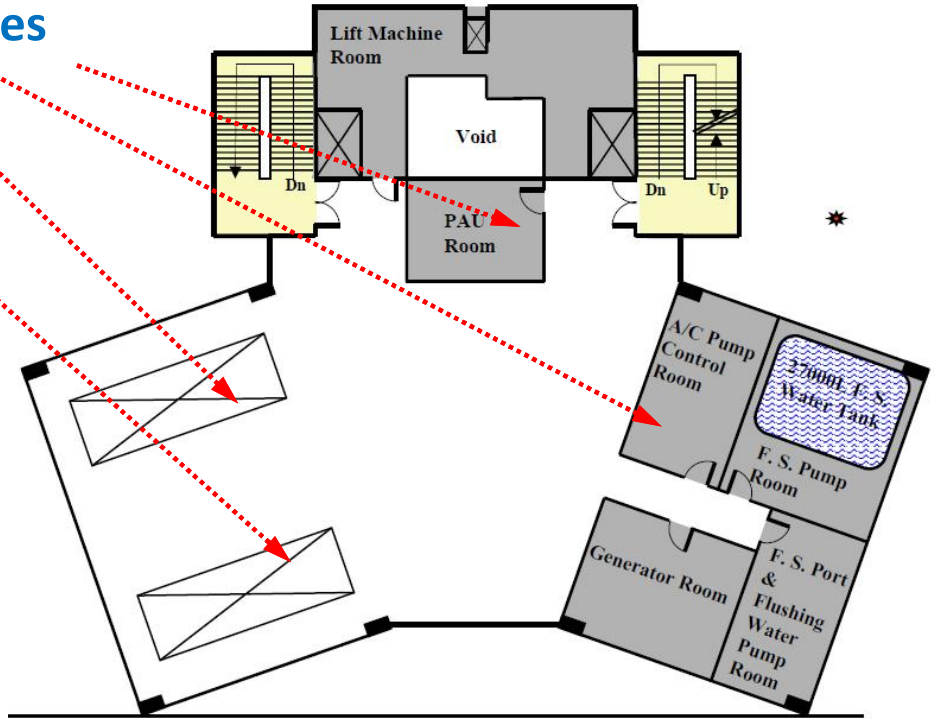
Chilled water pipe duct

Tsui Tsin Tong Building, HKU : 1/F

Ventilation for toilets and mechanical and electrical rooms

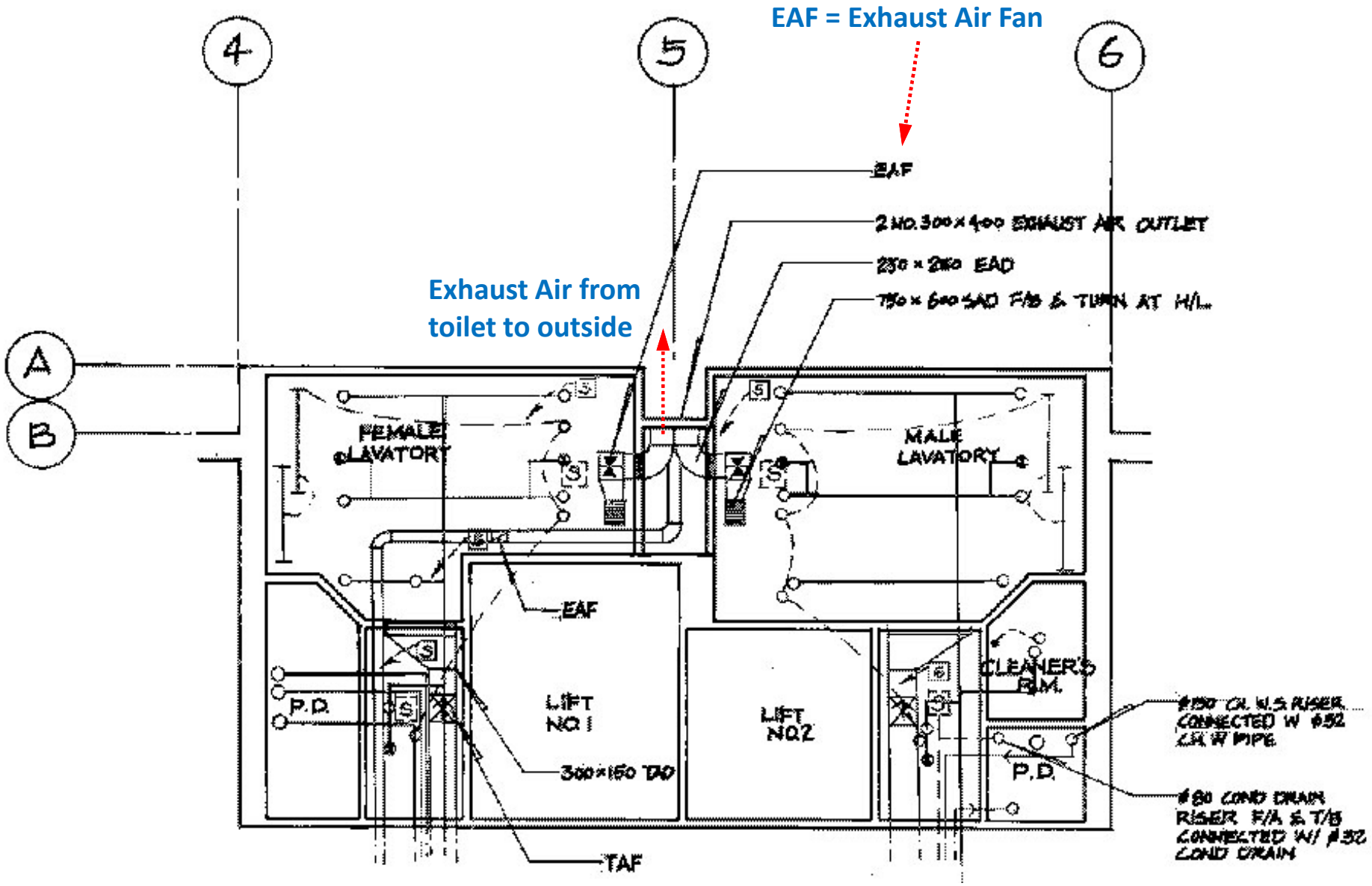


