HKIS – PQSL (16 Nov 2015)

Sr. Kenny Lui
BSc, LLB, MMgt, MACS
MHKIS, MRICS, RPS(QS), PFM

BASIC UNDERSTANDING OF MVAC SYSTEM AND MEASUREMENT

What are we going to cover tonight?

What is MVAC System?

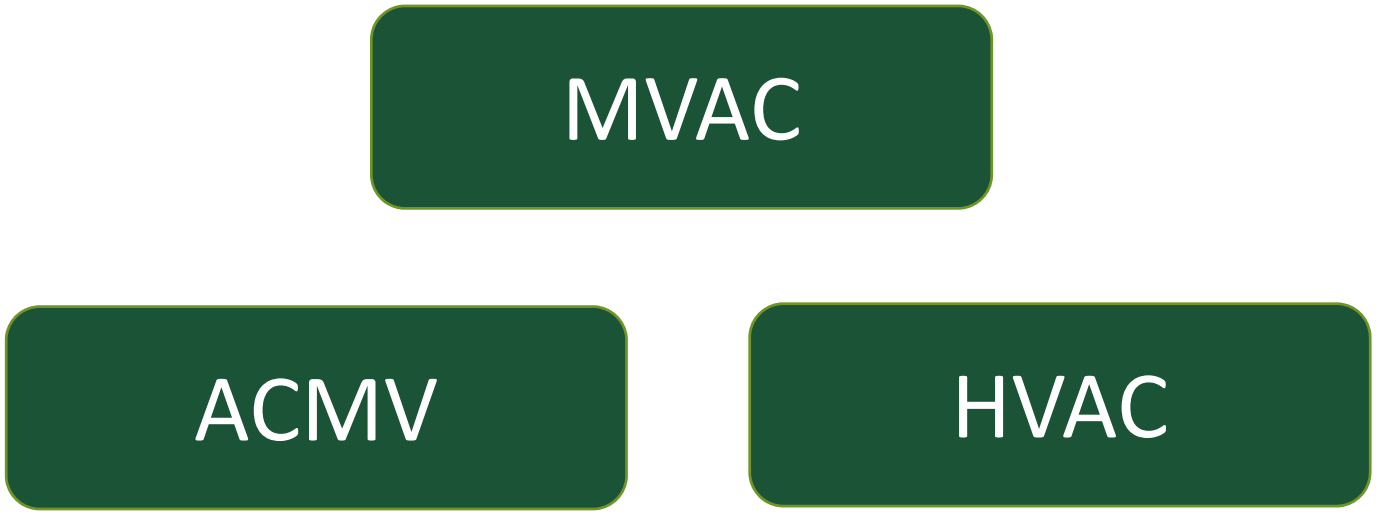
How to measure it from a QS perspective?

Disclaimer Note

This set of notes has been prepared according to the author's own experience of the relevant practice and is intended for educational purpose and information only. No responsibility for loss occasioned to any person acting or refraining from action occasioned by or as a result of any material included will be accepted by the author or its company.

The materials and information contained herein are not intended to offer or provide any technical advice concerning the topics covered. Please consult professional engineers or your QS senior where necessary.

What is MVAC System?



What is MV?

MV

A. Music Video

B. Mechanical Ventilation

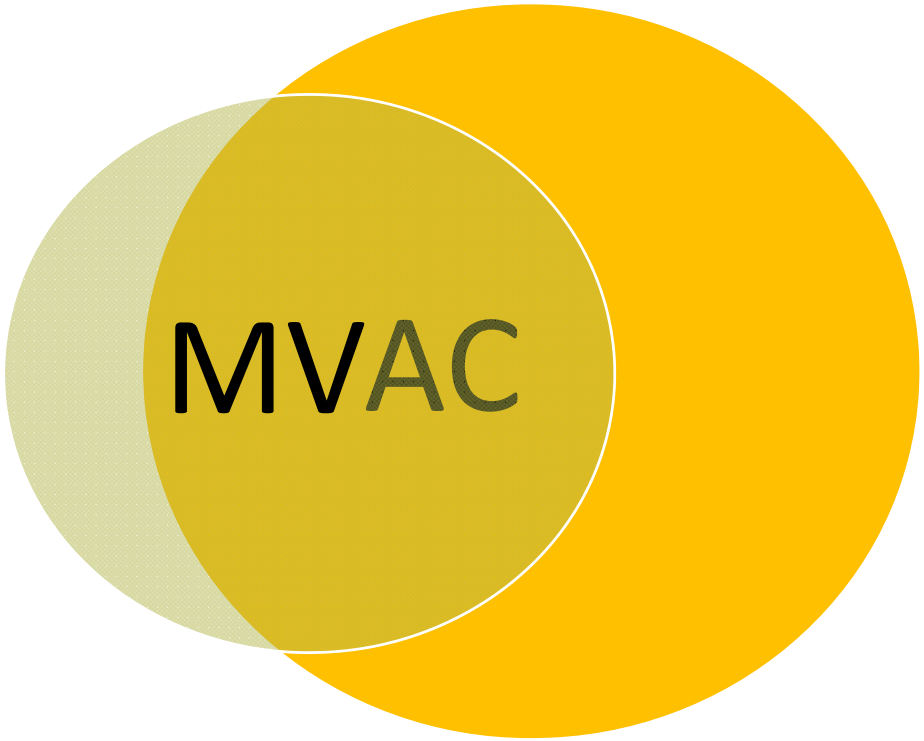
What is AC?

AC

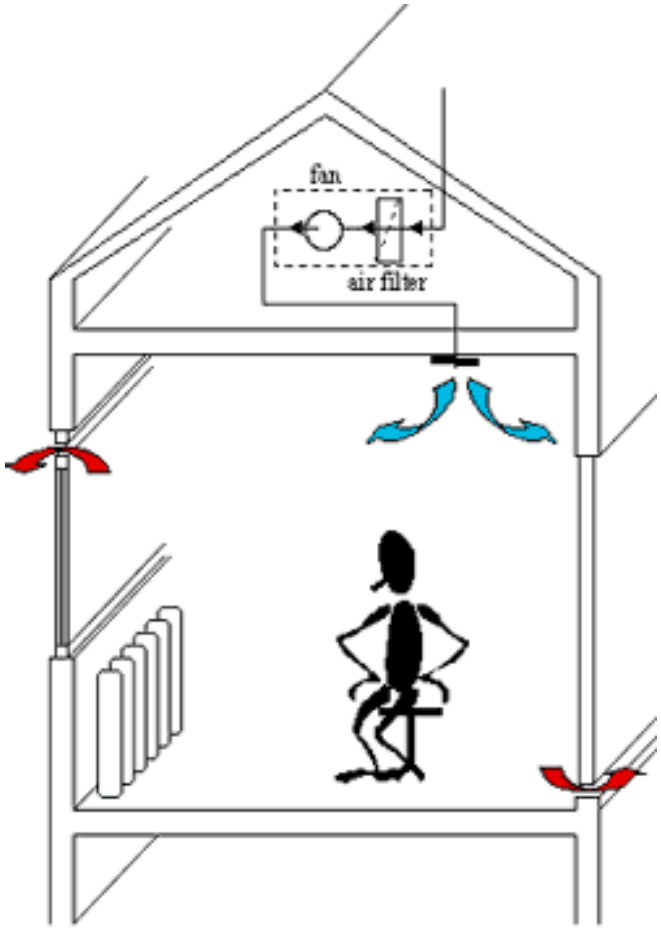
A. Alternating Current

B. Air Conditioning

What is MVAC System?

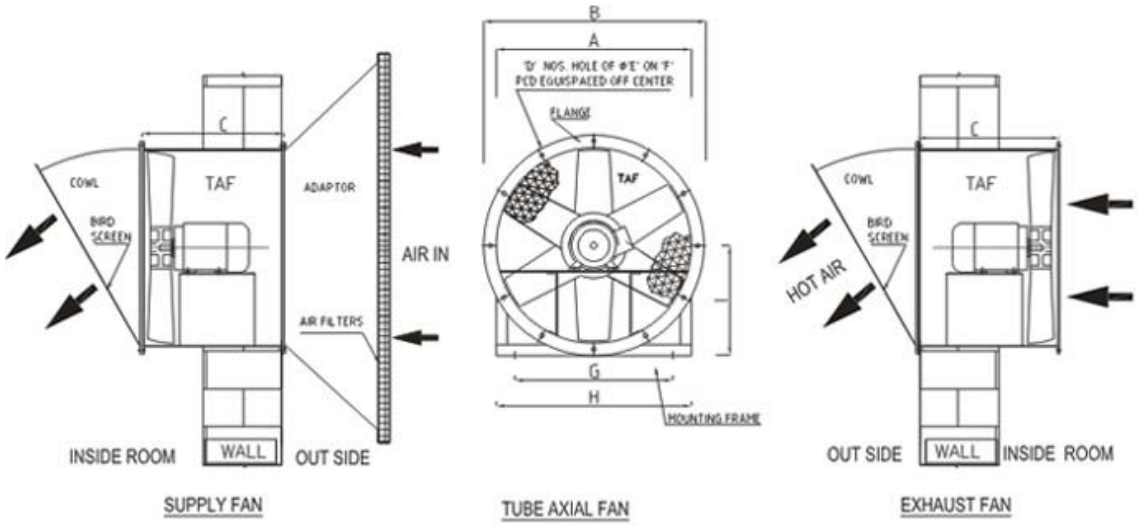


MV System



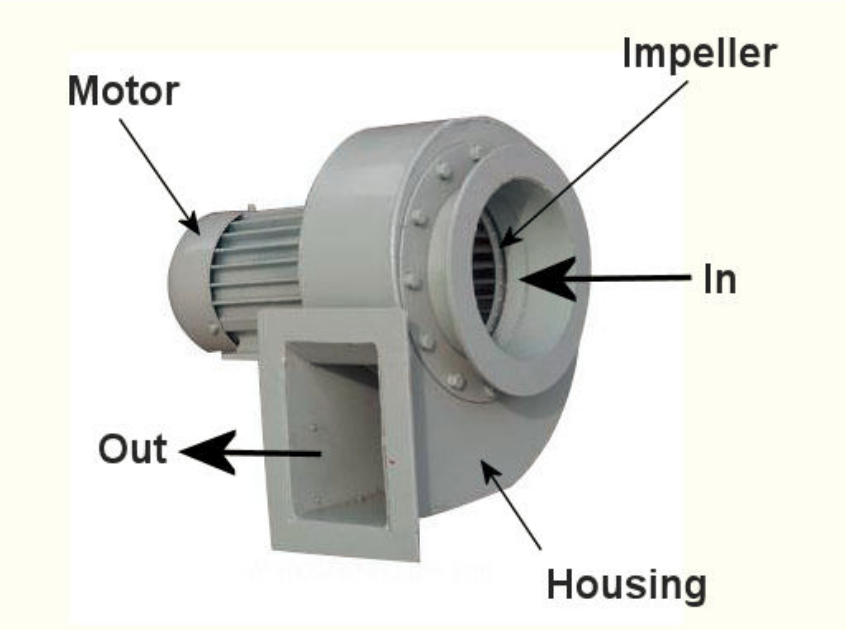
MV System

Axial Fans



MV System

Centrifugal Fans



Centrifugal Fans

Axial Fans

MVAC System

The Combined Gas Law

Now we can combine everything we have into one proportion:

$$V \alpha \frac{T}{P}$$

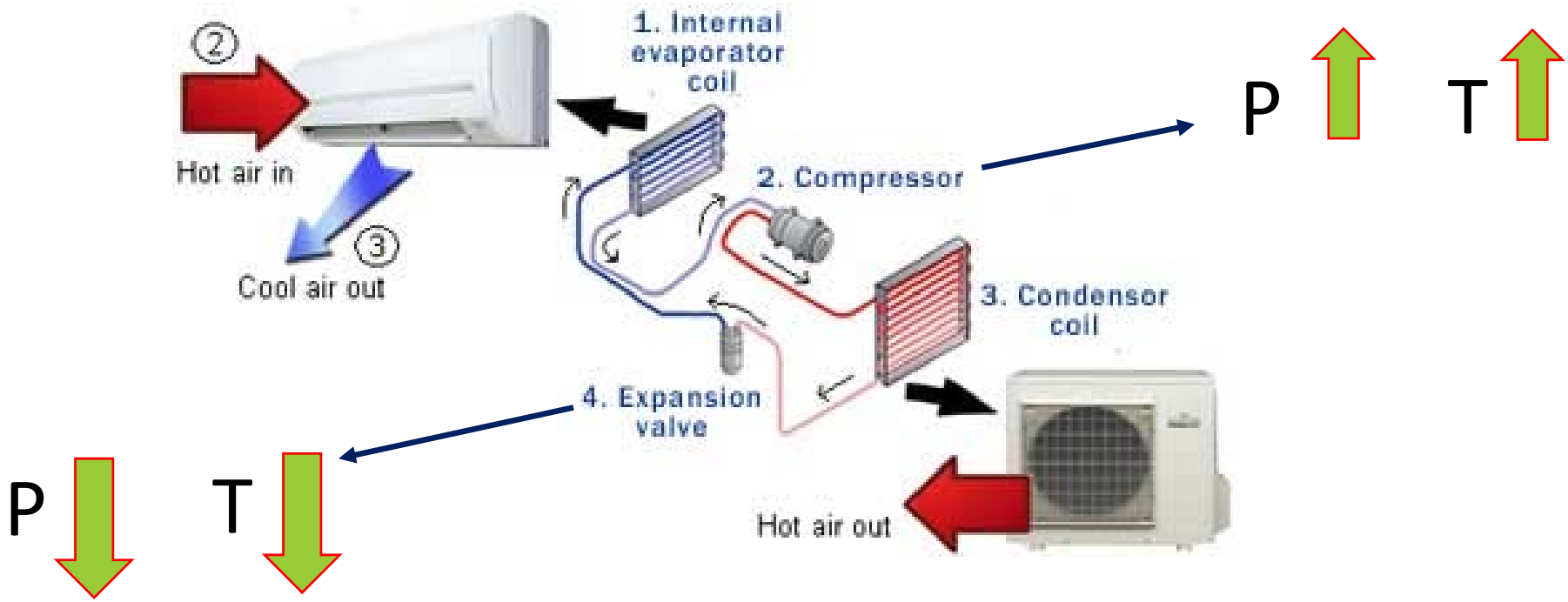
The volume of a given amount of gas is proportional to the ratio of its Kelvin temperature and its pressure.
Same as before, a constant can be put in:

$PV / T = C$

As the pressure goes up, the temperature also goes up, and vice-versa.
Also same as before, initial and final volumes and temperatures under constant pressure can be calculated.

$P_1V_1 / T_1 = P_2V_2 / T_2 = P_3V_3 / T_3$ **etc.**

MVAC System


2
Hot air in
3
Cool air out
1. Internal evaporator coil
2. Compressor
3. Condensor coil
4. Expansion valve
Hot air out
P
T
P
T

MVAC System

Window Type Air-Conditioners

Moveable Air-Conditioners

MVAC System

Wall Air Conditioners

Ceiling Mounted / Cassette Air-Conditioners

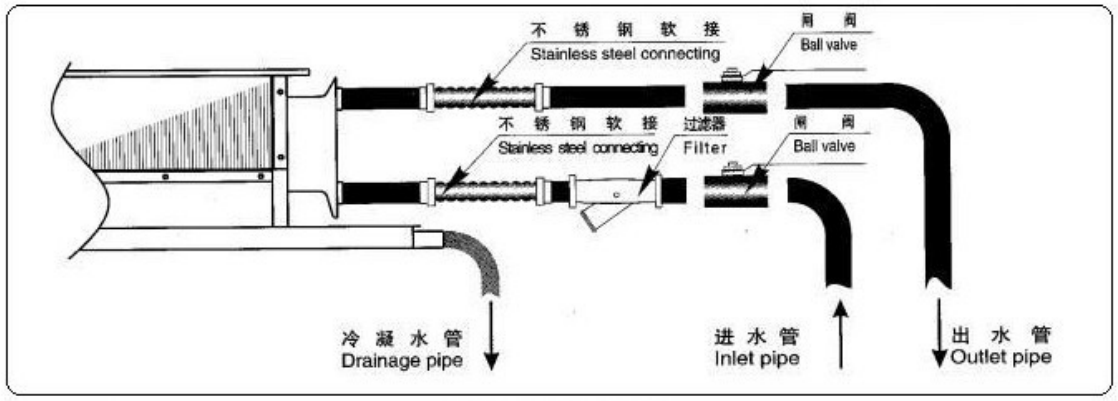
Chillers

Cooling towers

Air handling units

Fan Coil Units

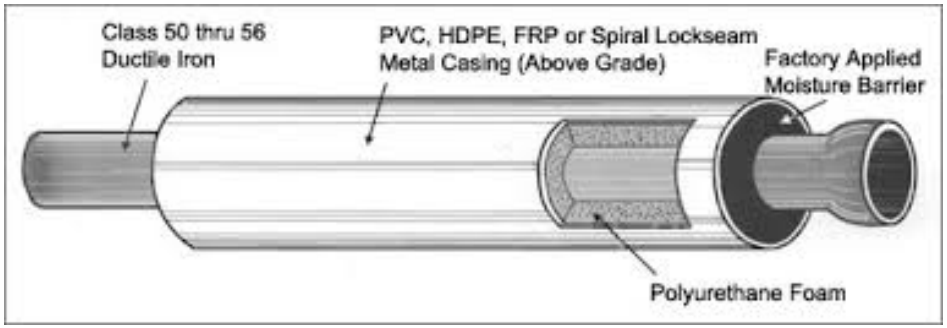
Pipeworks to / from Fan Coil Units



Chilled water pipeworks

Insulation

Protective Coverings and Finishings

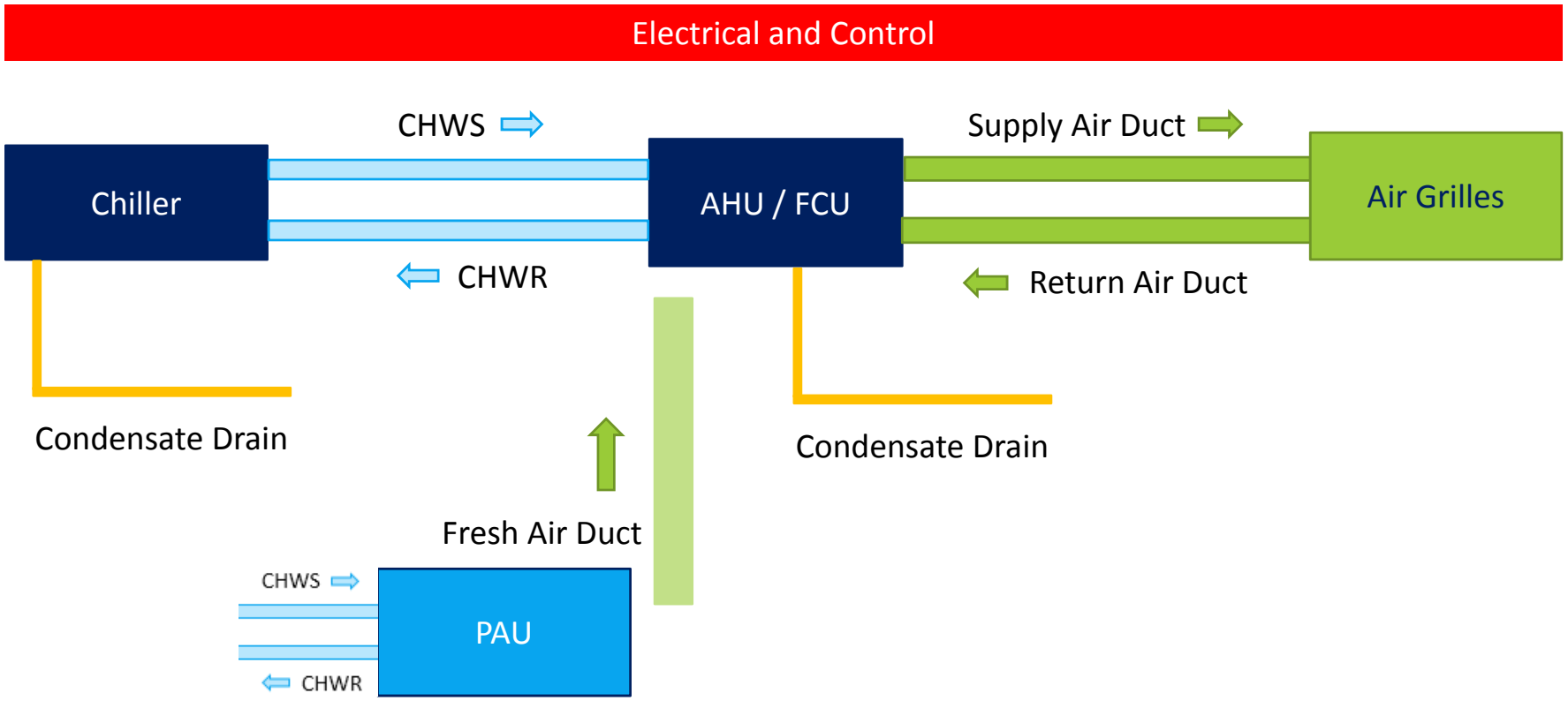


Ductwork

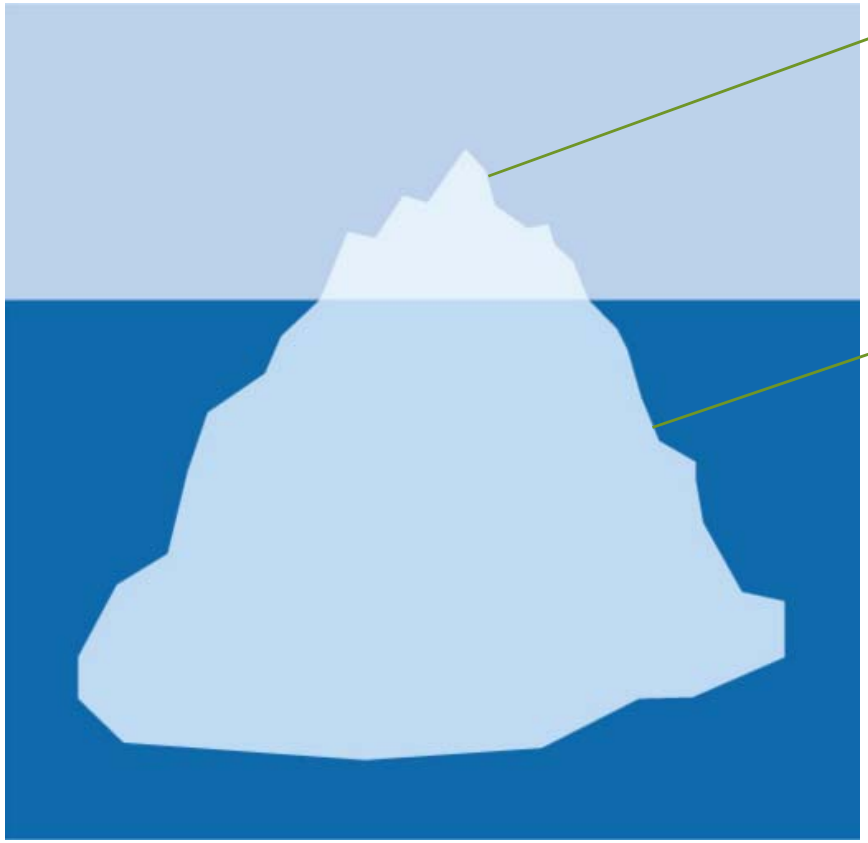
Insulation

Protective Coverings and Finishings

MVAC System


Electrical and Control
CHWS
Supply Air Duct
Chiller
AHU / FCU
Air Grilles
CHWR
Return Air Duct
Condensate Drain
Condensate Drain
Fresh Air Duct
CHWS
PAU
CHWR

