

CLIENT.



**FOREIGN FACULTY  
HOSTEL**

DRAWINGS STATUS.

***TENDER DRAWINGS***

MARCH - 2021

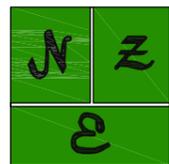
PROJECT

HVAC SYSTEM FOR FOREIGN HOSTEL  
SUKKUR IBA UNIVERSITY.

PROJECT NO.

IBA(FFH)-2021-10

M&P CONSULTANT.



**N.Z ENGINEERING**

PLOT NO. 70C , M-01 JAMI  
COMMERCIAL , STREET 9  
PHASE-VII, D.H.A KARACHI.  
Tel: +92 213 5314095  
Email: [info@nzengineers.net](mailto:info@nzengineers.net)

ARCHITECT

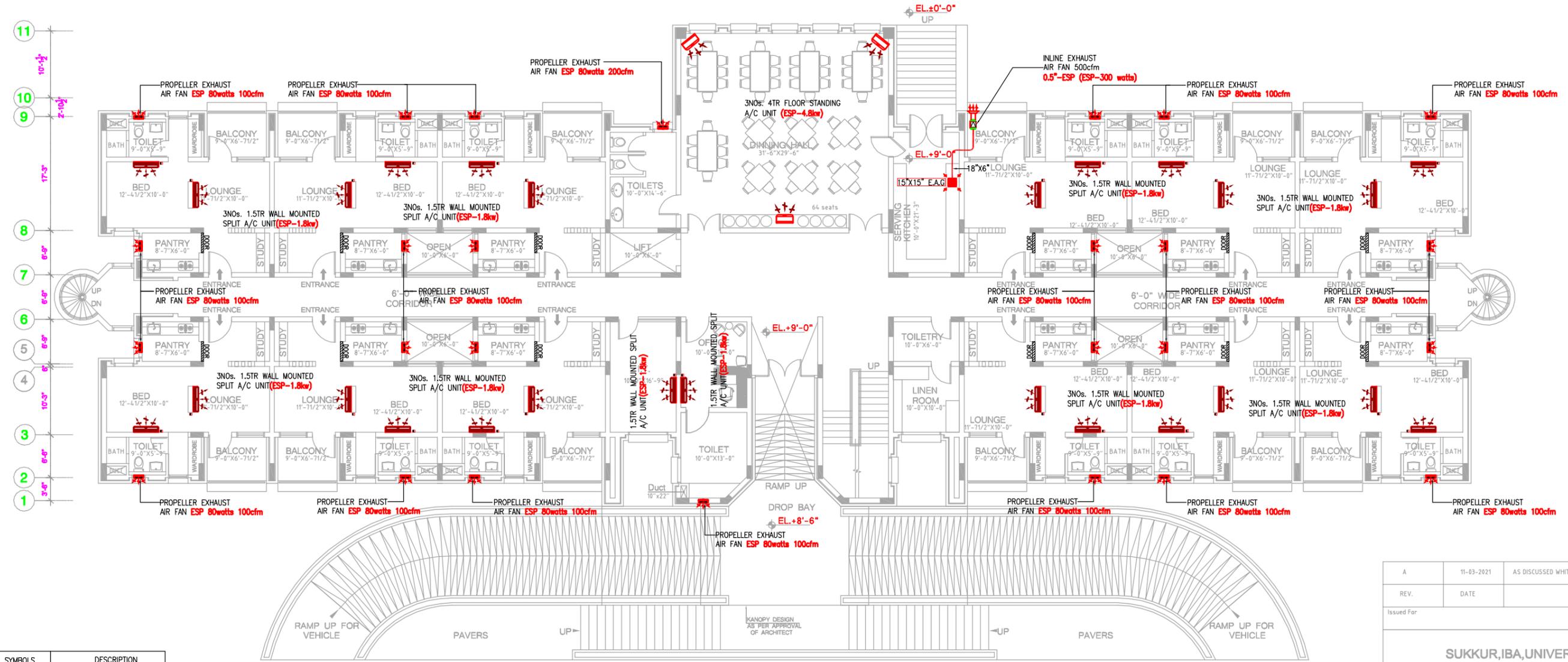
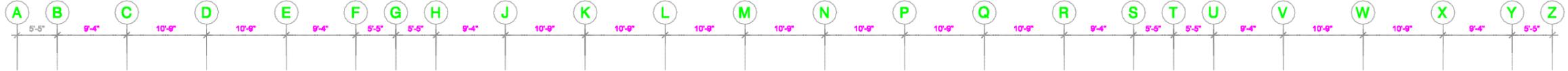
**Habib Fida Ali**

4 CH. KHALIQUZZAMAN ROAD, KARACHI 75530  
TEL: 5661683,5661684, FAX:92-21-5686891

## LIST OF DRAWINGS

S. NO	DRAWING NOS.	DESCRIPTION	SCALE	DATE
01	H-01	LAYOUT OF PROPOSED A/C UNIT PLACEMENT SYSTEM AT GROUND FLOOR	AS SHOWN	MARCH - 2021
02	H-02	LAYOUT OF PROPOSED A/C UNIT PLACEMENT SYSTEM AT FIRST FLOOR	AS SHOWN	MARCH - 2021
03	H-03	LAYOUT OF PROPOSED A/C UNIT PLACEMENT SYSTEM AT SECOND FLOOR	AS SHOWN	MARCH - 2021
04	H-04	LAYOUT OF PROPOSED A/C DRAIN & REFRIGERANT PIPING SYSTEM AT GROUND FLOOR	AS SHOWN	MARCH - 2021
05	H-05	LAYOUT OF PROPOSED A/C DRAIN & REFRIGERANT PIPING SYSTEM AT FIRST FLOOR	AS SHOWN	MARCH - 2021
06	H-06	LAYOUT OF PROPOSED A/C DRAIN/REFRIGERANT PIPING & OUTDOOR PLACEMENT SYSTEM AT SECOND FLOOR	AS SHOWN	MARCH - 2021
07	H-07	HVAC GENERAL DETAIL	AS SHOWN	MARCH - 2021
08	H-08	HVAC GENERAL NOTES	AS SHOWN	MARCH - 2021

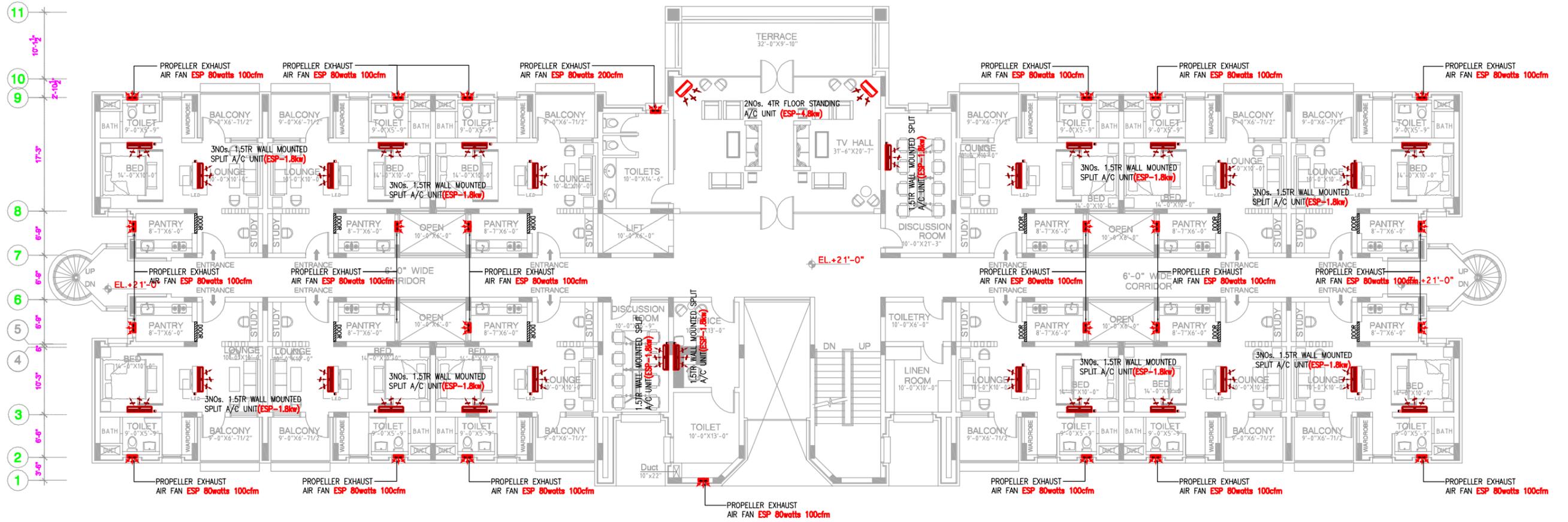
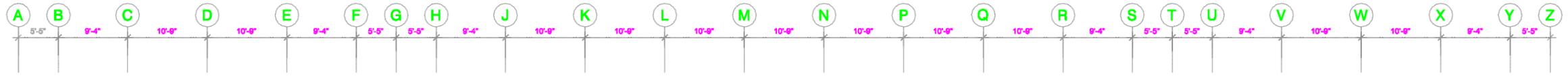
REV.	DATE	AS DISCUSSED WITH CLIENT
Issued For		
<b>SUKKUR, IBA, UNIVERSITY</b>		
DRAWING TITLE		<b>FOREIGN FACULTY HOSTEL</b>
LIST OF DRAWINGS		
ARCHITECT	Scale 1/16" = 1'-0"	
<b>HABIB FIDA ALI</b> A/C Drainage Specialist Sukkur-I.B.A. University, Sukkur, Sindh	Date	MARCH, 2021
<b>M&amp;P CONSULTANT</b> <b>N.Z ENGINEERING</b> PLOT NO. 102, M-61 JAMSHEDPUR CHANDIGARH, INDIA PHONE NO. 91-172-2610000 FAX NO. 91-172-2610001 Email: hfi@nzengineering.com	Drawn	MTF
DOCUMENT TYPE	Checked	ZD
DRAWING STATUS	Drawing No	H-00
<b>TENDER DRAWING</b>		



SYMBOLS	DESCRIPTION
	WALL MOUNTED SPLIT A/C UNIT PROPOSED
	A/C OUTDOOR UNIT
	REFRIGERANT PIPE
	DRAIN PIPE
	PROPELLER EXHAUST AIR FAN
	INLINE EXHAUST AIR FAN
	EXHAUST AIR GRILL

SNOs.	DIS.
1.5TR	WALL MOUNTED SPLIT A/C UNIT 1.8KW/220V/1PH/30MZ
2.0TR	WALL MOUNTED SPLIT A/C UNIT 2.4KW/220V/1PH/30MZ
4.0TR	FLOOR STANDING A/C UNIT 4.8KW/220V/3PH/50MZ

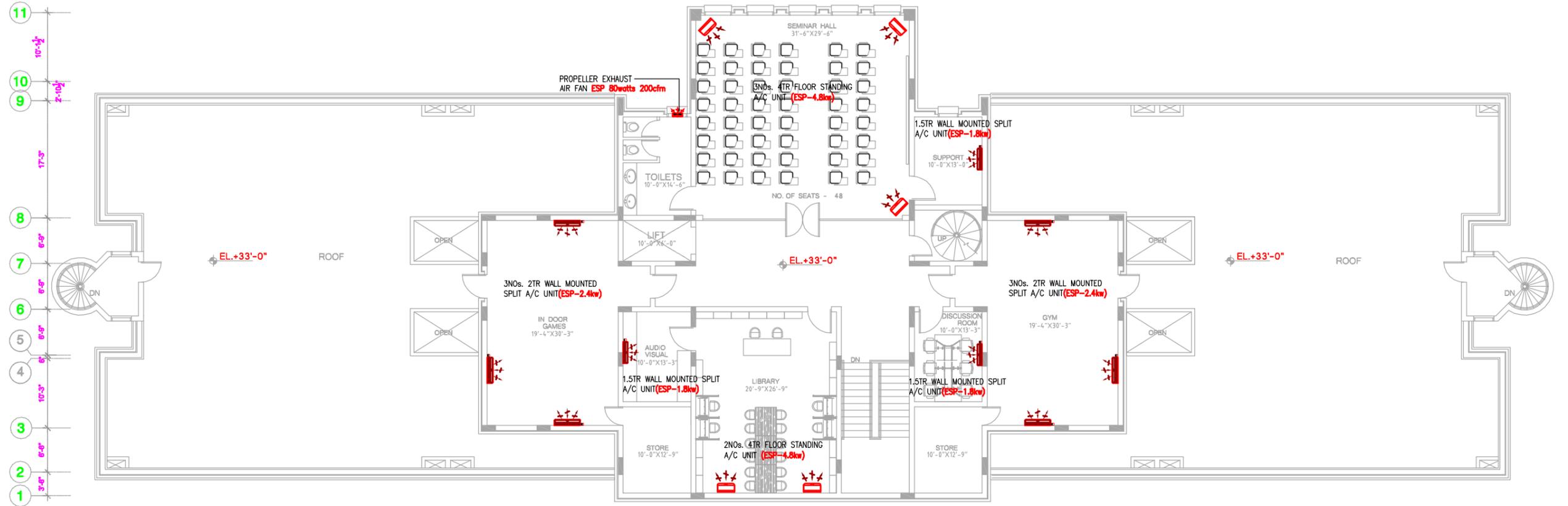
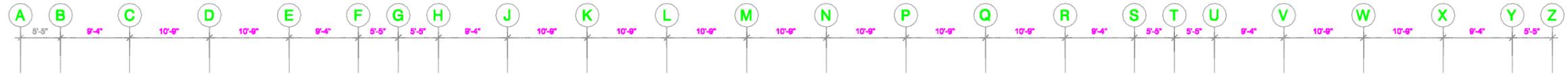
A	11-03-2021	AS DISCUSSED WHIT CLIENT
REV.	DATE	
Issued For		
<b>SUKKUR, IBA, UNIVERSITY</b>		
DRAWING TITLE		FOREIGN FACULTY HOSTEL
<b>LAYOUT OF PROPOSED A/C SYSTEM AT GROUND FLOOR PLAN</b>		
ARCHITECT	HABIB FIDA ALI 4-D, Malir Cantonment Road Sector 11/11, Phase 1, Malir, Karachi-75100	Scale 1/16" = 1'-0"
M&P CONSULTANT	<b>N.Z. ENGINEERING</b> PLOT NO. 100, 44-A, LEAS COMMERCIAL AREA, PHASE 1 HABIBTOWN, DHA KARACHI 10-103, 103/103/103/103 Karachi-75100	Date MARCH, 2021
DOCUMENT TYPE	TENDER DRAWING	Drawn MTF
DRAWING STATUS	TENDER DRAWING	Checked ZD
		Drawing No H-01



SYMBOLS	DESCRIPTION
	WALL MOUNTED SPLIT A/C UNIT PROPOSED
	A/C OUTDOOR UNIT
	REFRIGERANT PIPE
	DRAIN PIPE
	PROPELLER EXHAUST AIR FAN
	INLINE EXHAUST AIR FAN
	EXHAUST AIR GRILL

SNOs.	DIS.
1.5TR	WALL MOUNTED SPLIT A/C UNIT 1.8KW/220V/1PH/30MZ
2.0TR	WALL MOUNTED SPLIT A/C UNIT 2.4KW/220V/1PH/30MZ
4.0TR	FLOOR STANDING A/C UNIT 4.8KW/220V/3PH/50MZ

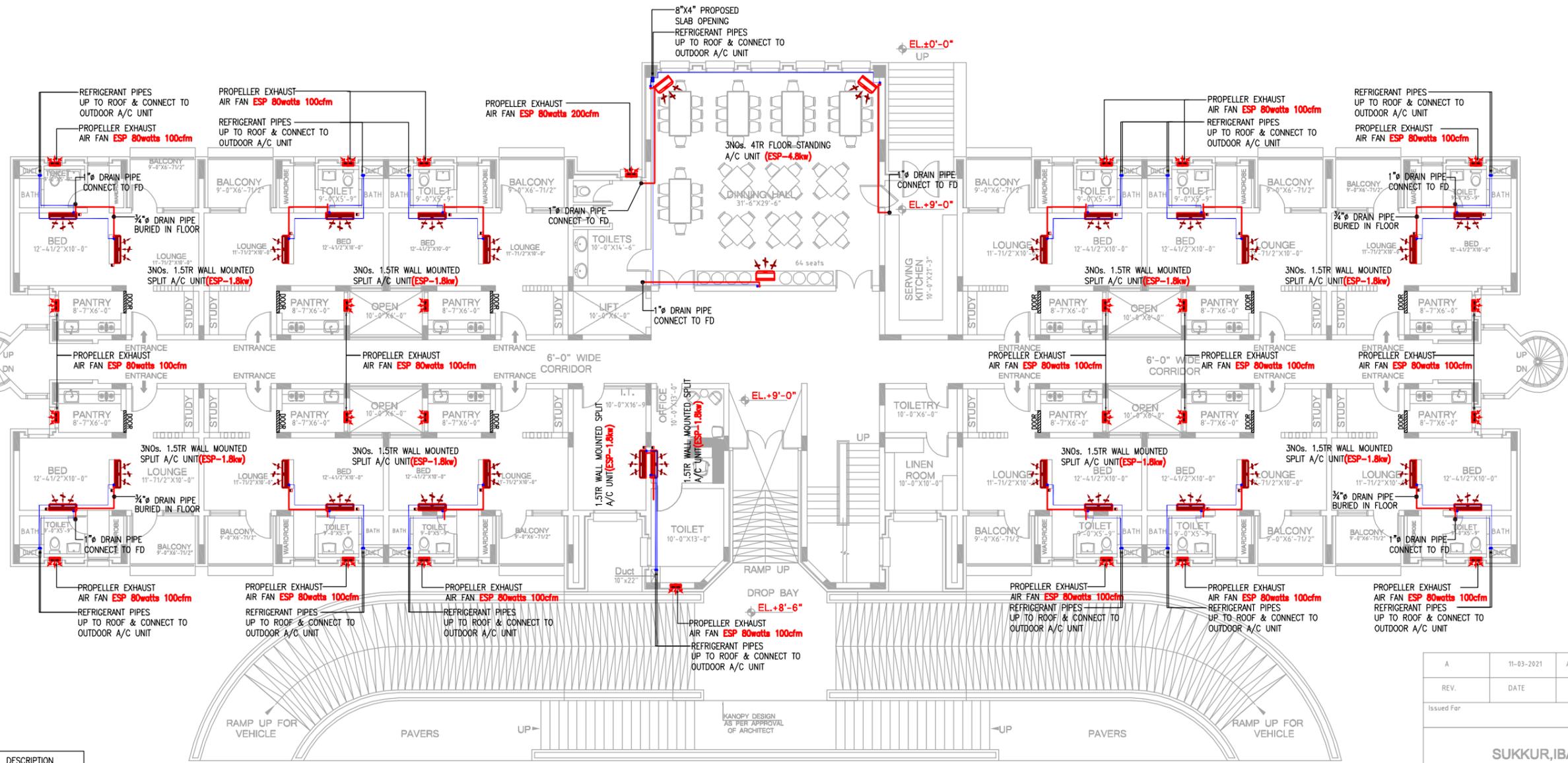
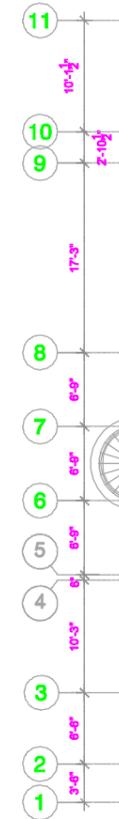
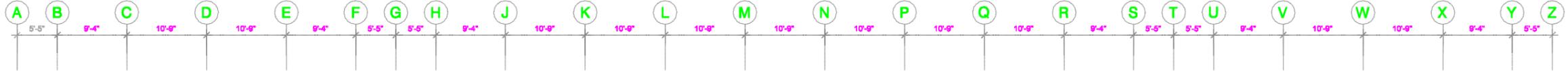
A	11-03-2021	AS DISCUSSED WHIT CLIENT
REV.	DATE	
Issued For		
<b>SUKKUR, IBA, UNIVERSITY</b>		
DRAWING TITLE		FOREIGN FACULTY HOSTEL
<b>LAYOUT OF PROPOSED A/C SYSTEM AT FIRST FLOOR PLAN</b>		
ARCHITECT	HABIB FIDA ALI 4-D, Bahadurabad Road F-7/47, Sector 7, F-7, Islamabad	Scale 1/16" = 1'-0"
M&P CONSULTANT	<b>N.Z. ENGINEERING</b> PLOT NO. 100, 44-11 EAST CHAKRALAKH, PHASE 9 HABIBYIA, D.I.K. KARACHI Tel: 3473 2144 Email: nze@nze.com.pk	Date MARCH, 2021
DOCUMENT TYPE		Drawn MTF
DRAWING STATUS		Checked ZD
		Drawing No H-02
<b>TENDER DRAWING</b>		