Tsui Tsin Tong Building, HKU : 6/F



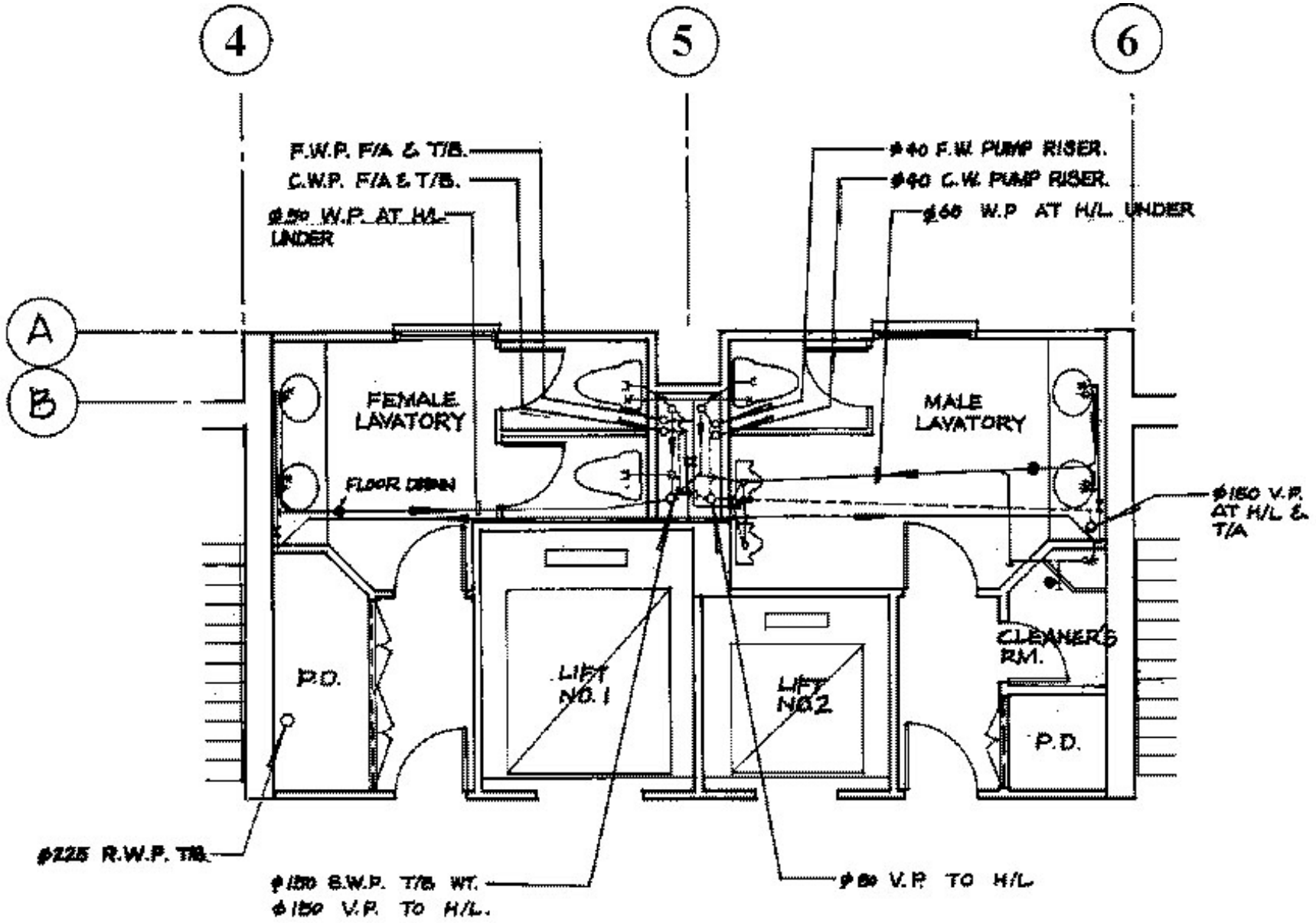
Tsui Tsin Tong Building, HKU : Roof

http://www.safety.hku.hk/homepage/pdf/FPTTT.pdf ; http://arch.hku.hk/teaching/intgtech/content.htm ;



