



UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION
JANUARY 2014 SESSION

SUBJECT CODE : FCB 21003
SUBJECT TITLE : DUCTING AND PIPING NETWORK
LEVEL : BACHELOR
TIME / DURATION : **9.00 am - 12.00 noon**
(3 HOURS)
DATE : **03 JUN 2014**

INSTRUCTIONS TO CANDIDATES

1. Please read the instructions given in the question paper CAREFULLY.
2. Duct calculator is allowed to perform duct sizing.
3. Please write your answers on the answer booklet provided.
4. Answer should be written in blue or black ink except for sketching, graphic and illustration.
5. The drawings need to be returned with the answer booklet.
6. This question paper consists of ONE (1) section only. Answer ALL questions.
7. Answer all questions in English.

THERE ARE 5 PAGES OF QUESTIONS, EXCLUDING THIS PAGE.

INSTRUCTION: Answer ALL questions.
Please use the answer booklet provided.

Question 1

Appendixes 1 and 2 show a 9-storey office building floor layout. The chiller plant room is located at the ground floor and there are 2 mechanical plant rooms on each floor. Cooling tower and ventilation fan are proposed to be installed at the cooling tower area where the wall height is just 5ft. The air conditioning system installed for the building shall be the water-cooled chiller system. The ceiling height of ground floor and 1st floor to 8th floor are 15ft and 10 ft, respectively from the floor level, whilst the space above the ceiling is limited to 2.5 ft for the ducting and piping installation purpose.

- (a) Referring Appendix 1,2 & 3, estimate
- i. the total supply air and return air for each area for 1st floor. (10 Marks)

 - ii. the cooling capacity for each area for the 1st floor. (10 Marks)

Question 2

Based on your calculation in Question 1 or assume the cooling capacity for each floor is about 745,000 Btu/hr, sketch your proposed ducting layout in a single line diagram complete with duct dimensions and air flow rate at each diffusers/grilles for the 1st floor for its

- (a) Air conditioning system
(10 Marks)
- (b) Centralized toilet ventilation system.
(5 Marks)
- (c) What type of fan that you would propose for the toilet ventilation system? Justify your selection in terms of the features and advantages of the selected fan type.
(5 Marks)

Question 3

(a) Based on your calculation in Question 1 or assumption in Question 2, sketch your proposed piping layout complete with pipe dimension and water flow rate in a single line diagram for both chilled water and condenser water systems for the whole building.

(10 Marks)

(b) Show typical connection for

i. Air handling unit

(5 Marks)

ii. Condenser water pump

(5 Marks)

Question 4

Based on your proposed ducting and piping layout in Question 2 and 3,

- (a) Calculate the total external static pressure for the air conditioning ducting system.
(8 Marks)
- (b) Select the correct AHU model from the catalogue provided based on your calculation above.
(2 Marks)
- (c) Calculate the total head for the chilled water system.
(8 Marks)
- (d) Select the correct chilled water pump from the catalogue provided based on your calculation above.
(2 Marks)

Question 5

During testing and commissioning of the air handling unit for office building, your technicians have collected data for one (1) of the AHUs installed at the 2nd floor, shown in Appendix 4 and 5 and submitted to you as the HVAC engineer. Based on the test report,

(a) fill in the spaces labeled with (a), (b), (c), (d) and (e).