SYMBOLS	DESCRIPTION
	WALL MOUNTED SPLIT A/C UNIT PROPOSED
	A/C OUTDOOR UNIT
	REFRIGERANT PIPE
	DRAIN PIPE
	PROPELLER EXHAUST AIR FAN
	INLINE EXHAUST AIR FAN
	EXHAUST AIR GRILL

SNOs.	DIS.
1.5TR	WALL MOUNTED SPLIT A/C UNIT 1.8KW/220V/1PH/30MZ
2.0TR	WALL MOUNTED SPLIT A/C UNIT 2.4KW/220V/1PH/30MZ
4.0TR	FLOOR STANDING A/C UNIT 4.8KW/220V/3PH/50MZ

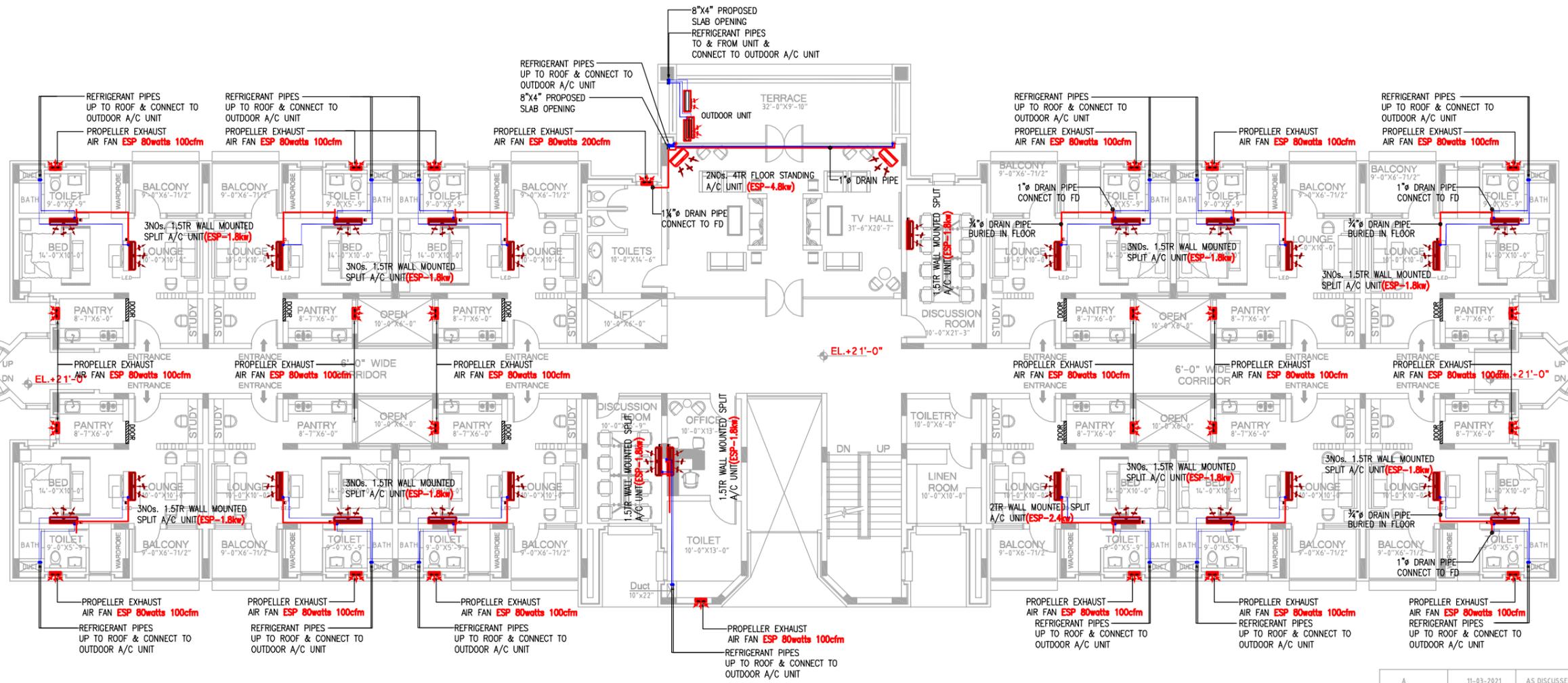
A	11-03-2021	AS DISCUSSED WITH CLIENT
REV.	DATE	
Issued For		
<b>SUKKUR, IBA, UNIVERSITY</b>		
DRAWING TITLE		FOREIGN FACULTY HOSTEL
<b>LAYOUT OF PROPOSED A/C SYSTEM AT SECOND FLOOR PLAN</b>		
ARCHITECT	HABIB FIDA ALI 4-D, Habibiyyan Road Sector 10/11, Phase 10, Sukkur, Sindh, Pakistan	Scale 1/16" = 1'-0"
M&P CONSULTANT	<b>N.Z. ENGINEERING</b> PLOT NO. 102, 44-45, 46-47 COMMERCIAL, PHASE 9 HABIBYLA, D.I. KARACHI Tel: 9923 22166 Email: nze@nze.com.pk	Date MARCH, 2021
DOCUMENT TYPE		Drawn MTF
DRAWING STATUS		Checked ZD
		Drawing No H-03
<b>TENDER DRAWING</b>		



SYMBOLS	DESCRIPTION
	WALL MOUNTED SPLIT A/C UNIT PROPOSED
	A/C OUTDOOR UNIT
	REFRIGERANT PIPE
	DRAIN PIPE
	PROPELLER EXHAUST AIR FAN
	INLINE EXHAUST AIR FAN
	EXHAUST AIR GRILL

SNOs.	DIS.
1.5TR	WALL MOUNTED SPLIT A/C UNIT 1.8KW/220V/1PH/30MZ
2.0TR	WALL MOUNTED SPLIT A/C UNIT 2.4KW/220V/1PH/30MZ
4.0TR	FLOOR STANDING A/C UNIT 4.8KW/220V/3PH/50MZ

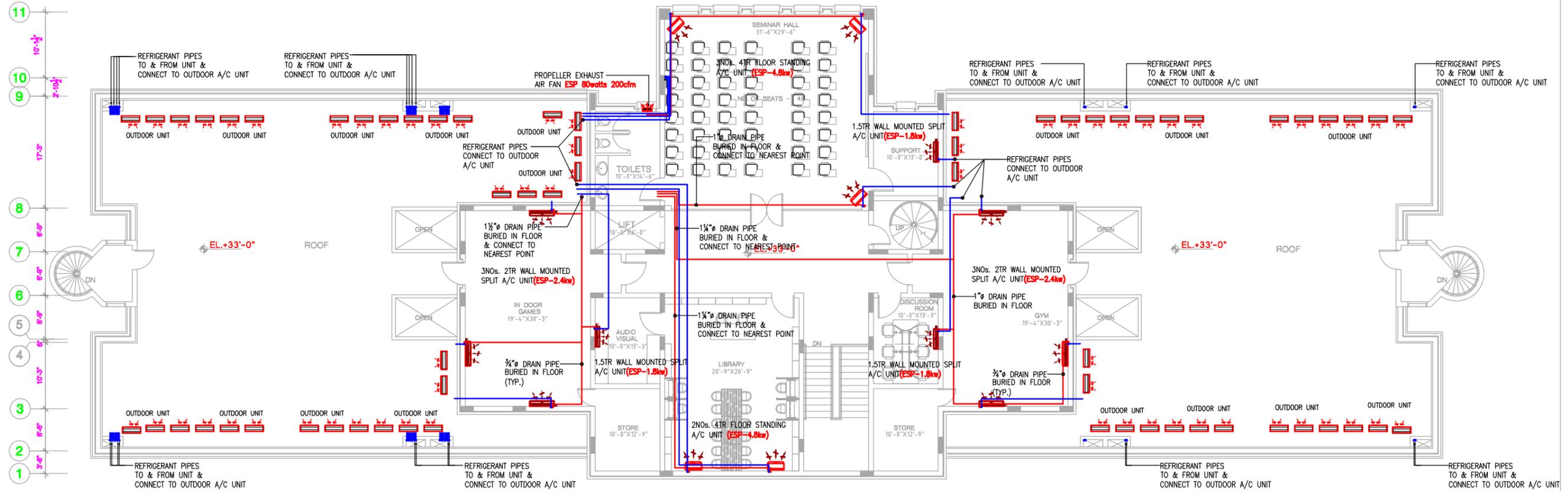
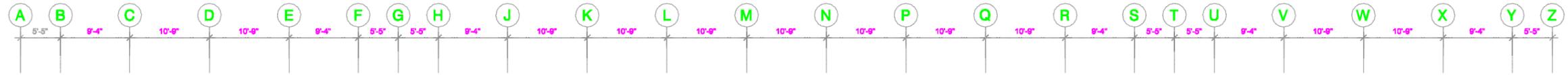
A	11-03-2021	AS DISCUSSED WHIT CLIENT
REV.	DATE	
Issued For		
<b>SUKKUR, IBA, UNIVERSITY</b>		
DRAWING TITLE		FOREIGN FACULTY HOSTEL
<b>LAYOUT OF PROPOSED A/C DRAIN &amp; REFRIGERANT PIPING SYSTEM AT GROUND FLOOR PLAN</b>		
ARCHITECT	HABIB FIDA ALI 4-D, Bahadurabad Road P.O. Box 101, Faisalabad, Pakistan	Scale 1/16" = 1'-0"
M&P CONSULTANT	<b>N.Z ENGINEERING</b> PLOT NO. 10, 44, 45, 46 CHAK 10B, DISTRICT Faisalabad RAHWAL, D.S.A. KARACHI Tel: 9927812816 Email: nze@nzengeering.com	Date MARCH, 2021
DOCUMENT TYPE	TENDER DRAWING	Drawn MTF
DRAWING STATUS	TENDER DRAWING	Checked ZD
		Drawing No H-04



SYMBOLS	DESCRIPTION
	WALL MOUNTED SPLIT A/C UNIT PROPOSED
	A/C OUTDOOR UNIT
	REFRIGERANT PIPE
	DRAIN PIPE
	PROPELLER EXHAUST AIR FAN
	INLINE EXHAUST AIR FAN
	EXHAUST AIR GRILL

SNOs.	DIS.
1.5TR	WALL MOUNTED SPLIT A/C UNIT 1.8KW/220V/1PH/30MZ
2.0TR	WALL MOUNTED SPLIT A/C UNIT 2.4KW/220V/1PH/30MZ
4.0TR	FLOOR STANDING A/C UNIT 4.8KW/220V/3PH/50MZ

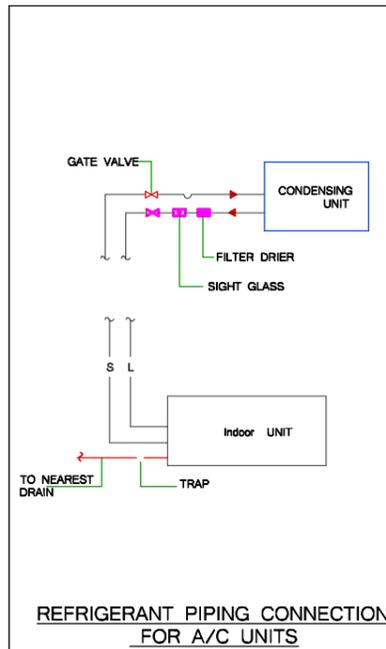
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REV.	DATE	
Issued For		
<b>SUKKUR, IBA, UNIVERSITY</b>		
DRAWING TITLE		FOREIGN FACULTY HOSTEL
<b>LAYOUT OF PROPOSED A/C DRAIN &amp; REFRIGERANT PIPING SYSTEM AT FIRST FLOOR PLAN</b>		
ARCHITECT	HABIB FIDA ALI	Scale 1/16" = 1'-0"
M&P CONSULTANT	<b>N.Z ENGINEERING</b>	Date MARCH, 2021
DOCUMENT TYPE		Drawn MTF
DRAWING STATUS		Checked ZD
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<b>TENDER DRAWING</b>		



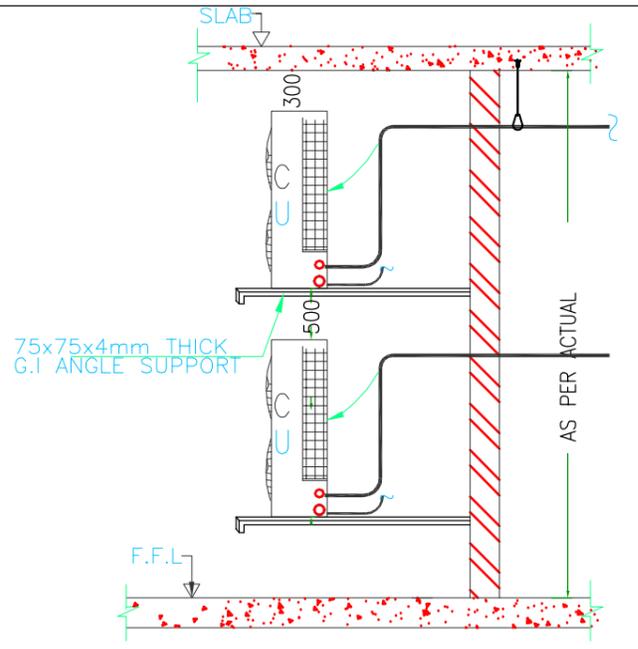
SYMBOLS	DESCRIPTION
	WALL MOUNTED SPLIT A/C UNIT PROPOSED
	A/C OUTDOOR UNIT
	REFRIGERANT PIPE
	DRAIN PIPE
	PROPELLER EXHAUST AIR FAN
	INLINE EXHAUST AIR FAN
	EXHAUST AIR GRILL

SNOs.	DIS.
1.5TR	WALL MOUNTED SPLIT A/C UNIT 1.8KW/220V/1PH/30MZ
2.0TR	WALL MOUNTED SPLIT A/C UNIT 2.4KW/220V/1PH/30MZ
4.0TR	FLOOR STANDING A/C UNIT 4.8KW/220V/3PH/50MZ

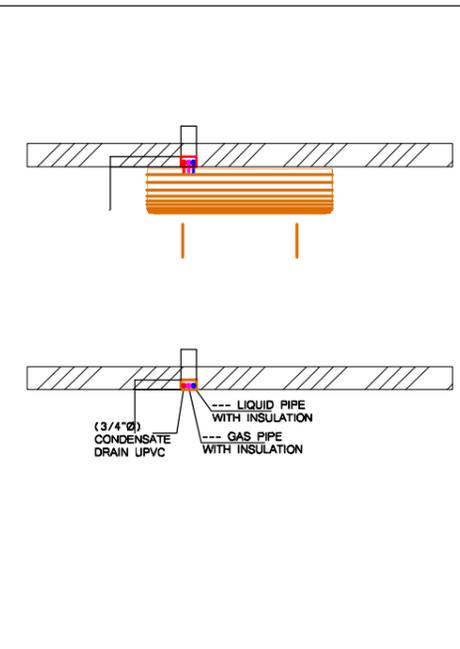
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REV.	DATE	
Issued For		
<b>SUKKUR, IBA, UNIVERSITY</b>		
DRAWING TITLE		FOREIGN FACULTY HOSTEL
<b>LAYOUT OF PROPOSED A/C DRAIN &amp; REFRIGERANT PIPING SYSTEM AT SECOND FLOOR PLAN</b>		
ARCHITECT	Scale 1/16" = 1'-0"	
HABIB FIDA ALI 4-D, Bahawalpur Road Sector 10/11 Phase 1 Sukkur, Sindh, Pakistan		Date MARCH, 2021
M&P CONSULTANT <b>N.Z. ENGINEERING</b> PLOT NO. 100, 44-11 EAST COMMERCIAL DISTRICT HABIBYIA, D.M.A. KARACHI Tel: 0373 2511000 Fax: 0373 2511001		Drawn MTF
DOCUMENT TYPE		Checked ZD
DRAWING STATUS		Drawing No H-06
<b>TENDER DRAWING</b>		



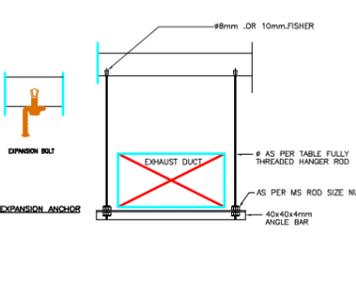
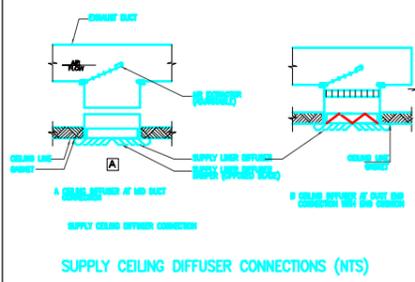
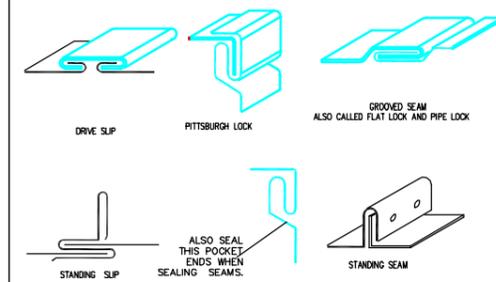
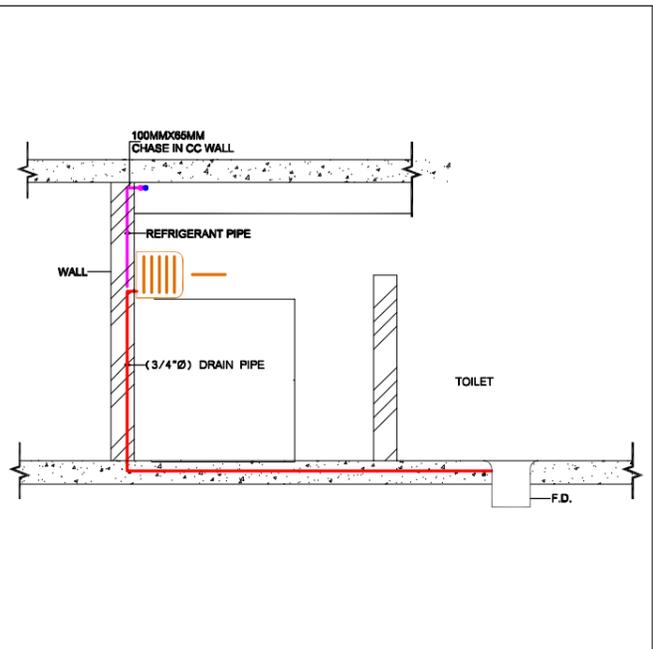
REFRIGERANT PIPING CONNECTION FOR A/C UNITS



TYPICAL INSALLATION DETAIL OF CONDENSING UNIT IN UTILITY CLOSET



PLACEMENT OF A/C UNITS

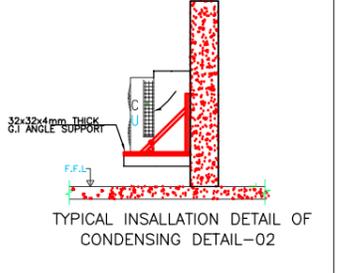
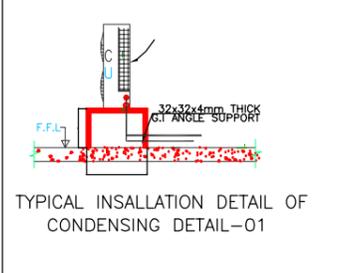
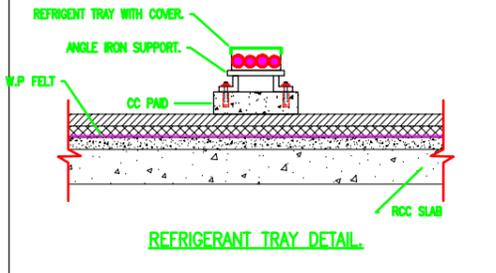
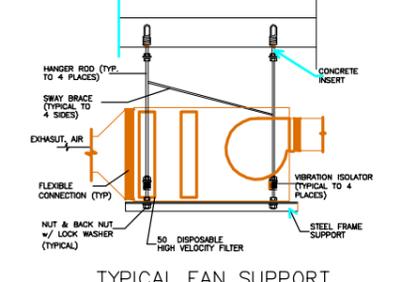


