

SULIT



**BAHAGIAN PEPERIKSAAN DAN PENILAIAN
JABATAN PENDIDIKAN POLITEKNIK
KEMENTERIAN PENDIDIKAN TINGGI**

JABATAN KEJURUTERAAN AWAM

PEPERIKSAAN AKHIR

SESI JUN 2015

CB503 : VENTILATION & AIR CONDITIONING 3

TARIKH : 22 OKTOBER 2015

MASA : 11.15 AM – 1.15 PM (2 JAM)

Kertas ini mengandungi LAPAN (8) halaman bercetak.
Bahagian A: Esei (6 soalan)
Dokumen sokongan yang disertakan : Appendix I, II & III

JANGAN BUKA KERTAS SOALAN INI SEHINGGA DIARAHKAN

(CLO yang tertera hanya sebagai rujukan)

SULIT

SECTION A : 100 MARKS

BAHAGIAN A : 100 MARKAH

INSTRUCTION:

This section consists of **SIX (6)** essay questions. Answer **FOUR (4)** questions only.

ARAHAN:

Bahagian ini mengandungi ENAM (6) soalan esei. Jawab EMPAT (4) soalan sahaja.

QUESTION 1

SOALAN 1

CLO1
C5

- (a) Cumulative cooling load from wall, ceiling, floor, door and glass windows for a room is 2.91 kW. Calculate the total cooling load if the room is occupied by 40 students for one session of 3 hours class and has 40 computers and 12 units of fluorescent lamps. Latent heat from student is 139 watts, computer is 180 watts and fluorescent lamp is 36 watts.

Beban penyejukan terkumpul dari dinding, siling, lantai, pintu dan tingkap kaca bagi sebuah bilik adalah 2.91 kW. Kira jumlah beban penyejukan jika bilik dihuni oleh 40 orang pelajar untuk satu sesi kelas selama 3 jam dan 40 unit computer serta 12 unit lampu kalimantang. Haba pendam dari pelajar adalah 139 watt, computer adalah 180 watt dan lampu kalimantang adalah 36 watt.

[20 marks]

[20 markah]

CLO1
C5

- (b) The room needs to install 4 units of air conditioner. Referring to the catalogue in Figure 1a, suggest preferable air conditioner unit.

Bilik tersebut memerlukan 4 unit penyamanan udara untuk dipasang. Merujuk katalog pada Rajah 1a, cadangkan unit penyamanan udara yang sesuai.

[5 marks]

[5 markah]

SPECIFICATIONS				WALL MOUNTED TYPE									
Model No.		I.U.	O.U.	ASA7A	ASA9A	ASA12A	AOA12A	AOY14A	AOY17A	ASY18A	ASY24A	ASY30A	
Item				AOA7A	AOA9A	AOA12A	AOA12A	AOY14A	AOY17A	AOY18A	AOY24A	AOY30A	
Capacity			kW	1.95 – 1.95	2.60 – 2.60	3.40 – 3.45	3.85 – 4.00	4.75 – 4.90	5.30 – 5.40	6.80 – 6.90	8.05 – 8.20		
			BTU/h	6,700 – 6,700	8,900 – 8,900	11,600 – 11,800	13,100 – 13,700	16,200 – 16,700	18,100 – 18,400	23,200 – 23,600	27,500 – 28,000		
Moisture Removal			l/h	0.7	1.3	1.8	540	1.6	2.1	2.0	2.5	3.0	
			m ³ /h	340	540	540	540	1,600	2,590	840	950	1,050	
Room Air Circulation(High)		I.U.	O.U.	1,330 – 1,400	1,295 – 1,325	1,760 – 1,830	1,600	220 – 240 / 1 / 50		2,590	3,320		
Input Power			W/Hz										
Running Current			A	2.80 – 2.90	4.00 – 3.90	6.10 – 6.20	6.90 – 7.00	8.00 – 7.80	8.40 – 8.00	12.20 – 12.20	13.80 – 13.70		
Power Consumption			kW	0.590 – 0.635	0.86 – 0.89	1.27 – 1.33	1.48 – 1.55	1.75 – 1.85	1.84 – 1.89	2.55 – 2.66	2.96 – 3.08		
EER			kW/kW	3.31 – 3.07	3.02 – 2.92	2.68 – 2.59	2.60 – 2.58	2.71 – 2.65	2.88 – 2.86	2.67 – 2.59	2.72 – 2.66		
Dimensions HxWxD			mm	248 x 808 x 170	257 x 808 x 187	285 x 900 x 172	285 x 900 x 172	320 x 1,120 x 220	320 x 1,120 x 220	320 x 1,120 x 220	320 x 1,120 x 220		
		I.U.	kg(lbs)	7.5(17)	8(18)	10(22)	10(22)	16(35)	16(35)	16(35)	16(35)		
Net Weight			mm	535 x 650 x 250	535 x 685 x 250	530 x 750 x 250	530 x 750 x 250	643 x 840 x 336	643 x 840 x 336	900 x 900 x 350	900 x 900 x 350		
		O.U.	kg(lbs)	24(53)	31(66)	36(79)	36(79)	55(121)	59(130)	65(143)	79(174)		
Connection Method													
Connection Pipe Size (Small/Large)			mm	6.35 / 9.52	6.35 / 9.52	6.35 / 12.70	6.35 / 12.70	9.52 / 15.88	9.52 / 15.88	9.52 / 15.88	9.52 / 15.88		
Max Pipe Length Height Difference			m	10	15	10	10	20	20	30	30		
Permissible Range of Outdoor Temp.			°C	5	8	5	5	8	8	15	15		
				21 – 43	21 – 43	18 – 46	18 – 46	21 – 43	21 – 43	0 – 43	0 – 43		