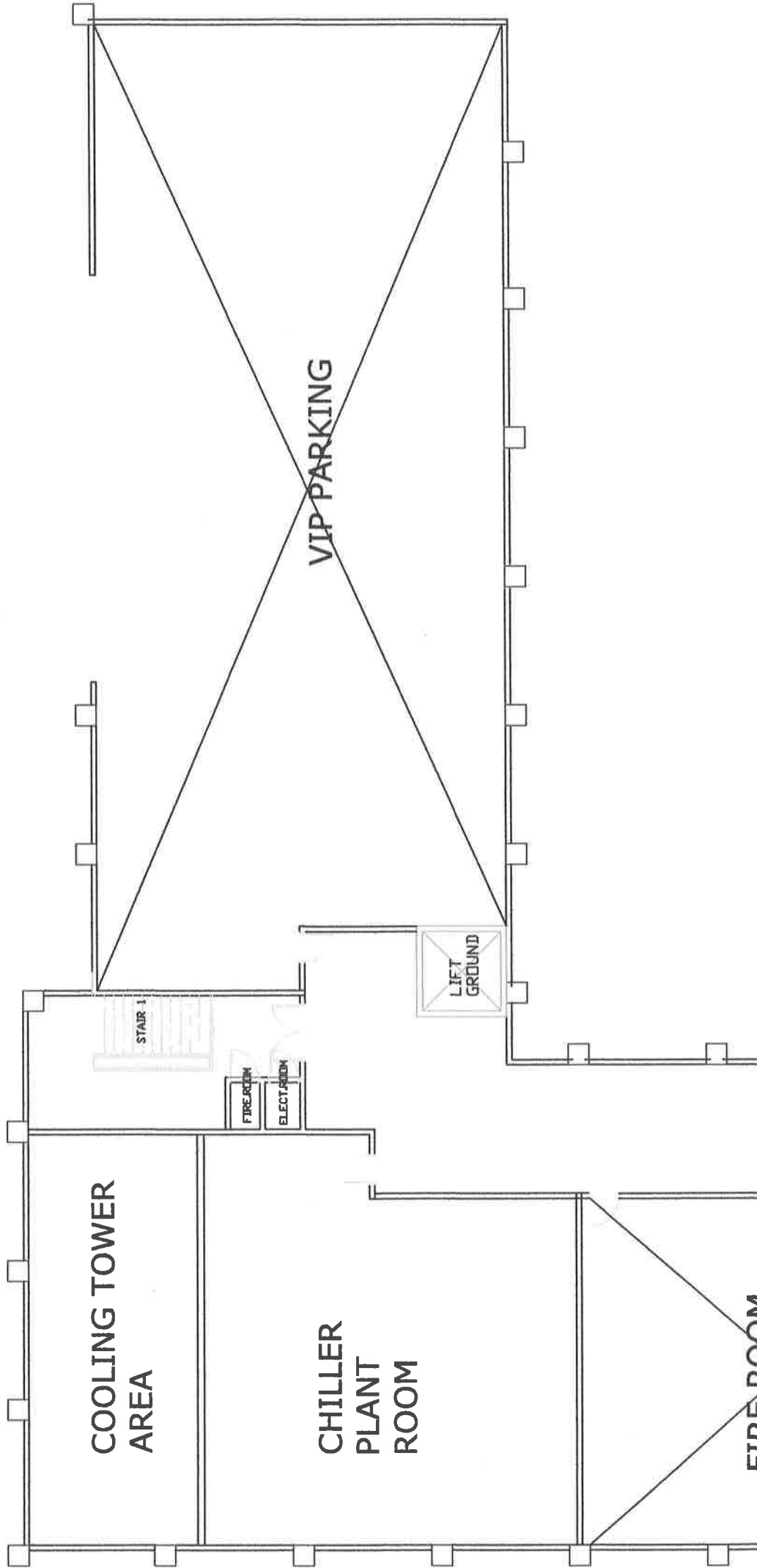
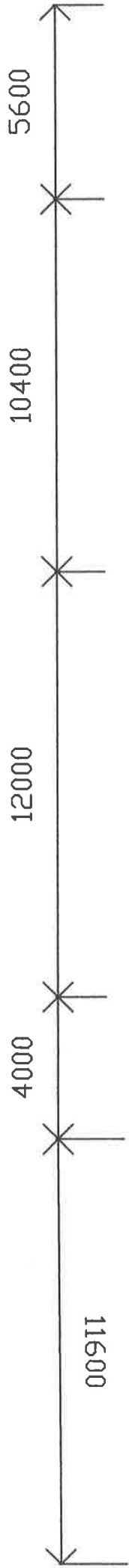
(5 Marks)

(b) analyse the data and propose the remedy work, if any.

