

CLIENT.



SUKKUR IBA UNIVERSITY

DRAWINGS STATUS.

TENDER DRAWINGS

MARCH - 2021

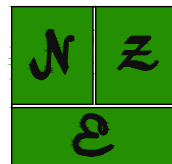
PROJECT

VENTILATION & EXHAUST SYSTEM FOR DINING
BLOCK SUKKUR

PROJECT NO.

IBA-2020-10

M&P CONSULTANT.



N.Z ENGINEERS

PLOT NO. 70C , M-01 JAMI
COMMERCIAL , STREET 9
PHASE-VII, D.H.A KARACHI.
Tel: +92 213 5314095
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ARCHITECT

Habib Fida Ali

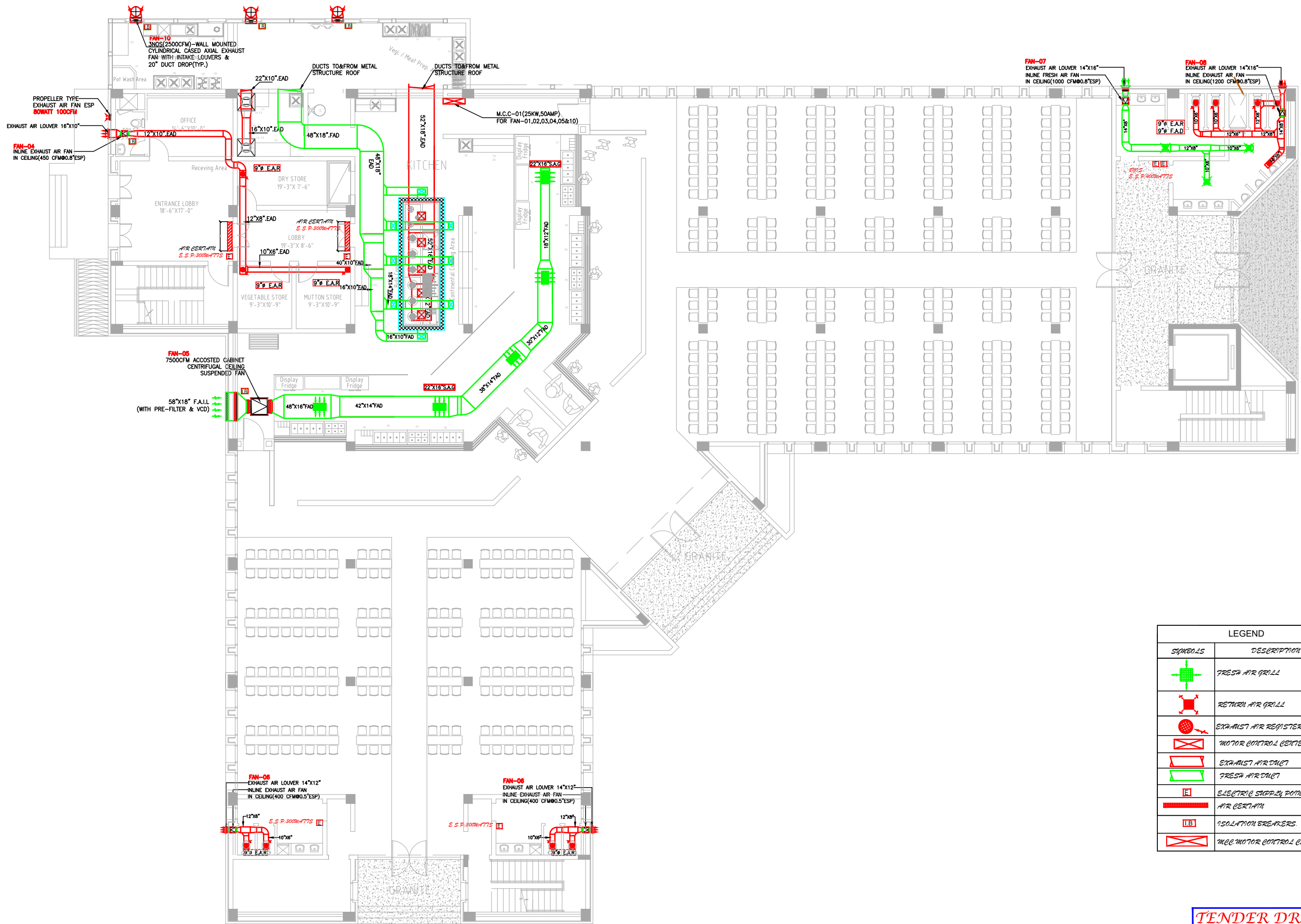
4 CH. KHALIQUZZAMAN ROAD, KARACHI 75530
TEL: 5661683,5661684, FAX:92-21-5686891