**SHEET METAL THICKNESS AND CONSTRUCTION FOR LOW VELOCITY RECTANGULAR DUCT WORK**

DUCT SIZE (INNER DIA)	THICKNESS OF SHEET	THICKNESS JOINT	SEAM TYPE	CONSTRUCTION
UP TO 24	0.75	0.75	DOUBLE RIVET OR WELD	STANDARD
UP TO 36	0.875	0.875	DOUBLE RIVET OR WELD	STANDARD
UP TO 48	1.0	1.0	DOUBLE RIVET OR WELD	STANDARD
UP TO 60	1.125	1.125	DOUBLE RIVET OR WELD	STANDARD
UP TO 72	1.25	1.25	DOUBLE RIVET OR WELD	STANDARD
UP TO 84	1.375	1.375	DOUBLE RIVET OR WELD	STANDARD
UP TO 96	1.5	1.5	DOUBLE RIVET OR WELD	STANDARD
UP TO 108	1.625	1.625	DOUBLE RIVET OR WELD	STANDARD
UP TO 120	1.75	1.75	DOUBLE RIVET OR WELD	STANDARD
UP TO 132	1.875	1.875	DOUBLE RIVET OR WELD	STANDARD
UP TO 144	2.0	2.0	DOUBLE RIVET OR WELD	STANDARD
UP TO 156	2.125	2.125	DOUBLE RIVET OR WELD	STANDARD
UP TO 168	2.25	2.25	DOUBLE RIVET OR WELD	STANDARD
UP TO 180	2.375	2.375	DOUBLE RIVET OR WELD	STANDARD
UP TO 192	2.5	2.5	DOUBLE RIVET OR WELD	STANDARD
UP TO 204	2.625	2.625	DOUBLE RIVET OR WELD	STANDARD
UP TO 216	2.75	2.75	DOUBLE RIVET OR WELD	STANDARD
UP TO 228	2.875	2.875	DOUBLE RIVET OR WELD	STANDARD
UP TO 240	3.0	3.0	DOUBLE RIVET OR WELD	STANDARD

**SHEET METAL THICKNESS AND CONSTRUCTION FOR HIGH VELOCITY RECTANGULAR DUCT WORK**

LONGEST DIMENSION (INCHES)	STEEL ANGLE SIZE (IN)	HANGER ROD SIZE (IN)	SPACING (IN)
UP TO 18	1.5	1/4	48
UP TO 24	2.0	3/8	48
UP TO 30	2.5	1/2	48
UP TO 36	3.0	5/8	48
UP TO 42	3.5	3/4	48
UP TO 48	4.0	7/8	48
UP TO 54	4.5	1	48
UP TO 60	5.0	1 1/8	48
UP TO 66	5.5	1 1/4	48
UP TO 72	6.0	1 1/2	48
UP TO 78	6.5	1 3/4	48
UP TO 84	7.0	1 7/8	48
UP TO 90	7.5	2	48
UP TO 96	8.0	2 1/8	48
UP TO 102	8.5	2 1/4	48
UP TO 108	9.0	2 3/8	48
UP TO 114	9.5	2 1/2	48
UP TO 120	10.0	2 5/8	48
UP TO 126	10.5	2 3/4	48
UP TO 132	11.0	2 7/8	48
UP TO 138	11.5	3	48
UP TO 144	12.0	3 1/8	48
UP TO 150	12.5	3 1/4	48
UP TO 156	13.0	3 3/8	48
UP TO 162	13.5	3 1/2	48
UP TO 168	14.0	3 5/8	48
UP TO 174	14.5	3 3/4	48
UP TO 180	15.0	3 7/8	48
UP TO 186	15.5	4	48
UP TO 192	16.0	4 1/8	48
UP TO 198	16.5	4 1/4	48
UP TO 204	17.0	4 3/8	48
UP TO 210	17.5	4 1/2	48
UP TO 216	18.0	4 5/8	48
UP TO 222	18.5	4 3/4	48
UP TO 228	19.0	4 7/8	48
UP TO 234	19.5	5	48
UP TO 240	20.0	5 1/8	48
UP TO 246	20.5	5 1/4	48
UP TO 252	21.0	5 3/8	48
UP TO 258	21.5	5 1/2	48
UP TO 264	22.0	5 5/8	48
UP TO 270	22.5	5 3/4	48
UP TO 276	23.0	5 7/8	48
UP TO 282	23.5	6	48
UP TO 288	24.0	6 1/8	48
UP TO 294	24.5	6 1/4	48
UP TO 300	25.0	6 3/8	48
UP TO 306	25.5	6 1/2	48
UP TO 312	26.0	6 5/8	48
UP TO 318	26.5	6 3/4	48
UP TO 324	27.0	6 7/8	48
UP TO 330	27.5	7	48
UP TO 336	28.0	7 1/8	48
UP TO 342	28.5	7 1/4	48
UP TO 348	29.0	7 3/8	48
UP TO 354	29.5	7 1/2	48
UP TO 360	30.0	7 5/8	48
UP TO 366	30.5	7 3/4	48
UP TO 372	31.0	7 7/8	48
UP TO 378	31.5	8	48
UP TO 384	32.0	8 1/8	48
UP TO 390	32.5	8 1/4	48
UP TO 396	33.0	8 3/8	48
UP TO 402	33.5	8 1/2	48
UP TO 408	34.0	8 5/8	48
UP TO 414	34.5	8 3/4	48
UP TO 420	35.0	8 7/8	48
UP TO 426	35.5	9	48
UP TO 432	36.0	9 1/8	48
UP TO 438	36.5	9 1/4	48
UP TO 444	37.0	9 3/8	48
UP TO 450	37.5	9 1/2	48
UP TO 456	38.0	9 5/8	48
UP TO 462	38.5	9 3/4	48
UP TO 468	39.0	9 7/8	48
UP TO 474	39.5	10	48
UP TO 480	40.0	10 1/8	48
UP TO 486	40.5	10 1/4	48
UP TO 492	41.0	10 3/8	48
UP TO 498	41.5	10 1/2	48
UP TO 504	42.0	10 5/8	48
UP TO 510	42.5	10 3/4	48
UP TO 516	43.0	10 7/8	48
UP TO 522	43.5	11	48
UP TO 528	44.0	11 1/8	48
UP TO 534	44.5	11 1/4	48
UP TO 540	45.0	11 3/8	48
UP TO 546	45.5	11 1/2	48
UP TO 552	46.0	11 5/8	48
UP TO 558	46.5	11 3/4	48
UP TO 564	47.0	11 7/8	48
UP TO 570	47.5	12	48
UP TO 576	48.0	12 1/8	48
UP TO 582	48.5	12 1/4	48
UP TO 588	49.0	12 3/8	48
UP TO 594	49.5	12 1/2	48
UP TO 600	50.0	12 5/8	48
UP TO 606	50.5	12 3/4	48
UP TO 612	51.0	12 7/8	48
UP TO 618	51.5	13	48
UP TO 624	52.0	13 1/8	48
UP TO 630	52.5	13 1/4	48
UP TO 636	53.0	13 3/8	48
UP TO 642	53.5	13 1/2	48
UP TO 648	54.0	13 5/8	48
UP TO 654	54.5	13 3/4	48
UP TO 660	55.0	13 7/8	48
UP TO 666	55.5	14	48
UP TO 672	56.0	14 1/8	48
UP TO 678	56.5	14 1/4	48
UP TO 684	57.0	14 3/8	48
UP TO 690	57.5	14 1/2	48
UP TO 696	58.0	14 5/8	48
UP TO 702	58.5	14 3/4	48
UP TO 708	59.0	14 7/8	48
UP TO 714	59.5	15	48
UP TO 720	60.0	15 1/8	48
UP TO 726	60.5	15 1/4	48
UP TO 732	61.0	15 3/8	48
UP TO 738	61.5	15 1/2	48
UP TO 744	62.0	15 5/8	48
UP TO 750	62.5	15 3/4	48
UP TO 756	63.0	15 7/8	48
UP TO 762	63.5	16	48
UP TO 768	64.0	16 1/8	48
UP TO 774	64.5	16 1/4	48
UP TO 780	65.0	16 3/8	48
UP TO 786	65.5	16 1/2	48
UP TO 792	66.0	16 5/8	48
UP TO 798	66.5	16 3/4	48
UP TO 804	67.0	16 7/8	48
UP TO 810	67.5	17	48
UP TO 816	68.0	17 1/8	48
UP TO 822	68.5	17 1/4	48
UP TO 828	69.0	17 3/8	48
UP TO 834	69.5	17 1/2	48
UP TO 840	70.0	17 5/8	48
UP TO 846	70.5	17 3/4	48
UP TO 852	71.0	17 7/8	48
UP TO 858	71.5	18	48
UP TO 864	72.0	18 1/8	48
UP TO 870	72.5	18 1/4	48
UP TO 876	73.0	18 3/8	48
UP TO 882	73.5	18 1/2	48
UP TO 888	74.0	18 5/8	48
UP TO 894	74.5	18 3/4	48
UP TO 900	75.0	18 7/8	48
UP TO 906	75.5	19	48
UP TO 912	76.0	19 1/8	48
UP TO 918	76.5	19 1/4	48
UP TO 924	77.0	19 3/8	48
UP TO 930	77.5	19 1/2	48
UP TO 936	78.0	19 5/8	48
UP TO 942	78.5	19 3/4	48
UP TO 948	79.0	19 7/8	48
UP TO 954	79.5	20	48
UP TO 960	80.0	20 1/8	48
UP TO 966	80.5	20 1/4	48
UP TO 972	81.0	20 3/8	48
UP TO 978	81.5	20 1/2	48
UP TO 984	82.0	20 5/8	48
UP TO 990	82.5	20 3/4	48
UP TO 996	83.0	20 7/8	48
UP TO 1002	83.5	21	48



A	11-03-2021	AS DISCUSSED WITH CLIENT
REV.	DATE	
Issued For		
SUKKUR, IBA, UNIVERSITY		
DRAWING TITLE		<b>FOREIGN FACULTY HOSTEL</b>
HVAC GENERAL DETAIL		
ARCHITECT	HABIB FIDA ALI 1111-1111-1111 1111-1111-1111	Scale 1/16" = 1'-0"
M&P CONSULTANT	N.Z. ENGINEERING 1111-1111-1111 1111-1111-1111 1111-1111-1111 1111-1111-1111	Date MARCH, 2021
DOCUMENT TYPE		Drawn MTF
DRAWING STATUS	TENDER DRAWING	Checked ZD
		Drawing No H-07

# GENERAL NOTES :

1. THE MECHANICAL SYSTEM SHALL CONSIST OF ALL WORKS SHOWN ON THE DRAWINGS, INCLUDING PLANS, DIAGRAMS, DETAILS ETC., AND ALL WORKS AS IDENTIFIED IN THE SPECIFICATIONS. WORK INCLUDES FURNISHINGS, INSTALLING SYSTEM INTEGRATION, TESTING, TRAINING AND WARRANTY OF THE MECHANICAL SYSTEM AS SHOWN AND SPECIFIED. PROVIDE A COMPLETE AND WORKABLE MECHANICAL SYSTEM COMPLETE WITH ALL MECHANICAL AND ELECTRICAL WORKS AS REQUIRED FOR SYSTEM OPERATION.
2. CONTRACTOR SHALL VERIFY ALL SYSTEM AND PERFORMANCE SYSTEM OPERATION AS SPECIFIED.
3. PROVIDE ALL REQUIRED ELECTRICAL POWER, MOTOR, STARTERS, LOCAL ON \ OFF CONTROL AND CONTROL INTERFACE AND CONNECTIONS AS REQUIRED FOR SYSTEM OPERATION COORDI-NATE REQUIREMENTS WITH ELECTRICAL.
4. PROVIDE ALL REQUIRED EQUIPMENT GUARDS AND STRUCTURAL SUPPORT AS RECOMMENDED BY EQUIPMENT MANUFACTURERS TO SUPPORT EQUIPMENT AND TO ASSURE SYSTEM PERFORMANCE AND SAFE OPERATION. COORDINATE PRIOR TO INSTALLATION.
5. COORDINATE LOCATION OF ALL THERMOSTATS AND ALL WALL MOUNTED EQUIPMENT. LOCATIONS AS SHOWN ON THE DRAWINGS ARE FOR REFERENCE ONLY.
6. REFERENCE THE REFLECTED CEILING PLANS FOR LOCATION OF GRILLES, REGISTERS, DIFFUSERS AND OTHER CEILING MOUNTED DEVICES. MOUNT EQUIPMENT IN CONFORMANCE WITH ARCHITECTURAL FEATURES, IN THE CENTER OF CEILING TILES, IN THE CENTER OF ROOMS OR CORRIDORS OR WHERE SHOWN ON ARCHITECTURAL DRAWINGS. WHERE EQUIPMENT IS NOT SHOWN ON ARCHITECTURAL DRAWINGS PROVIDE SHOP DRAWINGS SHOWING PROPOSED CEILING LOCATIONS.
7. LOCATION AND DETAILS OF EQUIPMENT CONNECTIONS ARE APPROXIMATE. COORDINATE THIS INFORMATION WITH THE CONTRACTOR FURNISHINGS THE EQUIPMENT AND ADJUST INSTALLATION DETAILS PRIOR TO ROUGH-IN.
8. ALL MECHANICAL DRAWINGS SHALL BE READ IN CONJUNCTION WITH GENERAL NOTES, SPECIFICATIONS AND MISCELLANEOUS DETAILS.
9. WALL AND ROOF OPENINGS SHALL BE 13mm LARGER ALL AROUND THAN DUCT OR FIRE DAMPER SLEEVE PASSING THROUGH WALL OR SLAB AND THE VOID WILL BE FILLED WITH NON-COMBUSTIBLE MATERIAL.
10. EACH SPLIT UNIT SHALL BE WITH INDIVIDUAL/ SEPARATE DRAIN.
11. PIPE ALL CONDENSATE DRAIN LINES OF AHU'S TO THE NEAREST DRAIN POINT PROVIDED UNDER PLUMBING WORKS UNLESS OTHERWISE SHOWN ON THE DRAWING.
12. PROVIDE SLEEVES WHERE PIPES PENETRATE WALLS AND SLABS.
13. WHERE SHOW ON PLANS THE ROOM THERMOSTATS SHALL BE MOUNTED ON THE WALL @ 1.5 METER ABOVE FINISHED FLOOR LEVEL.
14. ROOF MOUNTED EQUIPMENT TO BE TROPICALIZED AND WATER PROOFED.
15. VIBRATING EQUIPMENT SHALL BE PROVIDED WITH ISOLATORS TO PREVENT VIBRATION TRANSMISSION.
16. INSTALL ALL EQUIPMENT AS PER MANUFACTURE'S RECOMMENDATIONS.
17. DESIGN CONDITIONS:  
32.10 INDOOR CONDITIONS:  
A. SUMMER – 22° CDB / 50%RH  
B. WINTER – 21.5° C  
32.20 OUTDOOR CONDITIONS:  
A. SUMMER – 108° CDB
18. CONTRACTOR SHALL PROVIDE WORKING SHOP DRAWING SHOWING ALL SUPPORTS OF PIPE & EQUIPMENT.
19. ALL EQUIPMENT EXPOSED TO WEATHER SHALL BE SUITABLE FOR OUTDOOR INSTALLATION.

A	11-03-2021	AS DISCUSSED WITH CLIENT
REV.	DATE	
Issued For		
<b>SUKKUR, IBA, UNIVERSITY</b>		
DRAWING TITLE		<b>FOREIGN FACULTY HOSTEL</b>
HVAC GENERAL NOTES		
ARCHITECT	Scale 1/16" = 1'-0"	
<b>HABIB FIDA ALI</b> P. O. Box 10000 Sukkur Sukkur, Sindh, Pakistan Mobile: 9999 9999 9999	Date	MARCH, 2021
<b>M&amp;P CONSULTANT</b> <b>N.Z ENGINEERING</b> SUKKUR, SINDH, PAKISTAN MOBILE: 9999 9999 9999 TEL: 999 999 9999 WWW.NZENGINEERING.COM	Drawn	MTF
DOCUMENT TYPE	Checked	ZD
DRAWING STATUS	Drawing No	H-08
<b>TENDER DRAWING</b>		



**[ TENDER DOCUMENTS ]**

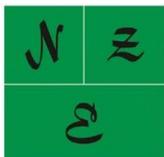
**FEBURARY, 2021.**

**DOCUMENTS TYPE**

**HVAC SYSTEM FOR FOREIGN  
FACULTY HOSTEL, SUKKUR IBA  
UNIVERSITY**

**PROJECT NO- IBA(FFH)-2021-10**

**MECHANICAL CONSULTANT.**



**N.Z ENGINEERING  
M&P CONSULTANT**

**ARCHITECT.**

**Habib Fida Ali.**

<b>HVAC SYSTEM WORKS</b>		
1	SECTION-01	SPECIMEN GUARANTEES
2	SECTION-02	INSTRUCTIONS TO TENDERERS AND TERMS & CONDITIONS
3	SECTION-03	TERMS OF PAYMENT.
4	SECTION-04	EVALUATION CRITERIA
5	SECTION-05	SPECIAL CONDATION OF CONTRACT
6	SECTION-06	SPECIFICATION OF HVAC WORKS
7	SECTION-07	BILL OF QUANTITY
8	SECTION-08	COMPLETE TENDER DRAWINGS

## SECTION – 01

**SPECIMENGUARANTEES, ETC.**

## 01. FORM OF CONTRACT AGREEMENT

THIS AGREEMENT made and entered at ----- on this ----- day of ----- by and between -----(name and address)----- (hereinafter called the "Employer" which expression shall include its successors, assigns and legal representatives) of the one part and ----- (name and address) ----- (hereinafter called the "Contractor" which expression shall include its successors, legal representatives and permitted assign) of the other part.

WHEREAS the Employer is desirous for the manufacture, supply, assembly, construction, installation, completion, testing, commissioning, adjusting, balancing and maintenance of certain works, viz., -----

-----  
(hereinafter called the "works") and has caused his Consultants, NZ ENGINEERING, M-01,Plot # 70c Jami Commercial Lane-9 Phase-7 DHA , KARACHI. Pakistan, (hereinafter called the "Consultant") to prepare specifications, schedules, and drawings detailing and describing the works.

WHEREAS, under the procedure, tenders have heretofore been received by the Employer for the works and the tender of the Contractor for the works has been accepted by the Employer.

NOW THEREFORE, for and in consideration of the promises, covenants, agreements hereinafter contained and to be performed by the parties hereto, the said parties hereby covenant and agree as follows:

1. In this Agreement words and expressions shall have the same meaning as are respectively assigned to them in the General Conditions of Contract hereinafter referred to:
2. The following documents shall be deemed to form and be read and constructed as part of this Agreement, viz.,
  - (a) The said Tender No. ----- dated ----- and Salient Features of Contract, as amended herein.
  - (b) The instructions to tenderers & terms & conditions
  - (c) The Special Conditions of Contract.
  - (d) The term and payment
  - (e) The evaluation criteria
  - (f) The Specifications.
  - (g) The Drawings.
  - (h) The Schedule of bill of quantities.
  - (i) Addenda Nos. (if any).
  - (j) The letter of Award of Work No. ----- dated ----- and all related correspondence mentioned therein.
  - (k) -----

3. In consideration of the covenants and agreements to be kept and performed by the Contractor, and for the faithful performance of this contract, and the completion of the works embraced therein, according to the specifications, drawings and conditions herein contained and referred to, the Employer shall pay and the Contractor shall receive and accept as full compensation for everything furnished and done by the Contractor under this Agreement, the contract price at the time and in the manner prescribed by the contract.

4. The Contractor, at his own proper cost and expense, shall do all work and furnish all labour, equipment, materials, tools, machinery and supplies for the manufacture, assembly, construction, installation, completion, testing, commissioning, adjusting, balancing and maintenance of the said works as outlined and described in the specifications, schedules and drawings except such equipment and materials which are to be furnished by the Employer.

5. The maintenance of a rate of progress in the works, which will result in its completion within the specified time, is an essential feature of this contract, and the Contractor agrees to proceed with all due diligence and care at all times to take full precautions to ensure the time of completion as defined herein. The said works shall be started on the date shown in the Memorandum of the tender and the Contractor shall have the works called for under the contract fully completed within the times stated in the Memorandum of the tender except for maintenance which shall be completed in the period named in the said Memorandum after issuance of Certificate of Substantial Completion.

