



UNIVERSITI KUALA LUMPUR
Malaysia France Institute

FINAL EXAMINATION
JANUARY 2014 SESSION

SUBJECT CODE : FCD 20303
SUBJECT TITLE : DUCTING AND PIPING SYSTEM
LEVEL : DIPLOMA
TIME / DURATION : **9.00 am - 12.00 noon**
(3 HOURS)
DATE : 26 MAY 2014

INSTRUCTIONS TO CANDIDATES

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

THERE ARE 6 PAGES OF QUESTIONS, EXCLUDING THIS PAGE.

INSTRUCTION: Answer ALL questions.

Please use the answer booklet provided.

Question 1

Appendix 1 shows an Auditorium floor layout. There are three (3) air handling unit (AHU) room in the building, and a mechanical plant room is located at the back of the stage. The air conditioning system installed for the building shall be the ducted water-cooled package (WCP) system. The ceiling height is 25 ft and the space above the ceiling is approximately 30 inches.

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

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

Question 2

Based on your calculation in Question 1 or assume the cooling capacity for the whole building is 3,420,000 Btu/hr, sketch your proposed ducting layout in a single line diagram complete with duct dimensions and air diffusers/grilles location for the whole floor for its

- (a) Air conditioning system (10 Marks)
- (b) 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 in a single line diagram for the condenser water system.

(10 Marks)

(b) Show typical connection for

i. Water-cooled package unit (WCPU)

(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 for each ducted WCPU.
(8 Marks)
- (b) Select the correct WCPU model from the catalogue provided based on your calculation above.
(2 Marks)
- (c) Calculate the total head for the condenser water pump.
(8 Marks)
- (d) Select the correct condenser water pump from the catalogue provided based on your calculation above.
(2 Marks)

Question 5

During testing and commissioning of the WCPU installed in the auditorium, your technicians have collected the following data and submitted to you as the HVAC engineer. Based on the test report,

(a) Fill in the spaces labeled with a, b and c.

(6 Marks)

(b) Analyse and comment on the system.

(14 Marks)

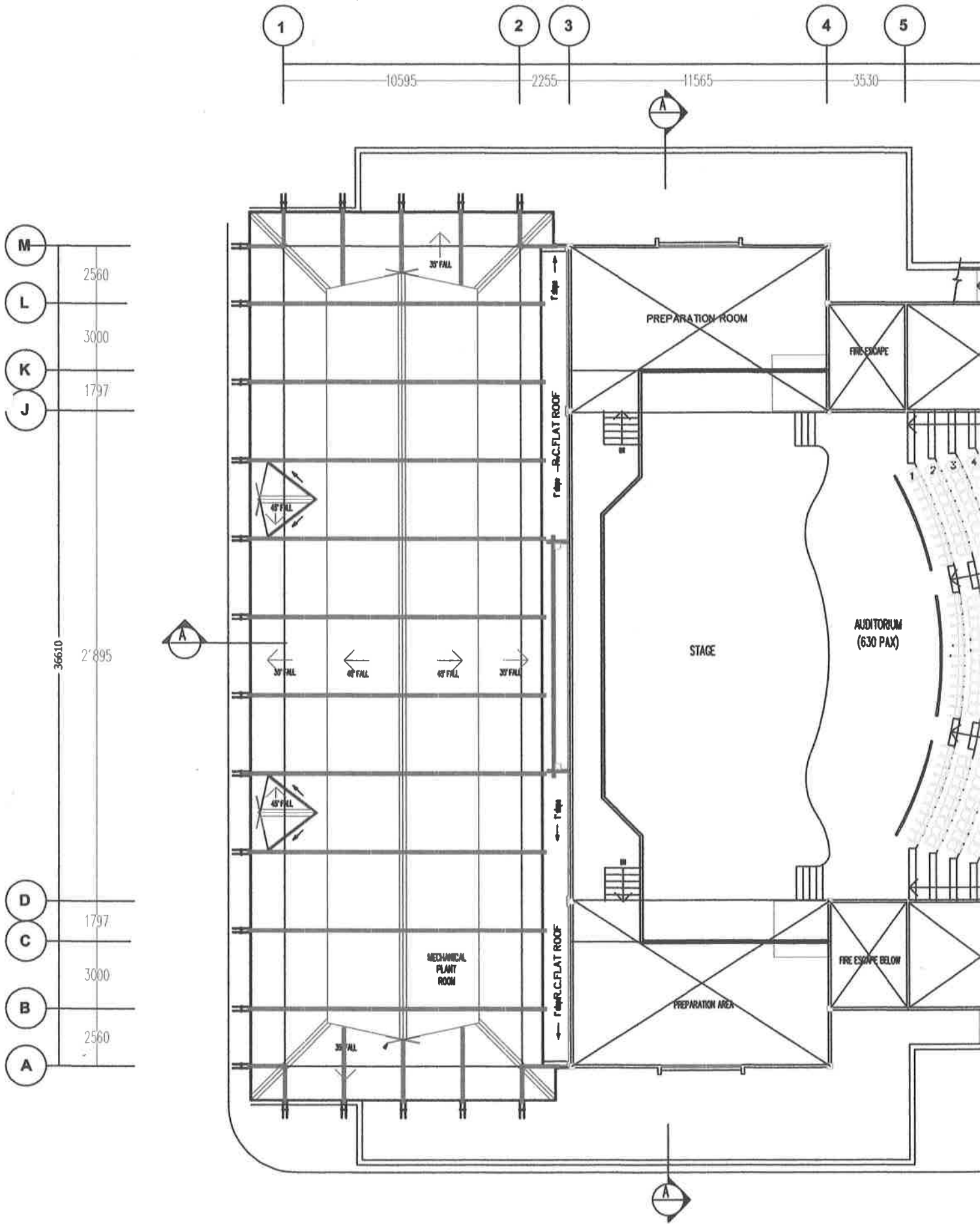
TITLE : TESTING AND COMMISSIONING RECORDS
 SYSTEM : WATER-COOLED PACKAGE UNIT
 Equipment/Ref :
 Manufacturer :
 Model / Serial :
 Location :