LIST OF DRAWINGS

S. NO	DRAWING NOS.	DESCRIPTION	SCALE	DATE
01	H-01	LAYOUT OF PROPOSED VENTILATION & EXHAUST SYSTEM AT GROUND FLOOR	AS SHOWN	MARCH-2021
02	H-02	LAYOUT OF PROPOSED VENTILATION & EXHAUST SYSTEM AT FIRST FLOOR	AS SHOWN	MARCH-2021
03	H-03	LAYOUT OF PROPOSED VENTILATION & EXHAUST SYSTEM AT SECOND FLOOR	AS SHOWN	MARCH-2021
04	H-04	LAYOUT OF PROPOSED VENTILATION FAN PLACEMENT AT ROOF LEVEL	AS SHOWN	MARCH-2021
05	H-05	SECTIONAL DETAILS	AS SHOWN	MARCH-2021
06	H-06	HVAC GENERAL NOTES & VENTILATION FAN SCHEDULE	AS SHOWN	MARCH-2021
07	H-07	HVAC GENERAL DETAIL – I	AS SHOWN	MARCH-2021
08	H-08	HVAC GENERAL DETAIL – II	AS SHOWN	MARCH-2021
09	H-09	KITCHEN EXHAUST AIR HOOD DIMENSIONAL DETAIL	AS SHOWN	MARCH-2021
10	H-10	M.C.C DETAIL	AS SHOWN	MARCH-2021