MVAC System



What do you hear tonight

What do we not discuss / explore tonight

MVAC System

Further Reading / Study

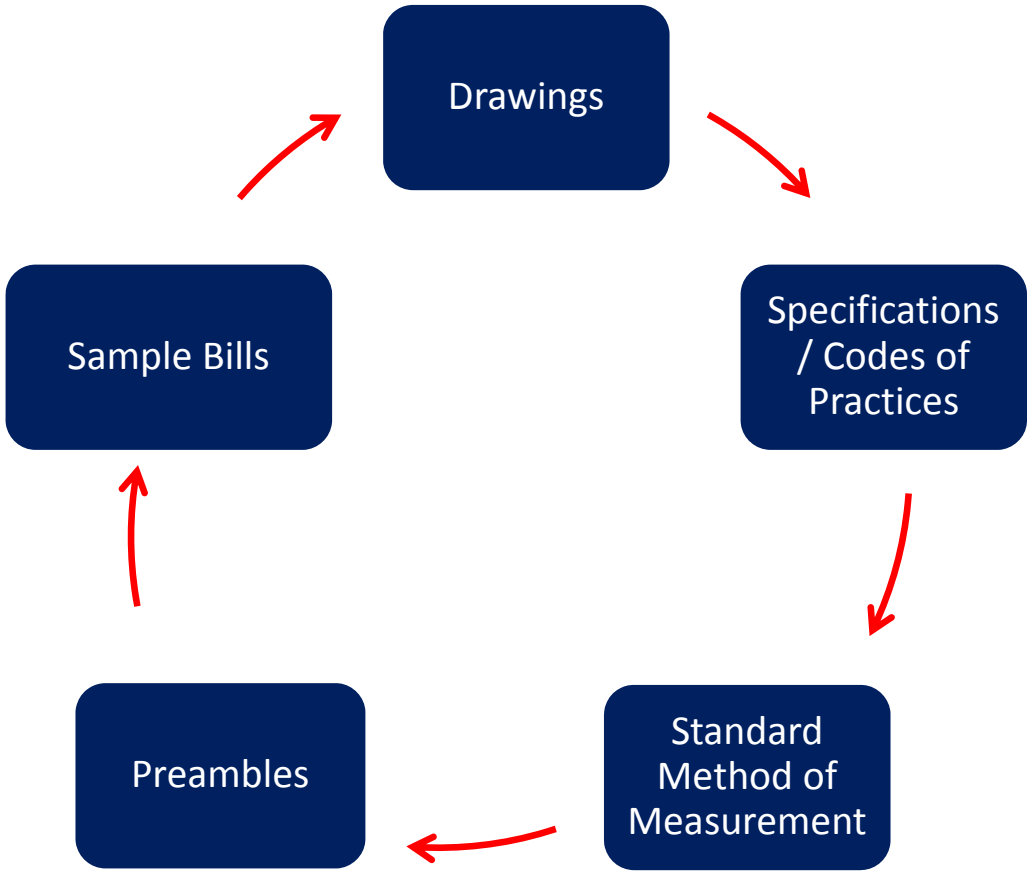
http://www.airintelligence.co.uk/wp-content/uploads/2012/10/cooling-cooling.jpg

http://ac2015.net/posts/air-conditioner-working-principle/

https://www.youtube.com/watch?v=_lFUlA1PZ8U

How to measure it from a QS perspective?

Preparation for Measurement



Preparation for Measurement

Drawings

Specifications / Codes of Practices

Standard Method of Measurement

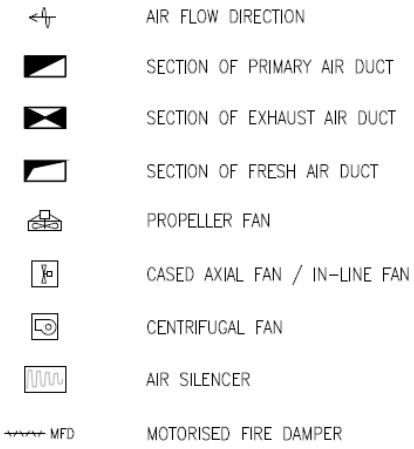
Preambles

Sample Bills, if any

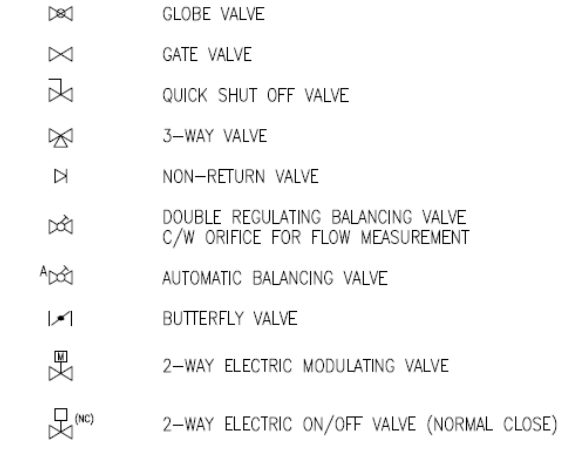
Drawings

Legend, Notes & Abbreviations

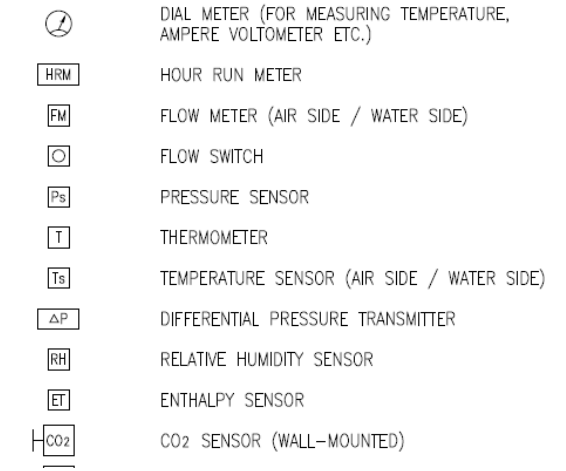
LEGEND : (AIR SIDE SYSTEM)



LEGENDS : (WATER SIDE SYSTEM)



LEGENDS : (ELECTRICAL & CONTROL SYSTEM)



Drawings

Legend, Notes & Abbreviations

GENERAL NOTES:

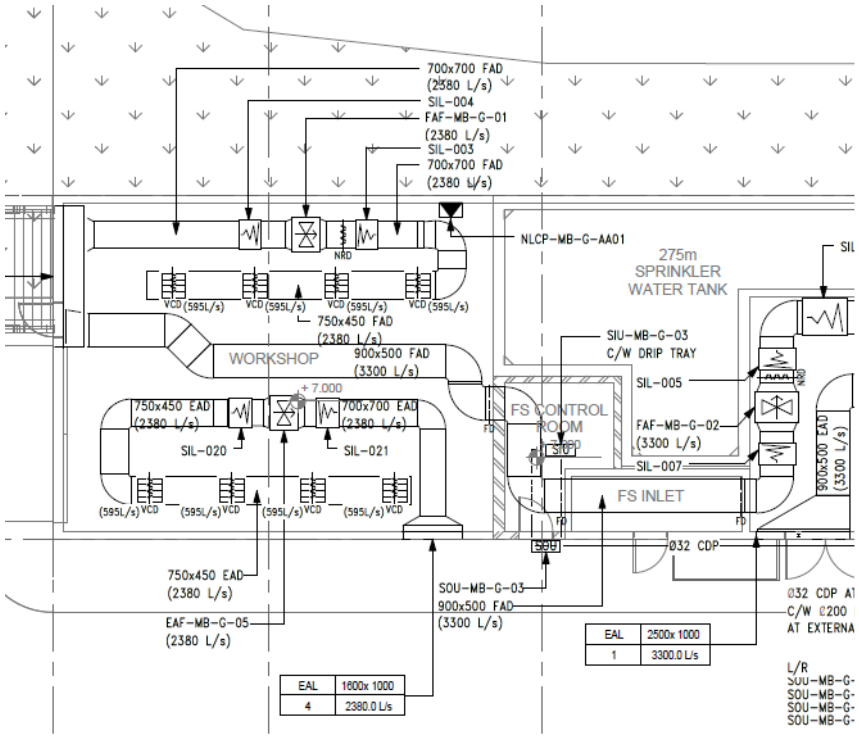
1. UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS (MM).
2. THE USAGE OF FRESH WATER COOLING TOWER IS SUBJECT TO APPROVAL BY EMSD/WSD.
3. VENTILATION DUCTWORK AND AIR CONDITIONING PIPE WORK SUPPORT SYSTEM SHALL BE OF STAINLESS STEEL TYPE 316 CONSTRUCTION.
4. FRESH AIR SUPPLY SHOULD COMPLY WITH EXCELLENT CLASS OF GUIDANCE NOTES FOR MANAGEMENT OF INDOOR AIR QUALITY (IAQ) AND ASHRAE STANDARD 62.1–2007.
5. ODOUR REMOVAL EFFICIENCY FOR MANNED AREAS FRESH AIR SUPPLY SHOULD BE AT LEAST 90% FOR AMBIENTODOUR LEVEL OF 25 TO 30 OU AND A DUST FILTER OF AT LEAST 50% REMOVAL EFFICIENCY.
6. SOUND ATTENUATORS AND OTHER MEANS OF VIBRATION ISOLATION OR ACOUSTIC TREATMENT SHALL BE PROVIDED FOR EQUIPMENT WHETHER OR NOT SHOWN ON DRAWINGS OR IN ADDITION TO THOSE SHOWN ON DRAWINGS AND AT LOCATIONS NECESSARY TO REDUCE MECHANICAL EQUIPMENT NOISE SO AS TO ACHIEVE THE DESIGN NOISE LEVEL RATINGS AS SPECIFIED. THE CONTRACTOR SHALL INCLUDE ANY SECONDARY ATTENUATION NECESSARY TO ENSURE THAT THE EQUIPMENT SELECTED COMPLIES WITH THE MAXIMUM PERMISSIBLE NOISE LEVELS GIVEN IN THE SPECIFICATION.

ABBREVIATION :

ABCHI	ABSORPTION CHILLER
AFFL	ABOVE FINISHED FLOOR LEVEL
BCHI	CHILLER (EQUIPMENT SCHEDULE NOTATION)
BCHIP	WATER PUMP (EQUIPMENT SCHEDULE NOTATION)
BCT	COOLING TOWER (EQUIPMENT SCHEDULE NOTATION)
BF	FAN (EQUIPMENT SCHEDULE NOTATION)
BFCU	FAN COIL UNIT (EQUIPMENT SCHEDULE NOTATION)
BFIU	FLOOR MOUNTED VRV INDOOR UNIT (EQUIPMENT SCHEDULE NOTATION)
BFOU	FLOOR MOUNTED VRV OUTDOOR UNIT (EQUIPMENT SCHEDULE NOTATION)
CS	CONDUCTIVITY SENSOR
DDC	DIRECT DIGITAL CONTROLLER
DL	DOOR LOUVRE
EA	EXHAUST AIR
EAD	EXHAUST AIR DUCT
EAF	EXHAUST AIR FAN
EAG	EXHAUST AIR GRILLE
EAL	EXHAUST AIR LOUVRE
EJ	EXPANSION JOINT
ETL	ELECTRIC THERMAL LINK
FAD	FRESH AIR DUCT