Tsui Tsin Tong Building, HKU- 3/F Part Plan - Lavatory - Services Layout Above False Ceiling

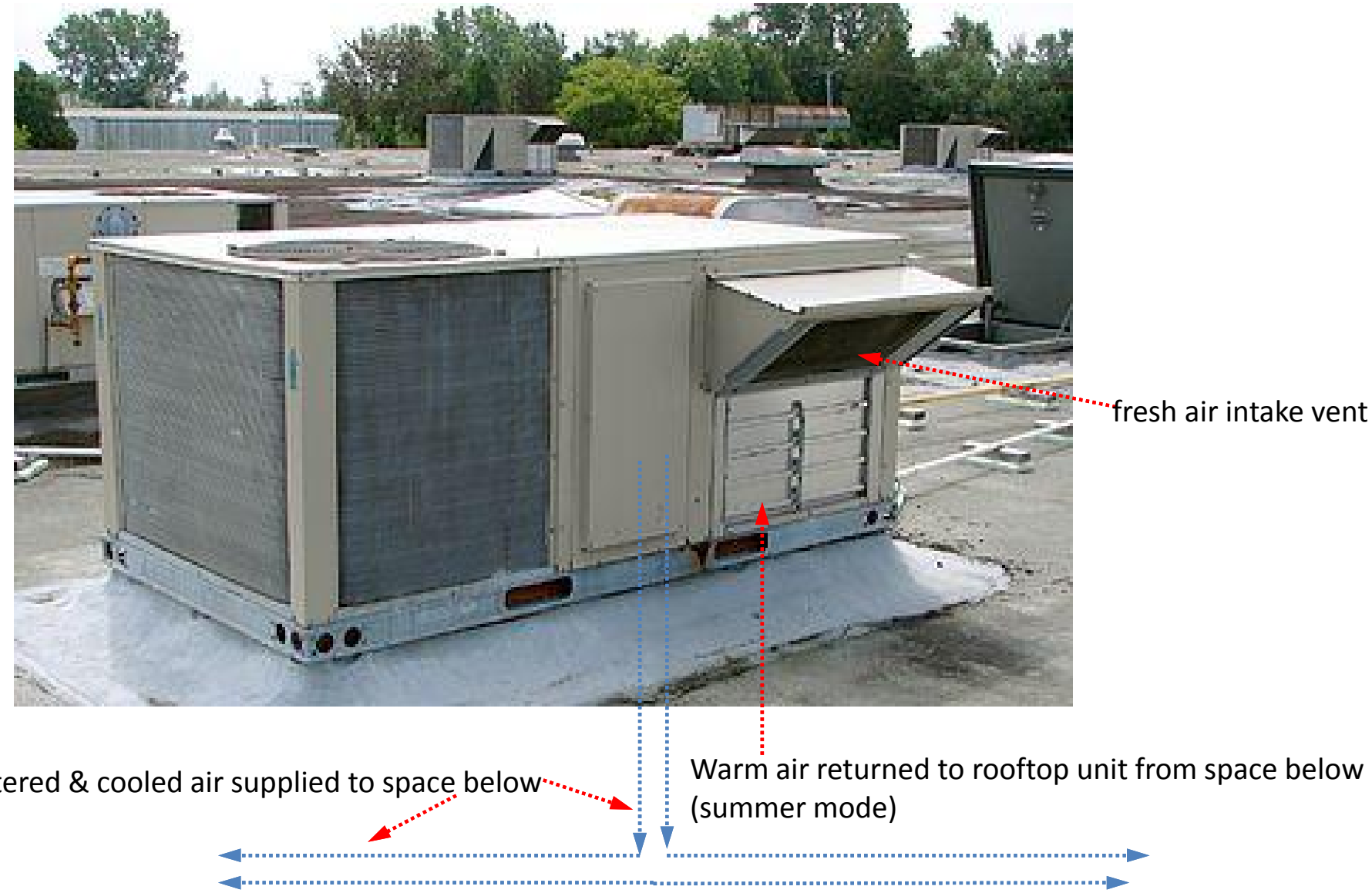
http://arch.hku.hk/teaching/intgtech/97.htm



