

Construction Measurement III

SBQ3314

Air Conditioning Installations – Split Unit

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Table of Contents

1. Air conditioning installations: main components of window & split unit
2. SMM2 measurement rules for air conditioning installations
3. Taking off list for air conditioning installations
4. Heading and description.

Main components

Main Components

PREAMBLES

EQUIPMENT: CONDENSING UNIT & FAN COIL UNIT ETC

PIPEWORKS

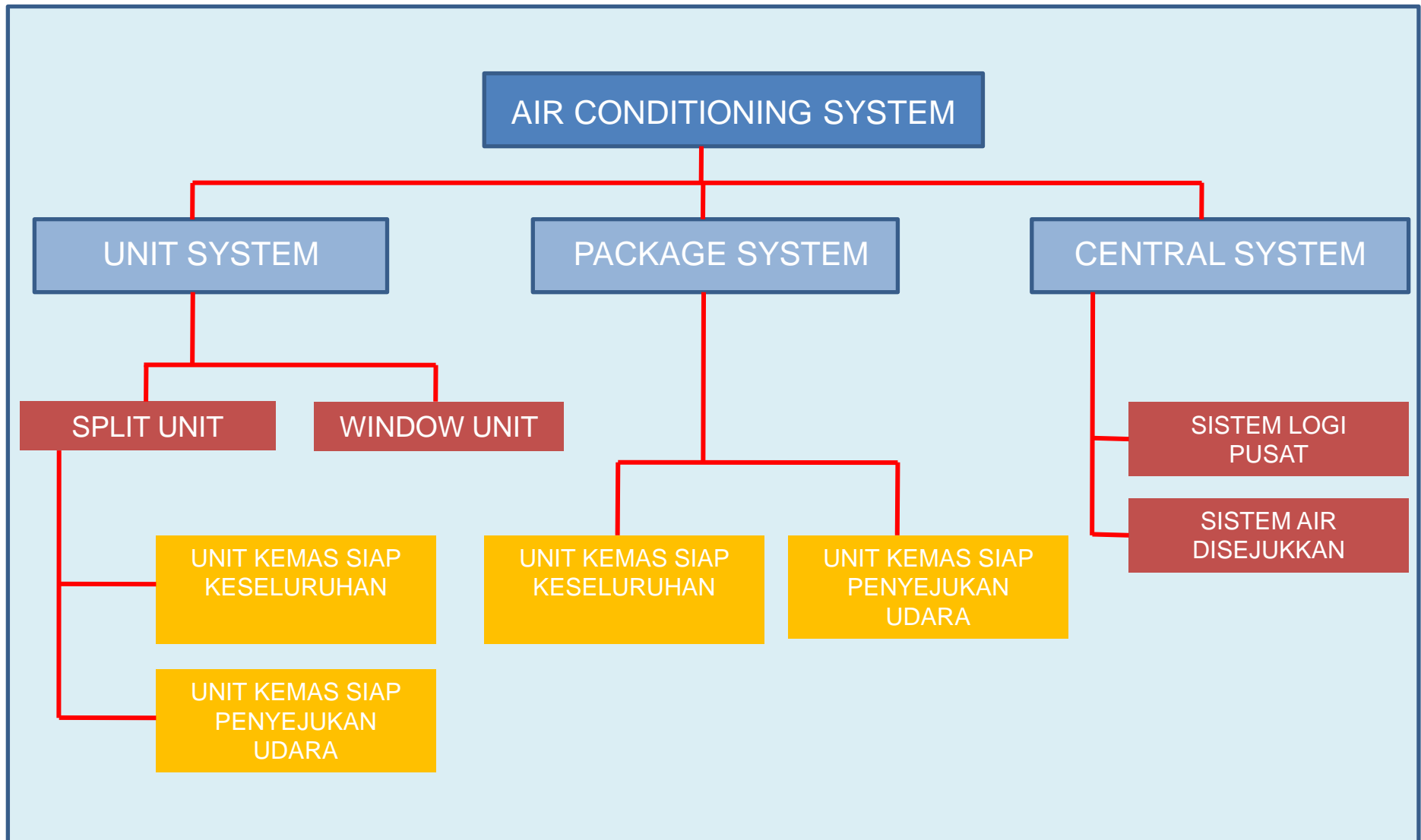
INSULATION TO DUCTWORK/PIPE

BUILDER'S WORK