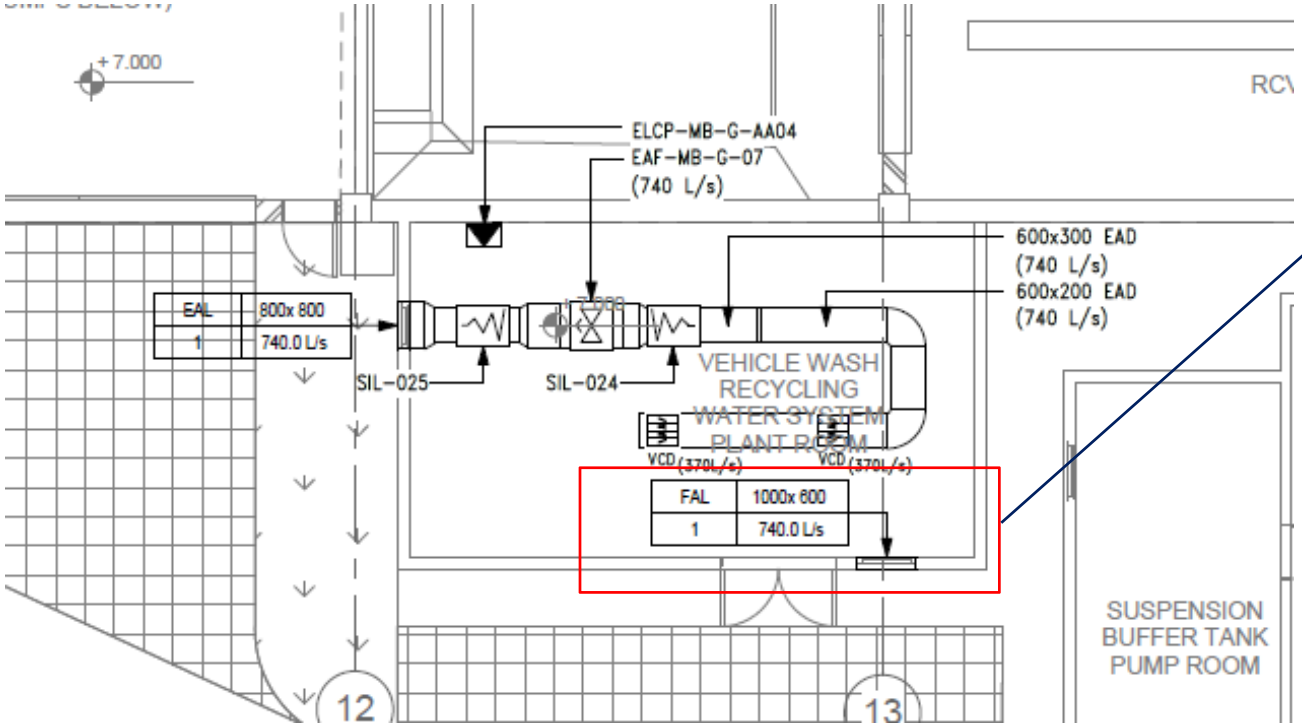
Drawings

Layout



Drawings

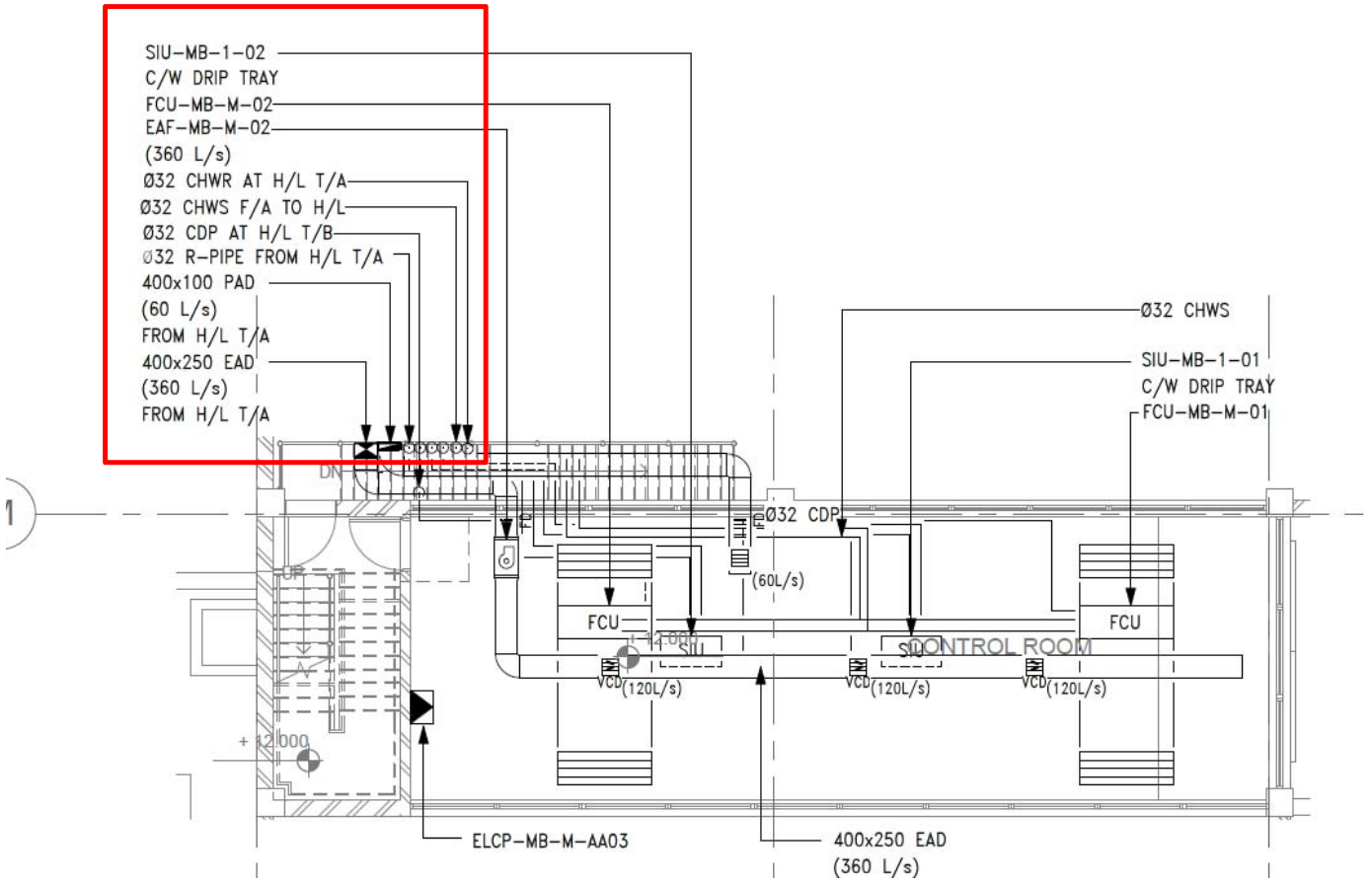
Layout



Fresh Air Louvre – Builder's Trade

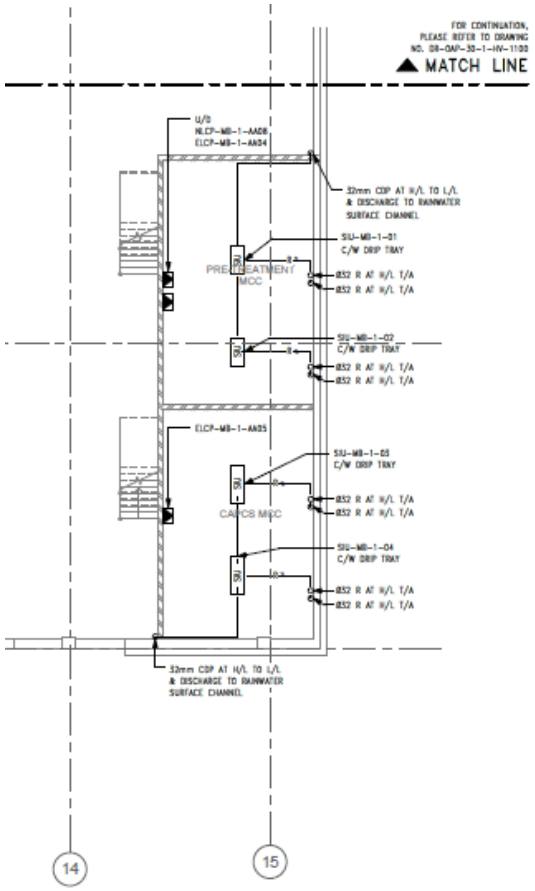
Drawings

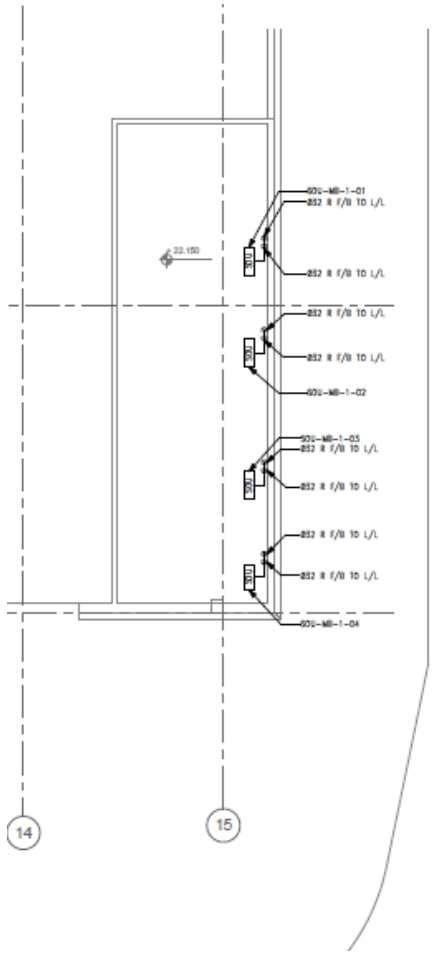
Layout



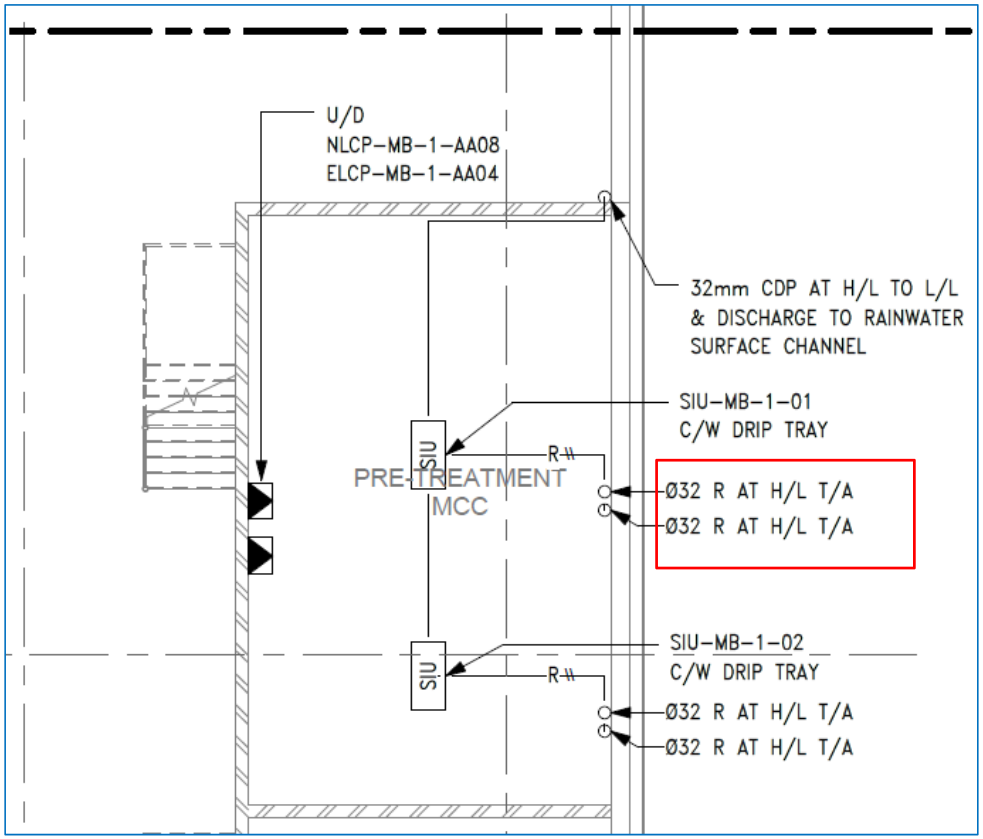
Drawings

Layout

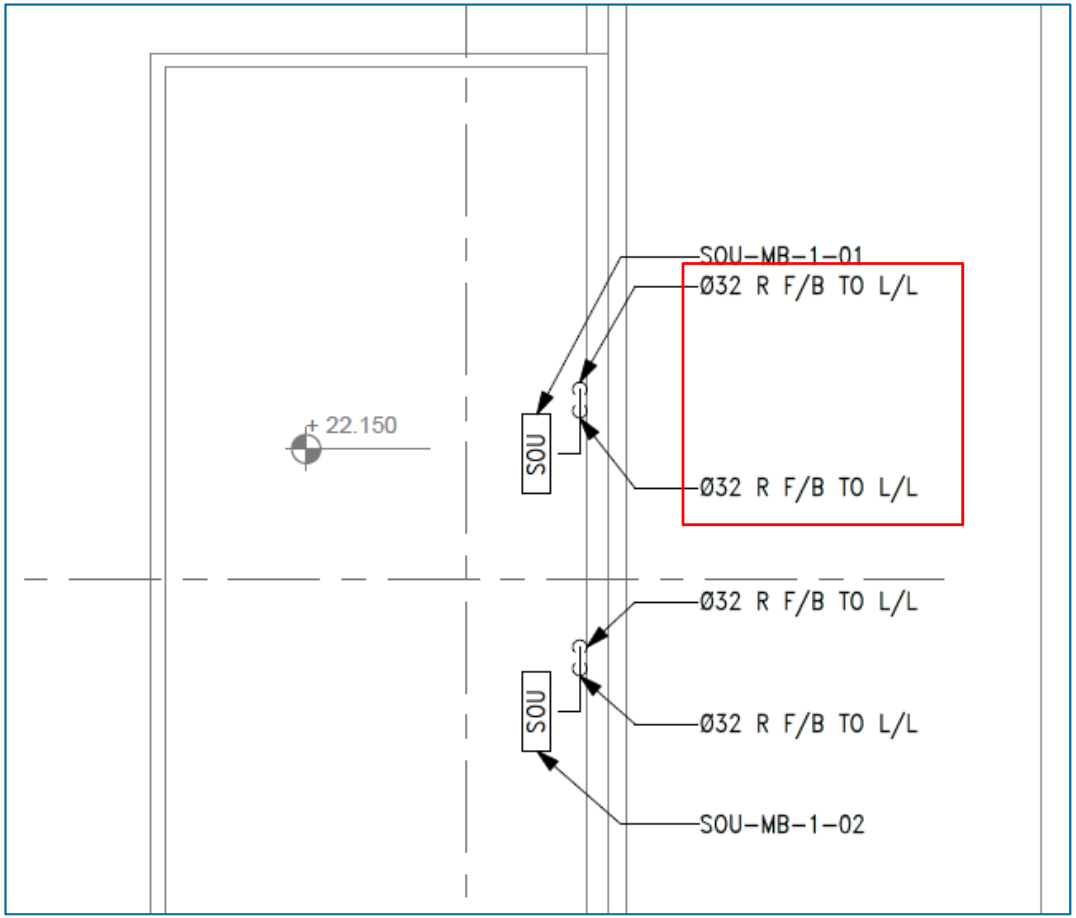




At 1/F

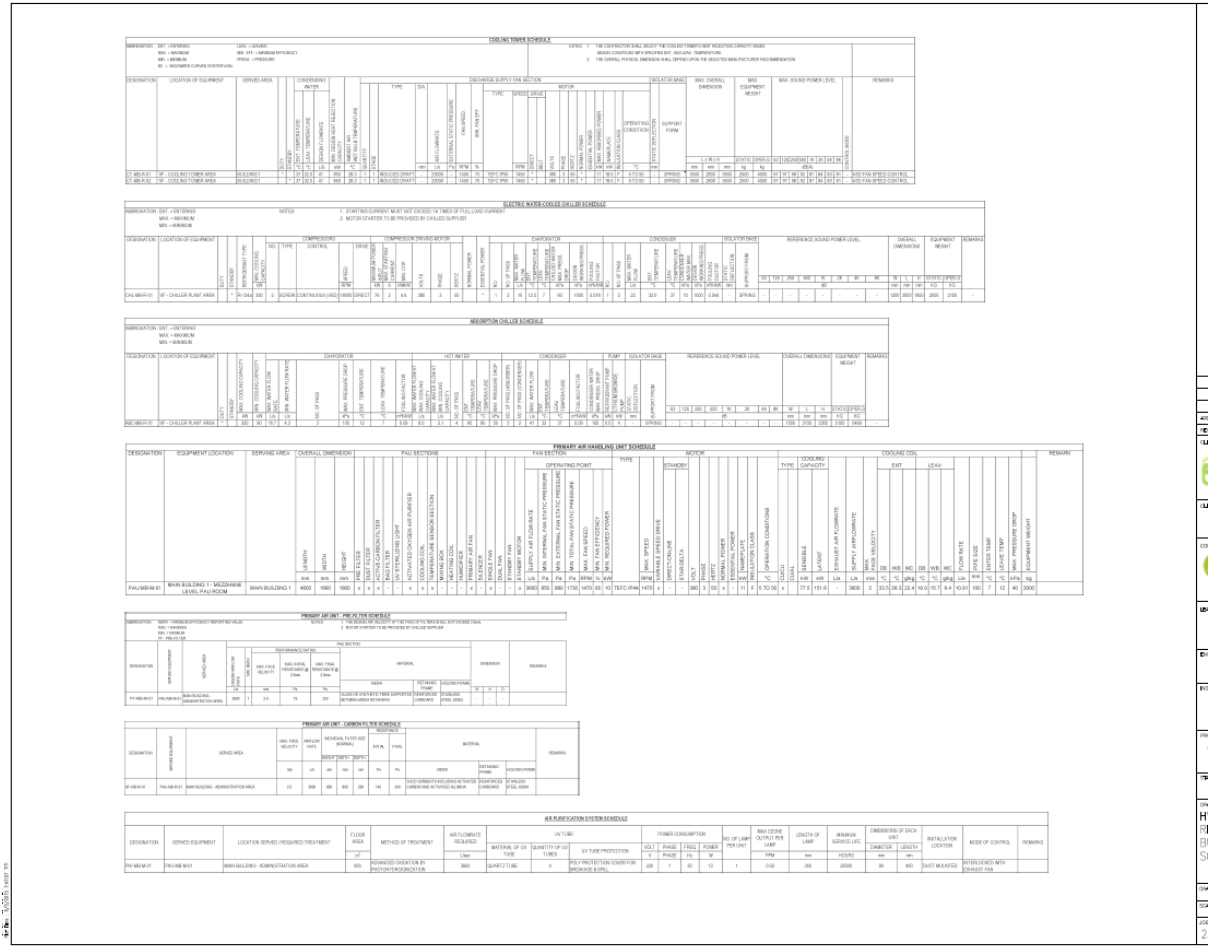


At Roof Level



Drawings

Equipment Schedule



Drawings

Equipment Schedule

FAN SCHEDULE

ABBREVIATION:
DIA. = DIAMETER
PRESS. = PRESSURE
MIN. EFF. = MINIMUM EFFICIENCY
FAF = FRESH AIR FAN
EXF = EXHAUST AIR FAN
MAX = MAXIMUM
MIN = MINIMUM
H = HORIZONTAL
V= VERTICAL
ILCF = IN LINE CENTRIFUGAL FAN
CENT = CENTRIFUGAL FAN
PROP = PROPELLER
TBD - TO BE DETERMINED

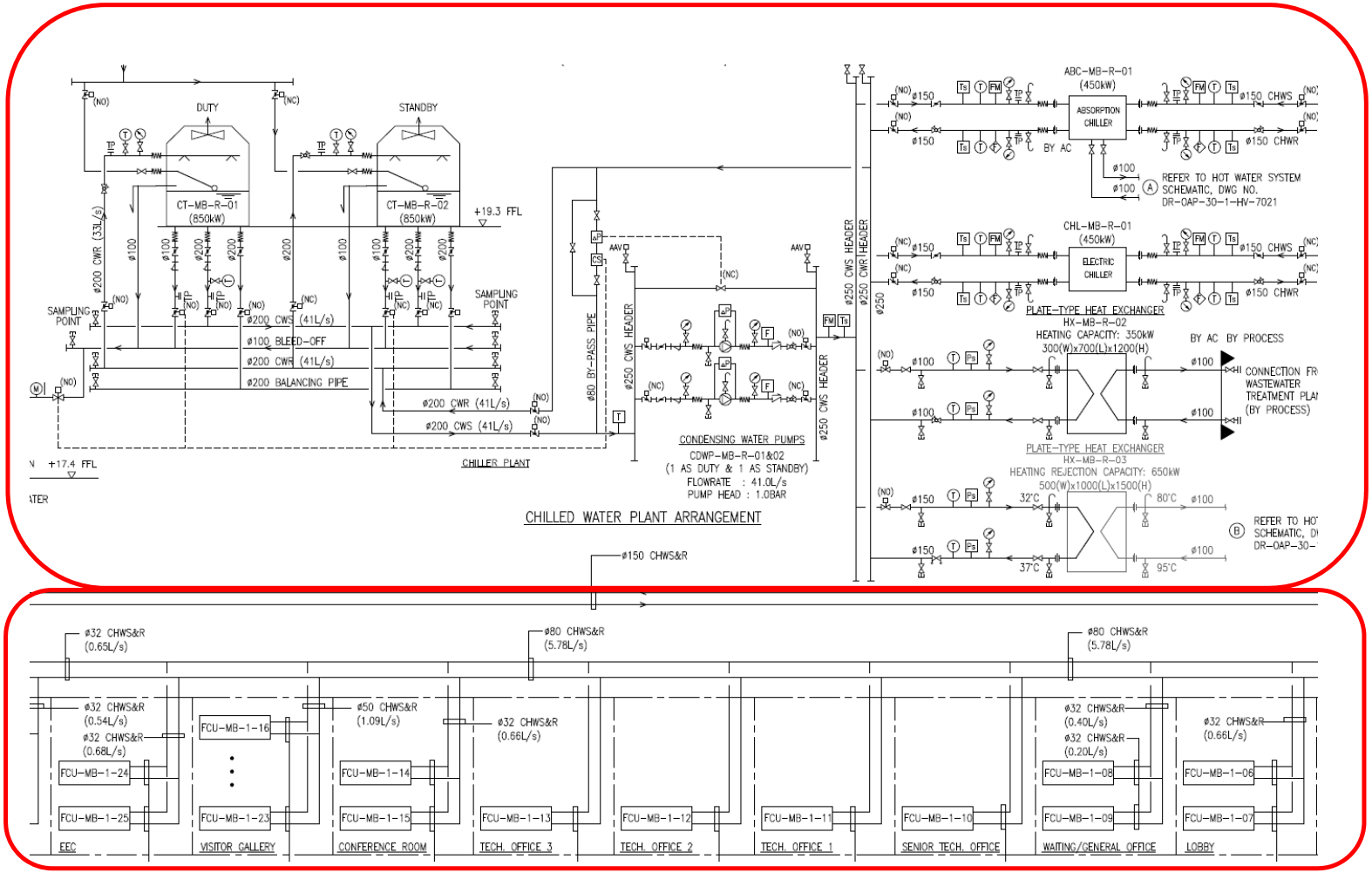
DESIGNATION	EQUIPMENT LOCATION	SERVED AREA	DUTY	STANDBY	ARRANGEMENT	AIR FLOW	IMPELLER			PERFORMANCE								
							MIN. DIAMETER	TYPE	MAX. RPM	MIN. AIR FLOW RATE	FAN STATIC PRESS	FAN TOTAL PRESS	MIN EFF	MAX POWER REQUIRED	TYPE	VOLTS	PHASE	HERTZ
							mm			L/s	Pa	Pa	%	kW				
FAF-MB-G-01	BUILDING 1 - G/F - WORKSHOP	WORKSHOP	*		H	H	700	AXIAL	1450	2380	370	470	50	2.46	TEFC IP44	380	3	50
FAF-MB-G-02	BUILDING 1 - G/F - FS&SPRINKLER PUMP ROOM	FS&SPRINKLER PUMP ROOM	*		H	H	900	AXIAL	1450	3300	620	720	50	5.23	TEFC IP44	380	3	50
FAF-MB-1-01	BUILDING 1 - 1/F - CHILLER PLANT ROOM	CHILLER PLANT ROOM	*		H	H	700	AXIAL	1450	2150	250	350	55	1.51	TEFC IP44	380	3	50
FAF-MB-M-01	BUILDING 1 - M/F - CORRIDOR	WATER RECYCLING PUMP ROOM, FM200 ROOM, IRRIGATION PUMP ROOM, PAU ROOM, PLUMBING PUMPS&TANKS ROOM, LOBBY, SOLAR HOT WATER SYSTEM	*		H	H	900	AXIAL	1450	3000	530	630	55	3.78	TEFC IP44	380	3	50
EAF-MB-G-01	BUILDING 1 - G/F - PANTRY	MAIN BUILDING G/F FILING ROOM, PANTRY 1	*		H	H		ILCF	1450	230	430	530	25	0.54	TEFC IP44	220	1	50
EAF-MB-G-02	BUILDING 1 - G/F - WAITING AREA	MAIN BUILDING G/F M+F TOILET, CHANGING ROOM 1+2	*		H	H		ILCF	1450	520	420	520	25	1.19	TEFC IP44	220	1	50
EAF-MB-G-03	BUILDING 1 - G/F - WAITING AREA	MAIN BUILDING G/F IT ROOM 1	*		H	H		ILCF	1450	140	200	300	25	0.18	TEFC IP44	220	1	50
EAF-MB-G-04	BUILDING 1 - G/F - FS&SPRINKLER PUMP ROOM	FS&SPRINKLER PUMP ROOM	*		H	H	600	AXIAL	1450	3300	290	390	55	2.57	TEFC IP44	380	3	50
EAF-MB-G-05	BUILDING 1 - G/F - WORKSHOP	WORKSHOP	*		H	H	700	AXIAL	1450	2380	350	450	50	2.36	TEFC IP44	380	3	50
EAF-MB-G-06	BUILDING 1 - G/F - CHEMICAL STORE	CHEMICAL STORE	*		H	H		ILCF	1450	540	220	320	25	0.76	TEFC IP44	220	1	50
EAF-MB-G-07	BUILDING 1 - G/F - VEHICLE WASH RECYCLING WATER SYSTEM PLANT ROOM	VEHICLE WASH RECYCLING WATER SYSTEM PLANT ROOM	*		H	H	560	AXIAL	1450	740	200	300	50	0.49	TEFC IP44	220	1	50
EAF-MB-1-01	BUILDING 1 - 1/F - EEC MALE TOILET	EEC TOILET M+F, DIS. TOILET, EPD TOILET M+F, CHANGING ROOM 3+4	*		H	H		ILCF	1450	1890	490	590	35	3.50	TEFC IP44	380	3	50
EAF-MB-1-02	BUILDING 1 - 1/F - RECEPTION	STORAGE, DOC. STORE, EQUIP STO, PANTRY 2	*		H	H		ILCF	1450	430	470	570	20	1.35	TEFC IP44	220	1	50
EAF-MB-1-03	BUILDING 1 - 1/F - GENERAL OFFICE	MAIN BUILDING 1/F IT ROOM 2	*		H	H		ILCF	1450	150	200	300	20	0.25	TEFC IP44	220	1	50
EAF-MB-1-04	BUILDING 1 - 1/F - CHILLER PLANT ROOM	CHILLER PLANT ROOM	*		H	H	600	AXIAL	1450	2150	210	310	55	1.33	TEFC IP44	380	3	50
EAF-MB-1-05	BUILDING 1 - 1/F - FM200 ROOM	FM200 ROOM	*		H	H	250	PROP	1450	100	20	120	55	0.02	TEFC IP44	220	1	50
EAF-MB-M-01	BUILDING 1 - M/F - HOT WATER SYSTEM PLANT ROOM	WATER RECYCLING PUMP ROOM, FM200 ROOM, IRRIGATION PUMP ROOM, PAU ROOM, PLUMBING PUMPS&TANKS ROOM, LOBBY, HOT WATER SYSTEM PLANT	*		H	H	700	AXIAL	1450	3000	370	470	55	2.82	TEFC IP44	380	3	50
EAF-MB-M-02	BUILDING 1 - M/F - SCADA & CONTROL ROOM	SCADA & CONTROL ROOM	*		H	H		ILCF	1450	360	310	410	25	0.65	TEFC IP44	220	1	50

Drawings

Schematic (Water side)

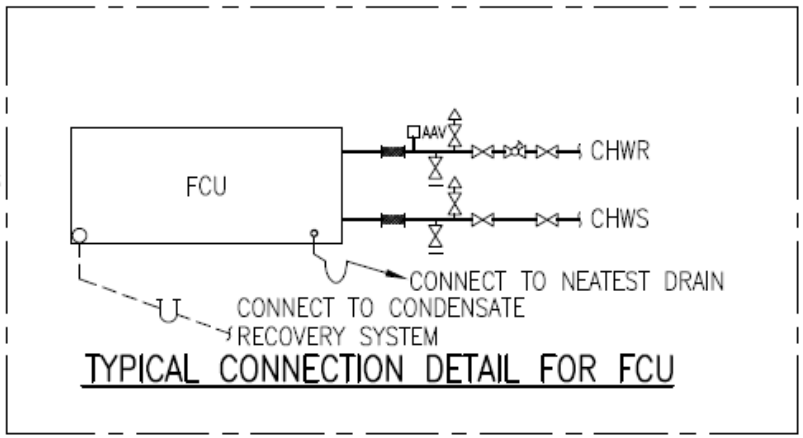
Plant Room Area

Non-Plant Room Area

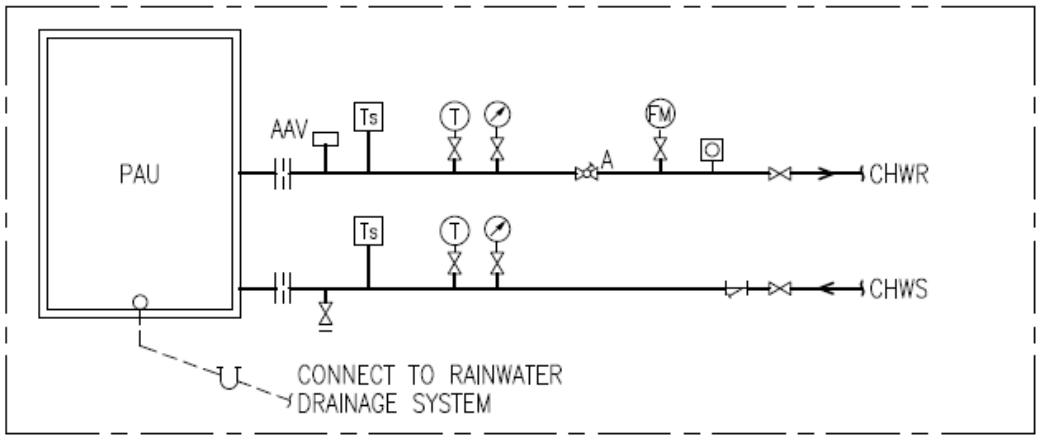


Drawings

Schematic (Water side)