Tsui Tsin Tong Building, HKU- 3/F Part Plan - Lavatory - Services Layout Below False Ceiling

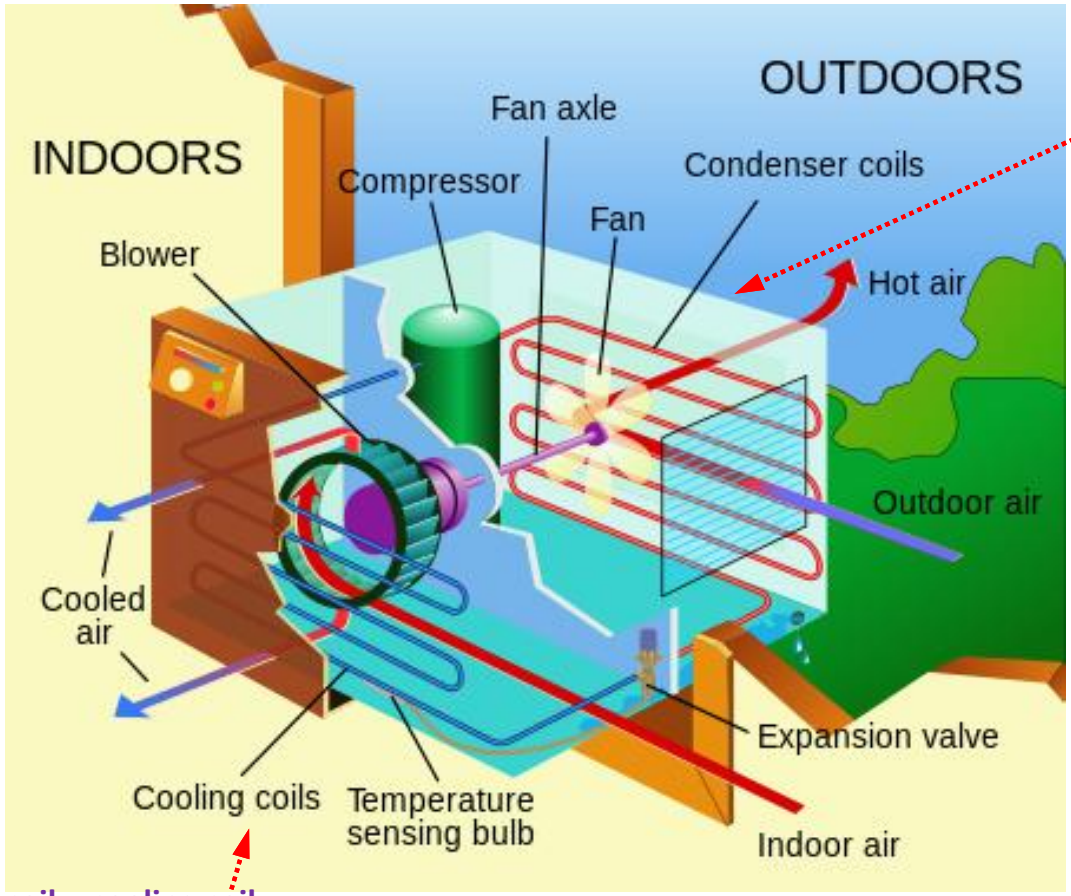
http://arch.hku.hk/teaching/intgtech/97.htm