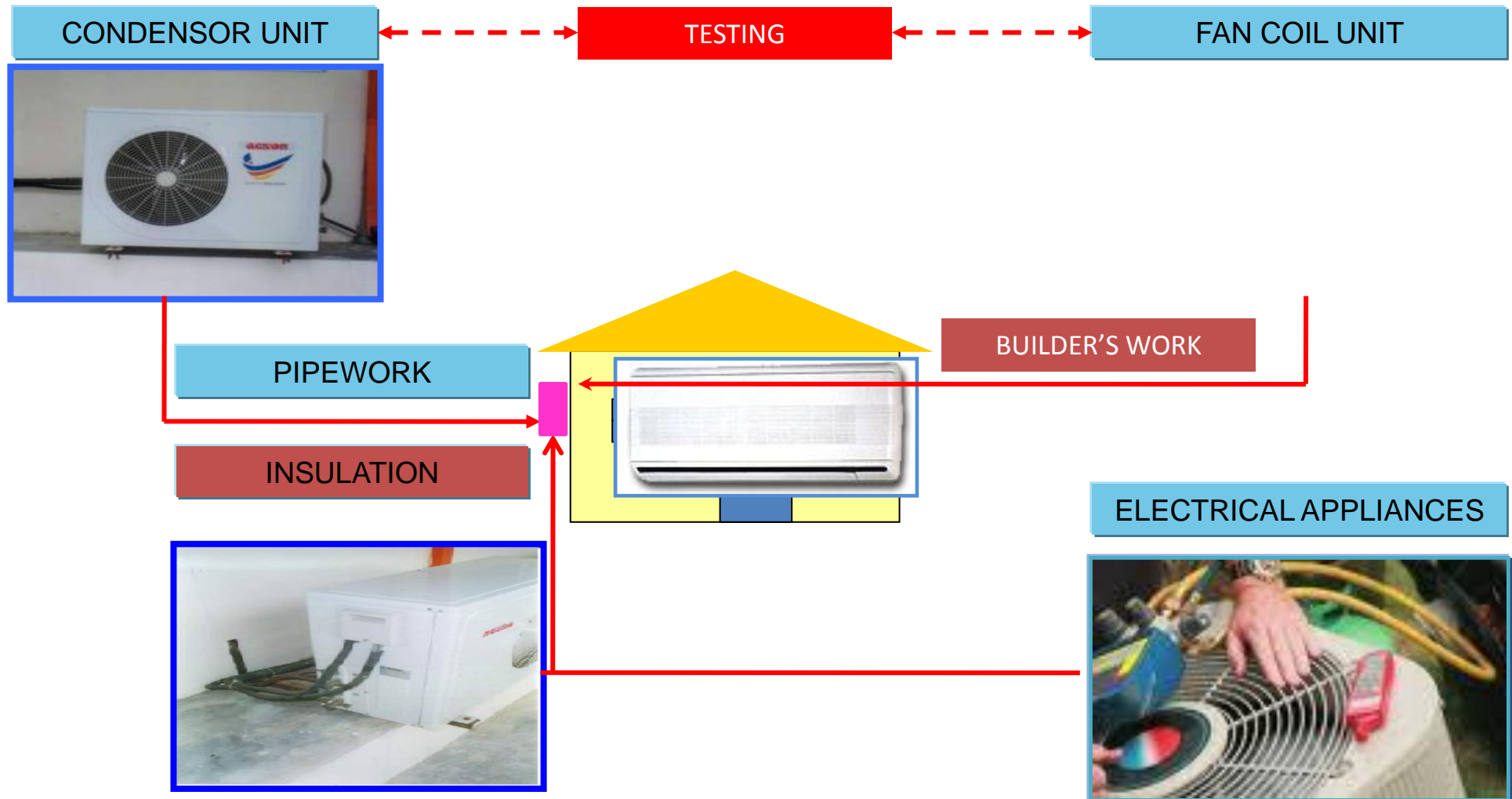
ELECTRICAL SYSTEM

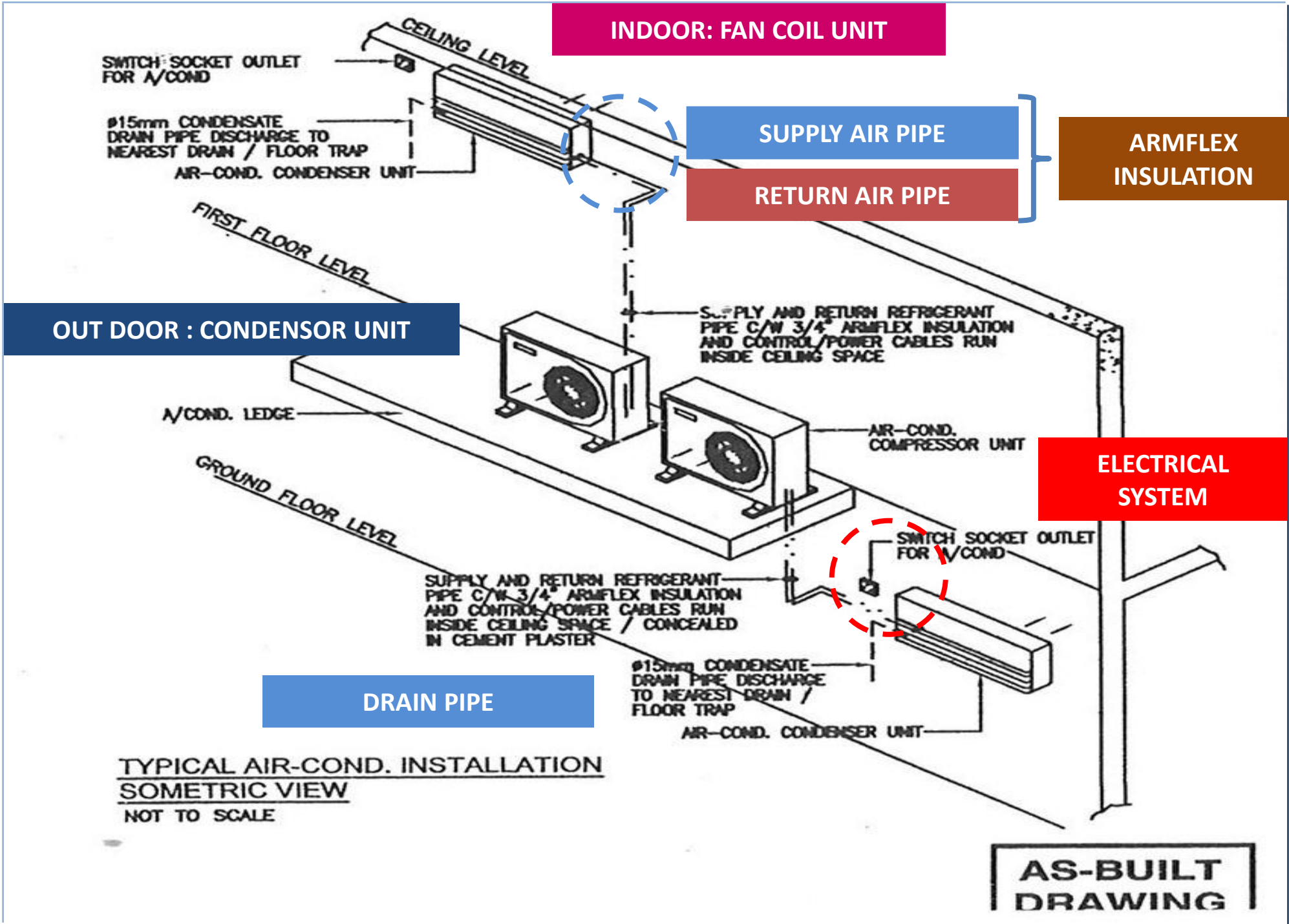
TESTING

Main Systems



Main Components





Split Unit System

FAN COIL UNIT

CONDENSER UNIT



SPLIT UNIT SYSTEM-:
TYPE: Wall Mounted
BTUIR: (9,500 - 25,000)
Kw: (2.8 - 7.3)