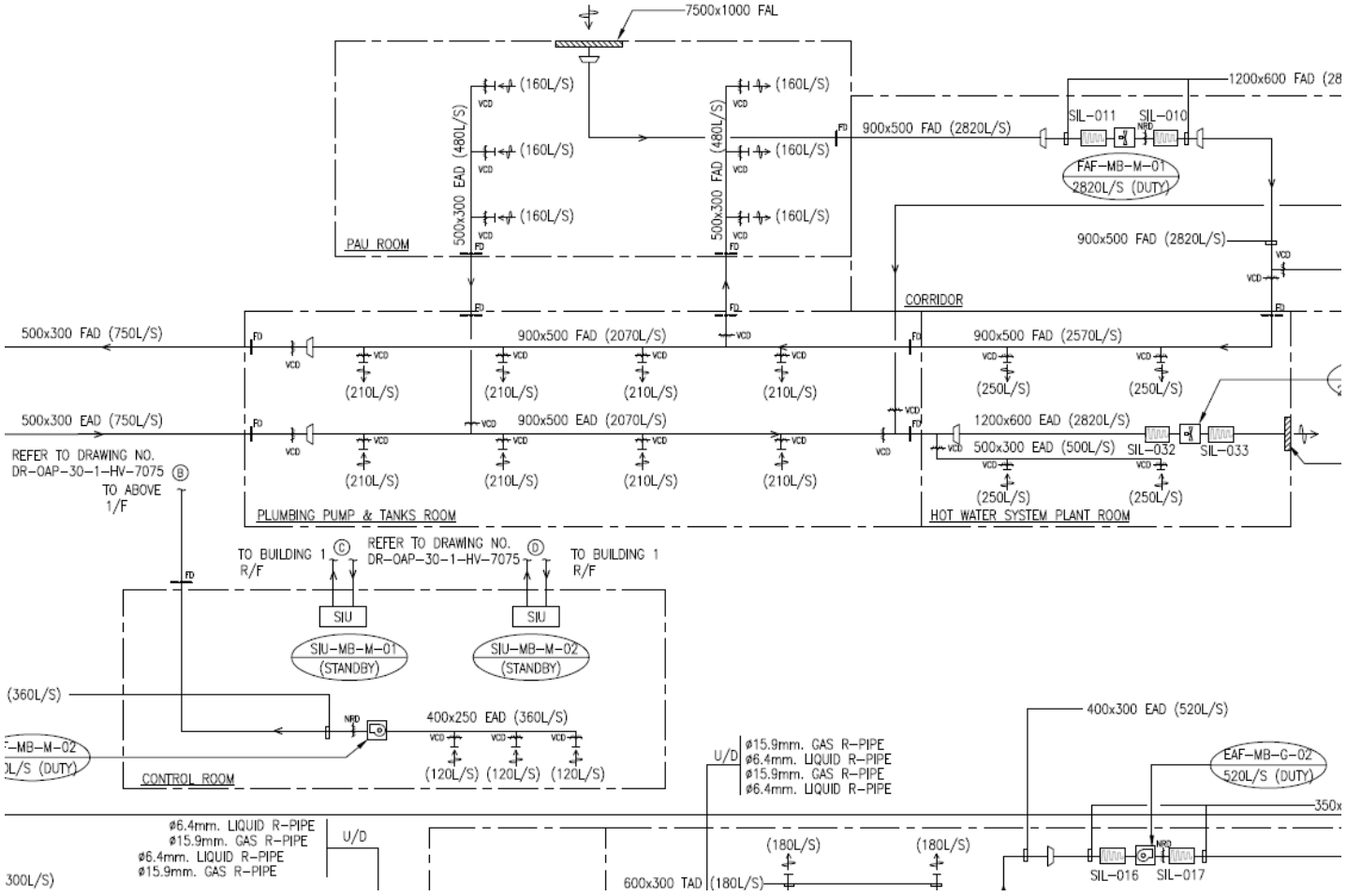
TYPICAL CONNECTION DETAIL FOR FCU



CONNECTION DETAILS FOR PAU
(FOR EACH COOLING COIL)

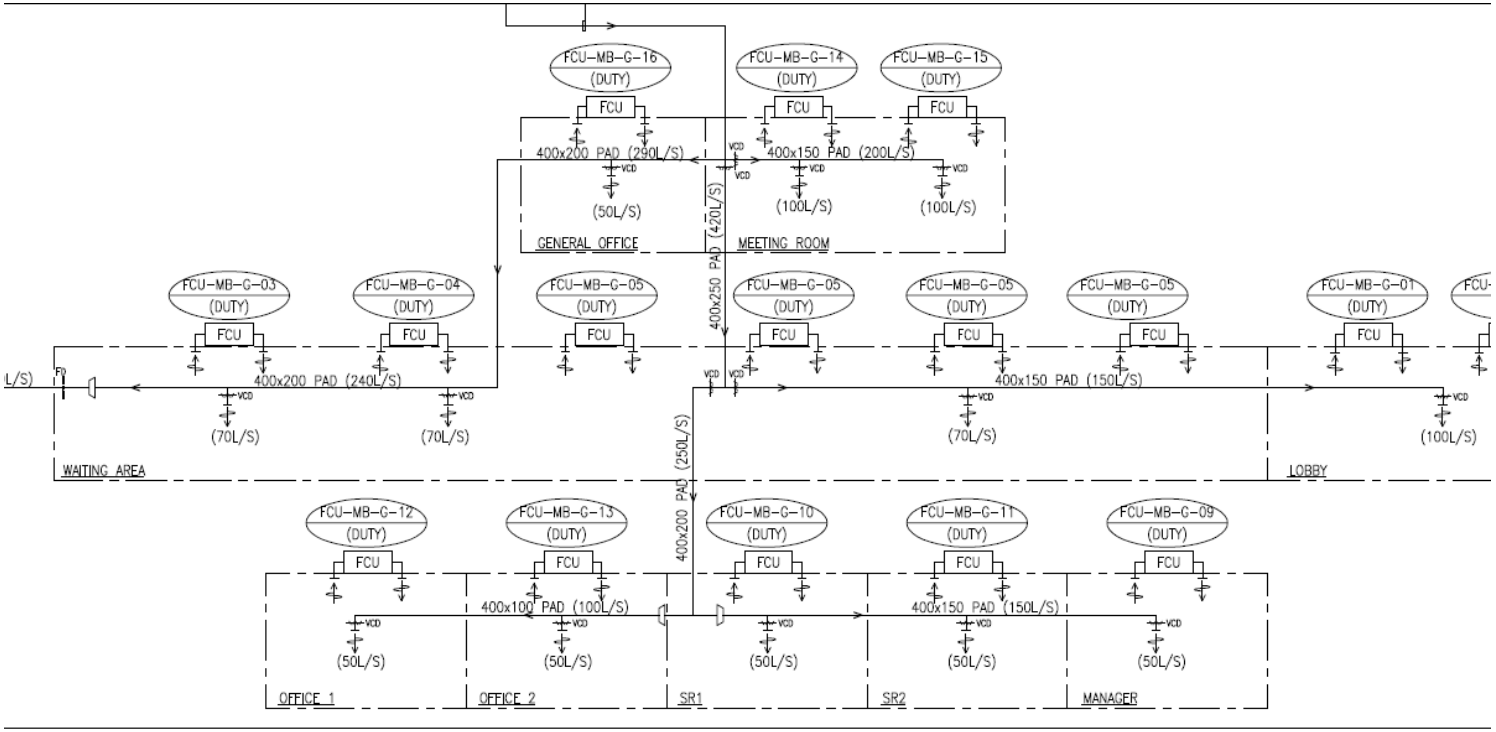
Drawings

Schematic (Air side) Mech. Vent.



Drawings

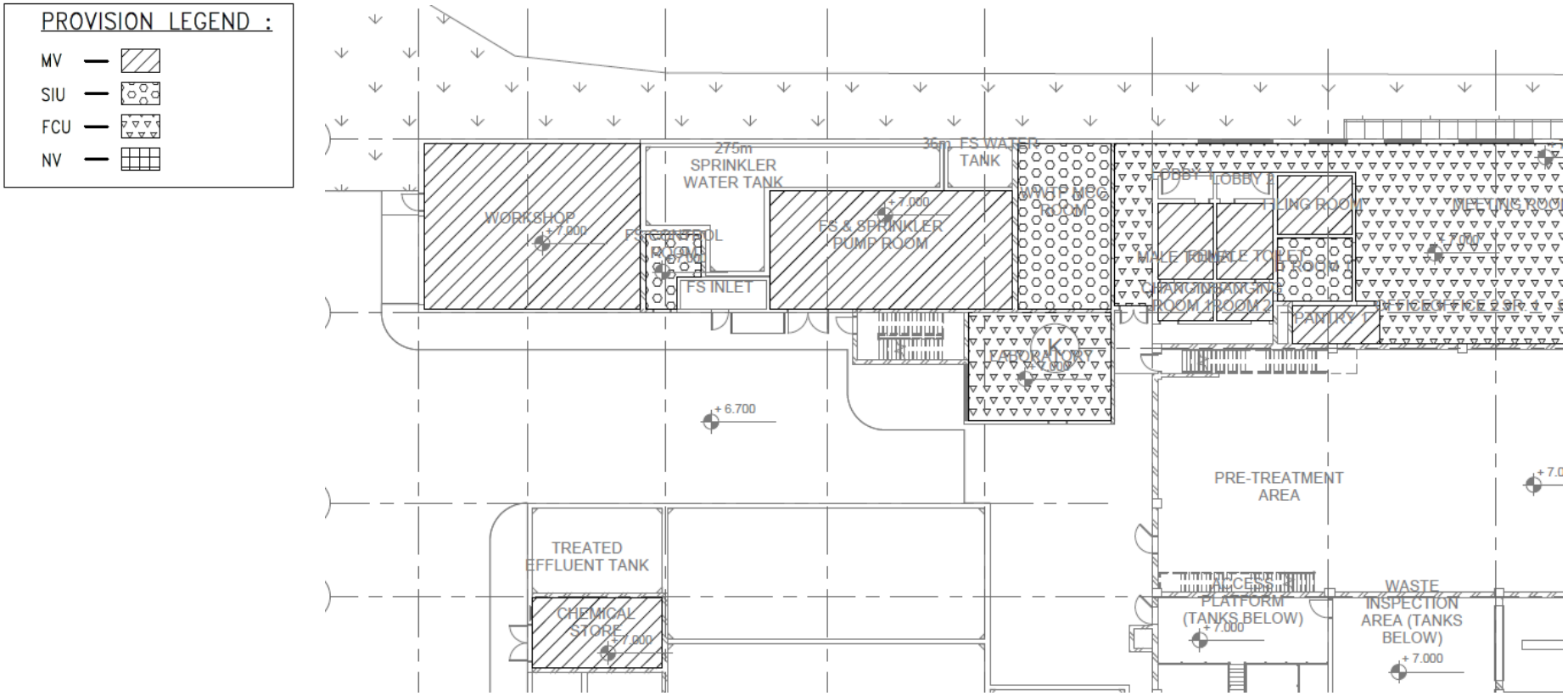
Schematic (Air side) A/C



ADMINISTRATION BUILDING – PRIMARY AIR UNIT AIR SIDE SCHEMATIC DIAGRAM

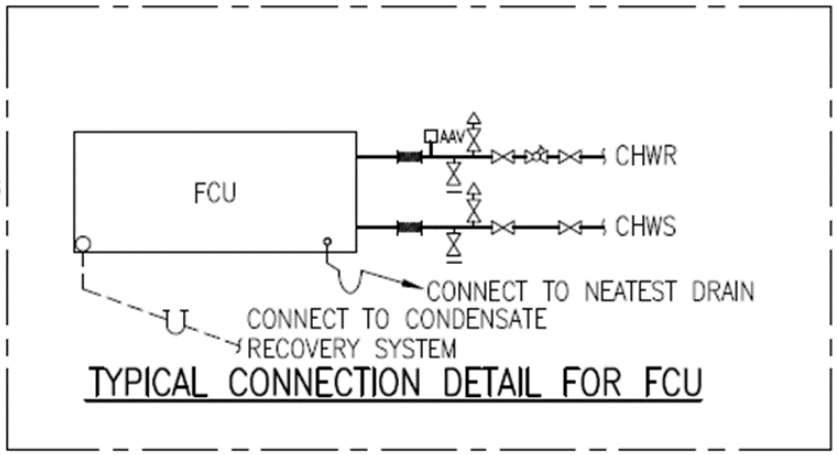
Drawings

MVAC Provision Zoning

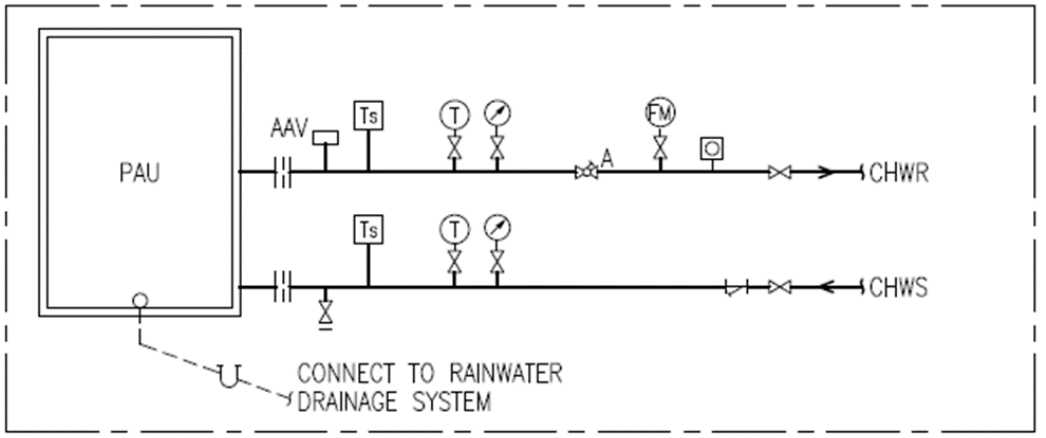


Drawings

Typical Details



TYPICAL CONNECTION DETAIL FOR FCU



CONNECTION DETAILS FOR PAU
(FOR EACH COOLING COIL)

Drawings

Cable Schedules

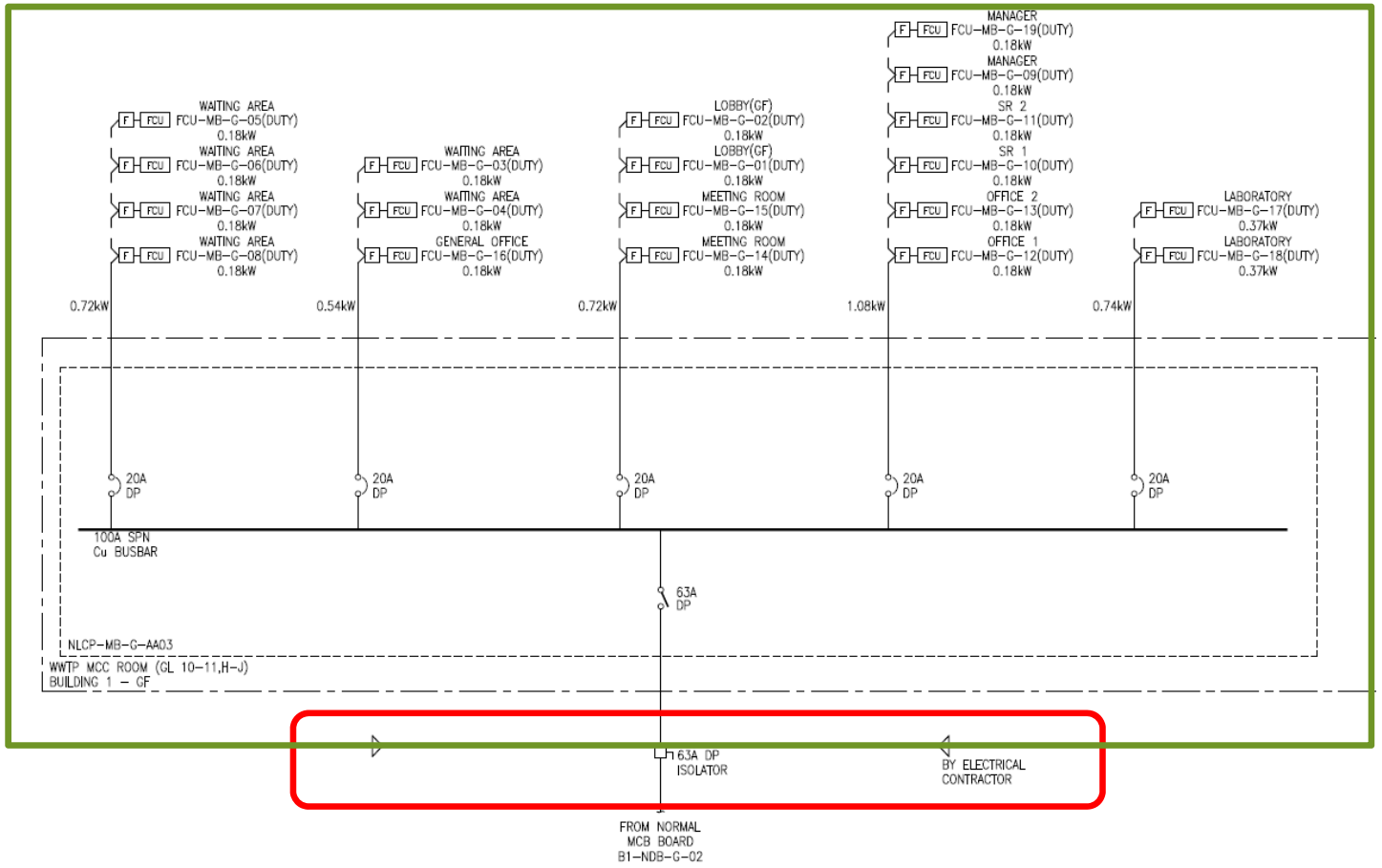
CABLE SCHEDULE :

PROTECTIVE DEVICE MCB/MCCB	CABLE SIZE 1/C Cu. CABLE
10A SP	2x1.5mm^2
16A SP	2x2.5mm^2
20A SP	2x2.5mm^2
32A SP	2x4mm^2
32A SP RCBO FOR 13A SOCKET (RING CIRCUIT)	4x2.5mm^2
32A SP RCBO FOR 32A SOCKET (RADIAL CIRCUIT)	2x4mm^2
16A TP	4x2.5mm^2
20A TP	4x4mm^2
32A TP	4x6mm^2
40A TP	4x10mm^2
63A TP	4x16mm^2
80A TP	4x25mm^2
100A TP	4x35mm^2
160A TP	4x70mm^2

REF.	TWO-CORE ARMOURED CABLE
S95	1x95mm^2 2/C XLPE/SWA/LSHF CU CABLE
S70	1x70mm^2 2/C XLPE/SWA/LSHF CU CABLE
S50	1x50mm^2 2/C XLPE/SWA/LSHF CU CABLE
S35	1x35mm^2 2/C XLPE/SWA/LSHF CU CABLE
S25	1x25mm^2 2/C XLPE/SWA/LSHF CU CABLE
S16	1x16mm^2 2/C XLPE/SWA/LSHF CU CABLE
S10	1x10mm^2 2/C XLPE/SWA/LSHF CU CABLE
S6	1x6mm^2 2/C XLPE/SWA/LSHF CU CABLE
S4	1x4mm^2 2/C XLPE/SWA/LSHF CU CABLE
S2	1x2.5mm^2 2/C XLPE/SWA/LSHF CU CABLE

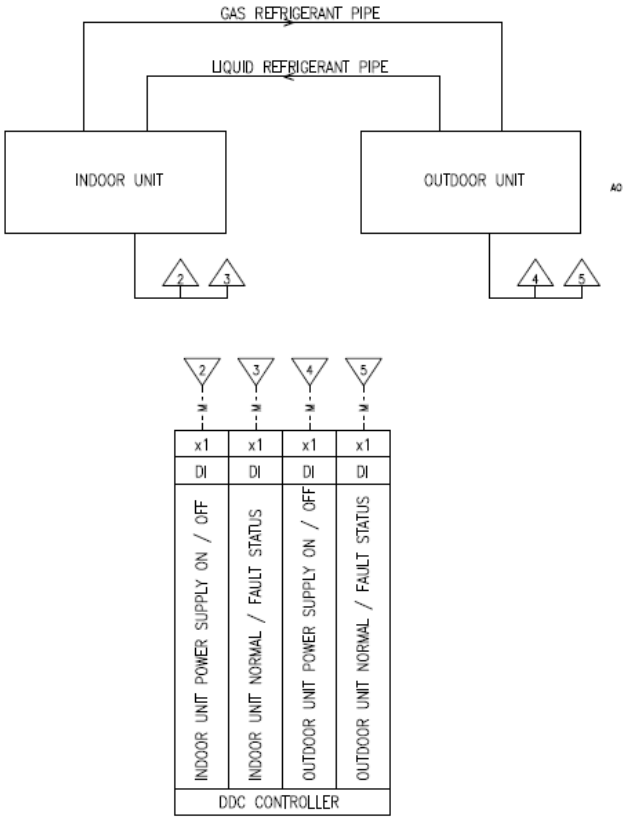
Drawings

Electrical Schematic



Drawings

Control Schematic



CONTROL SCHEMATIC OF SPLIT-TYPE SYSTEM

Drawings

Legend, Notes & Abbreviations

Schematic (Water side)