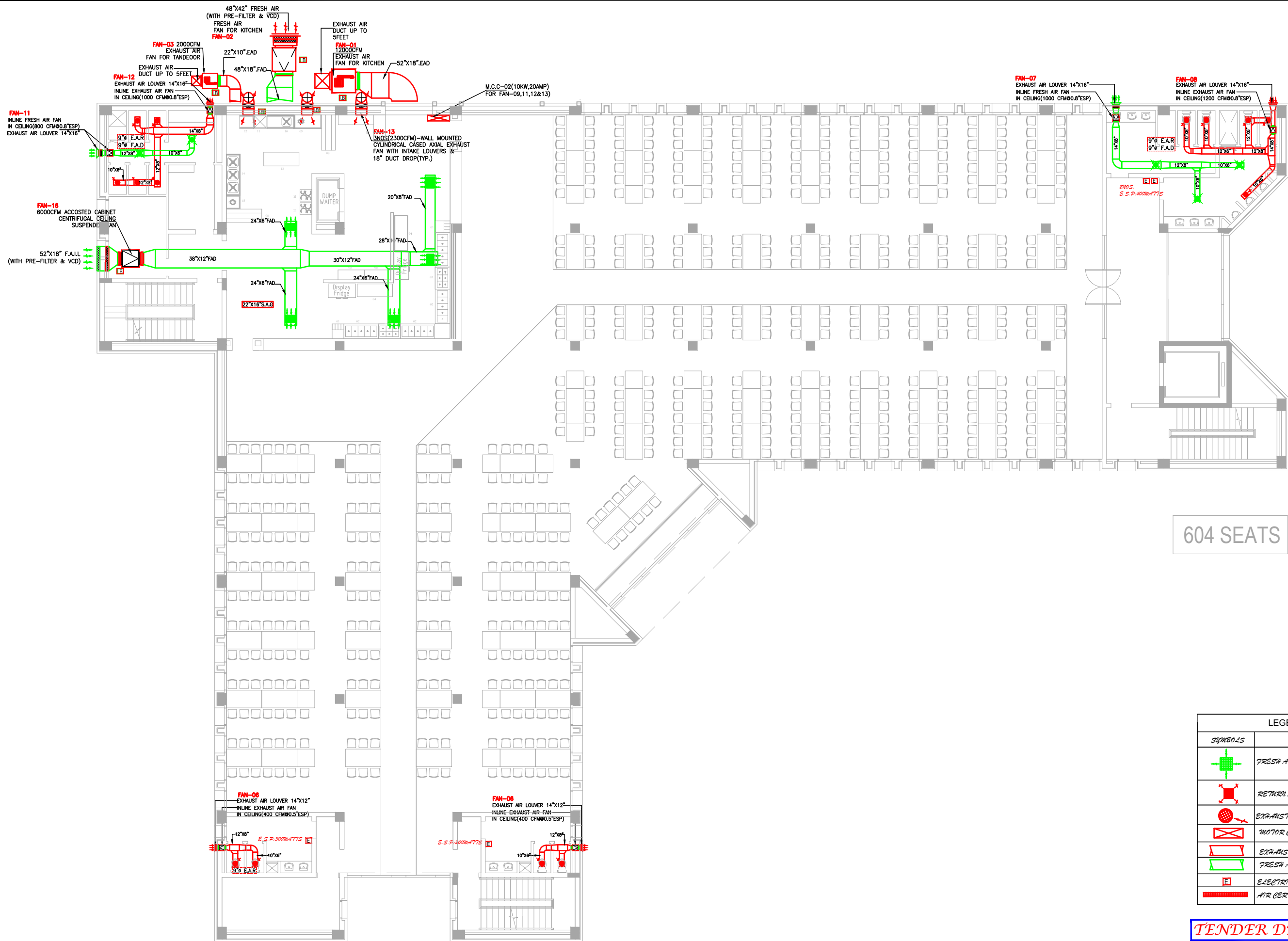
TENDER DRAWING

PROJECT SUKKUR IBA UNIVERSITY DINING BLOCK	ARCHITECT Habib Fida Ali <small>4 CH. KHALIQUZZAMAN ROAD, KARACHI 75530 TEL: 5661 683, 5661 684, FAX: 92-21-5686891</small>	M&P CONSULTANT. N.Z ENGINEERS <small>PLOT NO. 70C, M-01 JAMI COMMERCIAL, STREET 9 PHASE-VII, D.H.A KARACHI. Tel: +92 213 5314095 Email: info@nzengineers.net</small>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th>REV.</th> <th>DT.</th> <th>DIS.</th> </tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> </table>	REV.	DT.	DIS.																DRAWING TITLE. <div style="border: 1px solid red; padding: 2px; display: inline-block;">DINING BLOCK.</div> LIST OF DRAWING	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td colspan="2">PROJECT #. IBA-2020-10</td> </tr> <tr> <td>DRAWING #.</td> <td>H-00</td> </tr> <tr> <td>DRAWING SCALE.</td> <td>N.T.S</td> </tr> <tr> <td>DATE.</td> <td>MARCH-2021</td> </tr> <tr> <td>DRAW BY.</td> <td>MTF</td> </tr> <tr> <td>CHECKED BY.</td> <td>ZD</td> </tr> </table>	PROJECT #. IBA-2020-10		DRAWING #.	H-00	DRAWING SCALE.	N.T.S	DATE.	MARCH-2021	DRAW BY.	MTF	CHECKED BY.	ZD	DRAWING SHEET. A-3 PAPER SIZE
REV.	DT.	DIS.																																		
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TENDER DRAWING