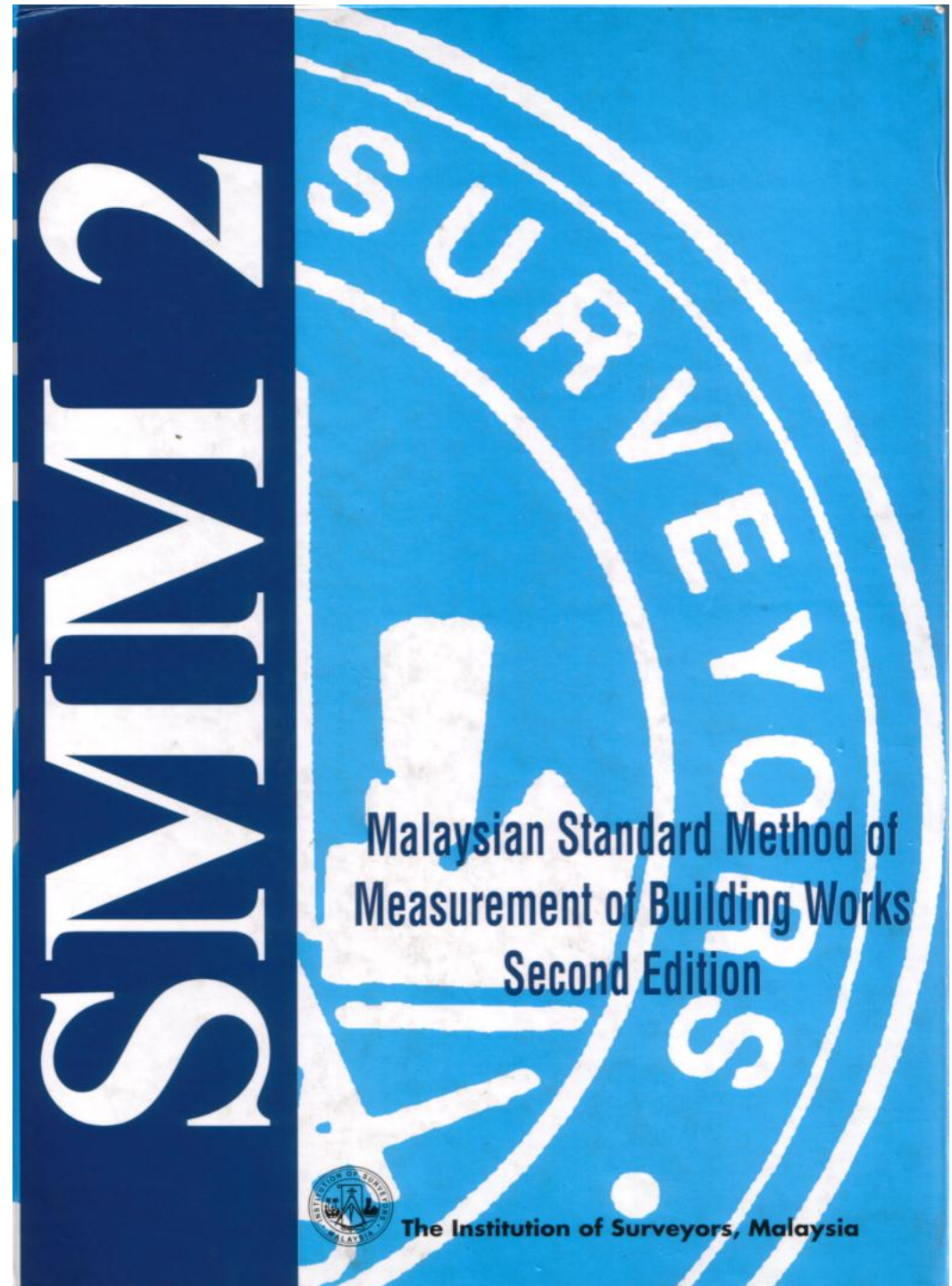
SMM2 measurement rules

AIR CONDITIONING AND VENTILATION SYSTEM

MEASUREMENT RULES

SECTION Q

**PLUMBING AND MECHANICAL
ENGINEERING INSTALLATIONS**



Measurement rules: SECTION Q :AIR CONDITIONING INSTALLATIONS

Q.1 Information

Q.2 Classification Of Work

Q.3 Location of works

PIPEWORKS

Q.7 Generally

Q.8 Pipe and Fittings

Q.9 Special Connection, etc

Q.10 Labour

Q.11 Sundries

Q.12 Pipework Support

Q.13 Connection

Q.14 Ducting and fittings

Q.16 Ductwork supports

Q.18 Ducting and ducting fittings

EQUIPMENT AND ANCILLARIES

Q.19 Generally

BUILDER'S WORK

Q.31 Generally

Q.32. Particularly

Equipment

Measurement Rules : AIR CONDITIONING INSTALLATIONS

GENERALLY

Q.1 INFORMATION

AIR CONDITIONING SYSTEM AND INSTALLATION

Generally

Q.1. Information

- 1 Particulars of the following shall be given :
 - a) Regulation, etc.
 - b) Kind and quality of material.
 - c) Gauge, thickness or substance of material.
 - d) Any tests, etc.



CONDENSING UNIT

ITEM	DESCRIPTION	UNIT	QTY	RATE	AMOUNT (RM)
	<u>AIR-COOLED MULTI SPLIT SYSTEM</u>				
	<u>OUTDOOR UNIT</u>				
a	York' or other equal or approved air-cooled condensing unit with a cooling capacity 48000 BTU/HR with type R22 refrigerant complete with fans, motors and all necessary refrigerant piping (m/s) and connection and bolted to roof slab	No	1	12,742.00	
b	York' or other equal or approved air-cooled condensing unit with a cooling capacity 48000 BTU/HR with type R22 refrigerant complete with fans, motors and all necessary refrigerant piping (m/s) and connection and bolted to roof slab	No	1	16,259.00	
c	York' or other equal or approved air-cooled condensing unit with a cooling capacity 72000 BTU/HR with type R22 refrigerant complete with fans, motors and all necessary refrigerant piping (m/s) and connection and bolted to roof slab	No	1	16,259.00	
d	York' or other equal or approved air-cooled condensing unit with a cooling capacity 78000 BTU/HR with type R22 refrigerant complete with fans, motors and all necessary refrigerant piping (m/s) and connection and bolted to roof slab	No	1	16,259.00	
e	York' or other equal or approved air-cooled condensing unit with a cooling capacity 90000 BTU/HR with type R22 refrigerant complete with fans, motors and all necessary refrigerant piping (m/s) and connection and bolted to roof slab	No	1	17,670.00	
	TO COLLECTION:				-

Measurement Rules : AIR CONDITIONING INSTALLATIONS

- Q.1.2 Assembling and jointing together the component parts of composite units and providing any necessary connecting flanges and jointing materials shall be deemed to be included with the items concerned. Where composite units are supplied by the Employer, particulars shall be given of the assembly work involved.
- Q.1.3 Patterns, moulds, templets and the like shall be deemed to be included with the items.