6. The term the "Consultant" in this Agreement and conditions of contract shall mean the said N.Z ENGINEERING , or in the event of their dissolution or in any way ceasing to be the Consultant for the purpose of this contract, such other person(s) as may be nominated or appointed for this purpose by the Employer and notified in writing to the Contractor.

IN WITNESS whereof the parties hereto or herein have hereinto set their respective hands and seals on the day the month and the year first above-mentioned.

Signed, sealed and delivered  
by -----

Signed, sealed and delivered  
by -----

for and on behalf of  
-----  
(Employer)

for and on behalf of  
-----  
(Contractor)

in the presence of  
-----  
(name and designation)

in the presence of  
-----  
(name and designation)

## 02. SPECIMEN OF TENDER EARNEST MONEY GUARANTEE

KNOW ALL MEN BY THESE PRESENTS that ----- (name and address) ----- (hereinafter called the "Tenderer" which expression shall include its successors and permitted assigns) and -----(name and address) --- ----- (hereinafter called the "Guarantor" which expression shall include its successors and assigns) are jointly and severally held firmly bound in the sum of Rs.------(Rupees-----only)to ----- (name and address) ----- (hereinafter called the "Employer" which expression shall include its successors, assigns and legal representatives).

WHEREAS the Tenderer has submitted the accompanying Tender dated ----- for ----- ----- (hereinafter called the "works") to the said Employer, and

WHEREAS the Employer has required as a condition for considering the said tender that the Tenderer deposit with the Employer either by a Pay Order or Demand Draft of a scheduled Bank in favour of the Employer or by a confirmed and irrevocable Guarantee (Bond) for an amount of Rs.----- (Rupees----- only) conditioned that in the event of failure of the Tenderer to abide by his Tender for a period of ----- days from -----(date of opening of Tender) ----- and if the Tender is accepted to execute the Contract Agreement for the said works and furnish the required Performance Bond, the entire sum becomes payable immediately to the Employer as liquidated damages and not as penalty for the Tenderer's failure to perform.

NOW THE CONDITIONS OF THE above written Bond are such that:

1. If the Tenderer fails to abide by his Tender for the period mentioned and if the Tender is accepted by the Employer then the Tenderer fails to sign the Contract Agreement and provide a Performance Bond within ----- days of being requested to do so in accordance with the conditions of tendering, the Guarantor hereby unconditionally and irrevocably undertakes to pay forthwith the sum of Rs.----- (Rupees----- only) to the Employer within three days after a demand is made by the Employer without any question and without any reference of any nature whatsoever to the Tenderer and irrespective of any dispute existing between the Tenderer and the Employer in respect of the acceptance or rejection of the Tender and irrespective of the pendency of any dispute before any Arbitrator or in any Court of Law.
2. In the event of the Tenderer fulfilling the aforesaid obligations as certified by the Engineer who will be the sole and exclusive judge in this respect, this Guarantee will come to an end as the purpose would have been served.
3. The certificate of the Engineer that the Tenderer has failed to comply with the conditions or any of them herein mentioned shall be final, conclusive and binding on all the parties and the Employer will be entitled to demand forthwith from the Guarantor the aforesaid sum on the issuance of the said certificate.
4. That the liability of the Guarantor shall not be discharged until such time that a release has been granted to the Guarantor in writing under the signature of the Engineer.
5. That the liability of the Guarantor shall not be affected at any time by any forbearance or indulgence being given to the Tenderer or by his death or insolvency.

6. That the payment under this Bond shall be made by the Guarantor in the name of the Employer and a receipt issued by the Employer shall discharge the Guarantor from his liability to the Employer under this Bond.

7. That any notice or demand under this Bond may be made by the Employer and may be left at the Guarantor's address mentioned herein or at any changed address as may be communicated by the Guarantor to the Employer in writing against receipt of the Employer, or the said notice of demand may be sent by registered post to the Guarantor addressed as aforesaid and shall be deemed to have been given at the time when it should have been delivered in due course of post and a certificate signed by the Employer that the envelope containing the notice was posted shall be conclusive.

8. This Bond shall remain in force upto ----- for the amount of Rs.----- (Rupees -----only).

IN WITNESS WHEREOF the Guarantor and the Tenderer have signed and sealed this Bond on this ----- day of -----.

Signed, sealed and delivered  
by -----

Signed, sealed and delivered  
by -----

for and on behalf of  
-----  
(Guarantor)

for and on behalf of  
-----  
(Tenderer)

in the presence of  
-----  
(name and designation)

in the presence of  
-----  
(name and designation)

### 03. FORM OF PERFORMANCE BOND

THIS BOND is executed at ----- on this -----day of ----- by -----(name)-----  
 ----having its registered Office at -----(full address)----- (hereinafter called the "Surety" which expression  
 shall include its successors and assigns) and -----(name)-----whose registered Office is at -----  
 --(full address)----(hereinafter called the "Contractor" which expression shall include its successors and  
 permitted assigns) in favour of ----- (name and address) ----- (hereinafter called the  
 "Employer" which expression shall include its successors and assigns).

WHEREAS the Contractor by an Agreement which shall be signed between the Employer of the one part  
 and the Contractor of the other part (hereinafter called the "contract") has agreed for the manufacture,  
 supply, construction, assembly, installation, completion, testing, commissioning, adjusting, balancing and  
 maintenance of certain works as therein mentioned viz.-----  
 -----  
 (hereinafter called the "works") in conformity with the provisions of the said contract.

AND WHEREAS one of the conditions of entering into Contract Agreement is that the Contractor shall  
 provide to the Employer a Performance Bond in the sum of Rs.----- (Rupees -----  
 ----- only) for due fulfilment of the contract.

AND WHEREAS, the Surety has agreed to give to the Employer this Performance Bond on the terms and  
 conditions mentioned hereinafter.

NOW THEREFORE, THIS BOND WITNESSETH:

1. That the Contractor shall duly perform and observe all the terms, provisions, conditions,  
 stipulations and his obligations contained in the contract according to the true purport, intent and  
 meaning thereof or as may be determined by the Employer who shall be the Sole Judge in the matter.
2. In the event of default being committed by the Contractor of which the Engineer shall be the  
 sole exclusive judge, the Surety shall satisfy and discharge within three days after demand of all the  
 damages sustained by the Employer on account of the default of the Contractor, as may be solely and  
 exclusively determined by the Engineer, without any reference of any nature whatsoever to the  
 Contractor and without any question whatsoever and whether or not the Contractor disputes his  
 liability in respect thereof and whether or not any arbitration or Court case is pending in respect of  
 the dispute.
3. That the liability of the Surety under this Performance Bond shall be upto the amount of Rs.-----  
 ----- (Rupees ----- only) and this Bond shall become  
 null and void if the Contractor has carried out the works and also performed his obligations strictly in  
 accordance with the contract to the full satisfaction of the Engineer, who will be the sole and  
 exclusive judge to determine whether or not the Contractor has carried out the works and fulfilled his  
 obligations in accordance with the contract.
4. The Engineer can complete that portion of the works, which the Contractor has not  
 commenced or not satisfactorily executed, upto the amount of the Performance Bond, at the expense  
 of the Surety.

5. That the liability of the Surety shall not be discharged until such time that a release has been granted to the Surety in writing under the signature of the Engineer.
6. No alteration in the terms of the said contract made by agreement between the Employer and the Contractor or in the extent or nature of the works to be executed thereunder and no allowance of time by the Employer or the Engineer under the said contract nor any forbearance or forgiveness in or in respect of any matter or thing concerning the said contract on the part of the Employer or the Engineer shall in any way release the Surety from any liability under this Bond.
7. That the payment under this Bond shall be made by the Surety in the name of the Employer and a receipt issued by the Employer shall discharge the Surety from his liability to the Employer under this Bond.
8. That any notice or demand under this Bond may be made by the Employer and may be left at the Surety's address mentioned herein or at any changed address as may be communicated by the Surety to the Employer in writing against receipt of the Employer, or the said notice of demand may be sent by registered post to the Surety addressed as aforesaid and shall be deemed to have been given at the time when it should have been delivered in due course of post and a certificate signed by the Employer that the envelope containing the notice was posted shall be conclusive.
9. This Bond shall remain in force upto ----- for the amount of Rs.----- (Rupees ----- only).

IN WITNESS WHEREOF the Surety and the Contractor have signed and sealed this Bond on the day the month and the year mentioned above.

Signed, sealed and delivered  
by -----

for and on behalf of  
-----  
(Surety)

in the presence of  
-----  
(name and designation)

Signed, sealed and delivered  
by -----

for and on behalf of  
-----  
(Contractor)

in the presence of  
-----  
(name and designation)

Note:

The Surety may be a scheduled Bank or an approved Insurance Company.

**04. SPECIMEN OF MOBILIZATION ADVANCE GUARANTEE**

To

-----,  
 -----,  
 -----,  
 -----.

Dear Sirs,

WHEREAS you have entered into a contract with -----(name and address)----- (hereinafter called the "Contractor" which expression shall include its successors and permitted assigns) for ----- (hereinafter called the "works").

AND WHEREAS at our request and at the request of the Contractor you have agreed to advance to the Contractor a sum of Rs.----- (Rupees-----only) to be used by the Contractor for the procurement and transport of Plants, Equipment and materials for the said works (inclusive of any temporary works).

NOW THEREFORE we do hereby agree, undertake and guarantee:

1. That the Contractor shall use the advance amount of Rs.----- (Rupees-----only) for the purposes of procurement and transport of Plants, Equipment and materials for the works inclusive of any temporary works as defined in the Contract Agreement dated ----- entered into between you and the Contractor.
2. That the Contractor shall repay the above said advance amount to you either by getting the same deducted from his running bills as per the General Conditions of Contract or from his own resources.
3. In the event of the Contractor failing to utilize the advance for the purpose for which it has been given by you and/or the Contractor failing to make the payment of the same to you as per the General Conditions of Contract, we hereby guarantee the payment of the amount of Rs.----- (Rupees-----only) or such other amount as may be outstanding against the Contractor within three days after demand made by you on us without any question or without any reference of any nature whatsoever to the Contractor and irrespective of existence of any dispute between you and the Contractor and irrespective of pendency of any dispute with the Contractor before any Arbitrator or any Court of Law.
4. That a demand certifying that the Contractor has failed to utilize the advance for the purpose for which it has been given and/or has failed to repay the same and signed by the Engineer will be conclusive against the Contractor and against us which certified demand shall not be questioned by us for any reason whatsoever and it would be sufficient authority for us to make the payment to you.
5. That our liability under this Guarantee shall stand reduced automatically to the extent of the adjustment made from the running bills of the Contractor and a certificate signed by the Engineer to this effect shall be conclusive and binding on us.

6. That the payment hereunder shall be made by us under this Guarantee in your name and a receipt issued by you shall be sufficient that the payment has been made to you hereunder.
7. That our liability under this Guarantee shall not be discharged until such time that a release has been granted to us in writing under the signature of the Engineer.
8. That no alteration in the terms of the said contract made by agreement between you and the Contractor or in the extent or nature of the works to be executed thereunder and no allowance of time by you or the Engineer under the said contract nor any forbearance or forgiveness in or in respect of any matter or thing concerning the said contract on your part or on part of the Engineer shall in any way release us from any liability under this Guarantee.
9. That any notice or demand under this Guarantee may be left at our address mentioned hereinafter or at any changed address as may be communicated by us to you in writing against your receipt, or the said notice of demand may be sent by registered post to us addressed as aforesaid and shall be deemed to have been given at the time when it should have been delivered in due course of post and your certificate that the envelope containing the notice was posted shall be conclusive.
10. That you shall have collective and/or several right to recover the full amount under this Guarantee from us which shall be paid by us to you as per Clause 6 hereof.
11. That this Guarantee shall remain binding on us and we shall be liable to you and/or your successors-in-interest or assigns.
12. This Guarantee shall remain in force upto ----- for the amount of Rs.----- (Rupees --  
-----only).

Signed, sealed and delivered on this-----day of-----  
by -----and by -----

for and on behalf of

-----  
(Guarantor)

in the presence of

-----  
(name and designation)

-----  
(name and designation)

## SECTION-02

## INSTRUCTIONS TO TENDERERS AND TERMS &amp; CONDITIONS

1. The tenderers are required to furnish the following information in addition to that required in the tender notice & Evaluation Criteria with their tenders, failing which their tenders are liable to be rejected:
  - I. Organization structure of the “ Contracting Firm” (whether the firm is a partnership or Limited Company etc.
  - II. Details of works of similar nature executed during the last five years with supported by documentary evidence( Photostat copies to be attached).
  - III. Proof of financial stability.
  - IV. Programme of work to ensure that the work will be completed within the allotted time on the prescribed format.
  - V. Undertaking to the effect that the firm has never been black listed by any Government / Semi Government / Private Organization.
  - VI. The Contractors / Bidders must be licensed by the Pakistan Engineering Council. (PEC,s Category C-4 & ME-01).
2. Set of tender documents, duly signed on each page and official seal stamped on each page including annexure, Addendum/Corrigendum, if any and supplementary information and **Earnest Money @ 2%** of the quoted rates in shape of Pay Order / Demand Draft / Bank Guarantee in favor of Sukkur IBA University, valid for a minimum period of twenty eight (28) days beyond the bid validity date (i.e. 120 days+28 days validity) from any Schedule Bank registered in Pakistan on prescribed format (refundable to unsuccessful bidder after award of Contract) must reach the office of the Director of Engineering on or before the time and date fixed in the Tender notice for receipt of the Tenders.
3. Tender must be filled in English and all enclosed document should be in English.
4. Tenders are to be irrevocable and valid for acceptance for a period of hundred & twenty (120) calendar days from the Tender opening date.
5. Documents submitted by Tenderers in connection with the Tender for above named Works will be treated as confidential and will not be returned, except Financial Proposal of Non-responsive Bidders.
6. Incomplete and Conditional Tenders shall be rejected at the sole discretion of the Employer.
7. Tenderers will not be reimbursed for any expenses of any kind whatsoever incurred in connection with preparation and submission of their Tenders.
8. Unit rates should be mentioned both in word and figures in Pak Rupees. If there is a discrepancy between the Unit Price & Total Price i.e. obtained by multiplying the Unit Price and quantity, the Unit price shall prevail and the total price shall be corrected. If there is a discrepancy between the words and figures, the amount in the words shall prevail. If there is a discrepancy between the total bid price enter in the Form of Bid and the total shown in the Schedule of Prices, the amount stated in the Form of Bid will be corrected by the Employer’s Engineer in accordance with the corrected Schedule of Price. If the Bidder does not accept

the corrected amount of Bid, his Bid will be rejected and his Bid Security will be forfeited.

9. The entire work should be completed within **24 weeks** from the date of issue of the work order.
10. The rates should be inclusive of all taxes (including GST, custom & other duties, Govt. Levy as applicable at the time of Payment), insurance, overheads, transportation, labour charges for handling, commissioning and testing at the site etc.
11. The supplier/contractor should be registered with General Sales Tax and Income tax Departments and shall submit GST invoice with the bill.
12. The exemption in Income Tax will only be allowed against the Exemption Certificate issued by the Income Tax Department.
13. The supplier /contractor will submit GST Registration Certificate, GST Invoice and paid copy of Professional Tax along with the bill. The bill will not be entertained without these documents.
14. The supplier/Contractor may visit the site on any working day to form a clear understanding of the work, before quoting the rates.
15. The contractor/supplier should provide complete information including Technical computerized selection, selection drawing, technical Submittal along with the dimensional drawings, sectional details, technical details, certificates mentioned in the specification/tender documents etc. for the quoted equipment with the Bid.
16. In case of award of work, 10% (ten percent) of the billed amount will be deducted from every bill as security deposit.
17. The **Earnest Money @ 2%** of the quoted rates in shape of Pay Order / Demand Draft / Bank Guarantee in favor of Sukkur IBA University, valid for a minimum period of twenty eight (28) days beyond the bid validity date (i.e. **120** days + 28 days validity). The Bank Guarantee should be from any Scheduled Bank registered in Pakistan on prescribed format.
18. Conditional/incomplete tenders and tenders without earnest money will not be accepted.
19. This tender is only an invitation to offer and the Sukkur IBA University reserves the right to accept or reject any or all tenders.
20. If the tender/bid does not meet the specifications and other requirement, the same will be rejected and their Financial Bid will be returned un-opened.
21. In case of acceptance of tender, the supplier/contractor will submit a Performance Bond amounting to 10% of tender cost in shape of Bank Guarantee **within 28 days** of issuance of Acceptance Letter. Performance Bond shall be issued by any Scheduled Bank registered in Pakistan on prescribed format. Performance Bond shall be valid for following period:
  - (a) **24 Weeks** (for execution of works as prescribed in Schedule of Prices, Specifications etc.)
  - (b) For Maintenance / Warranty Period which shall be started after completing the entire scope of works as per Contract. The same shall be valid for the whole Currency of Works including Maintenance / Warranty Period

22. If Contractor failed to provide Performance Bond, the Earnest Money will be forfeited and the client reserves the right to accept the 2<sup>nd</sup> lowest bidder and he will not be allowed to participate in future tenders with Sukkur IBA University.
23. The successful tenderers shall have to execute Agreement with the **Sukkur IBA University**, within 14 days after issuance of acceptance letter, in its standard form. In case of default the Earnest Money will be forfeited and the Bank reserves the right to accept the 2<sup>nd</sup> lowest bidder. After execution of the Agreement, the work order for commencement of the work shall be issued.
24. The contractor will submit 03 sets of operation & maintenance manuals, spares manual As Built Drawings along with / before the Delivery of the Equipment.
25. The employer proposes to advance an amount equal to 10% of tendered cost as mobilization advance against a bank guarantee, to be obtained by the supplier/contractor at his own expenses from any Scheduled Bank registered in Pakistan as per Proforma of the agreement-cum-guarantee included in this tender document.
26. The total amount of mobilization advance will be recovered from the contractor's Running / interim bills.
27. The client reserved right to increase /decrease the quantity mentioned in BOQ upto any extend as per there requirements / budget.
28. TERMS OF PAYMENTS
  - 28.1 For Terms and payments refer, refer Section-03
29. PENALTIES
  - 29.1 For Penalties, refer Section 03
30. WARRANTY
  - 30.1 The Equipment shall be covered under the Standard Warranty Period of 24 Months from the date of Shipment / 24 Months from the date of commissioning whichever occurs earlier. However extended Warranty Period may be offered by any Supplier
31. The consultant/ client shall disqualify a supplier or contractor if it finds, at any time, that the information submitted by contractor /supplier concerning his qualification as supplier or contractor was false and materially inaccurate or incomplete.
32. The tender shall be proceeds **"SINGLE STAGE – TWO ENVELOPE PROCEDURE."**

## SECTION – 03

TERMS OF PAYMENT**A. TERMS OF PAYMENT**

1. ALL ADVANCE PAYMENTS SHALL BE MADE AGAINST FURNISHING THE **BANK GUARANTEE** IN FAVOR OF SUKKUR IBA UNIVERSITY IN REQUIRED FORMAT FROM ANY SCHEDULED BANK REGISTERED IN PAKISTAN.

- |      |   |                   |
|------|---|-------------------|
| i)   | Mobilization Advance  | 10%(Total amount) |
| ii)  | Upon delivery of the material / equipment at Site subject to confirmation of the Quantities delivered, specifications, Acceptance of Consultant & Engineer In charge (IBA-SUKKUR) | 40%               |
| iii) | Balance Payment shall be made against Running Bills which will be jointly scrutinized by Engineer In charge (IBA-SUKKUR) & Consultant   |                   |

2. Payments against Clause (ii) and (iii) shall be subject to a adjustment / deduction of 10% Mobilization Advance (upto the complete recovery) and 10% Retention Money.

3. 10% Performance Bond shall be released after satisfactory completion of Maintenance / Warranty Period (i.e. 12 Months after commissioning of the System)

4. Retention Money shall be released as follows:

- |     |  |     |
|-----|--|-----|
| (a) | One Month after issuance of Completion Certificate             | 50% |
| (b) | After satisfactory completion of Maintenance / Warranty Period | 50% |

**B. PENALTIES**

1. In case of delay in work the Client shall have the right to impose the Liquidated Damages as compensation @ 0.1% of the total cost of the tender per day. (Up to maximum 10% of total cost of works) after which client reserves the right at its Sole Discretion to rescind the Contract and take the action as per Contract Agreement. Performance Bond & Earnest Money shall be forfeited without reference to the Contractor. The Contractor may not be allowed to participate in future tenders with client.