Figure 1a : Air Conditioner Catalogue

QUESTION 2

SOALAN 2

CLO2
C1(a) State **FIVE (5)** sources of cooling load in a building.*Nyatakan LIMA (5) sumber beban penyejukan di dalam bangunan.*

[5 marks]

[5 markah]

CLO2
C2(b) Explain **FIVE (5)** ways on how to reduce solar radiation from getting into building.*Terangkan LIMA (5) cara bagaimana mengurangkan solar radiasi daripada memasuki bangunan.*

[10 marks]

[10 markah]

CLO2
C3

(c) Sketch and label the summer air conditioning system.

Lakar dan labelkan sistem pendingin hawa musim panas.

[5 marks]

[5 markah]

CLO2
C4

(d) If given dry-bulb temperature is 25°C and wet-bulb temperature is 20°C (refer Appendix III Psychrometric chart) find:

- Relative humidity
- Dew-point temperature
- Humidity ratio
- Specific volume
- Specific enthalpy

Jika diberi suhu buli kering 25°C dan suhu bebuli basah 20°C (rujuk Appendix III carta psikrometrik) dapatkan:

- Kelembapan relatif
- Suhu takat embun

- iii. Nisbah kelembapan
- iv. Isipadu tertentu
- v. Entalpi tertentu

[5 marks]

[5 markah]