Measurement Rules : AIR CONDITIONING INSTALLATIONS

- Q.1.4 Priming and painting off-site and proprietary finishes or surface treatment applied as part of the production process **shall be described** stating whether applied before or after fabrication or assembly.
- Q.1.5 Except where otherwise stated the method of fixing and the provision of nails, bolts, nuts, holes, screws, plugs, shot-fired pins and the like **shall be given in the description of the work.**

Measurement Rules : AIR CONDITIONING INSTALLATIONS

- Q.1.6 The **nature of the background** to which work is to be fixed shall be given in the description. Any necessary drilling of the backgrounds shall be deemed to be included. Backgrounds shall be **classified as follows** :
- a) Building-board which shall be deemed to include hardboard, compressed cement sheet, plasterboard, fibreboard and similar materials which do not grip woodscrews.
 - b) Timber which shall be deemed to include softwood, hardwood, blockboard, plywood and similar materials which will grip wood-screws when a lead-hole has been drilled.
 - c) brickwork, concrete or stone work
 - d) plain metal
 - e) glass



FAN COIL UNIT

ITEM	DESCRIPTION	UNIT	QTY	RATE	AMOUNT (RM)
	<u>OUTDOOR UNIT(CONT'D)</u>				
a	York' or other equal or approved air-cooled condensing unit with a cooling capacity 96000 BTU/HR with type R22 refrigerant complete with fans, motors and all necessary refrigerant piping (m/s) and connection and bolted to roof slab	No	1		
	<u>INDOOR UNIT</u>				
b	York' or other equal and approved fan coil unit a cooling capacity of 12,000 BTU/HR, complete with electronic refrigerant control valve, mode selector cooling, self diagnosis remote controller and self diagnosis circuit with malfunction code display, and fixed to ceiling with approved accessories	No	6		
c	York' or other equal and approved fan coil unit a cooling capacity of 24,000 BTU/HR, complete with electronic refrigerant control valve, mode selector cooling, self diagnosis remote controller and self diagnosis circuit with malfunction code display, and fixed to ceiling with approved accessories	No	8		
d	York' or other equal and approved fan coil unit a cooling capacity of 30,000 BTU/HR, complete with electronic refrigerant control valve, mode selector cooling, self diagnosis remote controller and self diagnosis circuit with malfunction code display, and fixed to ceiling with approved accessories	No	4		
	TO COLLECTION:				-

Measurement Rules : AIR CONDITIONING INSTALLATIONS

- Q.1.7. **Temporary work shall be so described.** Removing temporary work and making good after shall be deemed to be included with the item.
- Q.1.8. **Connecting to existing services** – shall be described

Measurement Rules : AIR CONDITIONING INSTALLATIONS

GENERALLY

Q.2. CLASSIFICATION OF WORK

Q.2.1 Work together with its metalwork, supports and the like (unless associated with more than one installation) shall be classified as follows and given under an appropriate heading :

t) Air handling installation, identifying whether ventilation supply, ventilation extract, ventilation with heating (air heated centrally), ventilation with heating (air heated locally), air conditioning (air heated centrally), air conditioning (air heated locally), or foul air extract.

Measurement Rules : AIR CONDITIONING INSTALLATIONS

Q.3. LOCATION OF WORK

Location of works :

- a. Internally
- b. Externally
- c. In plant rooms

Pipe works

Measurement Rules : AIR CONDITIONING INSTALLATIONS

PIPE WORKS

Q.7 GENERALLY

1. Purpose-made pipes and purpose-made pipe fittings shall be described.
2. Pipes and pipe fittings which are wrapped, coated or lined by the manufacturer shall be so described stating the type of treatment.
- 3. Pipework required to be temporarily fixed in position, dismantled for chromium-plating or other special finishing and subsequently refixed shall be so described.



SUPPLY AIR PIPE

RETURN AIR PIPE

DRAIN PIPE

ITEM	DESCRIPTION	UNIT	QTY	RATE	AMOUNT (RM)
PIPEWORKS					
Piping					
a	Supply Air Pipe 18.80mm Galvanised steel tubing to BS 1387 refrigerant pipe fixed to concrete slab with and including mild steel clips	m	218		
b	Return Air Pipe 37.60mm Galvanised steel tubing to BS 1387 refrigerant pipe fixed to concrete slab with and including mild steel clips	m	218		
c	Drain Pipe 18.80 mm Diameter galvanised drain pipe to Bs 1387 fixed to concrete slab with and including mild steel clips.	m	47		
e	<u>Extra Over</u> for 18.80 mm x 18.80 mm Diameter Galvanised Iron bend including jointing and fixing in supply air pipe	No	25		
f	<u>Extra Over</u> for 37.60 mm x 37.60 mm Diameter ditto in return air pipe	No	25		
g	<u>Extra Over</u> for 18.80 mm x 18.80 mm Diameter ditto in drain pipe	No	10		
h	<u>Extra Over</u> for 18.80 mm x 18.80 mm x 18.80 mm Diameter Galvanised Iron tee including jointing and fixing in supply air pipe	No	11		
j	<u>Extra Over</u> for 37.60 mm x 37.60 mm x 37.60 mm Diameter Galvanised Iron bend including jointing and fixing in return air pipe	No	11		
k	<u>Extra Over</u> for 18.80 mm x 18.80 mm x 18.80 mm Diameter Galvanised Iron bend including jointing and fixing in drain pipe	No	14		
TO COLLECTION:					
					-