PROJECT		ARCHITECT		M&P CONSULTANT		REV.		DT.		DS.		DRAWING TITLE.		PROJECT #.		DRAWING SHEET.	
 SUKKUR IBA UNIVERSITY DINING BLOCK		Habib Fida Ali 4 CH. KHALIQUZZAMAN ROAD, KARACHI 75530 TEL: 5661683, 5661684, FAX: 92-21-5686891		 N.Z. ENGINEERS PLOT NO. 70C, M-01 JAMI COMMERCIAL, STREET 9 PHASE-VII, D.H.A. KARACHI. Tel: +92 213 5314095 Email: info@nzengineers.net		A		28-02-2020		AS PER REVISED ARCHITECT PLAN		DINING BLOCK.		IBA-2020-10		H-01	
												LAYOUT OF PROPOSED VENTILATION SYSTEM GROUND FLOOR.		DRAWING #.		A-3 PAPER SIZE	
														DRAWING SCALE. 1/16" = 1'-0"			
														DATE. MARCH-2021			
														DRAW BY. MTF		CHECKED BY. ZD	

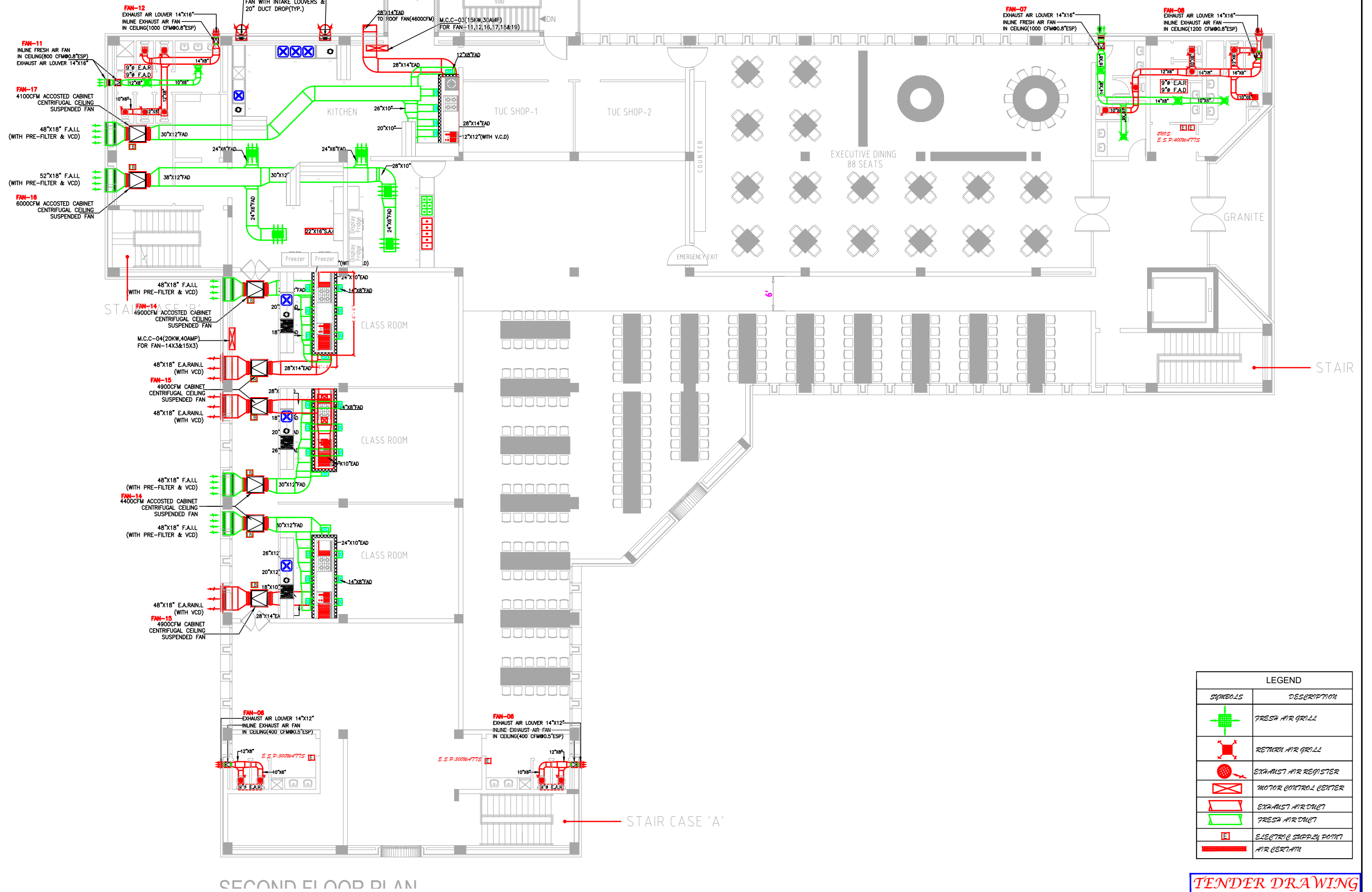


604 SEATS



LEGEND	
SYMBOLS	DESCRIPTION
	FRESH AIR GRILL
	RETURN AIR GRILL
	EXHAUST AIR REGISTER
	MOTOR CONTROL CENTER
	EXHAUST AIR DUCT
	FRESH AIR DUCT
	ELECTRIC SUPPLY POINT
	AIR RETURN

TENDER DRAWING

PROJECT	 <div>SUKKUR IBA UNIVERSITY DINING BLOCK</div>	ARCHITECT Habib Fida Ali 4 CH. KHALIQUZZAMAN ROAD, KARACHI 75530 TEL: 5661683, 5661684, FAX: 92-21-5686891	M&P CONSULTANT.  N.Z ENGINEERS PLOT NO. 70C, M-01 JAMI COMMERCIAL, STREET 9 PHASE-VII, D.H.A KARACHI. Tel: +92 213 5314095 Email: info@nzengineers.net	REV.	DT.	DIS.	DRAWING TITLE. <div>DINING BLOCK.</div> LAYOUT OF PROPOSED VENTILATION SYSTEM FIRST FLOOR.	PROJECT #.	IBA-2020-10	DRAWING SHEET. A-3 PAPER SIZE