Schematic (Air side) A/C

Schematic (Air side) Mechanical Ventilation

Layout

Equipment Schedule

ACMV Provision Zoning

Typical Details

Electrical and Control

Preparation for Measurement

Drawings

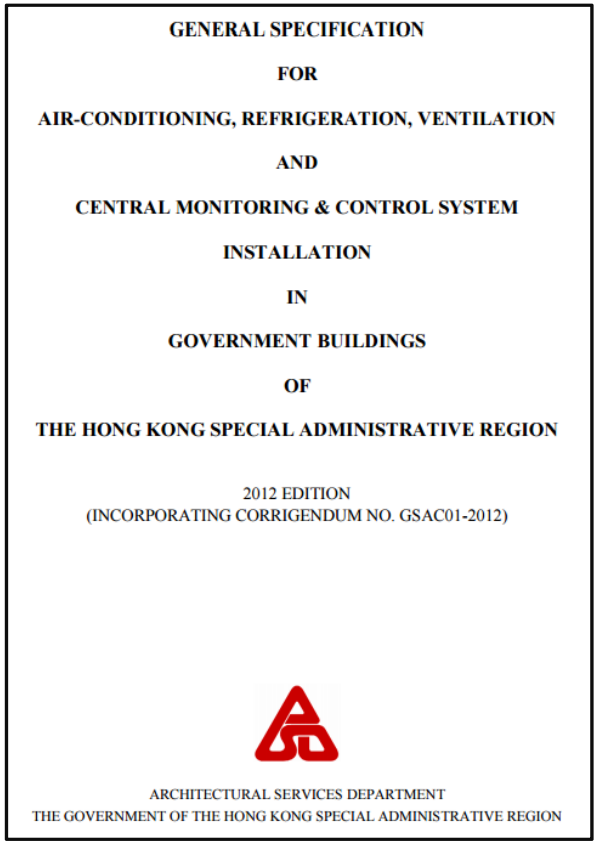
Specifications / Codes of Practices

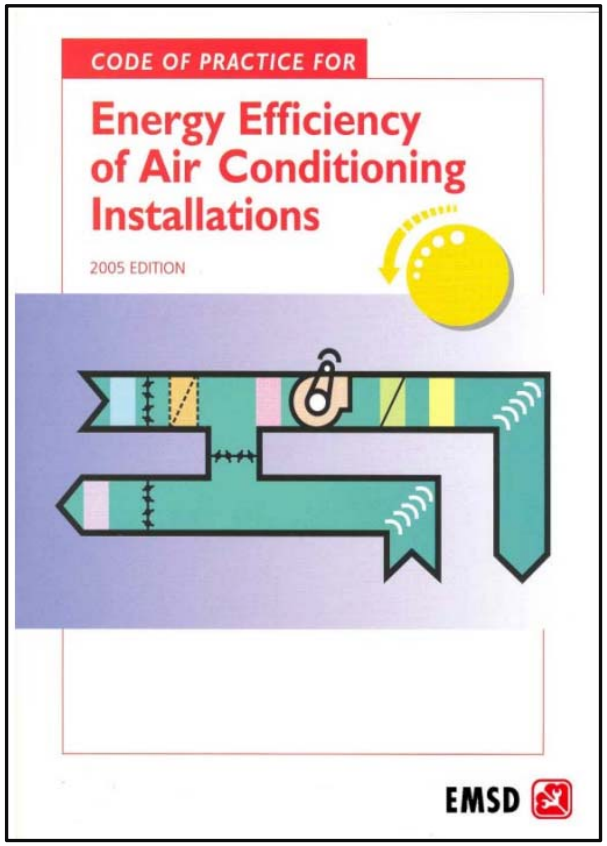
Standard Method of Measurement

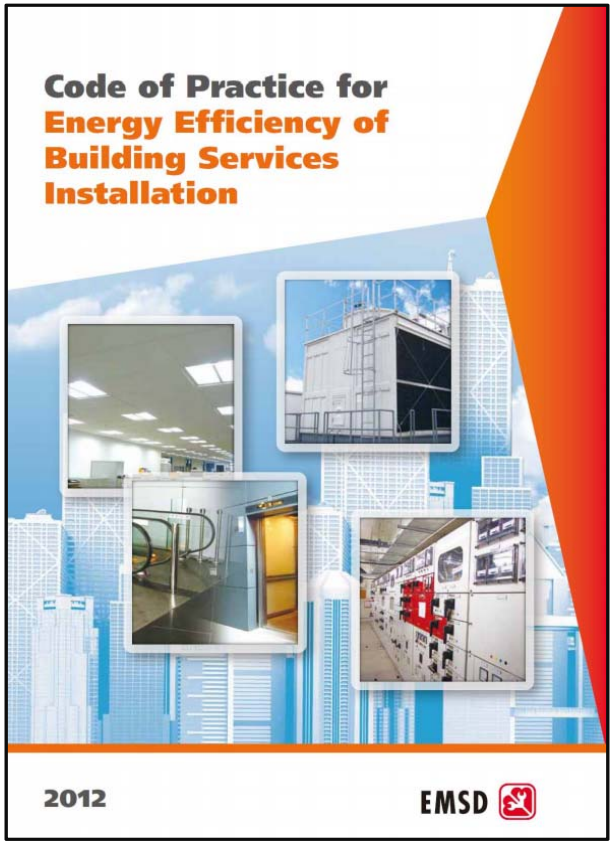
Preambles

Sample Bills, if any

Specification / Code of Practice







Specification / Code of Practice

Code of Practice for Energy Efficiency of Air Conditioning Installations, 2007

Table (8.5) : Minimum Insulation Thickness for Outdoor Refrigerant Pipe

Minimum Thickness of Insulation for Refrigerant Pipe Installations (mm)									
Outdoor Condition at 35 °C, 95% RH; wind speed = 1m/s; $h^{(3)}$=13.5									
	Fluid Operating Temperature								
Outer Diameter of Pipe(mm)[1]	0°C			-10°C			-20°C		
	Thermal Conductivity[2], λ			Thermal Conductivity[2], λ			Thermal Conductivity[2], λ		
	0.02	0.03	0.04	0.02	0.03	0.04	0.02	0.03	0.04
6	23	32	40	29	39	49	33	46	57
8	25	34	42	30	41	52	36	49	61
10	26	36	45	32	44	54	38	51	64
12	27	37	46	33	45	57	39	53	66
15	29	39	49	35	48	59	41	56	70

Preparation for Measurement

Drawings

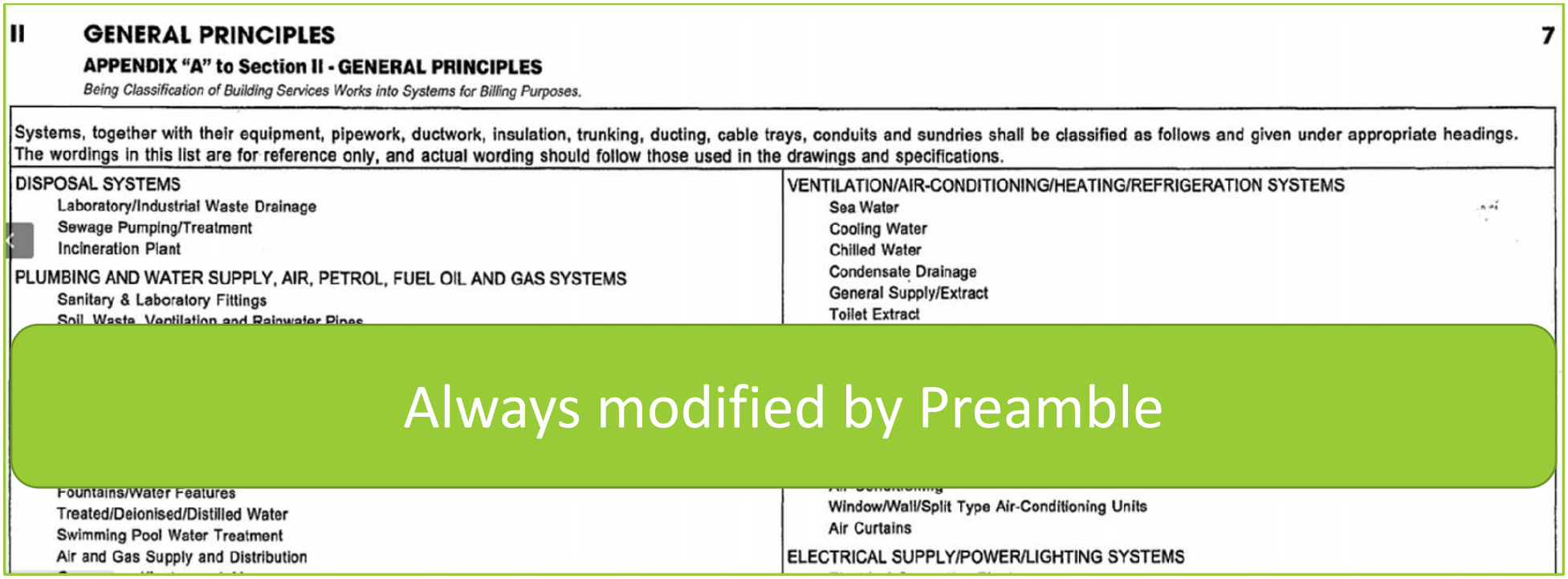
Specifications / Codes of Practices

Standard Method of Measurement

Preambles

Sample Bills, if any

HKSMM 4



II **GENERAL PRINCIPLES** 7

APPENDIX "A" to Section II - GENERAL PRINCIPLES

Being Classification of Building Services Works into Systems for Billing Purposes.

Systems, together with their equipment, pipework, ductwork, insulation, trunking, ducting, cable trays, conduits and sundries shall be classified as follows and given under appropriate headings. The wordings in this list are for reference only, and actual wording should follow those used in the drawings and specifications.

DISPOSAL SYSTEMS
- Laboratory/Industrial Waste Drainage
- Sewage Pumping/Treatment
- Incineration Plant

PLUMBING AND WATER SUPPLY, AIR, PETROL, FUEL OIL AND GAS SYSTEMS
- Sanitary & Laboratory Fittings
- Soil, Waste, Ventilation and Rainwater Pipes
- Fountains/Water Features
- Treated/Deionised/Distilled Water
- Swimming Pool Water Treatment
- Air and Gas Supply and Distribution

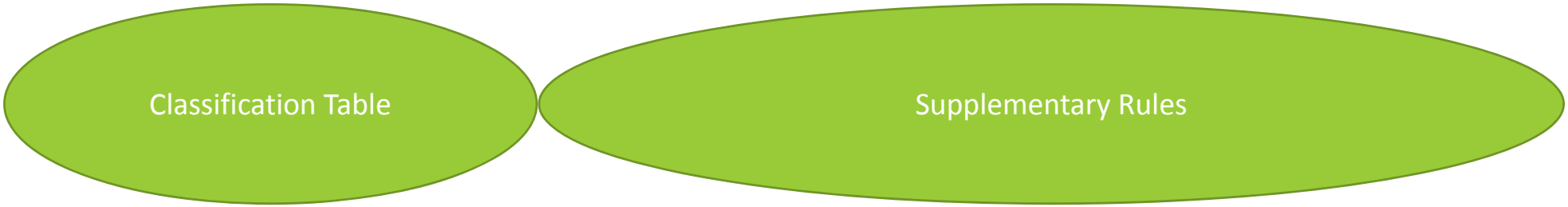
VENTILATION/AIR-CONDITIONING/HEATING/REFRIGERATION SYSTEMS
- Sea Water
- Cooling Water
- Chilled Water
- Condensate Drainage
- General Supply/Extract
- Toilet Extract
- Window/Wall/Split Type Air-Conditioning Units
- Air Curtains

ELECTRICAL SUPPLY/POWER/LIGHTING SYSTEMS

Always modified by Preamble

HKSMM 4

INFORMATION PROVIDED					MEASUREMENT RULES	DEFINITION RULES	COVERAGE RULES	SUPPLEMENTARY INFORMATION
			Qty					

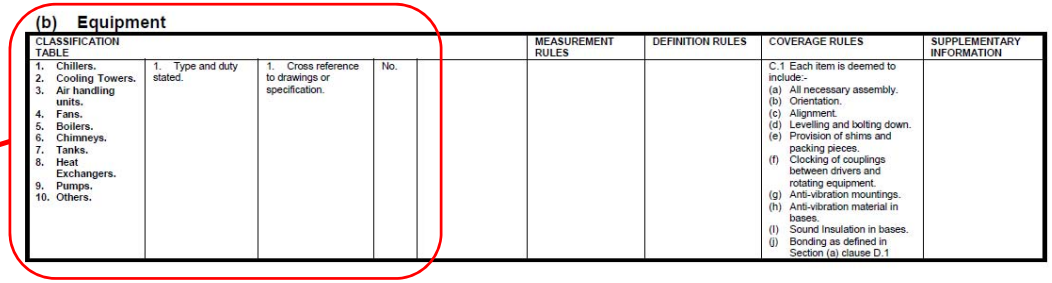


HKSMM 4

(b) Equipment

CLASSIFICATION TABLE					MEASUREMENT RULES	DEFINITION RULES	COVERAGE RULES	SUPPLEMENTARY INFORMATION
1. Chillers. 2. Cooling Towers. 3. Air handling units. 4. Fans. 5. Boilers. 6. Chimneys. 7. Tanks. 8. Heat Exchangers. 9. Pumps. 10. Others.	1. Type and duty stated.	1. Cross reference to drawings or specification.	No.				C.1 Each item is deemed to include:- (a) All necessary assembly. (b) Orientation. (c) Alignment. (d) Levelling and bolting down. (e) Provision of shims and packing pieces. (f) Clocking of couplings between drivers and rotating equipment. (g) Anti-vibration mountings. (h) Anti-vibration material in bases. (I) Sound Insulation in bases. (j) Bonding as defined in Section (a) clause D.1	

HKSMM 4



(b) Equipment

CLASSIFICATION TABLE					MEASUREMENT RULES	DEFINITION RULES	COVERAGE RULES	SUPPLEMENTARY INFORMATION
1. Chillers. 2. Cooling Towers. 3. Air handling units. 4. Fans. 5. Boilers. 6. Chimneys. 7. Tanks. 8. Heat Exchangers. 9. Pumps. 10. Others.	1. Type and duty stated.	1. Cross reference to drawings or specification.	No.				C.1 Each item is deemed to include:- (a) All necessary assembly. (b) Orientation. (c) Alignment. (d) Levelling and bolting down. (e) Provision of shims and packing pieces. (f) Clocking of couplings between drivers and rotating equipment. (g) Anti-vibration mountings. (h) Anti-vibration material in bases. (i) Sound Insulation in bases. (j) Bonding as defined in Section (a) clause D.1	

(b) Equipment

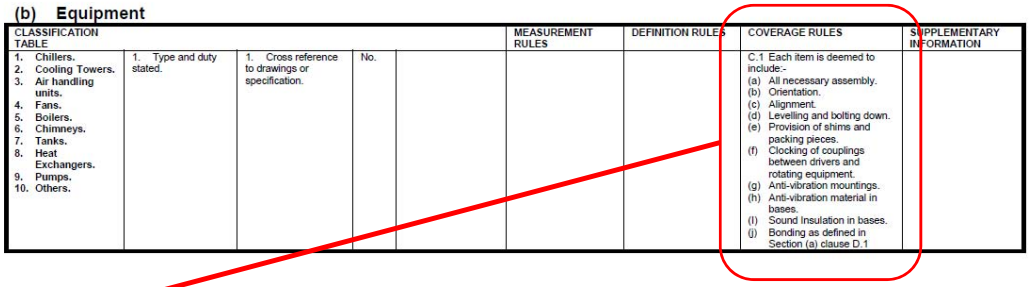
CLASSIFICATION TABLE			
1. Chillers. 2. Cooling Towers. 3. Air handling units. 4. Fans. 5. Boilers. 6. Chimneys. 7. Tanks. 8. Heat Exchangers. 9. Pumps. 10. Others.	1. Type and duty stated.	1. Cross reference to drawings or specification.	No.

HKSMM 4

COVERAGE RULES

C.1 Each item is deemed to include:-

(a) All necessary assembly.
(b) Orientation.
(c) Alignment.
(d) Levelling and bolting down.
(e) Provision of shims and packing pieces.
(f) Clocking of couplings between drivers and rotating equipment.
(g) Anti-vibration mountings.
(h) Anti-vibration material in bases.
(I) Sound Insulation in bases.
(j) Bonding as defined in Section (a) clause D.1



(b) Equipment

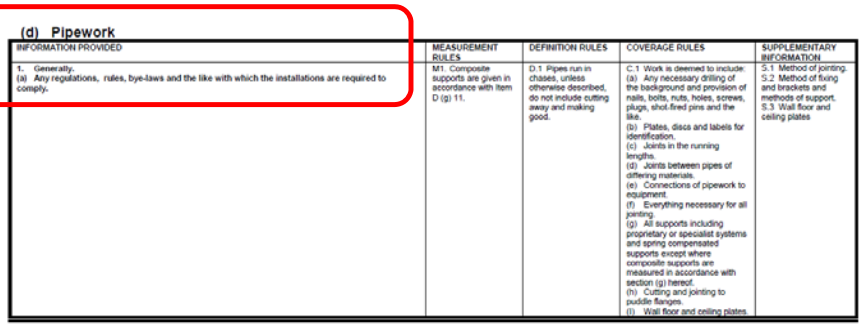
CLASSIFICATION TABLE					MEASUREMENT RULES	DEFINITION RULES	COVERAGE RULES	SUPPLEMENTARY INFORMATION
1. Chillers. 2. Cooling Towers. 3. Air handling units. 4. Fans. 5. Boilers. 6. Chimneys. 7. Tanks. 8. Heat Exchangers. 9. Pumps. 10. Others.	1. Type and duty stated.	1. Cross reference to drawings or specification.	No.				C.1 Each item is deemed to include:- (a) All necessary assembly. (b) Orientation. (c) Alignment. (d) Levelling and bolting down. (e) Provision of shims and packing pieces. (f) Clocking of couplings between drivers and rotating equipment. (g) Anti-vibration mountings. (h) Anti-vibration material in bases. (I) Sound Insulation in bases. (j) Bonding as defined in Section (a) clause D.1	

HKSMM 4

(d) Pipework

INFORMATION PROVIDED	MEASUREMENT RULES	DEFINITION RULES	COVERAGE RULES	SUPPLEMENTARY INFORMATION
1. Generally. **(a) Any regulations, rules, bye-laws and the like with which the installations are required to comply.**	M1. Composite supports are given in accordance with Item D (g) 11.	D.1 Pipes run in chases, unless otherwise described, do not include cutting away and making good.	C.1 Work is deemed to include: (a) Any necessary drilling of the background and provision of nails, bolts, nuts, holes, screws, plugs, shot-fired pins and the like. (b) Plates, discs and labels for identification. (c) Joints in the running lengths. (d) Joints between pipes of differing materials. (e) Connections of pipework to equipment. (f) Everything necessary for all jointing. (g) All supports including proprietary or specialist systems and spring compensated supports except where composite supports are measured in accordance with section (g) hereof. (h) Cutting and jointing to puddle flanges. (I) Wall floor and ceiling plates.	S.1 Method of jointing. S.2 Method of fixing and brackets and methods of support. S.3 Wall floor and ceiling plates

HKSMM 4



(d) Pipework

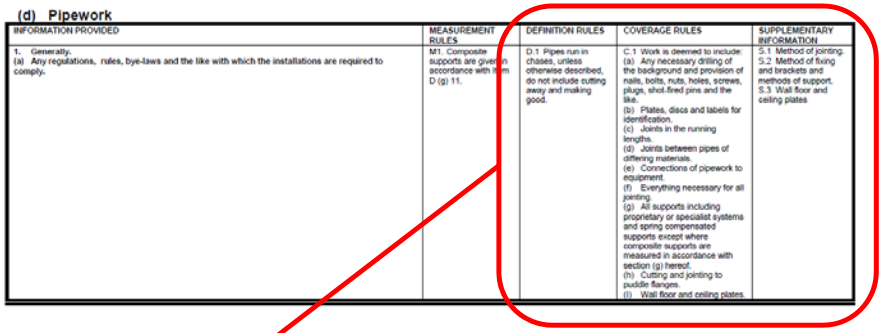
INFORMATION PROVIDED	MEASUREMENT RULES	DEFINITION RULES	COVERAGE RULES	SUPPLEMENTARY INFORMATION
1. Generally. (a) Any regulations, rules, bye-laws and the like with which the installations are required to comply.	M1. Composite supports are given in accordance with Item D (g) 11.	D.1 Pipes run in chases, unless otherwise described, do not include cutting away and making good.	C.1 Work is deemed to include: (a) Any necessary drilling of the background and provision of nails, bolts, nuts, holes, screws, plugs, shot-fired pins and the like. (b) Plates, discs and labels for identification. (c) Joints in the running lengths. (d) Joints between pipes of differing materials. (e) Connections of pipework to equipment. (f) Everything necessary for all jointing. (g) All supports including proprietary or specialist systems and spring compensated supports except where composite supports are measured in accordance with section (g) hereof. (h) Cutting and jointing to puddle flanges. (i) Wall floor and ceiling plates.	S.1 Method of jointing. S.2 Method of fixing and brackets and methods of support. S.3 Wall floor and ceiling plates

(d) Pipework

INFORMATION PROVIDED
1. Generally. (a) Any regulations, rules, bye-laws and the like with which the installations are required to comply.