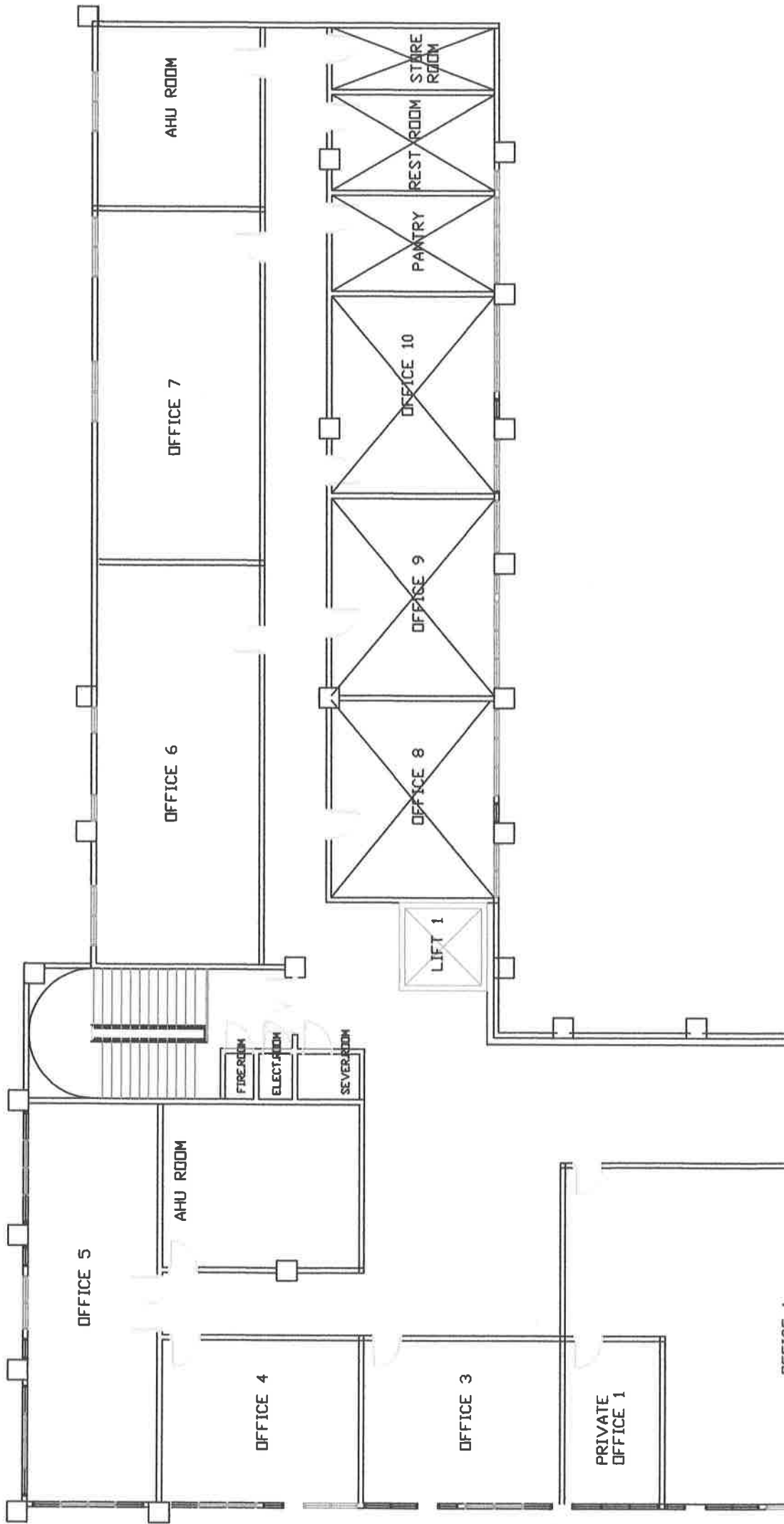
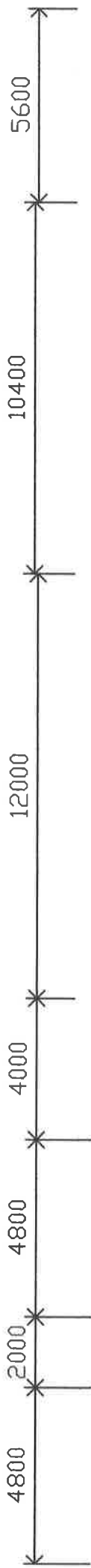
(15 Marks)

END OF QUESTION


**APPENDIX 1: OFFICE GROUND FLOOR
(TO BE RETURNED)**



APPENDIX 2: OFFICE - TYPICAL FLOOR 1st
 FLOOR TO 8TH FLOOR (TO BE RETURNED)



Appendix 3



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COOLING LOAD

Table 1: Design Cooling Load Check Figure:

Applications	Occupancy Sq Ft / Person			Lighting Watts / Sq Ft			Fresh CFM / Person			Air CFM / Sq Ft			Room Sensible Btu/h / Sq Ft			Room Total Btu/h / Sq Ft			Grand Total Btu/h / Sq Ft			Refrigeration Sq Ft / Ton*			Supply Air CFM / Sq Ft					
	Lo	Avg	Hi	Lo	Avg	Hi	Lo	Avg	Hi	Lo	Avg	Hi	Lo	Avg	Hi	Lo	Avg	Hi	Lo	Avg	Hi	Lo	Avg	Hi	Lo	Avg	Hi	Lo	Avg	Hi
Apartments (Flats)	150	100	50	1.0	2.0	4.0	25	35	40	.25	.35	.50	15	25	45	20	30	50	30	40	60	40	60	120	200	300	400	75	125	175
Auditoriums, Theaters	15	10	5	1.0	2.0	3.0	5.0	15	30	50	1.5	2.5	25	35	50	45	55	70	60	80	100	80	120	200	150	100	100	1.25	1.5	2.5
Educational Facilities																														
Classrooms	30	25	20	2.0	4.0	6.0	5.0	7.5	10	.20	.30	.40	25	40	55	35	50	65	45	60	80	60	80	275	200	150	100	1.0	1.4	1.8
Laboratories	75	80	40	2.0	3.0	6.0	10	15	20	.20	.40	.60	30	40	55	35	45	65	45	65	75	60	75	275	200	160	100	1.0	1.4	1.8
Cafeteria-Coffee House	20	15	10	1.5	3.0	4.5	7.5	10	15	.40	.60	.80	25	45	65	35	60	75	55	80	110	225	150	110	1.0	1.5	2.1			
Factories																														
Public Areas	50	35	25	3.0	4.5	6.0	5.0	10	15	.10	.25	.50	20	45	75	30	60	85	50	80	130	240	150	90	1.0	2.25	3.0			
Light Manufacturing	200	150	100	9.0	10.0	12.0	5.0	10	15	.05	.10	.15	35	55	75	40	60	80	60	80	120	200	150	100	1.5	2.75	3.0			
Heavy Manufacturing**	300	250	200	15.0	15.0	60.0	5.0	10	15	.03	.08	.10	75	115	155	80	120	160	120	150	200	100	80	60	3.0	4.0	6.5			
Heavy Manufacturing**	20	15	10	1.0	1.5	2.0	5.0	10	15	.50	.75	1.0	30	35	50	40	50	70	60	85	120	200	150	100	1.0	1.1	1.4			
Hospitals																														
Patient Rooms†	100	60	40	1.0	2.0	3.0	75	90	100	.75	1.8	2.5	15	35	50	20	40	55	60	80	120	165	200	100	75	75	12	1.7		
Public Areas	130	100	65	2.0	3.0	4.0	10	20	30	.25	.75	1.5	10	15	35	15	20	40	30	45	100	400	275	120	75	75	1.2	1.7		
Laboratories	150	100	50	2.0	5.0	10.0	20	30	50	.20	.50	1.0	25	45	60	30	55	70	45	70	100	275	175	120	100	100	1.5	2.0		
Libraries	150	100	50	2.0	4.0	6.0	5.0	7.5	10	.10	.20	.30	20	30	50	25	35	55	30	45	70	400	275	175	1.0	1.1	1.7			
Doctors Clinics	150	100	50	2.0	4.0	6.0	20	25	30	.25	.40	.60	20	40	60	25	45	65	40	60	80	300	200	150	1.0	1.4	2.0			
Offices																														
Private	150	125	100	4.0	6.0	8.0	20	25	30	.25	.40	.60	25	50	75	30	55	80	40	75	90	300	175	135	1.0	1.7	2.4			
General-Perimeter	125	100	75	4.0	6.0	8.0	10	15	20	.15	.25	.40	20	35	50	25	40	55	30	50	85	400	250	150	1.0	1.2	2.3			
General-Interior	125	100	75	4.0	6.0	8.0	10	15	20	.15	.25	.40	15	20	30	20	25	35	25	30	40	475	400	300	75	1.0	1.1			
Conference Rooms	45	30	15	4.0	6.0	8.0	20	30	50	.40	1.0	1.5	30	55	80	40	65	90	60	85	120	200	150	100	1.0	1.8	2.7			
Restaurants	25	20	15	1.5	1.7	2.0	10	15	20	.50	.75	1.0	30	35	50	40	50	70	60	85	120	200	150	100	1.25	1.5	2.0			
Shopping Centers																														
Beauty & Barber Shops	45	40	25	3.0	5.0	9.0	7.5	15	20	.20	.50	1.0	25	35	55	30	40	60	50	60	80	250	200	150	1.25	1.5	2.0			
Department Stores -Basement	40	30	20	3.0	4.0	5.0	5.0	7.5	10	.10	.20	.25	20	30	45	25	35	50	35	50	65	45	60	80	325	275	200	1.0	1.4	1.75
-Main Floor	40	25	20	4.0	6.0	9.0	5.0	7.5	10	.15	.25	.35	25	35	45	30	40	50	40	50	60	300	250	200	1.0	1.5	2.0			
-Upper Floors	80	50	40	2.0	4.0	6.0	5.0	5.0	7.5	.05	.10	.15	15	25	35	20	30	40	30	40	50	400	300	250	80	1.0	1.2			
	40	30	25	2.0	3.0	4.0	10	15	20	.25	.35	.50	30	35	45	40	45	55	60	65	75	200	180	160	1.25	1.5	2.0			
	40	25	20	3.0	4.0	6.0	5.0	7.5	10	.15	.25	.35	25	35	45	30	40	50	40	50	60	300	250	200	1.0	1.4	2.0			
	60	40	30	1.0	1.5	2.0	5.0	7.5	10	.10	.20	.30	10	15	25	15	20	30	25	30	40	500	400	300	75	1.2	1.5			
Specialty Shops	60	50	40	2.0	3.0	4.0	5.0	7.5	10	.10	.20	.30	25	35	45	30	40	50	40	50	60	300	250	200	1.2	1.4	2.0			