Measurement Rules : AIR CONDITIONING INSTALLATIONS

a) Shall be supplied and installed:

- all necessary interconnecting pipework between item of equipment
- all vents and exhausts
- all necessary pipe, valves, fittings, anchors, supports, brackets, insulation etc

b) Type of piping

i) Refrigerant pipe

- up to and including 2" bore, pipes shall be seamless coppers to BS 659. above 2 ½" bore pipes shall be galvanised steel heavy gauges to BS 1387

ii) Drain pipe

- drain pipes shall be seamless copper tubing for all size ¾" diameter and galvanised steel.

Measurement Rules : AIR CONDITIONING INSTALLATIONS

Q.8 PIPE AND FITTING

1. Pipes (measured over all pipe fittings, short running lengths and branches) shall be given in **metres** stating the type and the normal size. (Q.8.1)

Purpose-made pipe shall be so described and given separately. **Curved pipes** shall be so described stating the mean radius.

Joints in the running length shall be given in the description stating the method of jointing.

Measurement Rules : AIR CONDITIONING INSTALLATIONS

Q.8 PIPE AND FITTING

2. Flexible pipes and extensible pipes (measured as fully extended) shall each **be so described**. (Q.8.3)
3. Pipes laid or fixed in ducts, trenches and chases or embedded in in-situ concrete or screeds shall each **be so described**. (Q.8.4)

Measurement Rules : AIR CONDITIONING INSTALLATIONS

Q.9. SPECIAL CONNECTIONS, ETC.

1. Special connections and special joints in pipes shall each be **enumerated** separately (except where given in the description of another enumerated item) stating the nominal size and kind of pipe concerned and the method of jointing. **Classification shall be as follows :**
 - a) Connections between pipes of differing materials and differing grades of the same material.
 - b) Connections between pipes and appliances or equipment.
 - c) Connections to existing pipes.

Measurement Rules : AIR CONDITIONING INSTALLATIONS

Q.10.LABOURS

- Labours on pipes (e.g. made bends, made springs, made offsets, beaded ends, ornamental ends, etc.) shall be deemed to be included with the pipes on which they occur.

Measurement Rules : AIR CONDITIONING INSTALLATIONS

Q.11 SUNDRIES

6. Pipe-sleeves through walls, floors ceilings shall be **enumerated** stating the type, lengths, the nominal size and kind of pipe passing through and the type of packing required, and if to be supplied for fixing by other trades, this **shall be so described**.
7. Wall, floor or ceiling plates shall be grouped together as plates and **enumerated** stating the type and size.

Measurement Rules : AIR CONDITIONING INSTALLATIONS

Q.12 PIPEWORK SUPPORTS

1. Components or assemblies of components (e.g. clips, saddles, pipe-hooks, holderbats, brackets, rollers, chairs and hangers or black-plates and girder-lugs) used to fix supports for more than one pipe shall be **enumerated** separately stating the type and size of components.

Spring compensated components shall be so described stating the loading and movement to be accommodated.

Measurement Rules : AIR CONDITIONING INSTALLATIONS

EQUIPMENT AND ANCILLARIES

Q.19 GENERALLY

1. Unless otherwise stated, equipment such as boiler, generators, cylinder, pumps, cooling, air handling unit, fans, refrigerator equipment etc – **in numbers**

Condenser Unit And Fan Coil, etc.

- Measured in **nos** (Q.19.1)
2. **Packaged item** shall be described in conjunction with a manufacturer's detailed specification (Q.19.2)

Measurement Rules : AIR CONDITIONING INSTALLATIONS

EQUIPMENT AND ANCILLARIES

Q.19 GENERALLY

3. Any limiting dimensions on the size shall be given. (Q.19.3)
4. **Electrical connection** shall be given in accordance with **section R** .
(Q.19.4)
5. Platework, fuel hoppers dan supporting steelwork -**accordance**
Section P.