2. If the delivered Material / Equipment does not comply with the specifications or have any missing item or received in damaged / defective condition, Contractor shall rectify / make the System in good condition at his own expenses whatsoever without voiding the Manufacturer's Warranty (if any) within a period of 1 Week (Period shall be accorded by client in consultation with the Consultant) after which CLIENT reserves the right in its Sole Discretion to terminate the Contract and confiscate the Supplied Equipment along with forfeiture of Performance Bond without reference to the Contractor

## SECTION - 04

### TENDERER'S QUALIFICATION / EVALUATION CRITERIA

#### I. MANDATORY REQUIREMENTS BEFORE EVALUATION OF TENDER

- (a) Bidder must be registered with Pakistan Engineering C-4 (ME-01.)
- (b) Bidder should have completed minimum five (5) similar nature of work(s) of same / above capacity in the last 3 Years (complete detail with completion latter required)
- (c) The Interested bidders should have presence / support / branch offices in Karachi.
- (d) Bank Statement for Last 2 Years, Minimum turnover of Rs. 200 Million for at least any one year
- (e) The Firms / Bidders / Suppliers blacklisted by any Government / Semi Government Organizations shall not be eligible to bid. Affidavit to be submitted.
- (f) The Firms / Bidders / Suppliers in litigation with any Government / Semi Government Organizations shall not be eligible to bid. Affidavit to be submitted.
- (g) The Firms / Bidders / Suppliers who have failed to perform as per Contract with the Government / Semi Government Organization will not be eligible to bid. Affidavit to be submitted.
- (h) Organization structure of the "Contracting Firm" (whether the firm is a partnership or Limited Company etc.
- (i) Programmer of work to ensure that the work will be completed within the stipulated time on the prescribed format.

NOTE. THE EVALUATION OF ANY THESE BIDDERS SHALL BE CARRIED OUT WHO WILL COMPLY WITH THE ABOVE PARAMETERS.

#### II. TECHNICAL EVALUATION OF TENDER

- A It will be examined in detail whether the goods offered by the bidder comply with the technical provisions of the technical bidding documents. For this purpose, the bidder's data submitted with the bid will be compared with the specific work data prescribed by the Employer and technical, feature / criteria of the Goods detailed in the technical provisions. Other technical information submitted by the bidder regarding the scope of work will also be reviewed. In addition to this following Technical Details / Requirement must be provided / complied with the Tender Documents (Technical Bid).
- B Tender shall be rejected if it is Non-submission of verifiable proofs against the mandatory as well as general documentary, qualification and eligibility related requirements.

#### C. Technical Evaluation:

The firm cleared from initial screening will be evaluated as per following criteria:  
The total marks shall be 100. Minimum score for competing in the next stage is 75 %. The Financial Proposal of only the Audit Firm will be opened which secures 75 % or more in the Technical Evaluation.

S.NO	DETAILS	POINTS
1	Draft of Earnest Money	Mandatory
2	Bid /Quotation (As per pattern)	Mandatory
3	Certificate of Registration In Pakistan Engineering .	Mandatory
4	Income Tax Registration	Mandatory
5	General Sales Tax Registration	Mandatory
6	Proof of Non-Blacklisting: Affidavit on legal paper of appropriate value (duly attested from notary public)/letterhead that the Firms / Bidders / Suppliers blacklisted by any Government / Semi Government Organizations shall not be eligible to bid.	Mandatory
7	Proof of Non-Blacklisting: Affidavit on legal paper of appropriate value (duly attested from notary public)/letterhead that The Firms / Bidders / Suppliers in litigation with any Government / Semi Government Organizations shall not be eligible to bid. Affidavit to be submitted.	Mandatory
8	The Contractor /Bidders must be the sole distributor of the Split equipment since last Four Years (4Years) of the offered brand/system.	Mandatory
9	Bidder should have completed minimum eight (8) similar nature of work(s) of same / above capacity in the last 5 Years (complete detail with completion latter required	Mandatory
10	Bank Statement for Last 3 Years, Minimum turnover of Rs. 200 Million for at least any one year	Mandatory
11	The Interested bidders should have presence / support / branch offices in Karachi.	Mandatory
12	Technical Compliance Sheet Provide Technical Compliance Sheet in Tabulated Form specifying the compliance of each and every quoted item with minimum specification of required items mentioned in Bill of Quantity (BOQ) of this document.	Mandatory
13	Annual turnover (Max Points 15) a. 200 Millions (10 Points) b. 200 to 300 Millions (12 Points) c. Above 300 Millions (15 Points)	
16	No of similar nature of same or above capacity project in 5 Years. (Max Points 15) a. 6 Project (10 Points) b. 7 to 10 Year (12 Points) c. 10 to 15 Year (15 Points)	
17	Total No of employees (Max Points 10) a. 40 Employees (6 Points) b. 50 to 60 Year (8 Points) c. 70 to 100 Year (10 Points)	

19	Warranty/Guarantee Terms. (Max Points 30) a. 2 Years' service & Repair Warranty (20 Points) b. 3 Years' service & Repair Warranty (25 Points) c. 4 Years' service & Repair t Warranty (30 Points)	
	No of similar nature of project in 10 Years with Government & Public sector. (Max Points 15) a. 5 Project (10 Points) b. 6 to 7 Project (12 Points) c. 8 to 10 Project (15 Points)	
20	Bidder already work with Sukkur IBA University. (15Points)	

- a. Bids will be evaluated in fair, transparent and non-discriminatory manner. For the purpose of determining the Most Advantageous bid, following above mandatory scales of evaluation shall be taken into consideration for technical and financial bids.
- b. Failing to fulfill ANY of the Mandatory Requirement will disqualify the bidder from the process.
- c. After evaluation/marking of bidders in technical evaluation process, financial bids of technically qualified bidders only will be opened later on prior notice.
- d. For final grading of bidders towards contract award, Most Advantageous bid prices will be calculated to ascertain lowest bid for placement of procurement contract.

S.No.	Item	Approved Make
1	Split System	1. L.G – Korea 2. General-Thailand 3. Hitachi- Thailand 4. Mitsubishi- Thailand Approved Equal
2	Refrigerant pipes	1. Mueller (USA) Approved Equal
3	Pipe/Duct Insulation	1. Aeroflex (Thailand) 2. Aerofoam-UAE Approved Equal
4	UPVC Pipe	1. Dadex 2. AGM 3. Steelex Approved Equal
5	Electric Cables & Wires	1. Pakistan Cables Approved Equal
6	Ventilation/Air Curtains Fan	1. GreenHeck 2. S&P Fans Approved Equal
9	Concrete Fasteners & anchors	1. Hilti (UK/Germany) 2. Fischers (Germany) Approved Equal
10	Paints	1. ICI (Pakistan) 2. Berger (Pakistan) Approved Equal
11	Motors	1- Siemens 2- ABB 3. Approved equal
12	M.C.C & CABLE TRAY	1- Karimi Electric 2- Sunbeam 3- Husain & co. 3- Approved equal
13	Refrigerant Isolation Valve	1- Danfoss 2- Mueller 3- Emersion 4- Approved equal
14	Control wire	1- Belden 4- Approved equal
15	Aluminum Tape	1-Abro industries (USA) Approved Equal 2-

S.No.	Items	1- Approved Make
17	Vapor Barrier Coating	1. Foster (USA) 1- Approved Equal

**NOTE:**

Equipment & Material shall be supplied only from the authorized distributor. The Contractor shall submit complete technical details of the equipment, material and obtain Consultants approval prior to delivery on site. In case of "Approved Equivalent", it shall be at the discretion of the Consultant to accept the alternate proposal submitted by the Contractor.

## SECTION - 05

### SPECIAL CONDITIONS OF CONTRACT

#### 01. GENERAL CONDITIONS OF CONTRACT

- 1.1 The General Conditions of Contract shall be carefully studied by each tenderer before submitting his tender. Nothing stated herein shall waive any part of the General Conditions of Contract unless specifically stated herein. Where clauses of General Conditions of Contract are repeated in this section, it shall be only for calling special attention to them and/or as a further qualification, and it shall not mean as omitting any other clause or clauses of the General Conditions of Contract.

#### 02. SCOPE OF WORK

- 2.1 The accompanying specifications and drawings are intended to provide complete Airconditioning systems and ancillary works for the Building referred in the specifications and drawings, and the contract on lump sum cost basis is intended to provide all materials and labour necessary for manufacture, supply, construction, assembly, installation, completion, testing, commissioning, balancing and adjusting and maintenance of the complete Airconditioning systems and ancillary works, making them ready for operation in all respects and training of the Employer's personnel.

- 2.2 (a) The general scope of work is detailed and shown in the specifications and drawings. Furthermore included are all interconnecting piping, valves and fittings and electric wiring between and for various items of plant, equipment, controls and accessories.

- (b) Owner shall supply to the contractor, free of charge at site, certain equipment and materials as listed in the Schedule of Quantities. The contractor shall take delivery of these items, arrange careful storage and carry out assembly, installation of these items alongwith other items to be supplied by the Contractor so as to complete whole of the works in all respects as detailed in the specifications, drawings, schedules carefully study the specifications, manufacturers technical bulletins and drawings for the Employer supplied items so as to become fully familiar with the same for carrying out the works.

- 2.3 Within the general scope of work the following items are specifically included without limitation:

- a. VRF system
- b. Refrigerant & Air distribution system
- c. System automatic controls
- d. Water drain system for all equipment
- e. All cutting, chases and making of opening and subsequent repairs except beam and slab openings.
- f. Motor Control Centers and complete electric wiring and earthing for all the plants, equipment, automatic controls and safety devices from electric supply and earthing points provided by the Employer as shown in the drawings. The Contractor shall also supply starters etc. for all Owner supplied equipment.
- g. Painting of equipment and system components and all other incidentals to make the exhaust air systems and ancillary works installation complete and perfect and ready for operation in every respect.

- h. Commissioning, testing, balancing, adjusting, painting and all other incidentals to make the Airconditioning, Ventilation and other systems and all ancillary works installation complete and perfect and ready for operation in every respect.
  - I Adjusting and balancing of the complete air and water systems and automatic controls. The Contractor shall arrange the services of approved Specialist(s) for final balancing of the air exhaust system. The Contractor shall be responsible to provide the services of Engineers, technicians and skilled helpers as required by the Specialist(s) for carrying out the work.
  - J Test runs of the complete plant and systems after the completion of installation, commissioning, balancing and adjusting of equipment and systems.
  - K Servicing and maintenance of the complete plants during the period of maintenance (12 operating months).
- 2.4 The Contractor shall give written guarantee that all the equipment and materials supplied under the contract shall be brand new, of robust construction and standard manufacture, and that the materials and workmanship will be of best class, will be installed in a practical and first class manner, that the plants and systems will be complete for satisfactory operation, nothing being omitted by way of labour and material required to make them so although not specifically shown or mentioned in the drawings or specifications, and that these will be delivered to the Employer in well working order, complete and perfect in every respect.
- 2.5 The Contractor shall furnish all the required equipment, plants, devices, controls, etc. required to complete the works under applicable local codes or regulations required to complete the works.
- 2.6 The specifications are to be read in conjunction with the latest relevant British/American Standard Specifications and British/American Standard Codes of Practice. It shall be inherent in the interpretation of the contract documents that wherever British Specifications or Codes are referred to, they shall be deemed to be the British or American Standard Specifications or Codes and vice versa. Where differences or contradictions appear to arise between the British and American Standard Specifications or Codes, these differences or contradictions shall be referred to the Engineer for a decision.
- 2.7 In case any item or material offered deviates from the above standards, the tenderer shall clearly draw attention to all such deviations and no such item or material shall be supplied by the Contractor without prior written approval of the Engineer.
  - 2.8 The Contractor shall execute the works with materials in accordance with the specifications. All materials which in the opinion of the Engineer are not sound and/or do not meet with the above conditions, shall be immediately dismantled and/or removed from site by the Contractor at the request of the Engineer and replaced by appropriate approved materials without claim by or extra payment to the Contractor.
  - 2.9 The tenderer shall carefully check the sizes of the plant rooms, the pipe and duct passages and trenches, the pipe and duct shafts as shown in the drawings and confirm that his equipment, piping, ducting, wiring, etc. can be installed within the respective spaces allocated for the same.

### 03. RESPONSIBILITIES OF THE EMPLOYER AND CONTRACTOR

- 3.1 The Employer shall not provide any equipment, stores, materials, etc. to the Contractor for the purpose of completing the works or temporary works except where otherwise specified in the contract.  
The respective responsibilities of the Employer and the Contractor for the ancillary works shall be as detailed below.
- 3.2 Builders Work.
- (a) The Employer shall arrange all slab, beam and structural openings.
  - (b) All wall openings, cutting, chases, patching and making good shall be done by the Contractor. Only finishing and painting shall be arranged by the Employer after the Contractor had completed his work.
  - (c) All foundations for equipment mounting, MS Channels etc. will be constructed arranged by the Contractor who will also provide vibration isolators for isolation from the Building structure as required (and/or specified).
  - (d) The Contractor will supply and fix all necessary foundation and anchor bolts, concrete inserts, sleeves, brackets, clips, supports, stays, hangers, and hardware required for the complete installation. The Contractor shall supply and fix foundation and anchor bolts, concrete inserts and pipe sleeves before concreting. The Contractor will also be responsible for plugging of slab, wall and ceiling openings for all items and fittings where plugging has to be done by special plugs, screws or materials.
  - (e) The Contractor shall arrange for lifting of all equipment and materials (including Owner supplied equipment) to their respective plant rooms and locations. The Contractor will be responsible for any damage to the Building finishing. He shall ensure that no damage is caused to the structure.
- 3.3 Electrical Work.
- (a) The Contractor will be provided electric supply points, 400 volts, 3 phase, 4 wire alongwith two earthing points, or 220 volts, 1 phase with one earthing point, in the plant room as shown in the drawing.
  - (b) The Contractor shall be responsible for supply and installation of the Motor Control Centres and complete electric wiring and earthing work for all system, equipment and automatic control. He shall also check and confirm that the specified ratings of the supply point meet the requirements of his plant and equipment.

- (c) The responsibility of the Employer would be limited to provide the electric supply point and earthing points as detailed above and shown in the drawings.

3.4 Decorating Work.

The Contractor shall not be responsible for the decoration of the Building including false ceiling/boxing and any special decorative painting to the plant components visible in the occupied areas unless otherwise specified. The Contractor will be responsible otherwise for painting of all equipment, plants, components, piping and ducting as specified.

- 3.5 The Employer will arrange without charge to the Contractor, the supply of electricity, water and fuel during the commissioning, starting, testing and adjusting of the complete plant and during the Test Run. The Contractor shall be responsible for the supply of all other materials and labor required in this connection.

- 3.6 It will be the responsibility of the tenderer to clearly mention in detail any other particular work excluded by him in his tender but necessary to complete the works in all respects for satisfactory, efficient and trouble free operation.

04. COORDINATION

- 4.1 The Contractor shall acquaint himself fully with the requirements of the program of Building construction and the requirements of the Main Contractor, Electrical Contractor, Plumbing Contractor and any other Contractor carrying out the work in the Building. It would be necessary due to the nature of the air-conditioning works to arrange a proper sequence of installation with respect to the work of the other contractors. It shall be the responsibility of the Contractor to schedule his work so as to complete the air-conditioning installation work within the required time and without causing delay in the completion of the entire project.

05. GUARANTEES

- 5.1 The Contractor shall guarantee the performance (including specified capacities), fuel and electricity consumption of the plant and equipment offered by him. He shall state in his tender the natural gas/fuel oil consumption in cubic feet/litres per hour per horse power of the boilers, KW consumption of electric motor operated compressors/chillers/airconditioners and other equipment offered by him. The Contractor shall establish the performance, fuel and electricity consumption of the plant and equipment during the summer and winter test runs and will make all necessary adjustments to ensure that the performance and consumption is within the limits guaranteed by him.

- 5.2 The Contractor shall give to the Employer a written guarantee for the complete works against defective materials and faulty workmanship for the period of maintenance as specified in the Memorandum from the date of issue of Certificate of Substantial Completion by the Engineer. The guarantee shall also cover the maintenance of inside temperature and humidity conditions as specified. All defects of material or workmanship found in the work during the period of maintenance shall be removed and defective items replaced or repaired by the Contractor to the satisfaction of the Engineer without any additional cost to the Employer.
- 5.3 The Engineer shall inform the Contractor in writing in what respect any portion of the works, plant or equipment is defective. If any defect be not remedied within reasonable time by the Contractor, the Employer may proceed to do the defect rectification work at the Contractor's risk and expense but without prejudice to any other rights which the Employer may have against the Contractor in respect of such defects.
- 5.4 In case the replacements, repairs or renewals are of such a character as may affect the efficiency of the plant or equipment, the Engineer shall have the right to give to the Contractor within one month from such replacements, repairs or renewals notice in writing that a test be carried out to check the efficiency and performance of the plant or equipment and it shall be the duty of the Contractor to ensure that the efficiency and performance of the plant or equipment conform with the specified requirements.
- 5.5 In the event of any defect of material or workmanship occurring or being discovered during the period of maintenance, the period of maintenance shall continue until the cause of the defect has been discovered and remedied to the satisfaction of the Engineer.

06. **MANUFACTURERS/SUPPLIERS' GUARANTEES/WARRANTIES**

- 6.1 Manufacturer/Supplier's Guarantee/Warranty, specimen given below, for each equipment is an essential document to be supplied to the Employer before claiming payment for that equipment. The Guarantee/Warranty shall be duly sealed and signed by an authorised Executive of the Manufacturer/Supplier.
- 6.2 (a) The Contractor may obtain the Guarantee/Warranty from the Manufacturer/Supplier and submit the same to the Engineer/Consultant before claiming payment for the equipment in his bill, or
- (b) The Manufacturer/Supplier shall furnish the Guarantee/Warranty as an essential part of the documents submitted to the Bank to claim payment against the letter of credit established by the Employer.
- 6.3 The form of Guarantee/Warranty shall be:

"We hereby guarantee that the stores supplied are produced new in accordance with the contract specifications and that the materials used whether or not of our manufacture are in accordance with the latest appropriate standard specifications, the contract specifications and of good workmanship throughout. We shall replace free of cost FOB Factory or repair any part of the equipment for either a period not exceeding 12 calendar months after it has been taken over on completion of installation as certified in the Completion Certificate issued by the Employer or a period of 24 calendar months from the date of despatch from our Factory, whichever is shorter, which would be found defective due to material or faulty workmanship or in any way not in accordance with the contract specifications.

Our responsibility shall be limited to replace/ repair any part or parts of the stores found to be defective in workmanship or material provided the equipment is operated and maintained by the Employer in accordance with the generally approved practices and provided the Employer informs us in writing as soon as such defect becomes apparent.

Our obligation shall be to replace or repair any part or parts found defective FOB Factory and we shall not be responsible for any consequential damage or liability. We shall also not be responsible for any work done, equipment or part(s) supplied or repaired by others or for any loss, damages or expenses arising from such work, equipment, part(s) or repairs.

Signature and Seal \_\_\_\_\_  
 Manufacturer/Supplier's Name and  
 Address \_\_\_\_\_  
 Date \_\_\_\_\_ "

- 6.4 Wherever guarantees of operating capacity and efficiency, proper functioning, durability and the like are called for and/or wherever it is specified that the manufacturer shall furnish necessary technical manuals, drawings, performance data, test certificates, etc. and shall supervise the starting up of the equipment and adjustments after installation and starting up, and etc., and maintain it for the required period and perform similar other duties and services, the Contractor shall be held responsible for performance of the specified services for the actual conditions of the installation and he shall be held responsible for any default on the part of his suppliers/manufacturers/principals.

#### 07. DRAWINGS, TECHNICAL DATA AND MANUALS TO BE SUPPLIED

- 7.1 The Contractor when preparing any detailed shop drawings shall carefully check for all clearances, field conditions, avoidance of any hindrance with architectural features and proper coordination with all other services of the Building. Each shop drawing submitted by the Contractor shall include a certificate by the Contractor that all

related conditions on the site relevant to that particular installation have been checked and that no conflict exists. The Engineer/Consultant shall not approve any shop drawing submitted by the Contractor without such a certificate.

- 7.2 Manufacturers' performance data, performance and other test certificates and shop drawings for all main equipment giving complete information regarding dimensions, materials and other details confirming the adequacy of the equipment to be supplied shall be submitted to the Engineer/Consultant for approval.
- 7.3 All shop drawings etc. correct and conforming with the contract requirements, shall be submitted to the Engineer/Consultant sufficiently in advance of actual requirements to allow ample time for checking and approval and no claim for extension of the contract time will be considered by reasons of the Contractor's failure to submit the correct drawings etc. in time. The Contractor will submit eight copies of final corrected shop drawing for approval out of which 3 duly approved copies would be returned to him.