A large unitary air-conditioner: A Rooftop HVAC unit, [powerful fan, and many times more cooling capacity than a window unit] with view of fresh air intake vent.
http://en.wikipedia.org/wiki/HVAC



A typical home air conditioning window unit- a unitary air-conditioner

http://en.wikipedia.org/wiki/Air_conditioning



Reverse cycle air-conditioner (with more valves and controls) will supply warm air to interior, by pumping heat from the outside air, in fact, an air-to-air heat pump. energy efficient machine

condensate pipe to drain

Refrigerant pipes

evaporator-coil = cooling coil for home air-conditioner

Split type air conditioner- The indoor unit (fan + evaporator-coil unit) installed at high level of room

Split type air conditioner- The outdoor door unit (refrigerant compressor + fan condenser-coil unit)

Integrated Sustainable Approach

- Central air conditioning plant room to be provided for installation of chilled water pumps and water chillers [in Tsui Tsin Tong Building, the water chillers are air-cooled and are placed outdoor, so no indoor space is needed for the water chiller]
- Ceiling space at each floor to be provided for installation of fan coil units, [FCU] air ducts
- Plant rooms to be allowed in suitable floors for installation of air handling units [AHU]and primary air handling units[also called primary air units, PAU]
- Condensate, i.e. water collected in the cooling process of air, from FCU, AHU, PAU, to be collected for water green plants or for flushing purpose, now commonly discharged to waste water drain
- ENERGY efficient machines, and related controls to be provided to attain minimum use of energy, YET ATTAINING GOOD INDOOR AIR QAULITY and reasonable comfort conditions
- Optimized overall planning with other building services, and FUNCTIONS of the buildings to be carried out to attain **Integrated Sustainability**

Case study on overall *Building Services Integration*

- **Tsui Tsin Tong Building, HKU:** Building No.13 in HKU main campus map
- Case Study http://www.ad.arch.hku.hk/teaching/cases/tttsui/tttsui.htm
- Integrated technology study by BA(AS)-3 students 95/96 [HKU] : http://www.ad.arch.hku.hk/teaching/intgtech/
- Floor Layout and evacuation plans for **Tsui Tsin Tong Building, HKU :** http://www.safety.hku.hk/homepage/pdf/FPTTT.pdf

Basic Reading :

1. The diagrams of slides 1 to 32 of **Air Conditioning and Refrigeration: Air-side Systems** **http://www.mech.hku.hk/bse/mech3005/mech3005_0405_acr04.htm**

2. **Climatic Design of Buildings - An Overview** **http://arch.hku.hk/~cmhui/teach/65156-7.htm**

3. Smith, David Lee, *"Environmental Issues for Architecture"*, Chapter 12 & 13. Hoboken, N.J. : Wiley, c2011. HKU Lib. Call # 720.47 S645

4. Reid, Esmond, *"Understanding Buildings",* London : Construction Press, 1984. HKU Lib. Call # 690 R35

5. Basic Reading list - http://arch.hku.hk/~kpcheung/teaching/b1-read.htm

Further reference :

Air Conditioning and Refrigeration: Air-side Systems http://arch.hku.hk/~kpcheung/new2001/ac/

Tsui Tsin Tong Building, HKU http://arch.hku.hk/teaching/intgtech/

MECH3005: Building Services http://www.mech.hku.hk/bse/mech3005/schedule.htm -related slides

Building Energy Efficiency Research (BEER) http://arch.hku.hk/research/BEER/

Air Quality Health Index & Air Quality Information http://www.epd.gov.hk/epd/english/environmentinhk/air/air_quality/air_quality.html

Indoor Air Quality Certification Scheme for Offices and Public Places
http://www.epd.gov.hk/epd/english/news_events/current_issue/iaq_certification.html & http://www.iaq.gov.hk/cert/doc/CertGuide-eng.pdf

Innovative Urban Roof Greenhouses enriched with carbon dioxide breathed out by human beings
http://icee.hku.hk/chinachem01.pdf

Greening-The-Earth : Maximizing Rational combination of Water & Light & Land for Food & Bio-fuel http://icee.hku.hk/chinachem02.pdf

*** **Thank you very much** ***