* Refrigeration loads are for entire application. † Includes other equipment loads expressed in watts/sq ft.
 ‡ Air quantities shown are for all-air systems. ** Air quantities for heavy manufacturing areas are based on supplementary means to remove excessive heat

Appendix 4

PROJECT :
 TITLE : TESTING AND COMMISSIONING RECORDS
 DATE : _____

SYSTEM : AIR HANDLING UNIT
 Equipment/Ref : AHU-L-1
 Location :

FAN TEST SHEET

F A N	Manufacturer	-		Serial No.	-
	Type	-		Model No.	-
	Size (MM)	-			
		Unit	Design	Test	
	Volume	CFM	12,800	(a)	
	Speed	RPM	(b)	(b)	
M O T O R	Manufacturer	TECO		Output HP	20
	Type	TEFC		Frame No.	(c)
	Serial No	-		Full Load Current	(d)
	Voltage, V	415		Running Current	12.1/12.2/12.0
			Design	Test	
	Speed	RPM	(e)	(e)	
D R I V E	Manufacturer	Bando		Fan Pulley Dia.	5.5"
	Type	V-belt		Fan Shaft Dia.	38mm
	Belt Size	C35		Motor Pulley Dia.	5"
	No. Of Belt	3		Motor Shaft Dia.	38mm
S T A R T E R	Manufacturer	Telemechanique		O/Load Range	25 - 35A
	Type	star-delta		Timer Setting	5s
	O/Load Setting	29A			
REMARKS:-					

Appendix 5

PROJECT :
 TITLE : TESTING AND COMMISSIONING RECORDS
 DATE : _____

SYSTEM : AIR HANDLING UNIT
 Equipment/Ref : AHU-L-1
 Function :

LOCATION	DESIGN VOLUME	DUCT SIZE (" X ")	DUCT AREA	DESIGN VELOCITY
	12,800 CFM	36 X 30	SQFT	M/S

VELOCITY PROFILE (facing air flow)

		LEFT ← → RIGHT									
		1	2	3	4	5	6	7	8		
A		7.3	7.4	7.5	7.6	7.4	7.4	7.6	7.3	T O P ↑ ↓ B O T T O M	
B		7.5	7.6	7.3	7.5	7.9	7.8	7.6	7.6		
C		7.3	7.8	7.9	7.5	7.6	7.7	7.5	7.3		
D		7.4	7.3	7.4	7.9	7.8	7.8	7.5	7.4		
E		7.2	7.1	7.2	7.3	7.5	7.4	7.2	7.2		
F											
G											
H											
I											
J											
K											
L											
M											
							Total Velocity (m/s)				

AVERAGE VELOCITY	TEST VOLUME	PERCENTAGE	
M/S	CFM		

REMARKS : _____