QUESTION 3

SOALAN 3

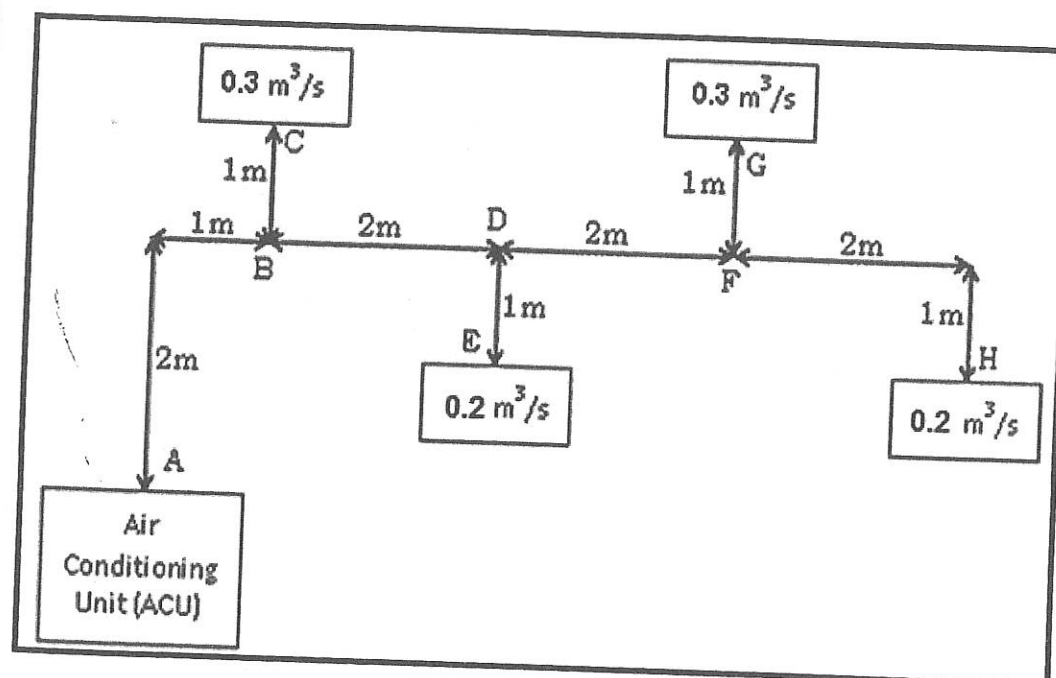


Figure 3a

Figure 3a shows an air duct supply system for one space. Based on Appendix I: Chart 4.19 and Appendix II : Chart 4.33, by using equal friction method and assuming that air velocity at duct AB is 4 m/s, calculate:

- i. Air volume for duct AB, BC, BD, DE, DF, FG and FH.
- ii. Pressure drop at duct AB in Pa/m.
- iii. Circular duct size for duct AB, BC, BD, DE, DF, FG and FH in mm.
- iv. Rectangular duct size for duct AB, BC, BD, DE, DF, FG and FH in mm if duct dimension ratio is 2:1.

CLO1
C5

Rajah 3a menunjukkan sistem sesalur udara bekalan bagi sebuah ruang. Berdasarkan kepada 'Appendix I: Chart 4.19' dan 'Appendix II: Chart 4.33', dengan menggunakan kaedah geseran sama dan anggapan bahawa halaju udara pada sesalur AB adalah 4m/s, kirakan:

- i. Isipadu udara bagi sesalur AB, BC, BD, DE, DF, FG dan FH.
- ii. Kejatuhan tekanan pada sesalur AB dalam Pa/m.
- iii. Saiz sesalur bulat bagi sesalur AB, BC, BD, DE, DF, FG dan FH (mm).
- iv. Saiz sesalur segiempat bagi sesalur AB, BC, BD, DE, DF, FG dan FH (mm) sekiranya nisbah dimensi sesalur ialah 2:1

[25 marks]

[25 markah]

QUESTION 4

SOALAN 4

CLO2
C5

- a) Describe vane axial fan regarding its function in ventilation system.

Huraikan kipas alir paksi bebilah beserta fungsinya dalam sistem pengudaraan.

[8 marks]

[8markah]

CLO2
C5

- b) Draw and label the vane axial fan.

Lukis dan labelkan kipas alir paksi bebilah.

[7 marks]

[7markah]

CLO2
C5

- c) Draw and label the propeller fan.

Lukis dan labelkan kipas pendorong.

[10 marks]

[10markah]

QUESTION 5

SOALAN 5

CLO3
C2

- (a) Explain
- four (4)**
- advantages of district cooling system.

Terangkan empat (4) kebaikan sistem penyejukan daerah.

[8 marks]

[8 markah]

CLO3
C3

- (b) District cooling plant equipment can be divided into three categories. State and give
- TWO (2)**
- examples for each category.

*Peralatan loji penyejukan daerah dapat dibahagikan kepada tiga kategori.**Nyatakan dan berikan DUA (2) contoh untuk setiap kategori.*

[9 marks]

[9 markah]

CLO2
C3

- (c) Sketch and label the schematic diagram of a district cooling system.

Lakarkan dan labelkan gambarajah skematik bagi sistem penyejukan daerah.

[8 marks]

[8 markah]

QUESTION 6

SOALAN 6

CLO3
C3

- (a) Define chilled beam system.

Definisikan sistem rasuk sejuk.

[5 marks]

[5 markah]

CLO3
C2

- (b) List
- TEN (10)**
- advantages of using the chilled beam system.