- 7.4 The Contractor shall clearly point out the differences, if any, between the details submitted and the requirements of the contract in covering letters sent with the submitted documents and drawings. He should also give reasons for his request for substitution so that if substitution is approved by the Engineer, necessary action may be taken for price adjustment. The Contractor will not otherwise be relieved of his responsibility for executing the works in accordance with the contract.
- 7.5 After completion of the installation work, the Contractor is to provide reproducible transparencies (quality to be approved by the Consultant) and 3 copies each of as-installed drawings showing runs and location of all the plant, equipment, controls, piping, ducting, electric wiring, burried work, etc. giving all necessary details of the works as actually installed.
- 7.6 Technical Manuals.
- The Contractor shall supply seven sets of printed manufacturers' installation, commissioning, operation, servicing and maintenance manuals, technical catalogues and detail spare parts manuals in English language for all items for the guidance of the Employer's operators in operation, servicing and maintenance of the plants and equipment.
- One set shall be supplied to the Consultant for scrutiny and approval well before shipment of the items by the manufacturers/suppliers.
- Each set shall be hard bound in volumes as directed by the Consultant.
- After approval by the Consultant, balance six hard bound sets shall be supplied to the Engineer simultaneously with or before the arrival of the items at site.
- 7.7 In case of any question regarding the Contractor's responsibility for preparation and supply of any detail shop drawings, data, as-installed drawings, technical manuals, etc., the Engineer's decision shall be final and binding as to the requirements of the shop drawings, data, as-installed drawings, technical manuals, etc. for the works.
- 7.8 The approval by the Engineer/Consultant of any submitted data, shop drawings, performance curves, test certificates for any item, arrangement and or layout shall not relieve the Contractor from any responsibility regarding the performance of the contract. Such approval shall not also relieve the Contractor from responsibility of error of any sort in the submitted data and shop drawings, etc.

## 01 GENERAL REQUIRMENTS FOR MEP WORKS

### 1.1 General

- 1.1.1. This specification forms an integral part of each section of MEP specifications.
- 1.1.2. This specifications covers Labour, materials, equipment and services to complete the MEP work as further specified and as shown on the Drawings.
- 1.1.3. All of the material to provide a complete and operational installation to the satisfaction of the Engineer. All incidental components and appurtenance necessary for the proper operation of the system shall be provided and installed as required whether or not they were specifically mentioned in the Contract Documents.

### 1.2. Definitions

- 1.2.1. Reviewed: Reviewed by the Engineer; normally a design or piece of equipment must be shown to have operated successfully for not less than two years under conditions generally similar to those required by this Contract. Facilities shall be given at the tender stage, if required by the Engineer, to enable him to evaluate the equipment's features and performance. The review of a design or piece of equipment shall be without prejudice to the acceptance tests required after installation.
- 1.2.2. Size: When related to pipe work means nominal size which generally approximates to the bore of steel tubes and the outside diameter of plastic tubes.
- 1.2.3. "Complete installation" shall mean not only the major items of plant and equipment conveyed by this specification, but all the incidental sundry components necessary for the complete execution of the works and for the proper operation of the installation, with their labour charges, whether or not these sundry components are mentioned in detail in the tender documents issued in connection with the contract.
- 1.2.4. "As indicated", "where indicated", and "unless otherwise indicated", refer to items or requirements which are, or may be given elsewhere in the tender documents issued in connection with the contract, (e.g. on a drawing, in a supplementary specification or in a schedule to this specification).
- 1.2.5. Provide: Supply, install and test.
- 1.2.6. Remove: Remove complete with all ancillary devices and equipment. Dispose of off- site in an environmentally safe manner. Ensure that equipment is completely isolated from any energy sources prior to removal. All piping and wiring shall be removed back to the nearest isolating point.

### 1.3. Regulations

- 1.3.1. The Work shall accord strictly with all rules, regulations, By-laws and requirements of all authorities having jurisdiction.
- 1.3.2. Drawings and specifications should not conflict with the above regulations but where there are apparent discrepancies the Contractor shall notify the Engineer in writing and obtain clarification before proceeding with the Work.

#### 1.4. Governing Standards

- 1.4.1 The installation shall comply with all relevant statutory instruments and regulations & in particular with the following:
- 1.4.1.1 The IEE regulations for electrical equipment in buildings.
  - 1.4.1.2 Any Regulations under Electricity.
  - 1.4.1.3 The Fire Safety regulations of the Local Civil Defence Authorities. Local Health and Safety at Work Regulations.
  - 1.4.1.4 Local Control of Pollution Regulations.
  - 1.4.1.5 ASHRAE standards.
  - 1.4.1.6 SMACNA standards for ductwork installation.
  - 1.4.1.7 NFPA standards. British Standards.
- 1.4.2. The Tender shall be based on regulations and standards current on the date of return of tenders. If these regulations are amended or new regulations are enacted after that date, the Engineer shall be notified immediately.
- 1.4.3. The materials, equipment and installations detailed in this specification are based on the standards and codes of practice indicated in the Contract Documents. In the event of a contradiction between this specification and any applicable standard or Code of Practice, this specification shall govern and the Engineer shall be notified immediately.
- 1.4.4. Where material and equipment are specified under a particular standard and supplied under an equivalent standard, a certificate of compliance shall be provided to the Engineer at his request.

#### 1.5 Permits, Fees Inspection(if applicable)

- 1.5.1 Obtain all required permits from the Municipality and/or Utility to complete your work. Make all submissions in a timely fashion with due regard for the requirements of the construction schedule.
- 1.5.2 Pay all fees and charges levied by the authorities having jurisdiction. Arrange for any permits, inspections and certificates and work carried out by the Municipality or Utilities in connection with your work. Perform all tests required by the governing authorities, including those tests specified under this Division, and submit a copy of the final approved inspection certificate for the approval of the Engineer before taking
- 1.5.3 over Certificate. All costs for testing to be borne by the Contractor including all consumables required for testing, commissioning, training and running of the facility until TOC is issued.
- 1.5.4 It is the contractor's responsibility to provide a comprehensive list of standards applicable to each municipality and / or utility company approval after soliciting this information from the concerned authority, and to provide compliance statements with standards before making submittals to authorities. Any calculations, sketches, drawings or information required shall be produced and provided by the contractor at no extra cost.

## 2. General as to MEP Works

- 2.1.1 The work throughout shall be executed in the best and most thorough manner, under the direction of and to the satisfaction of the Employer and the MEP Consultant, who will interpret the meaning of the drawings and specifications, and shall have the power to reject any works and materials which, in their judgment, are not in full accordance therewith.
- 2.1.2 The Contractor shall be responsible for his work until its completion and final acceptance and shall replace any of the same which may be damaged, lost or stolen, without additional cost to the Employer.
- 2.1.3 The Contractor shall put his work in place as fast as reasonably possible. He shall, at all times, keep competent engineers in charge of the work and shall facilitate its inspection by the Employer and Consulting Engineers. He shall also remove any rubbish caused by his work as expeditiously as possible.
- 2.1.4 Except for such changes as may be specifically approved by the Employer and Consulting Engineer, in accordance with alternates or options stated hereinafter, all work must be in full accordance with the intent of the plans and specifications, complete in every way and ready for satisfactory and efficient operation when delivered to the Employer.
- 2.1.5 The Contractor must guarantee that the materials and workmanship supplied under these specifications will be of the best grade, that the apparatus will be erected in a practical and first-class manner, that it will be complete in operation, nothing being omitted in the way of labour and materials required to make it so, although not specifically shown or mentioned herein, and that it will be delivered in well-working order, complete and perfect in every respect.
- 2.1.6 The Contractor shall thoroughly acquaint himself with the work involved, and must verify at the building all measurements necessary for the proper installation of his work, obtaining the same when necessary from the Employer. He shall also be prepared to promptly furnish, to other Contractors or Employer, any information relating to his own work necessary for the proper installation of other work and shall co-operate to secure the best progress of and harmony between, the works of the different trades, in the interests of the building as whole.
- 2.1.7 It is specifically intended, in this specification, that anything (whether material or labour) which is usually furnished as a part of such equipment as is hereinafter called for (and which is necessary for its proper completion and best operation), shall be furnished as a part of this contract without additional cost whether or not shown in details on the drawings or described in detail in the specification. This provision is in consideration of the fact that in many cases the use of apparatus of different makes may be considered which differs in detail from that described, although intended to fulfil the same functions.
- 2.1.8 The Employer will arrange, without charges to the Contractor, the supply of electricity, water and fuel during the commissioning starting, testing and adjusting of the complete plant, and summer and winter test runs. The Contractor shall be responsible for the supply of all other materials and labour required in this connection.

## 2.2 Co-Ordination of Work Done By Others

- 2.2.1 Due to the type of the installation, a fixed sequence of operations is required to properly install the complete system. It shall be the responsibility of the Contractor to closely schedule his work so that his work will be installed at the proper time and without delaying the completion of the entire project.

## 2.3 Cutting and Patching

- 2.3.1 In general cutting and patching will be done by the Contractor.
- 2.3.2 No structural opening shall be made by he Contractor without prior written approval of the competent authority (Structural consultant)

## 2.4 Approvals, Substitutions, etc.

- 2.4.1 Wherever hereinafter the words "FOR APPROVAL" or "APPROVED" are used in regard to manufactured specialties, or wherever it is desired to substitute a different make or type of apparatus for that specified, all information pertinent to the adequacy and adaptability of the proposed apparatus shall be submitted to the Architect and Consulting Engineer, and their approval secured before the apparatus is ordered.
- 2.4.2 Wherever operating results (such as quantity delivered, pressure obtained, or the like) are specified or a definite make and size of apparatus is specified, for which such quantities are readily determinable, the make and size of apparatus that is proposed to be used must conform substantially (in regard to such operating results) to the quantities specified or implied. The same shall apply to important dimensions relating to the installation and operation of the apparatus in co-ordination with the rest of the system, or to properly fitting it into the available space conditions.

## 2.5 Permits

- 2.5.1 All work specified herein shall be installed in full accordance with the requirements of all Governmental agencies having jurisdiction. The Contractor shall secure and pay for any necessary approvals, permits, inspections, etc., and he shall turn over the official records of the granting of permits to the Employer.
- 2.5.2 The Contractor shall obtain all necessary allowances, pay any royalties, etc., in connection with the use of any patented devices or systems and software shall hold the Employer harmless and immune from any claims or law-suits arising from such use.

## 2.6 Drawings, Changes and Installation

- 2.6.1 The drawings shall be considered to show the general character and scope of the work and not the exact details of the installation. The installation shall be complete with all accessories required for a complete and operative installation.
- 2.6.2. The location, arrangement and connection of equipment and material as shown on the drawings represent a close approximation to the intent and requirements of the Contract. The right is reserved by the Engineer to make reasonable changes required to accommodate conditions arising during the progress of the work, at no extra cost to the Contract.
- 2.6.3. All Electrical piping and duct work in finished areas shall be concealed in ceiling spaces and shafts or chased into walls. No exposed work shall be installed in such areas unless specifically accepted by the Engineer.
- 2.6.4. Vent pipes, exhaust hoods or other mechanical & electrical equipment mounted on roof, or housing for such equipment, shall not be close to the edge of roof than a distance equal to the height of the pipe, hood or equipment; unless specifically accepted by the Engineer.
- 2.6.5. The actual location of thermostats, switches, etc., shall be reviewed by the Engineer before installation.
- 2.6.6. The location and size of existing services shown on the drawings are based on the best available information. The actual location of existing services shall be verified in the field before work is commenced.
- 2.6.7. Changes and modifications necessary to ensure coordination and to avoid interference and conflicts with other trades, or to accommodate existing conditions, shall be made at no extra cost to the Contract.
- 2.6.8. The Contractor shall ensure that all plant to be supplied by him can be installed in the available space and that there is adequate access to admit all plant to its position and enable maintenance to be carried out on the plant without difficulty.
- 2.6.9 Special care shall be taken in areas where pour-gaps take place.

## 2.7 Shop Drawings

- 2.7.1 Shop Drawings shall indicate clearly all services and the materials and/or equipment actually being supplied, all details of construction, accurate dimensions, capacity operating characteristics and performance. Each material submission shall give the identifying number of the specific pump, fan, etc. for which it was prepared (e. g. Fan F-7).
- 2.7.2 Each shop drawings for non-catalogue items shall be prepared specifically for this project. Material submissions and brochures for catalogue items shall be marked clearly to show the Items being supplied.

- 2.7.3 This contractor shall prepare all shop drawings related to the particular material submittal and shall submit both the shop drawings and the material submittal simultaneously.
- 2.7.4. Ensure that electrical, structural, reflected ceiling coordination with all applicable trades is complete before submitting drawings for review.
- 2.7.5 Installation of any equipment shall not be commenced until after the shop drawings have been approved by the Engineer.
- 2.7.6 When requested, shop drawings shall be supplemented by data explaining the theory of operation. The Engineer may also request that this information be added to the maintenance and operating manual.
- 2.7.7 Shop drawings shall be in compliance with the requirements of "General Notes" drawing for each MEP trade. All piping (plumbing, drainage, chilled water cable trays etc.) and duct work under this contract shall be shown in double line at a scale to be advised by the Consultant.
- 2.7.8 A coordinated plan and section (running the entire length) for each shaft shall be prepared and submitted as part of shop drawings for approval.
- 2.7.9 The Consultants may call for additional drawing as required for the proper execution of the works.

## **2.8 Record Drawings**

- 2.8.1 During construction, the Contractor shall keep an accurate record of all deviations, between the work as shown on the drawings and that which is actually installed.
- 2.8.2 After completion of the installation work, the Contractor is to provide 3 sets of "as installed" drawings showing runs and location of all the equipment, controls, piping, ducting, electric wiring etc., giving all necessary details of the works as actually installed. The Contractor shall also supply electronic copies of drawings on AutoCAD 14 or later on CD.

## 2.9 Drawing Submissions

- 2.9.1 Unless otherwise indicated, the Contractor shall provide the following drawings:
- 2.9.1 Seven (7) sets of prints, and one electronic copy in CAD format on disk of builder's work drawings, (to a scale of 1:50).
- 2.9.2. Three sets of prints, and one electronic copy in CAD format on disk of detailed services and plant room layout drawings (to a scale of 1:50).
- 2.9.3. Three sets of prints, and one electronic copy in CAD format on disk of purpose-made diagrams detailing separately all the composite electrical circuit and wiring layouts.
- 2.9.4 Three sets of prints, and one electronic copy in CAD format on disk of drawings or any variations to the design suggested by or agreed with the Engineer.
- 2.9.5 Three sets of prints, and one electronic copy in CAD format on disk of "as installed" drawings, upon completion of the work and as a condition precedent to the certification by the Engineer that the work is complete.
- 2.9.6 Builder's work drawings shall show fully dimensioned, foundation, bases plinths, sumps, holes and sleeves details required and the overall size and weights of the plant concerned.
- 2.9.7 With the agreement of the Engineer, smaller holes, built-in fixings, etc., other than in plant rooms, may be marked out on site instead of on drawings.
- 2.9.8 Fully dimensioned plant room drawings shall detail for each plant room the location of each unit, pipe routes and connections with valves and fittings, duct routes and connection with accessories, drain connections, electrical connections and controls. All drawings shall include explanatory notes and shall show the required sizes of pipes and ducts with and without insulation as applicable.
- 2.9.9 If abbreviations are employed for the designation of components, an integral schedule shall be provided on the drawings to explain the meanings of the abbreviations.
- 2.9.10 Individual equipment drawings from the various manufacturers will not be accepted in lieu of these composite plant room drawings.
- 2.9.11 All drawings shall be produced on the latest version of AutoCAD available.

## 2.10 Coordination, Installation, Interference and Setting Drawings

- 2.10.1. Coordination, Installation, interference and setting drawings dimensioned and to scale, shall be submitted for the Engineer's review to make clear the work intended and to, show its relation to adjacent work and to the work of other trades. Three copies of such drawings shall be submitted for review, of which one will be retained by the Engineer.
- 2.10.2. The drawings must be comprehensive showing all details, dimensions, equipment, supports for services and sections through critical areas to properly coordinate all services and work of other trades. All drawings must be to 1:50 scale.
- 2.10.3. Site services drawings shall be prepared to show all existing services, modification to existing services and all new services within the entire construction area. Drawings must show all connections of new or existing services to Municipal services and must be approved by the relevant authorities. Location of all existing services shall be carefully detailed and dimensioned on the drawings showing all sizes and invert elevations.
- 2.10.4. Drawings shall be prepared with due regard to the construction schedule and shall be submitted to the Engineer, allowing reasonable time for examination and review.
- 2.10.5. Work shall not proceed in areas involved until after final approval of all such drawings has been obtained.
- 2.10.6. These drawings shall include all existing information.

## 2.11 Contractor's Technical Responsibilities

- 2.11.1. The Contractor shall provide detailed calculations for flow and head and electrical noise abatement and vibration control for all equipment whether these are supplied by him or the owner. These calculations shall be done prior to ordering the equipment and shall be submitted to the Engineers for review prior to ordering such equipment. This Contractor shall bear full responsibility for the final equipment sizing and selection. The Consultants may specify the details to be provided by the Contractor.
- 2.11.2. The contractor shall provide seismic restraints and supports for all equipment piping, duct work, etc. The supply and installation of all seismic restraints supports and hangars is part of this contractors scope of work. The Contractor shall submit technical details as to how the requirements for seismic restraints and supports was worked.
- 2.11.3. In case of any question regarding the Contractor's responsibility for preparation and supply of any detail shop drawings, data, etc., the Engineer's decision shall be final and binding as to the requirements of the shop drawings, technical manuals, data etc., for any particular part of the work.
- 2.11.4. The approval by the Engineer / Consultants of any submitted data, shop drawing, performance curves, test certificates for any item, arrangement and

/ or layout shall not relieve the Contractor from any responsibility regarding the performance of the contract. Such approval shall not also relieve the Contractor from responsibility of error of any sort in the submitted data and shop drawing.

## 2.12 Commissioning

2.12.1 Commissioning shall be planned and implemented as per International standards and known best practices. The Contractor submit for approval by the Consultants the methodology and commissioning procedure for each item of equipment and for the system as a whole.

2.12.2 The intent of these specifications is to:

- Determine the specific requirement of parts and whole (integrated systems).
- The commissioning process shall be documented and record compliance and acceptance as per approved procedure.

2.12.3 As a general rule the ASH RAE definition of commissioning process shall govern “a quality-oriented process for achieving, verifying, and documenting that the performance of facilities, system, and assemblies meets defined objectives and criteria”. A total process based on the ASHRAE commissioning guidelines shall be followed as directed.

2.12.4 In general commissioning shall follow National Environmental Balancing Bureau (NEBB) procedures.

2.12.5 The testing and commissioning shall as a minimum include but not be limited to the following areas:

- All HVAC Systems
  - Air quality and air tightness of the building
  - All plumbing systems
  - All mechanical systems
- All Fire Protection and life safety systems
  - All water systems & STP installation
  - All Food Service Systems
  - All Electrical Systems

2.12.6 The intention of the commissioning process is to demonstrate compliance with design intent and achievement of design parameters.

2.12.7 The Contractor shall notify the Engineer at least seven days in advance of any intended commissioning. He shall submit the Methodology and procedure for approval by the Consultants. On confirmation of the data and time by the Consultant the commissioning shall be carried out and witnessed by the Engineer/Consultants or such other persons/entities what the Employer may nominate.

- 2.12.8 Any Commissioning or testing carried out without being witnessed and approved shall not be considered as complying with the contract's requirements.
- 2.12.9 Details relating to commissioning, testing, balancing/ adjusting are included in the specifications for the various trades.

## **2.13 Tests on completion**

### **2.13.1 Contractors Obligations**

The Contractor shall carry out the Tests on Completion after providing the documents required.

The contractor shall give to the Engineer not less than 21 days notice of the date after which the Contractor will be ready to carry out each of the tests on Completion. Unless otherwise agreed, Tests on Completion shall be carried out within 14 days after this date, on such day or days as the Engineer shall instruct.

In considering the results of the Tests on Completion, the Engineer shall make allowances for the effect of any use of the works by the Employer on the performance or other characteristics of the works. As soon as the Works or a section have passed any Tests on Completion, the Contractor shall submit a certified report of the results of these Tests to the Engineer.