HKSMM 4

DEFINITION RULES	COVERAGE RULES	SUPPLEMENTARY INFORMATION
D.1 Pipes run in chases, unless otherwise described, do not include cutting away and making good.	C.1 Work is deemed to include: (a) Any necessary drilling of the background and provision of nails, bolts, nuts, holes, screws, plugs, shot-fired pins and the like. (b) Plates, discs and labels for identification. (c) Joints in the running lengths. (d) Joints between pipes of differing materials. (e) Connections of pipework to equipment. (f) Everything necessary for all jointing. (g) All supports including proprietary or specialist systems and spring compensated supports except where composite supports are measured in accordance with section (g) hereof. (h) Cutting and jointing to puddle flanges. (I) Wall floor and ceiling plates.	S.1 Method of jointing. S.2 Method of fixing and brackets and methods of support. S.3 Wall floor and ceiling plates



(d) Pipework

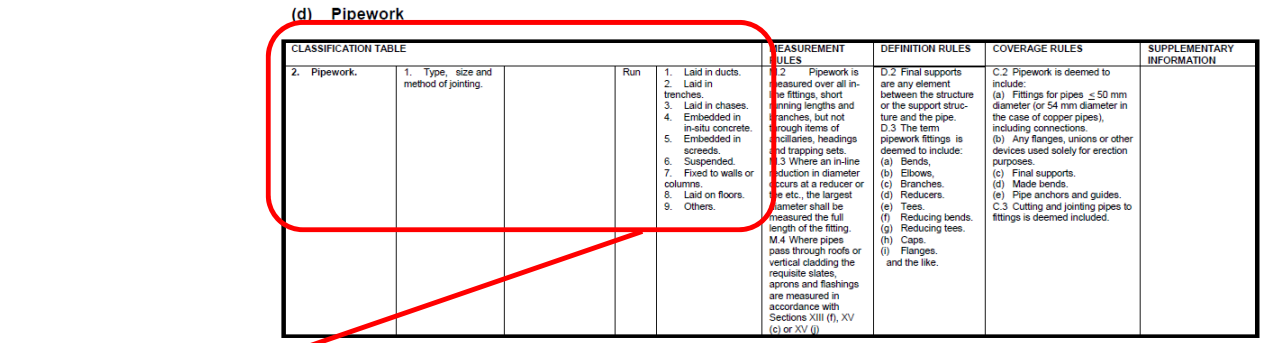
INFORMATION PROVIDED	MEASUREMENT RULES	DEFINITION RULES	COVERAGE RULES	SUPPLEMENTARY INFORMATION
1. Generally. (a) Any regulations, rules, bye-laws and the like with which the installations are required to comply.	M1. Composite supports are given in accordance with item D (g) 11.	D.1 Pipes run in chases, unless otherwise described, do not include cutting away and making good.	C.1 Work is deemed to include: (a) Any necessary drilling of the background and provision of nails, bolts, nuts, holes, screws, plugs, shot-fired pins and the like. (b) Plates, discs and labels for identification. (c) Joints in the running lengths. (d) Joints between pipes of differing materials. (e) Connections of pipework to equipment. (f) Everything necessary for all jointing. (g) All supports including proprietary or specialist systems and spring compensated supports except where composite supports are measured in accordance with section (g) hereof. (h) Cutting and jointing to puddle flanges. (i) Wall floor and ceiling plates.	S.1 Method of jointing. S.2 Method of fixing and brackets and methods of support. S.3 Wall floor and ceiling plates

HKSMM 4

(d) Pipework

CLASSIFICATION TABLE					MEASUREMENT RULES	DEFINITION RULES	COVERAGE RULES	SUPPLEMENTARY INFORMATION
2. Pipework.	1. Type, size and method of jointing.		Run	1. Laid in ducts. 2. Laid in trenches. 3. Laid in chases. 4. Embedded in in-situ concrete. 5. Embedded in screeds. 6. Suspended. 7. Fixed to walls or columns. 8. Laid on floors. 9. Others.	M.2 Pipework is measured over all in-line fittings, short running lengths and branches, but not through items of ancillaries, headings and trapping sets. M.3 Where an in-line reduction in diameter occurs at a reducer or tee etc., the largest diameter shall be measured the full length of the fitting. M.4 Where pipes pass through roofs or vertical cladding the requisite slates, aprons and flashings are measured in accordance with Sections XIII (f), XV (c) or XV (j)	D.2 Final supports are any element between the structure or the support structure and the pipe. D.3 The term pipework fittings is deemed to include: (a) Bends, (b) Elbows, (c) Branches. (d) Reducers. (e) Tees. (f) Reducing bends. (g) Reducing tees. (h) Caps. (i) Flanges. and the like.	C.2 Pipework is deemed to include: (a) Fittings for pipes $\leq$ 50 mm diameter (or 54 mm diameter in the case of copper pipes), including connections. (b) Any flanges, unions or other devices used solely for erection purposes. (c) Final supports. (d) Made bends. (e) Pipe anchors and guides. C.3 Cutting and jointing pipes to fittings is deemed included.	

HKSMM 4



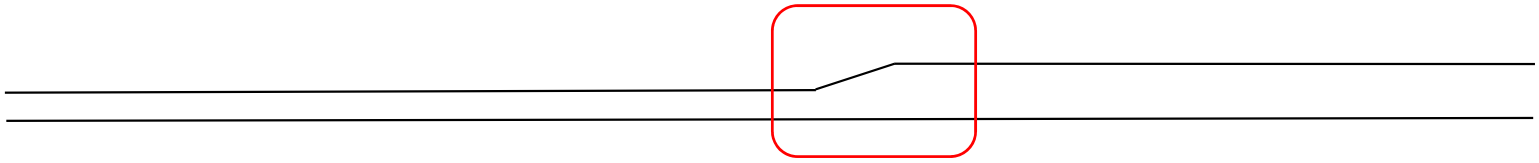
(d) Pipework

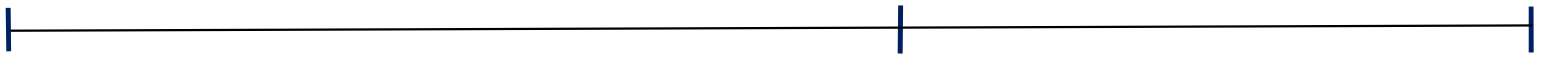
CLASSIFICATION TABLE					MEASUREMENT RULES	DEFINITION RULES	COVERAGE RULES	SUPPLEMENTARY INFORMATION
2. Pipework.	1. Type, size and method of jointing.		Run	1. Laid in ducts. 2. Laid in trenches. 3. Laid in chases. 4. Embedded in in-situ concrete. 5. Embedded in screeds. 6. Suspended. 7. Fixed to walls or columns. 8. Laid on floors. 9. Others.	M.2 Pipework is measured over all in-line fittings, short running lengths and branches, but not through items of ancillaries, headings and trapping sets. M.3 Where an in-line reduction in diameter occurs at a reducer or the etc., the largest diameter shall be measured the full length of the fitting. M.4 Where pipes pass through roofs or vertical cladding the requisite slates, aprons and flashings are measured in accordance with Sections XIII (f), XV (c) or XV (j).	D.2 Final supports are any element between the structure or the support structure and the pipe. D.3 The term pipework fittings is deemed to include: (a) Bends, (b) Elbows, (c) Branches. (d) Reducers. (e) Tees. (f) Reducing bends. (g) Reducing tees. (h) Caps. (i) Flanges. and the like.	C.2 Pipework is deemed to include: (a) Fittings for pipes ≤ 50 mm diameter (or 54 mm diameter in the case of copper pipes), including connections. (b) Any flanges, unions or other devices used solely for erection purposes. (c) Final supports. (d) Made bends. (e) Pipe anchors and guides. C.3 Cutting and jointing pipes to fittings is deemed included.	

CLASSIFICATION TABLE

2. Pipework.	1. Type, size and method of jointing.		Run	1. Laid in ducts. 2. Laid in trenches. 3. Laid in chases. 4. Embedded in in-situ concrete. 5. Embedded in screeds. 6. Suspended. 7. Fixed to walls or columns. 8. Laid on floors. 9. Others.

HKSMM 4

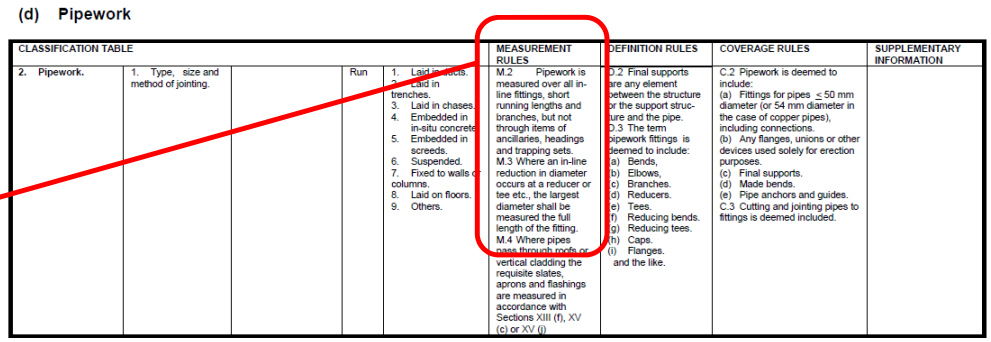


A. 

B. 

C. 

HKSMM 4



(d) Pipework

CLASSIFICATION TABLE					MEASUREMENT RULES	DEFINITION RULES	COVERAGE RULES	SUPPLEMENTARY INFORMATION
2. Pipework.	1. Type, size and method of jointing.		Run	1. Laid in ducts. 2. Laid in trenches. 3. Laid in chases. 4. Embedded in in-situ concrete. 5. Embedded in screeds. 6. Suspended. 7. Fixed to walls or columns. 8. Laid on floors. 9. Others.	M.2 Pipework is measured over all in-line fittings, short running lengths and branches, but not through items of ancillaries, headings and trapping sets. M.3 Where an in-line reduction in diameter occurs at a reducer or tee etc., the largest diameter shall be measured the full length of the fitting. M.4 Where pipes pass through roofs or vertical cladding the requisite slates, aprons and flashings are measured in accordance with Sections XIII (f), XV (c) or XV (j).	D.2 Final supports are any element between the structure or the support structure and the pipe. D.3 The term pipework fittings is deemed to include: (a) Bends, (b) Elbows, (c) Branches. (d) Reducers. (e) Tees. (f) Reducing bends. (g) Reducing tees. (h) Caps. (i) Flanges. and the like.	C.2 Pipework is deemed to include: (a) Fittings for pipes ≤ 50 mm diameter (or 54 mm diameter in the case of copper pipes), including connections. (b) Any flanges, unions or other devices used solely for erection purposes. (c) Final supports. (d) Made bends. (e) Pipe anchors and guides. C.3 Cutting and jointing pipes to fittings is deemed included.	

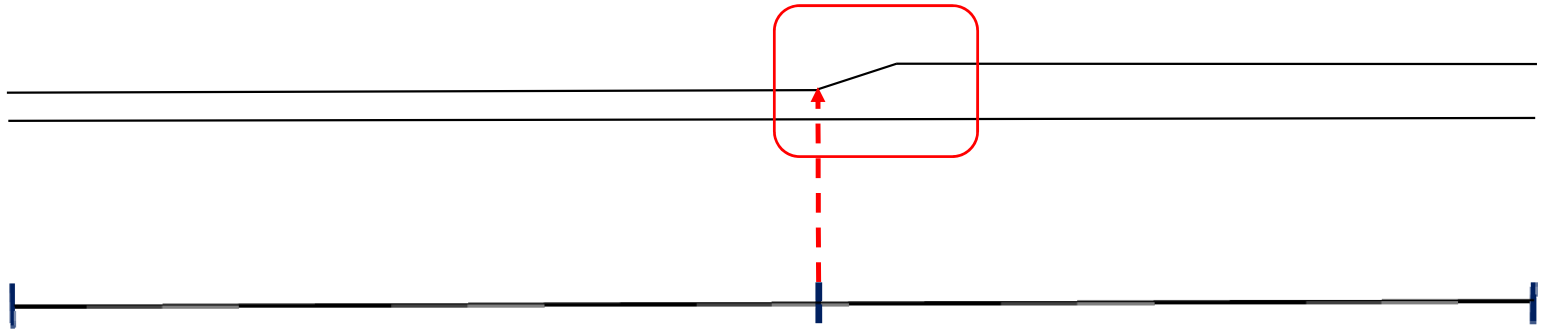
MEASUREMENT RULES

M.2 Pipework is measured over all inline fittings, short running lengths and branches, but not through items of ancillaries, headings and trapping sets.

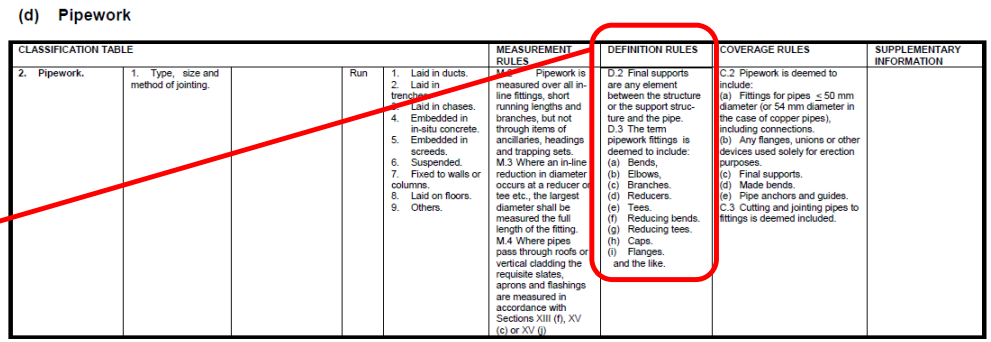
M.3 Where an in-line reduction in diameter occurs at a reducer or tee etc., the largest diameter shall be measured the full length of the fitting.

HKSMM 4

C.



HKSMM 4



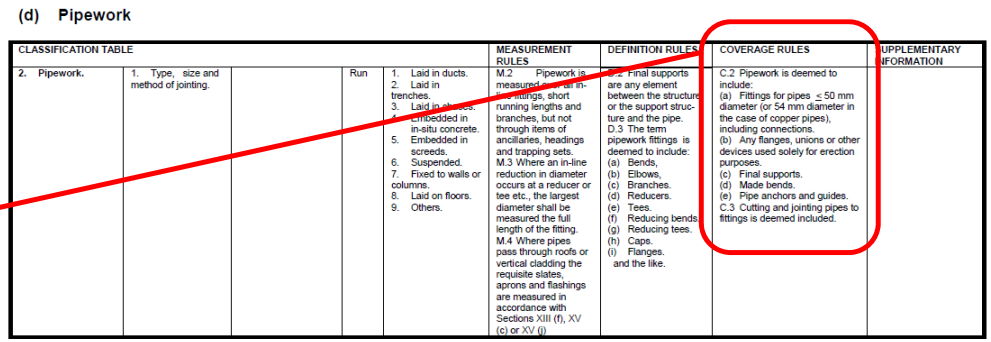
(d) Pipework

CLASSIFICATION TABLE					MEASUREMENT RULES	DEFINITION RULES	COVERAGE RULES	SUPPLEMENTARY INFORMATION
2. Pipework.	1. Type, size and method of jointing.		Run	1. Laid in ducts. 2. Laid in trenches. 3. Laid in chases. 4. Embedded in in-situ concrete. 5. Embedded in screeds. 6. Suspended. 7. Fixed to walls or columns. 8. Laid on floors. 9. Others.	M.2 Pipework is measured over all in-line fittings, short running lengths and branches, but not through items of ancillaries, headings and trapping sets. M.3 Where an in-line reduction in diameter occurs at a reducer or tee etc., the largest diameter shall be measured the full length of the fitting. M.4 Where pipes pass through roofs or vertical cladding the requisite slates, aprons and flashings are measured in accordance with Sections XIII (f), XV (c) or XV (j)	D.2 Final supports are any element between the structure or the support structure and the pipe. D.3 The term pipework fittings is deemed to include: (a) Bends, (b) Elbows, (c) Branches, (d) Reducers, (e) Tees, (f) Reducing bends, (g) Reducing tees, (h) Caps, (i) Flanges, and the like.	C.2 Pipework is deemed to include: (a) Fittings for pipes ≤ 50 mm diameter (or 54 mm diameter in the case of copper pipes), including connections. (b) Any flanges, unions or other devices used solely for erection purposes. (c) Final supports. (d) Made bends. (e) Pipe anchors and guides. C.3 Cutting and jointing pipes to fittings is deemed included.	

DEFINITION RULES

D.2 Final supports are any element between the structure or the support structure and the pipe.
D.3 The term pipework fittings is deemed to include:
(a) Bends, (b) Elbows, (c) Branches, (d) Reducers, (e) Tees,
(f) Reducing bends, (g) Reducing tees, (h) Caps, (i) Flanges, and the like.

HKSMM 4



(d) Pipework

CLASSIFICATION TABLE					MEASUREMENT RULES	DEFINITION RULES	COVERAGE RULES	SUPPLEMENTARY INFORMATION
2. Pipework.	1. Type, size and method of jointing.		Run	1. Laid in ducts. 2. Laid in trenches. 3. Laid in chases. 4. Embedded in in-situ concrete. 5. Embedded in screeds. 6. Suspended. 7. Fixed to walls or columns. 8. Laid on floors. 9. Others.	M.2 Pipework is measured over all in-line fittings, short running lengths and branches, but not through items of ancillaries, headings and trapping sets. M.3 Where an in-line reduction in diameter occurs at a reducer or tee etc., the largest diameter shall be measured the full length of the fitting. M.4 Where pipes pass through roofs or vertical cladding the requisite slates, aprons and flashings are measured in accordance with Sections XIII (f), XV (c) or XV (j).	D.2 Final supports are any element between the structure or the support structure and the pipe. D.3 The term pipework fittings is deemed to include: (a) Bends, (b) Elbows, (c) Branches. (d) Reducers. (e) Tees. (f) Reducing bends. (g) Reducing tees. (h) Caps. (i) Flanges. and the like.	C.2 Pipework is deemed to include: (a) Fittings for pipes ≤ 50 mm diameter (or 54 mm diameter in the case of copper pipes), including connections. (b) Any flanges, unions or other devices used solely for erection purposes. (c) Final supports. (d) Made bends. (e) Pipe anchors and guides. C.3 Cutting and jointing pipes to fittings is deemed included.	

COVERAGE RULES

C.2 Pipework is deemed to include:

(a) Fittings for pipes < 50 mm diameter (or 54 mm diameter in the case of copper pipes), including connections.

(b) Any flanges, unions or other devices used solely for erection purposes.

(c) Final supports.

(d) Made bends.

(e) Pipe anchors and guides.

C.3 Cutting and jointing pipes to fittings is deemed included.

HKSMM 4

In-line fittings

Accessories

Ancillaries

(d) Pipework - continued

CLASSIFICATION TABLE

3. Extra over pipework, other than copper, for fittings > 50 mm diameter.	1. Bends. 2. Elbows. 3. Branches. 4. Reducers. 5. Tees. 6. Reducing bends.		No.
4. Extra over copper pipes for fittings > 54 mm diameter. 5. Extra over pipes other than circular.	7. Reducing tees. 8. Caps. 9. Flanged ends 10. Others.		
6. Accessories.	1. Gullies, 2. Roof outlets. 3. Floor outlets., 4. Rainwater heads. 5. Aprons. 6. Cowls. 7. Gratings to outlets and rainwater heads. 8. Traps. 9. Puddle flanges. 10. Others.	1. Type and size stated.	
7. Ancillaries.	1. Valves. 2. Flow meters. 3. Flow switches. 4. Strainers. 5. Others.		No.

HKSMM 4

(f) Ductwork - continued

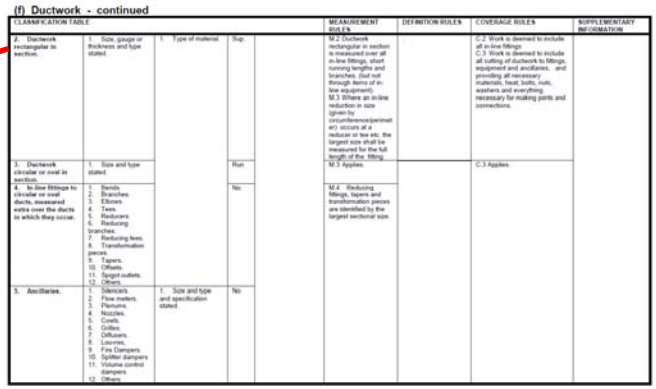
CLASSIFICATION TABLE					MEASUREMENT RULES	DEFINITION RULES	COVERAGE RULES	SUPPLEMENTARY INFORMATION
2. Ductwork rectangular in section.	1. Size, gauge or thickness and type stated.	1. Type of material.	Sup.		M.2 Ductwork rectangular in section is measured over all in-line fittings, short running lengths and branches, (but not through items of in-line equipment). M.3 Where an in-line reduction in size (given by circumference/perimeter) occurs at a reducer or tee etc. the largest size shall be measured for the full length of the fitting.	.	C.2 Work is deemed to include all in-line fittings C.3 Work is deemed to include all cutting of ductwork to fittings, equipment and ancillaries, and providing all necessary materials, heat, bolts, nuts, washers and everything necessary for making joints and connections.	
3. Ductwork circular or oval in section.	1. Size and type stated.		Run		M.3 Applies.		C.3 Applies.	
4. In-line fittings to circular or oval ducts, measured extra over the ducts in which they occur.	1. Bends. 2. Branches. 3. Elbows. 4. Tees. 5. Reducers. 6. Reducing branches. 7. Reducing tees. 8. Transformation pieces. 9. Tapers. 10. Offsets. 11. Spigot outlets. 12. Others.		No.		M.4 Reducing fittings, tapers and transformation pieces are identified by the largest sectional size.			
5. Ancillaries.	1. Silencers. 2. Flow meters. 3. Plenums. 4. Nozzles. 5. Cowls. 6. Grilles. 7. Diffusers. 8. Louvres, 9. Fire Dampers. 10. Splitter dampers 11. Volume control dampers. 12. Others.	1. Size and type and specification stated.	No.					