Senaraikan SEPULUH (10) kelebihan menggunakan sistem rasuk sejuk.

[10 marks]

[10 markah]

CLO3
C2

- (c) Described the operation of chilled beam system

Jelaskan operasi sistem rasuk sejuk

[10 marks]

[10 markah]

SOALAN TAMAT

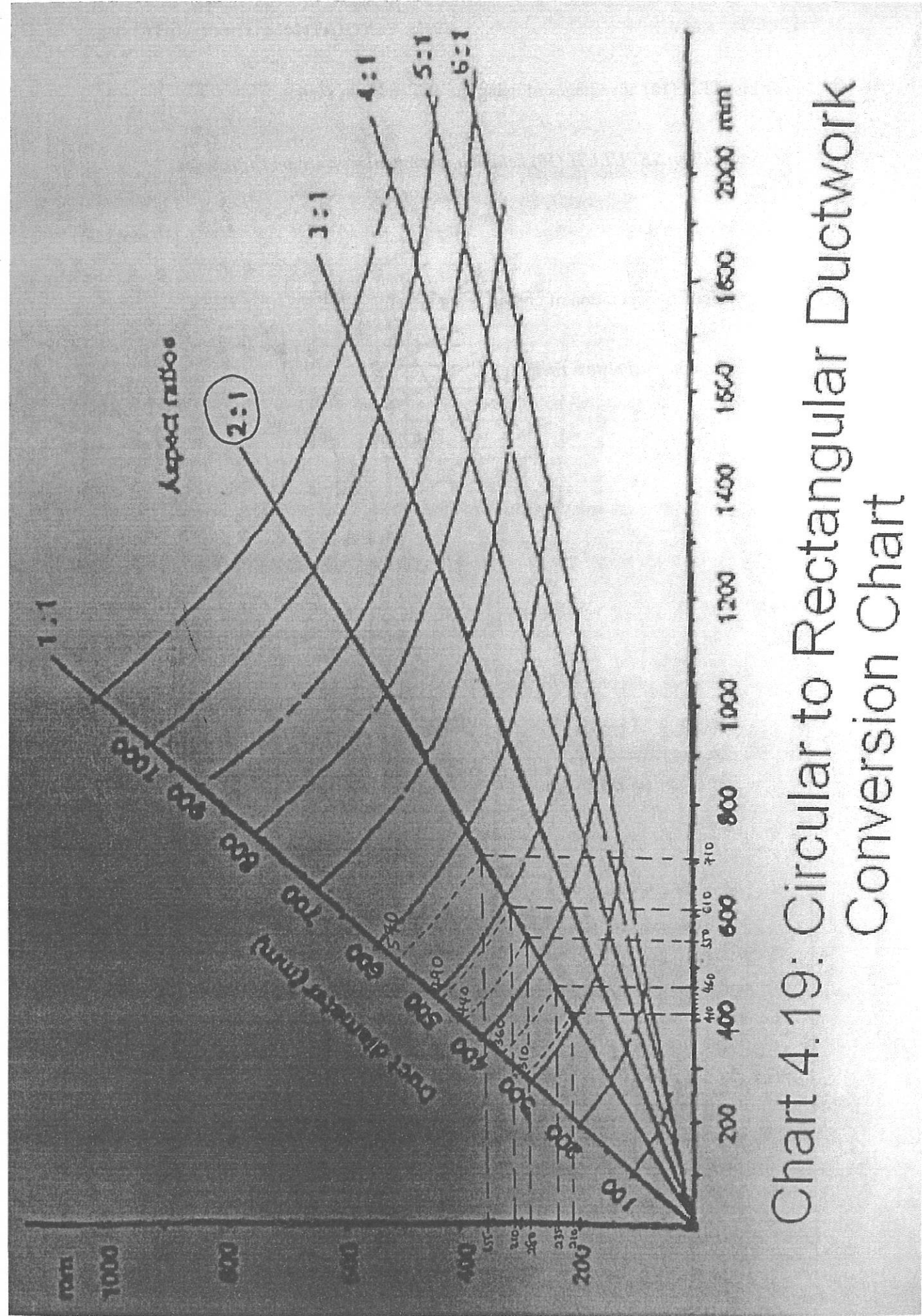
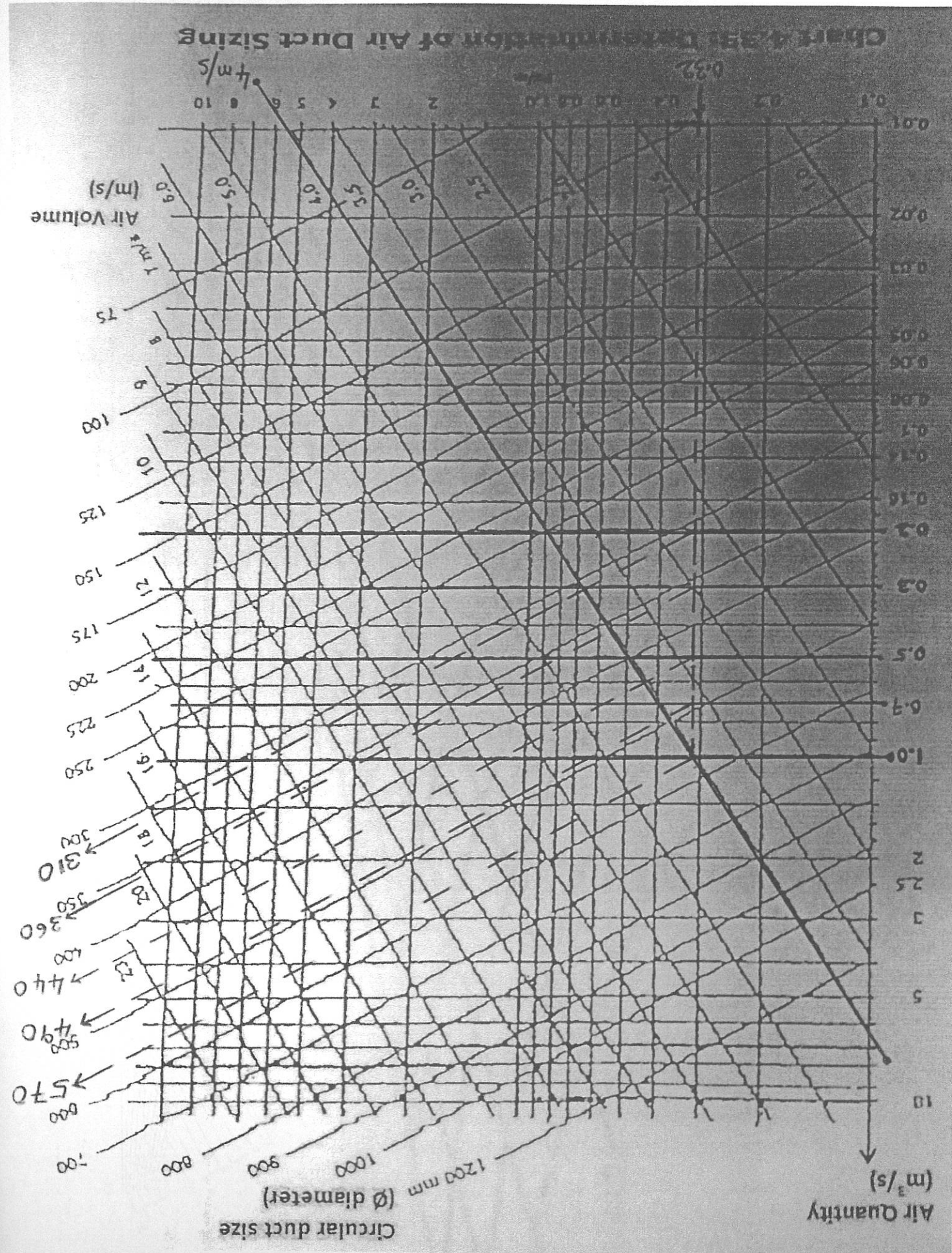


Chart 4.19: Circular to Rectangular Ductwork Conversion Chart





SI METRIC PSYCHROMETRIC CHART

BASED ON A BAROMETRIC PRESSURE
of 101.325 kPa
AT SEA LEVEL