### **2.13.2 Delayed test**

If the Test on Completion are being unduly delayed by the Contractor, the Engineer may be notice require the Contractor to carry out the Tests within 21 days after receiving the notice. The Contractor shall carry out the Tests on such day or days within that period as the Contractor may fix and of which he shall give notice to the Engineer.

### **2.13.3 Retesting**

If the Works, or a Section, fail to pass the Tests on Completion, and the Engineer or the Contractor may require the failed Tests, and Tests on Completion on any related work, to be repeated under the same terms and conditions.

If the Contractor fails to carry out the Tests on Completion within the period of 21 days, the Employer's Personnel may proceed with the Tests at the risk and cost of the Contractor. The Tests on Completion shall then be deemed to have been carried out in the presence of the Contractor and the results of the Tests shall be accepted as accurate.

### **2.13.4 Failure to Pass Tests on Completion**

If the Works, or a section, fail to pass the Tests on Completion repeated, the Engineer shall be entitled to:

- a) Order further repetition of Tests on Completion.
- b) If the failure deprives the Employer of substantially the whole benefit of the

Works or Section, reject the Works or Section (as the case may be), in which event the Employer shall have the right to claims cost of replacement rectification from the Contracts and have the work executed by other.

- c) Issue a Taking-Over Certificate, if the Employer so requests.

### **2.13.5 Operating and Maintenance Instructions**

2.13.5.1 Eight (08) sets of operating and maintenance instructions, covering completely the operation and maintenance of the MEP works systems and equipment shall be furnished to the Employer. The O&M manuals shall include:

- (i) Complete submitting of the equipment including catalogues.
- (ii) Operation and maintenance procedures.
- (iii) Fault trouble shooting
- (iv) Manufacturers Contact
- (v) Spare Parts list
- (vi) Maintenance Schedules.

### **2.14 Guarantees**

2.14.1 The Contractor shall give to the Employer, a written guarantee for the complete installation of all the works against defective materials and faulty workmanship, for the period of maintenance, from the date of issue of certificate of substantial completion by the Engineer. The guarantee shall also cover the maintenance of operating conditions as specified. All defects of materials or workmanship found in the installation during the period of maintenance shall be removed and defective items replaced or repaired by the Contractor without any additional cost to the Employer.

2.14.2 The Engineer shall inform the Contractor, in writing, in what respect any portion is defective. If any defect be not remedied within reasonable time by the Contractor, the Employer may proceed to do the work at the Contractor's risk and expense, but without prejudice to any other rights which the Employer may have against the Contractor in respect of such defects.

2.14.3 In case the replacements, repairs or renewals are of such a character as may affect the efficiency, the Engineer shall have the right to give to the Contractor, within one (01) month from such replacements, repairs or renewals, notice in writing that a test be carried out to test the efficiency and performance, and it shall be the duty of the Contractor to ensure that the efficiency and performance conform with the specified requirements.

2.14.4 In the event of any defect of material or workmanship occurring or being discovered during the period of maintenance, the period of maintenance shall continue until the cause of the defect has been discovered and remedied to the satisfaction of the Engineer.

## 2.15 Manufacturer's Guarantees

- 2.15.1 Each manufacturer shall give guarantee for all items and this guarantee by the manufacturer, shall be an essential part of the documents to be submitted by the Contractor to the Employer to claim payment against the equipment the guarantee shall state that the stores supplied are produced new, in accordance with the contract specifications and drawings, and that the materials used, manufactured, are in accordance with the latest appropriate standard specifications, the contract specifications and of good workmanship throughout. (The manufacturer will replace, free of cost F.O.B. factory, any part of the equipment for either a period not exceeding 12 calendar months after it has been taken over on completion of installation, as certified in the completion certificate issued by the Employer, or a period of 24 calendar months after the date of dispatch from the factory, whichever is shorter, which would be found defective due to unsound material or faulty workmanship, or in any way not in accordance with the contract specifications and drawings.)
- 2.15.2 The manufacturers responsibility shall be limited to replace any part or parts of the stores found to be defective in workmanship or material, provided the equipment is operated and maintained by the Employer in accordance with the generally approved practices, and provided the Employer informs in writing as soon as such defect becomes apparent.
- 2.15.3 The manufacturers' obligation shall be to replace or repair any part or parts found defective F.O.B. The factory and the manufacturer shall not be responsible for any consequential damage or liability.
- 2.15.4 Wherever guarantees of operating capacity and efficiency, proper functioning, durability and the like are called for and / or wherever it is specified that the manufacturer shall furnish necessary drawings, performance data, test certificates etc., and shall supervise the starting up of the equipment and adjustments after installation and starting up etc., and maintain it for the required period and perform similar other duties and services, the Contractor shall be held responsible for performance of the specified services for the actual conditions of the installation and he shall be held responsible for any default on the part of his suppliers / manufacturers.

## 2.16 Training

- 2.16.1 The Contractor shall arrange the training of the Employers dedicated O&M Staff. The training shall cover all major equipment and systems.
- 2.16.2 The trainings shall based on the Operation and Maintenance manuals and the equipment and systems themselves.
- 2.16.3 The Contractor shall arrange suitably qualified personnel approved by the Consultants for providing the necessary training.

- 2.16.4 The training shall consist of training in the class room type environment followed by practical demonstration of operating procedures.
- 2.16.5 Training shall continue until O&M personnel are able to operate the equipment.
- 2.16.6 Training shall be carried out prior to commissioning of the systems.

## **2.17 Spare Parts**

- 2.17.1 The Contractor shall provide spare parts for the various equipment's and systems as called for in the specification for each trade.

## **2.19 Painting**

Painting works shall be carried out as per Specifications No. 09 90 00 which is made part of these General requirements.

## **2.20 Vibration, Noise and Seismic Controls**

Vibration, noise and seismic controls works shall be carried out as per Specifications No. 13 48 00 which is made part of these General requirements.

**3-EXHAUST AIR FANS**

01. The fans shall be complete with the electric motors. The motors and motor starters provided in respective Motor Control Centers shall comply with the requirements as specified elsewhere in the documents. In case of fans with single phase motor of less than 500 watt rating a MCB with on-off switch and "on" indicating light may be provided instead of starter. Fan speed regulator is to be provided if specified in the Schedule. All electric motors for fans in this section shall be totally enclosed type unless otherwise specified. The motors shall be selected so as not to be overloaded under the specified operating conditions.
02. The fans shall be statically and dynamically balanced and tested in the factory. The fan-motor set shall be selected for quiet operation. The bearings may be sleeve, ball or roller type but must be silent running, heavy duty, self-aligning type and to prevent leakage of oil or grease, preferably sealed and permanently lubricated otherwise requiring only yearly lubrication with oil/grease cups provided in easily accessible position.
03. The fans shall not transmit vibrations to the Building structure. All fans except propeller type to be mounted on suitable rubber-in-shear or similar approved vibration isolators to isolate from the Building structure. If specified, vibration isolators to be provided for propeller fans.
04. The belt driven fans shall be provided with belt guard and variable pitch pulley to adjust fan speed +5-10% of the design selected speed for the specified duty.
05. Fans used for exhaust shall be provided with rain protection hood or louvers with insect screen on the exhaust side.
06. The fans shall be connected to the ducting with heavy duty fabric flexible connectors as specified elsewhere.
07. The propeller type fans shall be direct driven by totally enclosed fan motors.
08. The centrifugal fans shall be either aerofoil or backward curved non-overloading type. The fan to have all welded heavy constructed housing rigidly supported and braced to prevent drumming, oversized shaft with shaft seal, vee belt drive and inlet screen where no duct is connected to inlet. Fan scrolls more than 20 inch width will have a pan type access door set in a raised frame so that inner surface is flush and smooth with the scroll. The door shall be provided with lift handles and secured to the frame with handgrip bolts.
09. The fan shall be selected at flatter part of the performance curve so that the cfm does not vary more than 20% in the external static pressure range specified in the Schedule of Fans.

**4- PIPING**

01. Where screwed joints are used, the screw threads shall be cut clean and true, screwed joints made tight with Teflon thread seal tape, approved thread seal compound or litharge. Jute thread, red or white lead, pipe dope, caulking or filling compounds shall not be used. Reducing fittings shall be used to change pipe sizes and no bushings shall be used. All necessary unions shall be provided for easy dismantling.
02. All pipes shall be properly supported on clamps, hangers etc. of approved design. Supports shall be designed to permit free expansion and contraction to minimize vibrations. All hangers, clamps etc. for piping in the plant rooms, basements, inspection passages and vertical risers shall be provided with rubber in shear or spring or combination anti vibration supports to prevent transmission of vibrations to the building structure. No pipe shall be suspended from other pipes.
03. Expansion joints shall be installed in the piping at building expansion joints and where required at other locations to prevent undue stresses in the piping. The expansion joints may be installed with tie bars as recommended by the manufacturer for the required duty. Where space is available, expansion loop shall be used instead of an expansion joint.
05. All pipes passing through floors or walls shall have 20 gauge G I sleeves for the full depth of the finished floor construction or thickness of the finished wall and extending 6mm beyond the finished face of the structure on both sides.
06. All elbows shall be long radius type except where space limitations necessitate use of short radius type.
07. The Contractor shall provide all stop valves, balancing valves, check valves, drain cocks, steam traps, dirt traps, automatic vents, manual vents, thermometers, pressure gauges, strainers and other specialities as are required for proper operation of the whole system. Generally necessary valves etc are shown in the drawings. All valves, strainers and specialities shall be selected for 7 bar rating or 125% of working pressure of the system whichever is higher.
08. The Contractor shall provide strainers where necessary to protect all equipment, automatic control valves etc. where proper functioning would be affected by the dirt on the seat or by scoring of the seat.
09. At the time complete plant is operated and tested and any of the coils etc. do not have rapid and noiseless circulation due to trapped or air bound connections or any other reason of defective installation and workmanship, the Contractor shall be responsible to make proper alterations in these defective connections.
10. The piping installation shall not be accepted until it is free from foreign matters to the satisfaction of the Engineer.
11. The piping for fluorocarbon refrigerant circuits shall be hard drawn copper tubing with silver soldered joints. Equipment, valves, strainers, etc. shall have flanged joints as required for easy dismantling and servicing. In case of size 5/8" OD and below.
12. Fluorocarbon refrigerant piping shall be hard drawn seamless copper piping of refrigeration service quality.

**5-INSTALLATION**

- 1.0 The Contractor shall be responsible for the supply, manufacture, fabrication, assembly and installation of all the above items and all other items, accessories and materials required to complete the installation and make the plant ready for operation in all respects.
- 2.0 The installation work shall include all rigging, setting, assembling, aligning and grouting necessary to prepare each of equipment and its integral parts for normal continuous operation in locations shown on drawings and special attention shall be paid to all installation notes on the drawings and instructions in the manufacturers' technical bulletins.
- 3.0 The Contractor shall arrange for progressive shipment of equipment/materials with emphasis on early delivery for the items to be installed in the occupied areas. The shipments should commence and be completed within the periods specified in the Memorandum.
- 4.0 The Contractor shall be required to complete the work in all respects on floor wise basis. All work in an occupied floor will be completed and tested in all respects and then the Contractor will not be allowed to do any other work in that floor or interfere with the building finishing work of the Main Contractor except for the final testing and adjustment when the complete plant is commissioned and operated.
- 5.0 The Contractor shall be required to complete the installation in the occupied areas progressively and the entire installation within the times stipulated in the Memorandum.
- 6.0 The Contractor shall follow the procedures outlined in manufacturers' instruction books for handling, setting, assembling, installing, aligning, grouting etc. of equipment. For equipment not supplied with instruction books, the Contractor shall follow standard practices that are acceptable to the Engineer/ manufacturer taking all precautions to prevent damage to the equipment. The Contractor shall advise the Engineer of the installation procedure to be followed for each equipment and shall keep the Engineer informed as to the progress of the installation.
- 7.0 Equipment which is not weather proofed or which may be designated by the Engineer as subject to damage if exposed to the elements shall be covered and protected with tarpaulins or other approved means.
- 8.0 All equipment such as pumps, motors, refrigeration machines, air compressors, etc. shall be set carefully to the proper line and elevation and aligned, then bolted down and grouted in place.
- 9.0 After the piping has been installed, the coupling halves connecting driving and driven portions of equipment shall be checked for alignment. Wherever misalignment is found, the coupling halves shall be disconnected and the equipment shall be realigned. Piping or duct work which is connected to any equipment shall be supported by adequate hangers or other supports and shall be entirely free of any supporting assistance by the equipment. When the alignment is correct, the equipment shall be drilled and dowelled

- to the base plate. Accurate records shall be kept for the aligning of all rotating equipment.
- 10.0 Coupling bolts shall not be installed permanently until the correct direction of rotation has been established for the equipment. Wherever the manufacturer has not provided a directional arrow or marker, the Contractor shall provide the same.
  - 12.0 All uncrating, unpacking, cleaning, degreasing, removal of skids, protective covering and inspection prior to installation shall be performed by the Contractor. Due diligence and extreme care shall be exercised to prevent distortion and damage when unloading and moving equipment to its proper location. Ropes or slings shall be attached to the equipment as recommended by the manufacturer and in such a manner that the weight is properly distributed without abnormal strain on the equipment.
  - 13.0 All equipment shall be inspected prior to start-up by the Contractor. All work required to satisfy the inspection at the time of start-up such as but not limited to unbolting of covers, access doors, special scaffolding for inspection, removal of foreign matter, removal of belt guards, tightening of hold down bolts and flanges, etc. shall be performed by the Contractor.
  - 14.0 All required protection of shafts, flanges and similar parts of the equipment by grease coating or otherwise shall be provided.
  - 15.0 The Contractor shall furnish and install extension handles, extension oil cups or such similar fittings or appliances for lubrication, etc. of all equipment where same is not easily accessible, unless otherwise specified or shown on the drawings.
  - 16.0 Interferences. The Contractor shall coordinate the work of the different trades in order that interference between mechanical, electrical, architectural and structural work will be avoided. Piping, ducts, etc. shall be kept as close as possible to ceilings, walls, columns etc. in order to take up minimum space and all off-sets, fittings etc. required shall be furnished and installed by the Contractor without additional expense to the Employer. In case interference develops, the Engineer will decide which equipment, piping, etc. shall be relocated, regardless of which was first installed

## **6-CLEANING, TESTING AND ADJUSTING**

- 1.0 All air ducting sections shall be given a pressure test before fixing insulation and cutting openings for air devices. Any opening made shall be sealed off with air tight metal caps or any other convenient device for giving the pressure test.

The ducts shall be pressurized with a rotary blower or nitrogen cylinder:

- (a) Low pressure ducts upto 50mm wg.

All seams and joints shall be checked and all audible and noticeable leaks repaired in a good workmanlike manner by filling with a sealant, Zahabiya Duct Sealant or approved equal, from to the inside of the joint so that the air pressure tends to force the sealant into the joint.

The Contractor shall follow SMACNA procedure to carry out final measured leakage test for medium or high pressure ducting. A cfm leakage upto 10% of the volume of the duct section under test shall be permissible.

- 2.0 All refrigerant piping shall be tested with dry nitrogen at a pressure 1-1/2 time the operating pressure or at the test pressure limits fixed by the manufacturer. Refrigerant 12 and 22 systems shall be tested at 10/20 bar on the low/high sides respectively but air cooled Refrigerant 22 high side at 27 bar. The pressure shall be maintained for sufficient time to detect leaks and defects. All leaks and defects shall be made good in proper workman like approved manner. If necessary the piping shall be taken down and re-erected and any make shift or temporary repair of leaks will not be permitted. The pressure shall be maintained for atleast 24 hours in the final test. The system shall subsequently be given 975 mbar vacuum test for sufficient time to detect leaks and defects. Final vacuum shall be maintained for atleast 24 hours.
- 3.0 The Contractor shall test all electric motors, electric wiring and earthing and furnish test records to the Engineer.
- 4.0 After the entire installation has been completed, the Contractor shall operate the equipment under normal working conditions making all necessary adjustments in the equipment, plants, balancing valves, automatic controls, air vents, pressure reducing valves, air dampers, air devices, etc. until all requirements of performance are met.
- 5.0 Air Balancing.

All air systems shall be adjusted and operated for as long a time as necessary to test air flow in all parts of a system and the Contractor shall make all necessary adjustments to obtain proper and uniform air distribution throughout the Building, meeting the specified design requirements. The Contractor shall arrange for this purpose high quality instruments and meters duly calibrated and certified by the manufacturer and having all necessary probes, jets, scoops and collectors for measuring supply, return, fresh and exhaust air velocities and cfm, static pressure and total pressure in the ducts, plenums, fans, air handling equipment, supply, return, fresh and exhaust air devices (grilles, registers, diffusers and louvers). The suggested instruments are Alnor Series 6000-P Velometer or Alnor Compu Flow Electro Manometer with Micro Printer, Cambridge-Alnor PMS Meter and Dwyer combination Manometer-Air Velocity Meter. The Contractor shall inform the Consultant about the instruments he proposes to use. Air balancing and testing shall not begin until the system has been completed and is in full working order.

**7-ELECTRIC WIRING**

- 1.0 The Contractor will be responsible for complete electric wiring and earthing of the plant, equipment and controls. The Employer shall only provide 3 phase and neutral, 4 wire electric supply point(s) with two earthing points, and 1 phase, neutral and earth, 3 wire electric supply point(s) at locations shown in the drawings and detailed elsewhere in the documents.
- 2.0 The electrical work shall be carried out by licensed workmen authorized to undertake such works under the provisions of the Electricity rules.
- 4.0 The climatic conditions shall be temperatures between 2°C (min) and 45°C (max) with max. relative humidity 90%, unless lower min. and higher max. temperatures are specified elsewhere in the documents.
- 5.0 The electric wiring shall be carried out in MS or G.I. conduits as specified, 18g G.I. sheet metal trunking or cable trays, or G.I. (medium weight) piping as specified and/or shown in drawings. All wiring buried in floor or exposed to weather to be in G.I. piping (mw). MS conduit to be of 16g, given anti rust coating and then painted with black enamel paint. Conduits buried in slabs or walls may be PVC conduits or PVC Class D pipes as specified in the drawings. Sheet metal trunking or cable trays installed indoor shall have ventilation slots; those installed in Building shafts shall have removable covers and installed outside shall be of weather proof construction with removable covers. The wire sizes shall be selected for satisfactory operation at least 45°C ambient temperature derated according to installation method and grouping as envisaged.
- 6.0 The terminal connections for motors and where required for starters, shall be made in flexible conduit. The terminal wiring for 230 volt, 1 phase below 0.5 HP motors (such as for fan-coil units, small ventilation-exhaust fans) and their starter control switches can be exposed PVC insulated and sheathed wiring, connections protected within the terminal box so that no live lead is exposed.
- 7.0 The wiring for electric/electronic automatic controls shall preferably be with single conductor wire which may be PVC insulated within metal conduits, exposed shielded or exposed PVC insulated and sheathed wiring in accordance with the recommendations of the control manufacturer. The live connections shall be protected by the cover plates to avoid any hazard. The wiring outside the plant rooms or fan-coil unit enclosures must be in conduit to avoid any mechanical damage.
- 8.0 All Motor Control Centres(MCCs) or Control Boards shall be Factory fabricated of an approved listed manufacturer.
- 9.0 On each Motor Control Centre (MCC), the incoming supply shall have a circuit breaker for 20 amps and above rating and circuit breaker or disconnect switch with fuses for lower rating.  
The circuit breaker shall be of high rupture capacity, heavy continuous duty, moulded case type (MCCB) for 1000amps and below rating and air-breaker (ACB) type for rating above 1000 amps. The circuit breaker shall have adjustable magnetic short circuit trip and adjustable thermal overload trip. In MCCs with multi circuit outgoing, the incoming MCCB of 100amp and above or ACB shall have high and low voltage release, rated 415 volt  $\pm 20\%$  adjustable range. The MCCB or ACB to be manually reset after trip. The

minimum rupture capacities (IEC 157-1 P-1 rating or IEC 947-2 Icu rating) at 415 volt of MCCBs shall be as follows:

RATING	RUPTURE CAPACITY
Up to 30 amp rating	10 KA
40 to 225 amp rating	25 KA
250 to 400 amp rating	30 KA
500 to 600 amp rating	35 KA
800 amp rating	50 KA
1000 amp rating	65 KA

Miniature Circuit Breakers (MCB) shall have minimum rupture capacity of 5KA and to have off-on-reset switch with handle. The 3-phase MCB shall make or break all 3 circuits simultaneously. MCB may be used for single phase circuits up to 30amp rating. 3-phase MCB may be used for motors 4HP and below or for general power supply circuit 30amp and below.