HKSMM 4

(f) Ductwork - continued

CLASSIFICATION TABLE					MEASUREMENT RULES	DEFINITION RULES	COVERAGE RULES	SUPPLEMENTARY INFORMATION
2. Ductwork rectangular in section.	1. Size, gauge or thickness and type stated.	1. Type of material.	Sup.		M.2 Ductwork rectangular in section is measured over all in-line fittings, short running lengths and branches, (but not through items of in-line equipment). M.3 Where an in-line reduction in size (given by circumference/perimeter) occurs at a reducer or tee etc. the largest size shall be measured for the full length of the fitting.	.	C.2 Work is deemed to include all in-line fittings C.3 Work is deemed to include all cutting of ductwork to fittings, equipment and ancillaries, and providing all necessary materials, heat, bolts, nuts, washers and everything necessary for making joints and connections.	
3. Ductwork circular or oval in section.	1. Size and type stated.		Run		M.3 Applies.		C.3 Applies.	
4. In-line fittings to	1. Bends		No		M.4 Reducing			

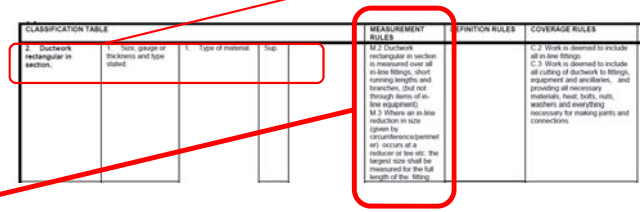
HKSMM 4

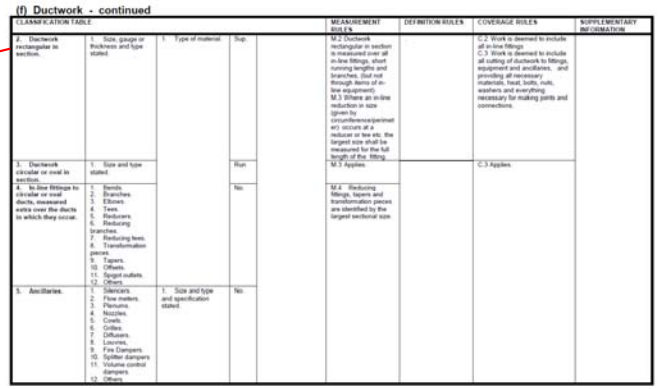


(f) Ductwork - continued

CLASSIFICATION TABLE					MEASUREMENT RULES	DEFINITION RULES	COVERAGE RULES	SUPPLEMENTARY INFORMATION
2. Ductwork rectangular in section.	1. Size, gauge or thickness and type stated.	1. Type of material.	Sup.		M.2 Ductwork rectangular in section is measured over all in-line fittings, short running lengths and branches, (but not through items of in-line equipment). M.3 Where an in-line reduction in size (given by circumference/perimeter) occurs at a reducer or tee etc. the largest size shall be measured for the full length of the fitting.	.	C.2 Work is deemed to include all in-line fittings C.3 Work is deemed to include all cutting of ductwork to fittings, equipment and ancillaries, and providing all necessary materials, heat, bolts, nuts, washers and everything necessary for making joints and connections.	
3. Ductwork circular or oval in section.	1. Size and type stated.		Run		M.3 Applies.		C.3 Applies.	
4. In line fittings to circular or oval ducts, measured extra over the ducts in which they occur.	1. Bends. 2. Branches. 3. Elbows. 4. Tees. 5. Reducers. 6. Reducing branches. 7. Reducing tees. 8. Transformation pieces. 9. Tapers. 10. Offsets. 11. Spigot outlets. 12. Others.		No		M.4 Reducing fittings, tapers and transformation pieces are identified by the largest sectional size.			
5. Ancillaries.	1. Silencers. 2. Flow meters. 3. Plenums. 4. Nozzles. 5. Cowls. 6. Grilles. 7. Diffusers. 8. Louvres. 9. Fire Dampers. 10. Splitter dampers 11. Volume control dampers. 12. Others	1. Size and type and specification stated.	No					

HKSMM 4



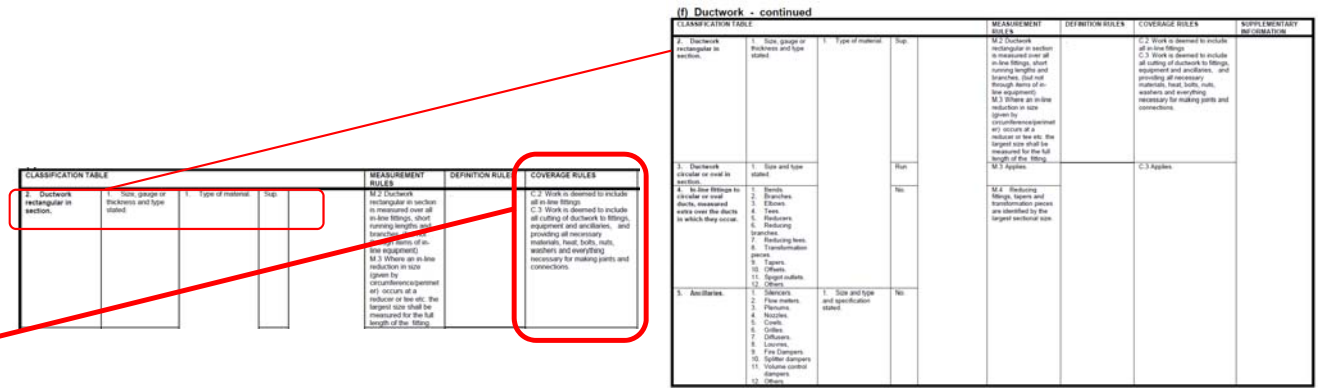


MEASUREMENT RULES

M.2 Ductwork rectangular in section is measured over all in-line fittings, short running lengths and branches, (but not through items of inline equipment).

M.3 Where an in-line reduction in size (given by circumference/perimeter) occurs at a reducer or tee etc. the largest size shall be measured for the full length of the fitting.

HKSMM 4



(f) Ductwork - continued

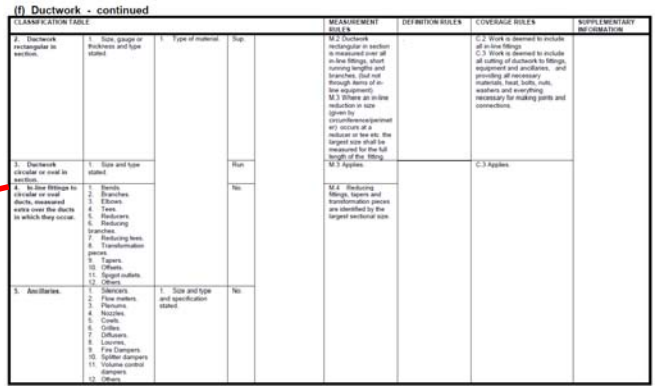
CLASSIFICATION TABLE					MEASUREMENT RULES	DEFINITION RULES	COVERAGE RULES	SUPPLEMENTARY INFORMATION
2. Ductwork rectangular in section.	1. Size, gauge or thickness and type stated.	1. Type of material.	Sup.		M.2 Ductwork rectangular in section is measured over all in-line fittings, short running lengths and branches, (but not through items of in-line equipment). M.3 Where an in-line reduction in size (given by circumference/perimeter) occurs at a reducer or tee etc. the largest size shall be measured for the full length of the fitting.		C.2 Work is deemed to include all in-line fittings C.3 Work is deemed to include all cutting of ductwork to fittings, equipment and ancillaries, and providing all necessary materials, heat, bolts, nuts, washers and everything necessary for making joints and connections.	
3. Ductwork circular or oval in section.	1. Size and type stated.		Run		M.3 Applies.		C.3 Applies.	
4. In line fittings to circular or oval ducts, measured extra over the ducts in which they occur.	1. Bends. 2. Branches. 3. Elbows. 4. Tees. 5. Reducers. 6. Reducing branches. 7. Reducing tees. 8. Transformation pieces. 9. Tapers. 10. Offsets. 11. Spigot outlets. 12. Others.		No.		M.4 Reducing fittings, tapers and transformation pieces are identified by the largest sectional size.			
5. Ancillaries.	1. Silencers. 2. Flow meters. 3. Plenums. 4. Nozzles. 5. Cowls. 6. Grilles. 7. Diffusers. 8. Louvres. 9. Fire Dampers. 10. Splitter dampers 11. Volume control dampers. 12. Others.	1. Size and type and specification stated.	No.					

COVERAGE RULES

C.2 Work is deemed to include all in-line fittings

C.3 Work is deemed to include all cutting of ductwork to fittings, equipment and ancillaries, and providing all necessary materials, heat, bolts, nuts, washers and everything necessary for making joints and connections.

HKSMM 4

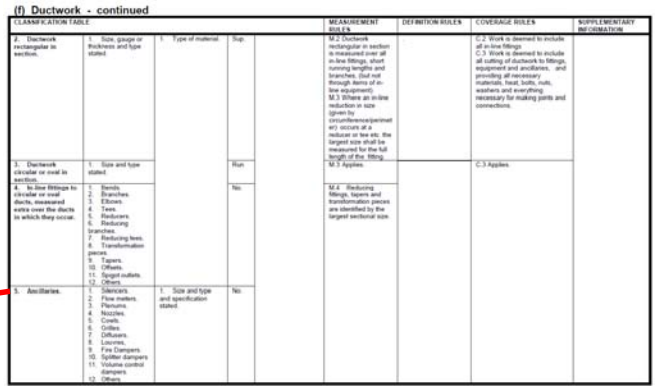


(f) Ductwork - continued

CLASSIFICATION TABLE					MEASUREMENT RULES	DEFINITION RULES	COVERAGE RULES	SUPPLEMENTARY INFORMATION
2. Ductwork rectangular in sections.	1. Size, gauge or thickness and type stated.	1. Type of material	Sup.		M.2 Ductwork rectangular in section is measured over all in-line fittings, short running lengths and branches, (but not through items of in-line equipment). M.3 Where an in-line reduction in size (given by circumference/perimeter) occurs at a reducer or tee etc. the largest size shall be measured for the full length of the fitting.		C.2 Work is deemed to include all in-line fittings C.3 Work is deemed to include all cutting of ductwork to fittings, equipment and ancillaries, and providing all necessary materials, heat, bolts, nuts, washers and everything necessary for making joints and connections.	
3. Ductwork circular or oval in sections.	1. Size and type stated.		Run		M.3 Applies.		C.3 Applies.	
4. In line fittings to circular or oval ducts, measured extra over the ducts in which they occur.	1. Bends. 2. Branches. 3. Elbows. 4. Tees. 5. Reducers. 6. Reducing branches. 7. Reducing tees. 8. Transformation pieces. 9. Tapers. 10. Offsets. 11. Spigot outlets. 12. Others.		No.		M.4 Reducing fittings, tapers and transformation pieces are identified by the largest sectional size.			
5. Ancillaries.	1. Silencers. 2. Flow meters. 3. Plenums. 4. Nozzles. 5. Coils. 6. Grilles. 7. Diffusers. 8. Louvres. 9. Fire Dampers. 10. Splitter dampers 11. Volume control dampers. 12. Others.	1. Size and type and specification stated.	No.					

4. In-line fittings to circular or oval ducts, measured extra over the ducts in which they occur.	1. Bends. 2. Branches. 3. Elbows. 4. Tees. 5. Reducers. 6. Reducing branches. 7. Reducing tees. 8. Transformation pieces. 9. Tapers. 10. Offsets. 11. Spigot outlets. 12. Others.		No.

HKSMM 4



(f) Ductwork - continued

CLASSIFICATION TABLE					MEASUREMENT RULES	DEFINITION RULES	COVERAGE RULES	SUPPLEMENTARY INFORMATION
2. Ductwork rectangular in sections.	1. Size, gauge or thickness and type stated.	1. Type of material	Sup.		M.2 Ductwork rectangular in section is measured over all in-line fittings, short running lengths and branches, (but not through items of in-line equipment). M.3 Where an in-line reduction in size (given by circumference/perimeter) occurs at a reducer or tee etc. the largest size shall be measured for the full length of the fitting.		C.2 Work is deemed to include all in-line fittings. C.3 Work is deemed to include all cutting of ductwork to fittings, equipment and ancillaries, and providing all necessary materials, heat, bolts, nuts, washers and everything necessary for making joints and connections.	
3. Ductwork circular or oval in sections.	1. Size and type stated.		Run		M.3 Applies.		C.3 Applies.	
4. In line fittings to circular or oval ducts, measured extra over the ducts in which they occur.	1. Bends. 2. Branches. 3. Elbows. 4. Tees. 5. Reducers. 6. Reducing branches. 7. Reducing tees. 8. Transformation pieces. 9. Tapers. 10. Offsets. 11. Spigot outlets. 12. Others.		No.		M.4 Reducing fittings, tapers and transformation pieces are identified by the largest sectional size.			
5. Ancillaries.	1. Silencers. 2. Flow meters. 3. Plenums. 4. Nozzles. 5. Cowls. 6. Grilles. 7. Diffusers. 8. Louvres. 9. Fire Dampers. 10. Splitter dampers 11. Volume control dampers. 12. Others.	1. Size and type and specification stated.	No.					

5. Ancillaries.	1. Silencers. 2. Flow meters. 3. Plenums. 4. Nozzles. 5. Cowls. 6. Grilles. 7. Diffusers. 8. Louvres, 9. Fire Dampers. 10. Splitter dampers 11. Volume control dampers. 12. Others.	1. Size and type and specification stated.	No.

Preparation for Measurement

Drawings

Specifications / Codes of Practices

Standard Method of Measurement

Preambles

Sample Bills, if any

Preambles

GENERAL PRINCIPLES (Cont'd)

All materials and workmanship shall, unless otherwise described, be in accordance with the Specification items. The rates for items in the Bills of Quantities shall include the work being executed in accordance with the Specification requirements as though the Specification items were fully set out in the Bills of Quantities. In the event that the materials or products to the specified standards (e.g. British Standards) are not available, the rates shall also include the costs of equivalent alternative materials or products conforming to the specified standards or performance and approved by the Architect.

Preambles

Whenever particulars/information are required by the HKSMM4 to be stated, given or included in the descriptions of the items, these particulars/information may not be stated, given or included in the descriptions of the items (such as kind and quality of material; tests with which material, plant and equipment are required to comply, method of jointing and fixing; size and shape of materials etc.), the Contractor shall refer to the Drawings, the Specification for these particulars/information and the cost of them shall be deemed to be included in the rates for these items in the Bills of Quantities for the Works.

Preambles

GENERAL PRINCIPLES (Cont'd)

A The quantities contained in the Bills of Quantities for building services works or systems are taken off from the Drawings which indicate the design intent, general routing and position of the building services works or systems. The quantities for the building services works or systems are measured flat on plan from point to point as shown on the Drawings and apart from service risers, the measurement does not take into account any additional service runs or fittings required to route locally around structural members or changes in levels etc, to suit the building structure items or architectural details. The rates for items for the building services works or systems shall be deemed to have allowed for this.

Preambles

The Drawings show only the design intent, general routing and position of the building services works or systems. The precise routing and location of the building services works or systems shall be determined by the Contractor who is responsible for the overall co-ordination of the Works including building services works or systems. The Contractor is also responsible for the production of co-ordination Drawings.

Preambles

GENERAL PRINCIPLES (Cont'd)

A. The typo errors in HKSMM4 should be amended as follows:

Page	Ref.	HKSMM4	Should be read as
164	XVII (g).2 Coverage Rules C.2 (b)	Any flanges, unions or other devices used solely for erection purposes	**Insulation to** any flanges, unions or other devices used solely for erection purposes
165	XVII (g).9.1.1	Details and size of **equipment** stated, and type and thickness of insulation to **equipment** given	Details and size of **ancillaries** stated, and type and thickness of insulation to **ancillaries** given
165	XVII (g).10.1	Details, size and type of **ancillaries** and type and thickness of insulation to **ancillaries** given	Details, size and type of **equipment** and type and thickness of insulation to **equipment** given

Preambles

MECHANICAL INSTALLATIONS

Generally

A Notwithstanding the requirements of the Measurement Rules M.5 of HKSMM4 Section XVII (a), building services installations or systems shall be classified into systems and measured under appropriate headings as shown in Annex "A" of the Preambles.

B Notwithstanding the requirements of the Measurement Rules M.2 of HKSMM4 Section XVII (a), works internally, externally or in plant rooms for Sundries of Mechanical Installations shall be grouped together and shall not be identified separately.

Preambles

Annex "A" – Classification of Systems for Building Services Installations or Systems

Building services installations or systems, together with their equipment, pipework, ductwork, insulation, cables, trunking, ducting, cable trays, conduits and sundries shall be classified into systems as follows and given under appropriate headings. The wordings in this list are for reference only, and actual wording should follow those used in the drawings and specifications.

PLUMBING AND DRAINAGE INSTALLATION

- Rainwater Disposal
- Soil, Waste and Ventilation Pipes System
- Sanitary Fittings
- Cold Water System
- Hot Water System
- Cleansing Water System
- Irrigation Water System
- Flushing Water System
- Underground Drainage System
- Sundries Services

FIRE SERVICE INSTALLATION

- Fire Hydrant and Hosereel System

MECHANICAL, VENTILATION AND AIR CONDITIONING SYSTEM

- Chilled Water System
- Condensate Water System
- Mechanical Ventilation System
- Air Conditioning System
- Unitary Air Conditioning System
- Electrical and Control
- Sundries Services

ELECTRICAL INSTALLATION

- Low Voltage Cubicle Switchboards
- Main and Sub-main Distribution
- General Lighting and Power

Preambles

XVII MECHANICAL INSTALLATIONS

(d) Pipework - continued

CLASSIFICATION TABLE

12. Screwed sockets. 13. Tappings. 14. Bosses.	1. Size and kind of pipe or flange connected.		No.
15. Welding necks welded to pipes or flanges	1. Size and kind of both pipes stated.		No.

Notwithstanding the requirements of HKSMM4 Sections XVII (d) 12 to 15, screwed sockets, tappings, bosses and welding-necks welded to pipes or flanges shall not be measured separately and shall be deemed to be included in the rates for items for pipework.

Preambles

(f) Ductwork - continued

CLASSIFICATION TABLE				
5. Ancillaries.	1. Silencers. 2. Flow meters. 3. Plenums. 4. Nozzles. 5. Cowls. 6. Grilles. 7. Diffusers. 8. Louvres, 9. Fire Dampers 10. Splitter dampers 11. Volume control dampers. 12. Others.	1. Size and type and specification stated.	No.	

Notwithstanding the requirements of HKSMM4 Sections XVII (f) 5, splitter dampers shall not be measured separately and shall be deemed to be included in the rates for items for ductwork (rectangular in section or circular or oval in section).

Preambles

XVII MECHANICAL INSTALLATIONS

(d) Pipework

CLASSIFICATION TABLE			
2. Pipework.	1. Type, size and method of jointing.		Run

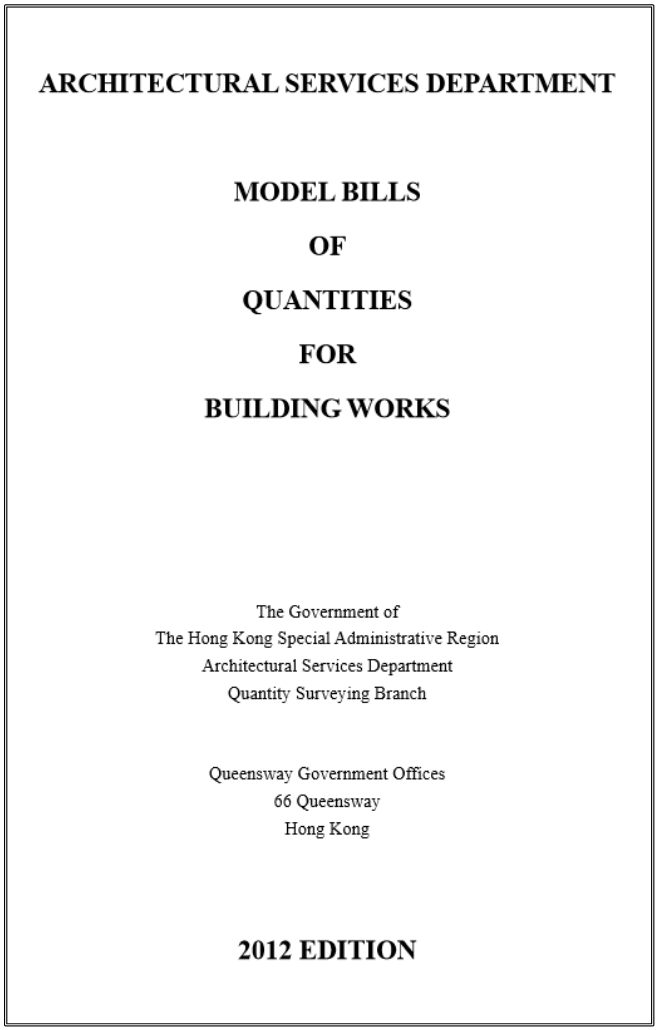
Notwithstanding the requirements of HKSMM4 Section XVII (d) 2, pipework and fittings for the Unitary Air Conditioning System under different set of unitary air conditioning units shall be measured together irrespective of their sizes and sizes of pipework and fittings shall not be stated.

Notwithstanding the requirements of HKSMM4 Section XVII (d) 2, insulation to pipework and fittings for the Unitary Air Conditioning System under different set of unitary air conditioning units shall be measured together irrespective of the size of pipework and fittings and sizes of pipework and fittings shall not be stated.

Preparation for Measurement

Drawings
Specifications / Codes of Practices
Standard Method of Measurement
Preambles
Sample Bills

Sample Bills



ARCHITECTURAL SERVICES DEPARTMENT

MODEL BILLS

OF

QUANTITIES

FOR

BUILDING WORKS

The Government of
The Hong Kong Special Administrative Region
Architectural Services Department
Quantity Surveying Branch

Queensway Government Offices
66 Queensway
Hong Kong

2012 EDITION

https://www.archsd.gov.hk/media/38193/Model_Bill_2012.pdf

Sample Bills

	COOLING WATER CONDENSING SYSTEM INTERNALLY / IN PLANT ROOM /			
	Ductile iron pipes and fittings 545 ; appropriate grade ; meta coating with bitumen painted e internally lined with cement m EN 545, BS EN 598, BS EN 969 t screwed joints ; off-site pre- metal mounting and fixing brackets			
	Pipework and fittings ; suspended from soffits			
A	* diameter (ACCD)		m	
	Pipework and fittings ; fixed to walls and columns			
B	* diameter (ACCD)		m	
	Pipework and fittings ; laid on floors			
C	* diameter (ACCD)		m	

CLASSIFICATION TABLE

2. Pipework.	1. Type, size and method of jointing.		Run	1. Laid in ducts. 2. Laid in trenches. 3. Laid in chases. 4. Embedded in in-situ concrete. 5. Embedded in screeds. 6. Suspended. 7. Fixed to walls or columns. 8. Laid on floors. 9. Others.

https://www.archsd.gov.hk/media/38193/Model_Bill_2012.pdf

Sample Bills

	Extra over pipework for			
D	* bends	(ACCD)		nr
E	* tees	(ACCD)		nr
F	* reducing bends	(ACCD)		
G	* reducing tees	(ACCD)		

CLASSIFICATION TABLE

3. Extra over pipework, other than copper, for fittings > 50 mm diameter.	1. Bends. 2. Elbows. 3. Branches. 4. Reducers. 5. Tees. 6. Reducing bends.
4. Extra over copper pipes for fittings > 54 mm diameter. **5. Extra over pipes other than circular.**	7. Reducing tees. 8. Caps. 9. Flanged ends 10. Others.

https://www.archsd.gov.hk/media/38193/Model_Bill_2012.pdf

Sample Bills

	COOLING WATER CONDENSING SYSTEM ; INTERNALLY / IN PLANT ROOM / EXTERNALLY# (Cont'd)			
	Bronze valves			
	Drain valves			
A	* diameter	(ACCD)		nr
	Brass cast iron valves			
	Motorized control valves ; DDC control			
B	* diameter	(ACCD)		nr
	Ductile iron valves			
	Butterfly valves			
C	* diameter	(ACCD)		nr

https://www.archsd.gov.hk/media/38193/Model_Bill_2012.pdf

Sample Bills

CHILLED WATER SYSTEM ; INTERNALLY / IN PLANT ROOM / EXTERNALLY# (Cont'd)

Design, supply and install packaged chillers ; * refrigerant ; factory assembled and tested units ; ARI Standard 550/590 ; BS EN 14511-1 to BS EN 14511-4 ; centrifugal type compressors ; condensers ; motors ; evaporators ; electronic/microcomputer control panel ; piping connections ; adequate acoustic treatment ; insulations ; all sensing devices, accessories and associated services ; as described in the Particular Specification and drawing nr. *

Fresh water cooled chillers

A cooling capacity * kW (ref. *) (ACCD)

(b) Equipment

CLASSIFICATION TABLE			
1. **Chillers.** 2. **Cooling Towers.** 3. **Air handling units.** 4. **Fans.**	1. Type and duty stated.	1. Cross reference to drawings or specification.	No.