Electrical wiring

BILLS OF QUANTITIES FOR:

ELECTRICAL WIRING

ITEM	DESCRIPTION	UNIT	QTY	RATE	AMOUNT (RM)
	<u>INSULATION TO PIPEWORK</u>				
a	Supply Air Pipe 25 mm thick close cell thermal insulation expanded rubber compound or approved equivalent to 18.8 mm Diameter galvanised steel tubing	m	218		
b	Drain Pipe 12 mm thick Armaflex or flexible expanded rubber compound insulation to 18.80 mm Diameter drain pipe	m	47		
	<u>AIR CONDITIONING PANEL</u>				
c	3 Phase 240 Volt air-conditioning electrical wiring installation to air-conditioning system including providing 10 Nos switch, any items of control wiring and the like provision of all necessary copper cables, wiring material concealed conduits fitting	No	1		

d	Upon completion allowed for the testing the foregoing air-conditioning system, make good and defect and leave the whole for the installation in perfect working order to the satisfaction of the engineer	Item			
	<u>BUILDER'S WORK</u>				
e	50 mm thick concrete Grade 15 as based 300 mm wide	m ³	0.1		
	TO COLLECTION:				-

Measurement Rules : AIR CONDITIONING INSTALLATIONS

EQUIPMENT AND ANCILLARIES

Q.20 Anti-vibration and sound insulation

Anti-vibration mountings for plant shall be **enumerated** stating the type and the size. Anti-vibration material and sound-insulating material in plant bases shall be given in **square metres** stating the nature of the material and the thickness.

Measurement Rules : ANTI VIBRATION



Measurement Rules : AIR CONDITIONING INSTALLATIONS

EQUIPMENT AND ANCILLARIES

Q.21 Equipment supports

1. Equipment supports shall be **enumerated** and described.
2. Particulars of the method of fixing shall be given in the description in accordance with clauses Q.1.5-6.

Measurement Rules : AIR CONDITIONING INSTALLATIONS

Q.22 JOINTING (PENYAMBUNGAN)

1. Particulars of the method of jointing – shall be given in the description of the equipment.

Measurement Rules : AIR CONDITIONING INSTALLATIONS

EQUIPMENT AND ANCILLARIES

Q.24 IDENTIFICATION PLATES

- Plates, discs and labels for identification plants shall be deemed to be included with the item concerned. (Q.24)
- Charts giving the keys – shall be enumerated

Insulation

Measurement Rules : AIR CONDITIONING INSTALLATIONS

INSULATION

Q.25 GENERALLY

1. Particulars of the following shall be given: (Q.25.1)
 - Kind and quality of material
 - Thickness of material
 - Finish of material
 - Method of fixing
2. Includes smoothing the material and working around supports.(Q.25.2)

Measurement Rules : AIR CONDITIONING INSTALLATIONS

Q.26 INSULATION TO PIPEWORK

1. Insulation to pipework – meter – stating types and size of the pipe.
2. Working insulation around ancillaries shall be enumerated separately – in numbers – extra over
3. Working insulation over flanges and pipe fitting shall be deemed.
4. Insulation boxes shall be enumerated separately – in numbers – stating types of material and infill.

BILLS OF QUANTITIES FOR:

INSULATION

ITEM	DESCRIPTION	UNIT	QTY	RATE	AMOUNT (RM)
	<u>INSULATION TO PIPEWORK</u>				
a	Supply Air Pipe 25 mm thick close cell thermal insulation expanded rubber compound or approved equivalent to 18.8 mm Diameter galvanised steel tubing	m	218		
b	Drain Pipe 12 mm thick Armaflex or flexible expanded rubber compound insulation to 18.80 mm Diameter drain pipe	m	47		
	<u>AIR CONDITIONING PANEL</u>				
c	3 Phase 240 Volt air-conditioning electrical wiring installation to air-conditioning system including providing 10 Nos switch, any items of control wiring and the like provision of all necessary copper cables, wiring material concealed conduits fitting -----	No	1		
d	Upon completion allowed for the testing the foregoing air-conditioning system, make good and defect and leave the whole for the installation in perfect working order to the satisfaction of the engineer	Item			
	<u>BUILDER'S WORK</u>				
e	50 mm thick concrete Grade 15 as based 300 mm wide	m ³	0.1		
	TO COLLECTION:				-

Measurement Rules : PIPE INSULATION

a) REFRIGERANT PIPE INSULATION

-shall be insulated with two layer of 25 mm thick close cell thermal insulation expanded rubber compound or approved equivalent.

b) RETURN REFRIGERENT PIPE INSULATION

-shall be insulated with 12 mm thick Armaflex or flexible expanded rubber compound

c) DRAIN PIPE

- Shall be 15mm diameter PVC condensate drain pipe discharge to nearest drain



Measurement Rules : INSULATION TO DUCTWORK

Q.27 INSULATION TO DUCTWORK

1. Insulation to ductwork – meter – stating types and size of the ducting.
2. Working insulation around ducting fittings, special fittings and ancillaries – in numbers – extra over

Measurement Rules : INSULATION TO EQUIPMENT

Q.28 INSULATION TO EQUIPMENT

1. Insulation to equipment – enumerated – stating overall size of the unit. Particular shall be given of any protection to the insulation.
2. Providing *detachable mattresses* and working insulation around *special fittings* and *ancillaries* – *shall be deemed*

Measurement Rules : SUNDRY INSULATION

Q.29 SUNDRY INSULATION

1. Loose insulation in trench, ducts, tank casings and like - shall be given separately in cubic metres stating nature of materials.
2. Cellular concrete insulation in trench and ducts (grouped together) - shall be given in cubic metres stating mix of the concrete.
3. Special protection or finish at opening through wall, valve chambers and the like – *shall each be described* enumerated.