The disconnect switch shall be rotary type. The fuses shall be HRC time lag link type according to BS 88:1952 and ASTA-20 certified. Two sets of replacement HRC fuses shall be supplied as spare for each disconnect switch.

Each outgoing individual circuit shall have a ACB or MCCB or MCB or disconnect switch with fuses according to rating limits specified above. The outgoing for each motor circuit shall be provided with:

1-phase MCB	for single phase motors up to 1HP
3-phase MCB	for 3-phase motors 4HP and below.
MCCB	for 3-phase motors above 4HP.

- 10.0 Single phasing preventer relay shall be provided for each 3 phase circuit of 1 HP and above rating as part of motor starter.
- 11.0 The Contractor shall supply and install necessary Motor Control Centres (MCCs), Control Boards, circuit breakers, disconnect switches, fuses, MCBs, earthing, etc. to complete the work. It is required, where possible, to mount all circuit breakers, disconnect switches, fuses, starters, contactors and relays, etc. in one machine room on one MCC for ease of operation.
- 13.0 The Contractor shall submit schematic electric wiring diagrams, manufacturer's construction drawings, component selection lists with manufacturers' technical literature for all components proposed to be used to the Consultant for checking and approval before the fabrication of MCCs and Control Boards is commenced. The work will be carried out only in accordance with the approved drawings and components.
- 14.0 All components and wires shall be selected/sized with required derating for site ambient and altitude as specified and close grouping within the enclosed space of a MCC or Control Board.
- 15.0 Each Motor Control Centre shall have three phase indicating lights, incoming supply voltmeter with phase selector switch, three ammeters one for each phase if more than one outgoing and total load 30 KW (40 HP) and above, an incoming ACB or MCCB according to load, a MCCB or MCB for each outgoing according to circuit rating, motor starters, ammeters, indicator lights, etc.

All starters/contactors for motors and equipment operation control shall have rotary type hand/off/auto switch. With HOA switch in "auto" position the motor/equipment shall be remote operated from the MCC so designated or Building DDC System as specified, "hand" position would permit local operation and testing, while the "off" position would ensure that all circuits are deenergised for servicing and checking.

- 16.0 Each out going shall circuit shall have a MCCB according to circuit rating and indicating lights. Each out going for motors shall have rotary type hand/off/auto switches, star-delta motor starters, contactors, ammeters, etc.
- 17.0 Contractor shall provide three set of fuses, indicating lamps, one manometer and one voltmeter as spares.

**8- SPECIAL TOOLS AND INSTRUMENTS FOR MAINTENANCE**

- 1.0 The Contractor shall supply to the Employer all necessary special tools and instruments required for proper operation, servicing and maintenance of the complete plant.
- 2.0 The tenderer shall give a complete List of special tools and instruments included in his tender.
- 3.0 Amongst others, following shall be included without limitation:
  - 3.1 Tong Tester of suitable range with Amp, Volt and ohm scales.
  - 3.2 One set each of open end, ring and adjustable spanners.
  - 3.3 One set each of flat and Philips head screw drivers.
  - 3.4 Set of hammers.
  - 3.5 Two pliers with flat and pointed nose.
  - 3.6 Set of Adjustable wrenches (Make: Force)
  - 3.7 Offset Box Wrenches (all Standard Sizes) (Make: Force)
  - 3.8 Electric Air Blower, Industrial Type (Make: Hyundai)
  - 3.9 Bench vice (6" Size) = 01 No.
  - 3.10 Karcher Machine (Make: Karcher)
  - 3.11 Service Bags= 05 No

**09-MAINTENANCE**

01. The Contractor shall be responsible without additional charge to the Employer for maintenance and servicing of the complete plant during the period of maintenance named in the Memorandum after the issue of the Certificate of Substantial Completion by the Engineer.
02. The Contractor shall be responsible for arranging all tools, instruments and Technical Staff including Specialist Technicians/Engineers required for the work. The Employer shall be responsible to supply all materials and spare parts required for the work excluding parts defective due to manufacturing defect which shall be replaced by the Contractor under the terms of the contract.
03. The Contractor shall service the complete plant regularly according to the Schedule of Servicing and Maintenance as approved or amended by the Consultant but not less than once a month during the operational seasons. The servicing and maintenance shall be carried out by competent skilled labor under supervision of a qualified Engineer. The Contractor shall take a certificate of satisfactory completion of monthly servicing from the Employer's Representative.
04. The Contractor shall carry out annual servicing, maintenance and overhauling of the complete plant at the end of the operational season and make the plant ready for operation in all respects well before the commencement of the next operational season. On receiving notification from the Contractor that annual servicing, etc. is nearing completion, the Consultant shall check the work carried out and give directions to the Contractor for completion of outstanding work, if any.
05. On satisfactory completion of annual servicing, maintenance and overhauling of the complete plant, the Engineer shall issue a Certificate of satisfactory completion to the Contractor.

## 10- PORTABLE FIRE EXTINGUISHERS

### PART ONE GENERAL

#### 1.0 REFERENCE

- 1.1. Conform to General Requirements and Conditions for MEP Works.
- 1.2. Comply with the requirements of NFPA-10.

#### 2.0 MATERIALS

- 2.1 Fire extinguishers shall comply with NFPA-10 for listing and labeling.
- 2.2 Fire extinguishers shall be as follows:  
Carbon dioxide: 5.0 Kg.  
Dry Chemical/Multipurpose: 4.5 Kg type ABC
- 2.3 Each fire hose cabinet shall be equipped with a 4.5 kg ABC fire extinguisher and 5 kg CO<sub>2</sub> fire extinguisher.

#### 3.0 INSTALLATION

- 3.1 Fire extinguishers shall be located shown on drawings and as prescribed in the NFPA 10 standard and in accordance with Local Defense

**11- AIR COOLED SPLIT AIR CONDITIONING UNIT**

1. Electrically operated, Refrigerant-HFC 410A split units cooling type air conditioner with remote air cooled condensing unit of minimum capacity as specified in Schedule of Equipment.

The condensing unit to be complete with compressors, air cooled condensers, condenser fans, fan motor, controls, casing and safety devices and all other accessories to complete the unit.

The fan coil unit to be suitable for installation within the space and as indicated on the drawings.

**PART TWO PRODUCTS**

2. MATERIAL

- I) INDOOR UNIT

Indoor Unit shall be wall mounted type. The casing shall be constructed of galvanized steel. The units shall be provided with decorative plastic side panels and return grille/filters on the front of the unit.

Drain pan shall be double walled insulated, epoxy resin coated rolled steel plate insulated with fire retardant foam coating with removable drain pan extended beyond coil to serve connections.

Fans shall be forward curved centrifugal direct driven type double width double inlet type. Bearings shall be permanently lubricated sealed ball bearings.

Motors shall operate on 220 volt 50 Hz power and shall be suitable for multi-speed control from manual selector and shall be tapped wound permanent split capacitor type with UL listed thermal overload protection. Maximum sound power level shall not exceed 56 dB at 250 cps.

The direct expansion cooling coil shall be fabricated of copper tubes with mechanically bonded aluminum fins, and tested to 31 bar pressure and suitable for working pressures up to 24.1 bar.

- II) CONDENSING UNIT

The air cooled condenser shall have ample surface area to meet the specified capacity requirements, weather proof construction with galvanized steel casing, copper tubes with mechanically bonded aluminum fins, working pressure 24.1 bar, propeller or axial flow type galvanized fans with vertical upward or side air discharge, totally enclosed fan motors with automatic direct on line magnetic starters. The condenser should preferably have liquid sub cooling arrangement.

The compressors shall be hermetically sealed reciprocating or Rotary type complete with suction and discharge valves with connections for pressure gauges, suction gas cooled motor having internal thermal over load protection

in each phase winding, internally spring mounted to provide quiet free floating operation forced feed lubrication system with built-in anti-sludging device.

The unit shall be complete with operating charges of refrigerant and oil and all interconnecting piping controls and accessories.

### III) CONTROLS

Provide thermostat and three speed on-off selector switch for each unit suitable for remote wall mounting.

The tenderer shall supply the following information.

- (a) Capacity of unit.
- (b) Motor BHP.
- (c) CFM capacity and static pressure of DX evaporator.
- (d) Manufacturer's performance guarantee certificate.
- (e) Over all dimensions.

### IV -SPARE PARTS

- 1.0 The tenderer shall include the price of complete set of spare parts for all items supplied by him required for two years operation for the specified operating hours as recommended by manufacturer and specified elsewhere. In particular, spares shall be provided for electrical equipment, fuses, controls, instruments, bearings, flexible couplings, belts, gaskets, O-rings, etc. without which the equipment would become non-operative.
- 2.0 The following spares shall be supplied for Split system (For each Typical model)
  - i. 2 Nos Spare Compressor for (Each Model)
  - ii. 2 Nos Spare Condenser Motors & Fan(Each Model)
  - iii. 2 Nos Spare Fan Motors for Each indoor Model. (Each Model)
  - iv. 03 Nos Spare of Cards indoor & out doors (Each Model)
- 3.0 The tenderer shall give a complete List of all the spare parts included in his tender.

### V-EQUIPMENT WARRANTY

The supplier shall be responsible for **1 YEAR** complete replacement warranty of the complete system.

**12- THERMAL AND ACCOUSTIC INSULATION****PART ONE GENERAL****1.1 REFERENCE**

1.1.1 Conform to General Requirements and Conditions for MEP Works, Division 1 Section 01 00 00.

1.1.2 Conform to Special Requirements for Mechanical Works Section 23 05 01.

1.1.3 Refer to detail sheet in the drawing package.

**PART TWO PRODUCTS****2.1 ACOUSTIC DUCT LINER**

2.1.1 Fibre glass duct liner with fabric on air side, to ASTM C1071 type 2 rigid board type, 48kg / m<sup>3</sup> density; 121°C maximum service temperature: maximum face velocity on fabri side 20.3m/s; non combustible; 25mm thick.

2.1.2 Application: 25mm thick where shown on drawings.

**2.2 INSULATION SCHEDULE**

2.2.1 Insulation shall be as per following schedule:

CONDENSATE PIPING	Elastomeric Foam Insulation 25mm thickness
SHEET METAL DUCTWOR	
Indoor	Fibreglass Blanket Insulation 25mm thickness 48Kg / m3 density.
Outdoor	Fibreglass Rigid Board 50mm thick 48Kg / m3 density.
Five Ducts	Rockwool Blanket with GI wire mesh 96 Kg / m3 density finished with insulating cement and painted.
Kitchen Hood Ducts	Calcium silicate block insulation wire mesh and finished with insulating cement and painted.

2.2.2 All insulation required for the work shall be new, of first-class quality and shall be furnished, delivered, erected and finished in every detail, and shall be so selected and arranged as to fit properly into the building spaces. Where no specific kind or quality is specified, a first-class standard article as approved by the Architect shall be provided.

### 2.2.3 Jackets and Facings

Vapor barrier jackets and facings shall have a permeance rating not to exceed 0.02, puncture resistance not less than 50 Beach units, and tensile strength no less than 241 .33 kPa in width.

Jackets and facings on insulation in exposed areas shall have a white finish suitable for painting without sizing.

All exterior ductwork shall be clad with 26 gauge Aluminum cladding

## PART THREE EXECUTION

### 3.1 EXECUTION

3.1.1 No installation shall be applied to any surface, until all foreign matter has been removed from the surface to be installed. All insulations shall be applied in a manner consistent with good practice and method.

3.1.2 Insulation shall be continuous through floors, walls, partitions, etc. except when otherwise indicated or specified. Where space will not permit application of insulation in wall or slab chase, the chase shall be packed full of 85% magnesium mineral wool asbestos rope, or fiber glass and protected with covers plates as approved by the consultants.

3.1.3 For cold air ducts, fiberglass insulation shall have vapour barrier of aluminum foil with internal fibreglass yarn reinforcement at maximum 5mm centers fixed with approved quality adhesive. Care shall be taken such that vapour barrier is not damage / pierced during installation, and any damage will be repaired with the same quality of vapour barrier. The installation shall be firmly fixed on the ducting / plenums with approved quality adhesive compound recommended by the installation manufacturer's Adhesive to approve by Consultant. The adhesive shall cover at least 25% duct area on the side and top, and 50% area at the bottom. All circumferential and longitudinal joints shall be lapped at least 50 mm and fully sealed with adhesives. Where rectangular ducts are 600 mm in width or greater, the insulation shall further mechanically secured to the ducts, and at least 25 mm wide metal bands shall be applied at the corners so that the mechanical fastener does not pierce the insulation and vapour barrier.

3.1.4 The insulation shall be applied to the full length of the ducts, including portions where internal sound absorber liner etc is fixed.

3.1.5 All access doors and removable panels shall be insulated and jacketed separately. The insulation jacket ends on the duct and door or panel shall be sealed with 50 mm wide PVC vapour seal self-adhesive type tape to prevent damage to the insulation due to use and servicing. Exposed cold air ducts in unconditioned spaces shall be insulated with 50 mm thick, 32 kg/m<sup>3</sup> dense Fiberglass insulation vapour sealed as specified above.

3.1.6 External and weather exposed insulated ducting shall be insulated as specified and then protected with a jacket of 20 kg roofing felt, all joints sealed with hot bitumen PBS PB4 or approved equal. The jacket shall be further mechanically

secured to the duct with 6 mm wide soft aluminum bands, generally spaced at 450 mm. Indigenous coarse cloth, canvas roofing felt and asphalt impregnated kraft paper of approved quality are to be used.

- 3.1.7 25mm thick rigid fiberglass duct insulation with a thermal conductivity of 0.041 W/m.°C at 23.8°C and a density of 48 kg/m<sup>3</sup>. Insulation shall be complete with a vapor barrier: jacket consisting of aluminum foil reinforced with fiberglass yarn and laminated with Kraft paper.
- 3.1.8 Insulation shall not be applied, unless the piping or apparatus to be covered has been tested according to specification.
- 3.1.9 All cements and adhesives shall be as recommended by the manufacturer of the insulation. Insulation, insulation jacket, canvas and adhesive shall be fire retardant with a flame spread not larger than 25 and a smoke developed rating not larger than 50 11 when tested in accordance with standard E 84-61 of the ASTM.
- 3.1.10 Insulation shall be installed in accordance with the manufacturer's printed installation instructions.
- 3.1.11 Valves and fittings shall be insulated with the same material as the pipe.
- 3.1.12 At each hanger or support for chilled water piping, the contractor shall install a section of high-density insulation between the pipe protection saddle and the pipe. Only the lower half of insulation, at hanger, will be replaced by an insert of high-density material so the top of pipe insulation and vapour barrier can be continuous. The high-density insulation shall be calcium silicate and extend 25mm beyond each end of shield. Seal with vapour barrier mastic.
- 3.1.12 Insulation for diesel or gas engine exhaust pipe and muffler shall be 50mm (2") thick calcium silicate. Do not insulate expansion bellows. Insulation shall be protected with 1.0mm aluminum cladding.
- 3.1.13 Where pipes are exposed to outside or unconditioned exposed spaces, they shall be covered with 0.8 mm thick Aluminium cladding.
- 3.1.14 Insulation for pipes, duct and other equipment in mechanical rooms and where exposed to weather; shall be enclosed in 0.8mm thick aluminum cladding with all joints sealed and arranged to shed water.
- 3.1.15 Where thermal insulation is applied to the outside, equipment and plant used to convey, store or generate fluids or gases at temperatures lower than the design ambient dew point temperature a water vapour barrier shall be provided. The vapour barrier shall be applied such that it is continuous and gives protection to the whole surface of the insulation which it protects. It shall not be pierced or otherwise, damaged by supports or by the application of external cladding. At points of support, means of load distribution shall be provided as necessary.

- 3.1.16 Apply insulation in strict accordance with manufacturer's recommendation including all seals and adhesive taking care of compatibility of such adhesives with the insulation. Submit manufacturer's data and compatibility recommendations for review.

**SUKKUR IBA UNIVERSITY.**  
**REVISED BOQ OF HVAC SYSTEM FOR FOREIGN FACULTY HOSTEL.**

S. No.	Description	Qty.	UNIT RATE (RS)		AMOUNT(RS)		
			COST OF SUPPLY	COST OF INSTALLATION	COST OF SUPPLY	COST OF INSTALLATION	TOTAL COST
1	2	3	4	5	6	7	8
1	Supply & Installation of Inverter base Cool & Heat type mini split type A/C units (T-3 Series) complete with ACRA-CLAD factory coated condenser fins, atmosphere friendly refrigerant etc. Complete with safety controls and accessories as per specification and drawings.	Nos.					
i.	Floor Standing (Capacity 4.0 TR )	10					
ii	Wall Mounted (Capacity 2.0 TR )	6					
iii.	Wall Mounted (Capacity 1.5 TR )	56					
2	Supply, Installation, Testing & Commissioning of Copper Piping with Isolation valve & 3/4" thick foam insulation, control wiring, cladding, pipe supports & pipe sleeves complete with all respects as per drawings & specification.	Rft.					
i.	4.0 TR	650					
ii	2.0 TR	280					
iii.	1.5 TR	2800					
3	Supply, Installation, Testing & Commissioning of UPVC Class-D Piping for equipment drain complete with Specialties, 3/4" thick form Insulation, Vapor Barrier, Jacketing & Cladding, fitting, Pipe Sleeves & hanger supports etc. as per specification and drawings.	Rft.					
i.	3/4" dia	950					
ii.	1" dia	150					

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S. No.	Description	Qty.	UNIT RATE (RS)		AMOUNT(RS)		
			COST OF SUPPLY	COST OF INSTALLATION	COST OF SUPPLY	COST OF INSTALLATION	TOTAL COST
iii.	1-1/4" dia	90					
iv.	1-1/2" dia	80					
4	Additional system atmosphere friendly refrigerant charge as per site requirement Complete with all respect as per specification and drawings.	1 Lot.					
5	Supply & Installation of 18 Gauge Cable try for Piping & electrical wiring complete with all respects.	Rft.					
i.	12" x 3"	150					
ii	8"x3"	450					
iii.	6"x3"	400					
6	M&P Services Shop drawings & As Built Drawings Color Copies. (Minimum scale 1-1/8") Hard Copy and Soft Copy in Autocad format in CD	4 Sets					
7	Cost of testing, Starting up, commissioning, balancing, adjusting and handling over of the complete Plant.	1 Job.					
8	Fire Stopping of Walls & Structure Openings/Core Cutting (For Small Openings - Hilti FS - ONE or Approved Equivalent)	1 Job.					
9	Stencilling, Painting & Finishing as per specification.	1 Job.					
10	Equipment foundation, lifting & shifting charges from Ground floor to foundation pads as per specification and drawings.	1 Job.					

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S. No.	Description	Qty.	UNIT RATE (RS)		AMOUNT(RS)		
			COST OF SUPPLY	COST OF INSTALLATION	COST OF SUPPLY	COST OF INSTALLATION	TOTAL COST
11	Cost of System operation for 3 months. (1 Operator).	1 Job.					
12	COST OF ANY OTHER ITEM WHICH IS MISSING AND NECESSARY TO COMPLETE THE JOB. (DETAIL MUST BE ATTACH)	---					
<b>TOTAL COST OF HVAC SYSTEM (Rs.)</b>							

**NOTES:**

- 1 The Contractor shall be responsible for the supply, procurement and delivery of all the material and shifting of the equipment to their respective location, installation, testing, commissioning of the systems in all respects.
  - 2 The quoted cost should include all overheads, profits, income tax and all other Taxes which are applicable, import duty (if any), insurance, packing, unpacking, transportation charges etc.
  - 3 The work at site shall be executed in accordance with the approved shop drawings which will be prepared by the Contractor.
  - 4 The work at site shall be executed in accordance with the approved shop drawings which will be prepared by the Contractor within 1 week after award of works and Manufacturers drawings, Contract Specifications etc.
  - 5 The work shall be awarded on item Rate cost basis.
  - 6 The complete system complete replacement warranty should be minimum 2years.
  - 7 The contractor will provide Equipment Operation & Maintenance Manuals (2 sets Hard copy & Soft Copy.)
  - 8 The contractor will provide Operation & Maintenance Instructions to Clients Representatives
  - 9 The Owner reserves the right to delete any item before award of works. The cost of such items shall be reduced.
- Abbreviation used in the BOQ are as follows:
- 10 a) Sq. Ft. .... Square Feet, (b) R. Feet. .... Running Feet, (c) Ton .... Ton weight, (d) TR .... Ton of refrigeration, (e) No. .... Number, (f) Lot .... Complete package/lump sum.