Cross reference to drawings or specification

Type and duty stated

Sample Bills

	Chilled water pump sets ; direct driven by electric motors ; cast iron casings ; stuffing boxes ; mechanical seal ; adequate insulations ; as described in the Particular Specification and drawing nr. *		
	Chilled water pump sets ; centrifugal type		
A	water flow rate * l/s ; differential static pressure * kPa (ref. *) (ACCD)		nr
	Design, supply and install removable working and service platform ; rigid construction ; stainless steel fixing bolts and nuts ; all necessary accessories		
	Working and service platform ; galvanised steel assembled		
B	approximate size * x * x * (ACCD)		nr

https://www.archsd.gov.hk/media/38193/Model_Bill_2012.pdf

Sample Bills

(f) Ductwork - continued

CLASSIFICATION TABLE

2. Ductwork rectangular in section.	1. Size, gauge or thickness and type stated.	1. Type of material.	Sup.

	AIR CONDITIONING SYSTEM ; INTERNALLY / PLANT ROOM / EXTERNALLY#			
	Hot-dipped galvanised steel sheet ductwork and fittings ; DW/144 medium pressure ; BS EN 10346, Grade DX51D+Z, coating type Z275 ; off site prefabricated ; insulated externally (insulation measured separately)			
	* thick ; rectangular ducts ; suspended from soffits			
B	duct size not exceeding 400 (longer side) (ACCD)		m2	
C	duct size 401 - 600 (longer side) (ACCD)		m2	

Type of material

Size, gauge or thickness and type stated

https://www.archsd.gov.hk/media/38193/Model_Bill_2012.pdf

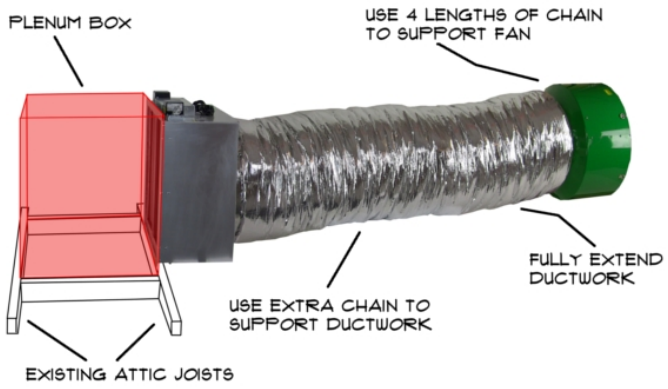
Sample Bills

	Flexible ductwork ; BS 476-12 Rating Class P ; BS 476-6 performance index not exceeding 12 ; Part 7 Class 1 ; tear-resistant fabric liner and cover ; impregnated and coated with plastics		
	Flexible ducts ; fixed to rigid ductwork or equipment spigots		
D	* diameter ; not exceeding 0.50m long	(ACCD)	nr
E	* diameter ; 0.51 - 1.00m long	(ACCD)	nr

https://www.archsd.gov.hk/media/38193/Model_Bill_2012.pdf

Sample Bills

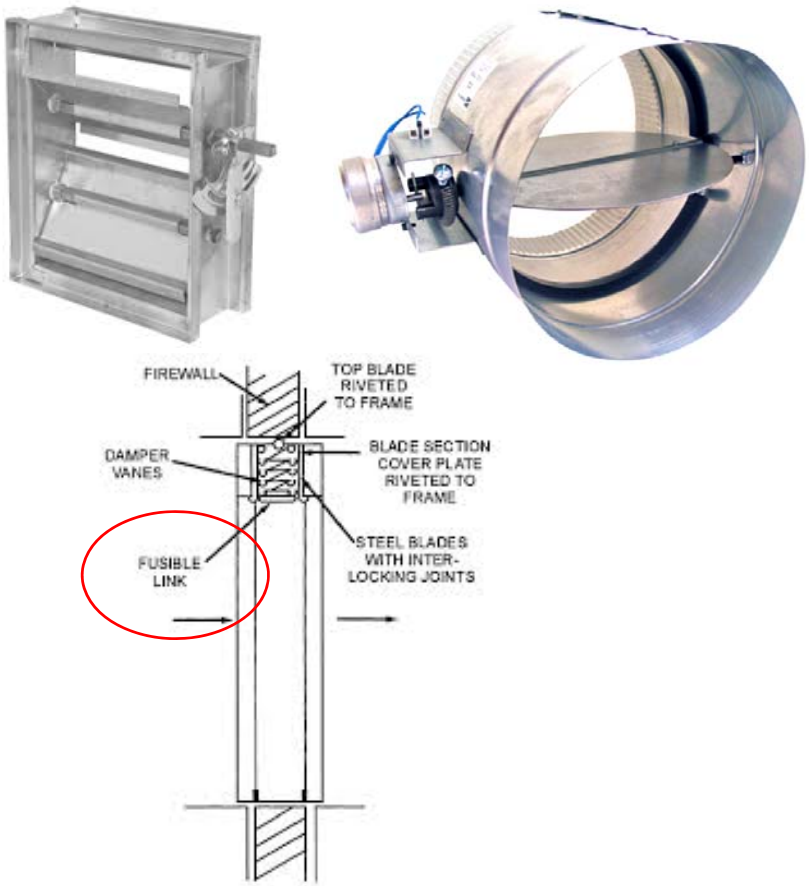
	AIR CONDITIONING SYSTEM ; INTERNALLY / IN PLANT ROOM / EXTERNALLY# (Cont'd)	
	Galvanised mild steel plenum boxes ; factory fabricated ; complete with appropriate insulation	
	Plenum boxes	
A	size * x * x * (ACCD)	nr
B	to suit external louvres ; * x * (ACCD)	nr



https://www.archsd.gov.hk/media/38193/Model_Bill_2012.pdf

Sample Bills

	Dampers ; galvanised mild steel ; DW/144 ; CIBSE Commissioning Code Series A and BSRIA Application Guide ; flanged type ; air leakage rate to BS EN 1751 ; padlocking facilities ; position indicators		
	Volume control dampers ; aerofoil, double skin, opposed blade low leakage type ; approved or accepted by FSD		
C	* x * (ACCD)		nr
	Fire or smoke dampers ; multi-bladed ; * hour fire rated ; approved or accepted by FSD		
D	* x * (ACCD)		nr
	Motorized shut-off dampers ; * hour fire rated ; actuated by automatic fire detectors		
E	* x * (ACCD)		nr



https://www.archsd.gov.hk/media/38193/Model_Bill_2012.pdf

Sample Bills

	AIR CONDITIONING SYSTEM ; INTERNALLY / IN PLANT ROOM / EXTERNALLY# (Cont'd)	
	Grilles ; aluminium	
	Supply air grilles ; complete with two adjustable louvres ; opposed blade multi-leaf dampers	
A	* x * (ACCD)	nr
	Return air grilles ; complete with single louvre ; opposed blade multi-leaf dampers	
B	* x * (ACCD)	nr

https://www.archsd.gov.hk/media/38193/Model_Bill_2012.pdf

Sample Bills

	Diffusers ; aluminium ; pan type ; complete with volume control dampers			
	Supply air diffusers			
D	* x *	(ACCD)		nr
	Linear slot diffusers ; multiple slot ; complete with plenum and fibreglass insulation			
E	* long ; * slots	(ACCD)		nr
	Dummy linear diffusers ; complete with demountable galvanised metal enclosure			
F	* long	(ACCD)		nr

https://www.archsd.gov.hk/media/38193/Model_Bill_2012.pdf

Sample Bills

	ELECTRICITY SUPPLY ; INTERNALLY, IN PLANT ROOM AND EXTERNALLY (Cont'd)		
A			nr
	CONTROL SYSTEM - AUTOMATIC CONTROL SYSTEM (ACS) ; INTERNALLY, IN PLANT ROOM AND EXTERNALLY		

To be discussed in Electrical and Control Sections

https://www.archsd.gov.hk/media/38193/Model_Bill_2012.pdf

Sample Bills

(i) Sundries

CLASSIFICATION TABLE

1. Marking the positions of all holes, mortices, chases and the like in the structure.	1. Where the nature of the work necessitates any of these to be formed during construction, the relevant particulars are given.		Item

	AIR CONDITIONING SUNDRIES ; INTERNALLY, IN PLANT ROOM AND EXTERNALLY			
	The following items in respect of the whole ACMV Installation			
	Allow for			
P	marking the positions of holes, mortices, chases and the like in the structure (ACCD)	-	item	

https://www.archsd.gov.hk/media/38193/Model_Bill_2012.pdf

Sample Bills

XVII MECHANICAL INSTALLATIONS

(i) Sundries

CLASSIFICATION TABLE				
1. Marking the positions of all holes, mortices, chases and the like in the structure.	1. Where the nature of the work necessitates any of these to be formed during construction, the relevant particulars are given.		Item	
2. Testing, setting to work and any commissioning required.	1. Details of any phased testing, setting to work and commissioning required.		Item	
3. Allow for the cost of all necessary fuel in connection with testing, setting to work and any commissioning required.			Item	

https://www.archsd.gov.hk/media/38193/Model_Bill_2012.pdf

Sample Bills

4. Preparation of all detailed design drawings required.	1. Number of copies required stated.		Item
5. Preparation of any working drawings required.	1. All requirements, including the information required, method of presentation and number of copies stated.		Item
6. Preparation of any builders' works drawings required.			Item
7. Preparation of "as fitted" record drawings.			Item
8. Provision of any mock-ups and/or prototypes as specified.	1. Detailed requirements are given.		Item

https://www.archsd.gov.hk/media/38193/Model_Bill_2012.pdf

Sample Bills

(i) Sundries - continued

CLASSIFICATION TABLE					MEASUREMENT RULES
9. Maintenance other than that required under defects liability.	1. Scope and duration of maintenance required including provision of consumable spares stated.		Item		M.1 If maintenance is required beyond the contract defects liability period this shall be given separately on a schedule basis and shall be the subject of a separate agreement.
10. Tuition of Employer's staff.	1. Scope and duration of tuition stated.		Item		
11. Provision of manuals.	1. All requirements including information required, method of presentation and number of copies stated.		Item		

https://www.archsd.gov.hk/media/38193/Model_Bill_2012.pdf

Sample Bills

12. Provision of spares and tools.	1. Detailed requirements stated.		Item
13. Fabricated composite support structures.			Kg. (No. stated)
14. Sleeves through walls, floors and ceilings etc.			Item.
15. Fire stopping.	1. Material to be used described.		Item
16. Disconnecting, setting aside and refixing for the convenience of other trades.	1. Type of equipment and purpose of disconnection stated.		Item

https://www.archsd.gov.hk/media/38193/Model_Bill_2012.pdf

A Reminder

Equipment → nr

Pipework → m

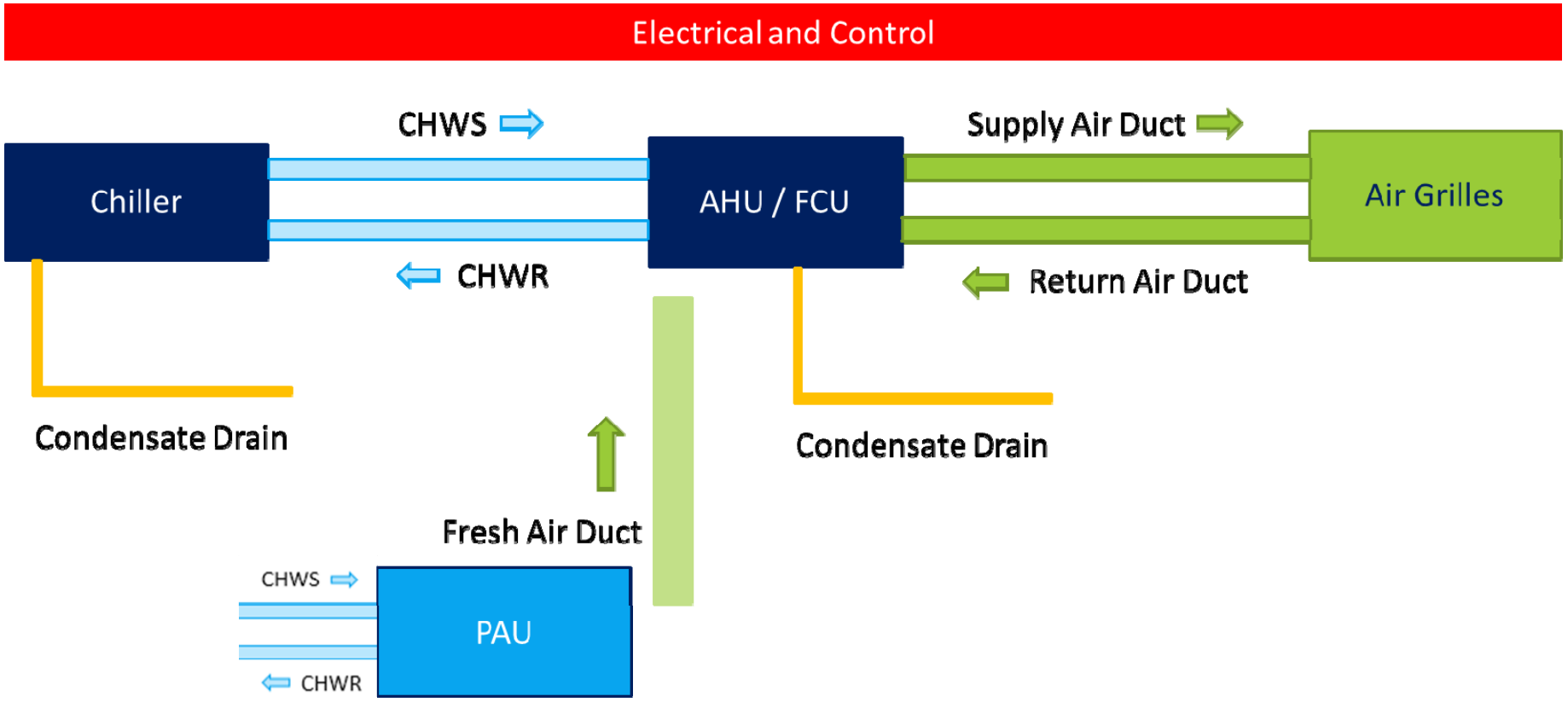
Pipework in-line fittings / ancillaries → nr

Ductwork (rectangular) → m2

Ductwork (circular / oval) → m

Ductwork in-line fittings / ancillaries → nr

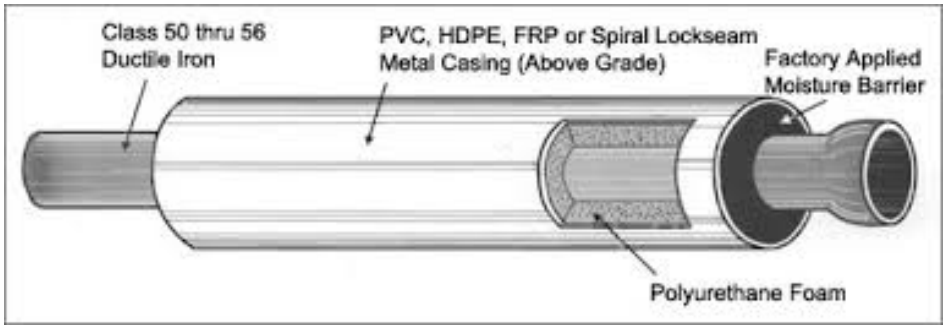
A Reminder


Electrical and Control
CHWS
Supply Air Duct
Chiller
AHU / FCU
Air Grilles
CHWR
Return Air Duct
Condensate Drain
Condensate Drain
Fresh Air Duct
CHWS
PAU
CHWR

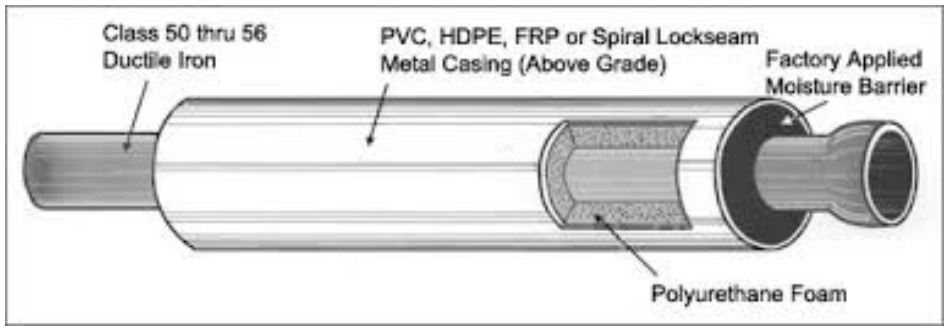
Chilled water pipeworks

Insulation

Protective Covering and Finishing



Chilled water pipeworks



What about:
Insulation
Protective Covering and Finishing

Chilled water pipeworks / Insulation / Protective Covering and Finishing

CLASSIFICATION TABLE					MEASUREMENT RULES
2. Insulation to pipework.	1. Type and thickness of insulation and size and type of pipework stated.		Run	1. Vapour barrier described.	M.2 Insulation to pipework is measured over all in-line fittings, but not through items of ancillaries
3. Extra over pipework insulation, other than copper pipes, for fittings > 50 mm diameter.	1. Bends. 2. Elbows. 3. Branches. 4. Reducers. 5. Tees.	1. Type and thickness of insulation and size of fitting stated.	No.		
4. Extra over pipework insulation for copper pipes for fittings > 54 mm diameter.	6. Reducing bends 7. Reducing tees. 8. Caps. 9. Flanged ends. 10. Others.		No.		
5. Insulation to pipework ancillaries.	1. Valves. 2. Strainers. 3. Others.	1. Type and thickness of insulation and size of pipework ancillaries stated.	No.		

Chilled water pipeworks / Insulation / Protective Covering and Finishing

CLASSIFICATION TABLE					MEASUREMENT RULES
2. Protective coverings and finishings to insulated pipework.	1. Type and thickness of coverings and finishings, type and thickness of insulation and size and type of pipework stated.		Run		M.1 Protective covering and finishings to insulated pipework is measured over all in-line fittings, but not through items of ancillaries
3. Extra over protective coverings and finishings to insulated pipework, other than copper pipes, for fittings > 50 mm diameter.	1. Bends. 2. Elbows. 3. Branches. 4. Reducers. 5. Tees. 6. Reducing bends.	1. Type and thickness of coverings and finishings, type and thickness of insulation and size of fittings stated.	No.		M.2 Extra for coverings and finishings to reducing fittings are identified by the largest diameter.
4. Extra over protective coverings and finishings to insulated copper pipework for fittings > 54 mm diameter.	7. Reducing tees. 8. Caps. 9. Flanged ends. 10. Others.		No.		
5. Protective coverings and finishings to insulated pipework ancillaries.	1. Valves. 2. Strainers. 3. Others.	1. Type and thickness of coverings and finishings, type and thickness of insulations and type and size of ancillaries stated.	No.		

Ductwork

Insulation

Protective Coverings and Finishings

(g) Insulation - continued

CLASSIFICATION TABLE					MEASUREMENT RULES
6. Insulation to rectangular ductwork.	1. Type and thickness of insulation stated.		Sup.	1. Vapour barrier described.	M.3 Insulation to rectangular ductwork is measured the nett area in contact with the base of all ducting as installed and overall ducting fittings and joints.
7. Insulation to circular or oval ductwork.	1. Type and thickness of insulation and size and shape of ductwork stated.		Run		
8. Items measured extra over insulation	1. Bends. 2. Branches 3. Others.	1. Type and thickness type and thickness of insulation to ancillaries given.			M.4 Extra over insulation for working around reducing fittings, tapers and transformation fittings etc. are identified by the largest sectional size.

Insulation to rectangular ductwork is measured the nett area in contact with the base of all ducting as installed and overall ducting fittings and joints

Ductwork / Insulation / Protective Covering and Finishing

CLASSIFICATION TABLE					MEASUREMENT RULES
6. Protective coverings and finishings to insulated rectangular ductwork.	1. Type and thickness of protective coverings and finishings, type and thickness of insulation stated.		Sup.		M.3 Protective coverings and finishings to insulated rectangular ductwork is measured the nett area in contact with the base of all ducting as installed and overall ducting fittings and joints.
7. Protective coverings and finishings to insulated circular or oval ductwork.	1. Type and thickness of protective coverings and finishings, type and thickness of insulation and size and shape of ductwork stated.		Run		
and finishings around in-line fittings					

Protective coverings and finishings to insulated rectangular ductwork is measured the nett area in contact with the base of all ducting as installed and overall ducting fittings and joints

Disclaimer Note

This set of notes has been prepared according to the author's own experience of the relevant practice and is intended for educational purpose and information only. No responsibility for loss occasioned to any person acting or refraining from action occasioned by or as a result of any material included will be accepted by the author or its company.

The materials and information contained herein are not intended to offer or provide any technical advice concerning the topics covered. Please consult professional engineers / your QS senior where necessary.


Thank
You