WATER-COOLED PACKAGE UNIT TEST SHEET


ITEM	DESCRIPTION	DESIGN	ACTUAL	REMARK
1	Fan Type	Centrifugal	Centrifugal	
2	Air Volume (L/s)	18,500	15,800	
3	Motor HP / RPM	20/1455	20/1455	
4	Motor Type	TEFC	TEFC	
5	Running Amp. / Ampere	25.9	22.1	
6	Full Load Amp. / Ampere	a	a	
7	Frame No.	b	b	
8	Volts / Phase / Hertz	415/3/50	415/3/50	
9	Blower Pulley, Inch	5.5	5.5	
10	Motor Pulley, Inch	4.5	4.5	
11	Belt Size / Qty	30/2	30/2	
12	Blower RPM	c	c	
ITEM	DESCRIPTION	YES	NO	REMARK
11	Check Primary Filter	/		
12	Check No Vibration Noise	/		
13	Check Thermostat	/		
14	Check Cooling Coil & Drainage	/		
15	Check BCMS Interlocking	/		

END OF QUESTION

APPENDIX 1: AUDITORIUM (TO BE RETURNED)



Appendix 2



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COOLING LOAD

Table 1: Design Cooling Load Check Figure:

DESIGN AND COOLING LOAD CHECK FIGURES																														
Applications	Occupancy Sq Ft / Person			Lighting Watts / Sq Ft			Fresh CFM / Person			Air CFM / Sq Ft			Room Sensible Btuh / Sq Ft			Room Total Btuh / Sq Ft			Grand Total Btuh / 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			
Apartments (Flats) Auditoriums, Theaters	150	100	50	1.0	2.0	4.0	25	35	40	25	35	50	15	25	35	45	20	30	50	30	40	60	40	50	300	200	100	75	1.25	1.75
	15	10	5	1.0	2.0	3.0	5.0	15	30	15	25	25	25	35	50	45	45	55	70	60	80	120	200	150	100	1.25	1.5	2.5		
Educational Facilities Classrooms Laboratories Cafeteria-Coffee House	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	100	275	200	150	1.0	1.4	1.8
	75	60	40	2.0	3.0	6.0	10	15	20	20	40	60	30	40	55	35	45	65	45	60	75	75	275	200	160	1.0	1.4	1.8		
	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 Light Manufacturing Heavy Manufacturing**	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	130	240	150	90	1.0	2.25	3.0		
	200	150	100	9.0†	10.0†	12.0†	5.0	10	15	05	10	15	35	55	75	40	60	80	60	80	100	120	200	150	100	1.5	2.75	3.0		
	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	5.5			
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† Public Areas Laboratories Libraries Doctors Clinics	100	60	40	1.0	2.0	3.0	75	90	100	75	1.8	2.5	15	35	50	20	40	55	60	120	165	200	100	75	75	1.2	1.7			
	130	100	85	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	1.2	1.7			
	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	1.0	1.5	2.0			
	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			
	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 General-Perimeter General-Interior Conference Rooms Restaurants	150	125	100	4.0	6.0	8.0	20	25	30	25	40	60	25	50	75	30	55	80	40	75	100	80	175	135	1.0	1.7	2.4			
	125	100	75	4.0	6.0	8.0	10	15	20	15	25	40	15	20	30	20	25	35	25	30	40	175	400	300	1.0	1.2	2.3			
	125	100	75	4.0	6.0	8.0	10	15	20	15	25	40	15	20	30	20	25	35	25	30	40	175	400	300	75	1.0	1.1			
	45	30	15	4.0	8.0	8.0	20	30	50	40	1.0	1.5	30	55	80	40	85	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 Department Stores -Basement -Main Floor -Upper Floors	45	40	25	3.0†	5.0†	9.0†	7.5	15	20	20	50	1.0	25	35	55	30	40	60	50	80	120	250	200	150	1.25	1.5	2.0			
	40	30	20	3.0	4.0	5.0	5.0	7.5	10	10	20	25	20	30	45	25	35	50	35	45	60	325	275	200	1.0	1.4	1.75			
	40	25	20	4.0	6.0†	9.0†	5.0	7.5	10	15	25	35	25	35	55	30	40	50	40	50	60	300	250	200	1.0	1.5	2.0			
	80	50	40	2.0	4.0	6.0†	5.0	7.5	10	15	25	35	25	35	55	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	45	60	45	55	65	75	80	90	200	180	160	1.25	1.5	2.0			
Specialty Shops	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			
	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