Measurement Rules : SUNDRIES

Q.30 SUNDRIES

1. Testing each installation shall be given as an **ITEM**.
stating any required qualifications, no of stage tests in addition to the final, purpose, instruments and appliances required, special insurances etc.

Testing

BILLS OF QUANTITIES FOR:

TESTING

ITEM	DESCRIPTION	UNIT	QTY	RATE	AMOUNT (RM)
	<u>INSULATION TO PIPEWORK</u>				
a	Supply Air Pipe 25 mm thick close cell thermal insulation expanded rubber compound or approved equivalent to 18.8 mm Diameter galvanised steel tubing	m	218		
b	Drain Pipe 12 mm thick Armaflex or flexible expanded rubber compound insulation to 18.80 mm Diameter drain pipe	m	47		
	<u>AIR CONDITIONING PANEL</u>				
c	3 Phase 240 Volt air-conditioning electrical wiring installation to air-conditioning system including providing 10 Nos switch, any items of control wiring and the like provision of all necessary copper cables, wiring material concealed conduits fitting	No	1		
d	Upon completion allowed for the testing the foregoing air-conditioning system, make good and defect and leave the whole for the installation in perfect working order to the satisfaction of the engineer	Item			
	<u>BUILDER'S WORK</u>				
e	50 mm thick concrete Grade 15 as based 300 mm wide	m ³	0.1		
	TO COLLECTION:				-

Builder's work

Measurement Rules : AIR CONDITIONING INSTALLATIONS

BUILDER'S WORK

Q.31 GENERALLY

1. Unless otherwise stated, all items of builder's shall be given in accordance with the **appropriate section**.
2. Builder's works in connection with plumbing and mechanical engineering installations **shall be grouped together under an appropriate heading**.

Measurement Rules : AIR CONDITIONING INSTALLATIONS

BUILDER'S WORK

Q.32 PARTICULARLY

1. Excavation works.
2. Inspection chamber-V.6.
3. Bedding and pointing equipments or unit of equipment.
4. Cutting away for and making goods after the plumbing and mechanical installations.
5. Etc

BILLS OF QUANTITIES FOR:

BUILDER'S WORK

ITEM	DESCRIPTION	UNIT	QTY	RATE	AMOUNT (RM)
	<u>INSULATION TO PIPEWORK</u>				
a	Supply Air Pipe 25 mm thick close cell thermal insulation expanded rubber compound or approved equivalent to 18.8 mm Diameter galvanised steel tubing	m	218		
b	Drain Pipe 12 mm thick Armaflex or flexible expanded rubber compound insulation to 18.80 mm Diameter darin pipe	m	47		
	<u>AIR CONDITIONING PANEL</u>				
c	3 Phase 240 Volt air-conditioning electrical wiring installation to air-conditioning system including proving 10 Nos switch, any items of control wiring and the like provision of all necessary copper cables, wiring material cocealed conduits fitting -----	No	1		
d	Upon completion allowed for the testing the foregoing air-conditioning system, make good and defect and leave the whole fo the installation in perfect working order to the satisfaction of the engineer	Item			
	<u>BUILDER'S WORK</u>				
e	50 mm thick concrete Grade 15 as based 300 mm wide	m3	0.1		
	TO COLLECTION:				-

Taking off list

SPLIT UNIT AIR CONDITIONING TAKING OFF LIST

1) Preambles (Note)

2) Equipment

Fan Coil Unit

- NO.

- Wall Mounted Split Unit

- 10,000 BTUH

- 12,000 BTUH

- 20,000 BTUH

- 25,000 BTUH

- Ceiling Cassette Split Unit

- 20,000 BTUH

Condenser Unit

- NO.

- Multi Split Condenser

- 30,000 BTUH

- 40,000 BTUH

- 35,000 BTUH

- 45,000 BTUH

SPLIT UNIT AIR CONDITIONING TAKING OFF LIST

- Split Condenser
 - 10,000 BTUH
 - 12,000 BTUH
 - 20,000 BTUH
 - 25,000 BTUH
- 3) Hanger - NO
- 4) Pipework - M
 - Refrigerant pipe
 - Condensate pipe
- 5) Insulation of Pipework - M
- 6) Electrical Wiring - ITEM
- 7) Builder's Work - ITEM
- 8) Maintenance - ITEM
- 9) Testing - ITEM