				A	28-02-2020	AS PER REVISED ARCHITECT PLAN		DRAWING #.	H-02	
								DRAWING SCALE.	1/16" = 1'-0"	
								DATE.	MARCH-2021	
								DRAW BY.	MTF	
								CHECKED BY.	ZD	



TENDER DRAWING

PROJECT  SUKKUR IBA UNIVERSITY DINING BLOCK	ARCHITECT Habib Fida Ali 4 CH. KHALIQUZZAMAN ROAD, KARACHI 75530 TEL: 5661683,5661684, FAX:92-21-5686891	M&P CONSULTANT.  N.Z ENGINEERS PLOT NO. 70C, M-01 JAMJI COMMERCIAL, STREET 9 PHASE-VII, D.H.A KARACHI, Tel: +92 213 5314095 Email: info@nzengineers.net	REV.	DT.	DS.	DRAWING TITLE. <div>DINING BLOCK.</div> LAYOUT OF PROPOSED VENTILATION SYSTEM SECOND FLOOR.	PROJECT #.	IBA-2020-10		DRAWING SHEET. A-3 PAPER SIZE
			A	28-02-2020	AS PER REVISED ARCHITECT PLAN		DRAWING #.	H-03 B		
			B	05-05-2020	AS PER REVISED ARCHITECT PLAN		DRAWING SCALE.	1/16" = 1'-0"		
							DATE.	MARCH-2021		
							DRAW BY.	MTF	CHECKED BY.	



LEGEND	
SYMBOLS	DESCRIPTION
	FRESH AIR GRILL
	RETURN AIR GRILL
	EXHAUST AIR REGISTER
	MOTOR CONTROL CENTER
	EXHAUST AIR DUCT
	FRESH AIR DUCT
	ELECTRIC SUPPLY POINT
	AIR CERTAIN

TENDER DRAWING

PROJECT



SUKKUR IBA UNIVERSITY
DINING BLOCK

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REV.	DT.	DIS.
A	28-02-2020	AS PER REVISED ARCHITECT PLAN

DRAWING TITLE.

DINING BLOCK.

LAYOUT OF PROPOSED VENTILATION SYSTEM
ROOF PLAN.

PROJECT #. IBA-2020-10

DRAWING #. H-04

DRAWING SCALE. 1/16" = 1'-0"

DATE. MARCH-2021

DRAW BY.

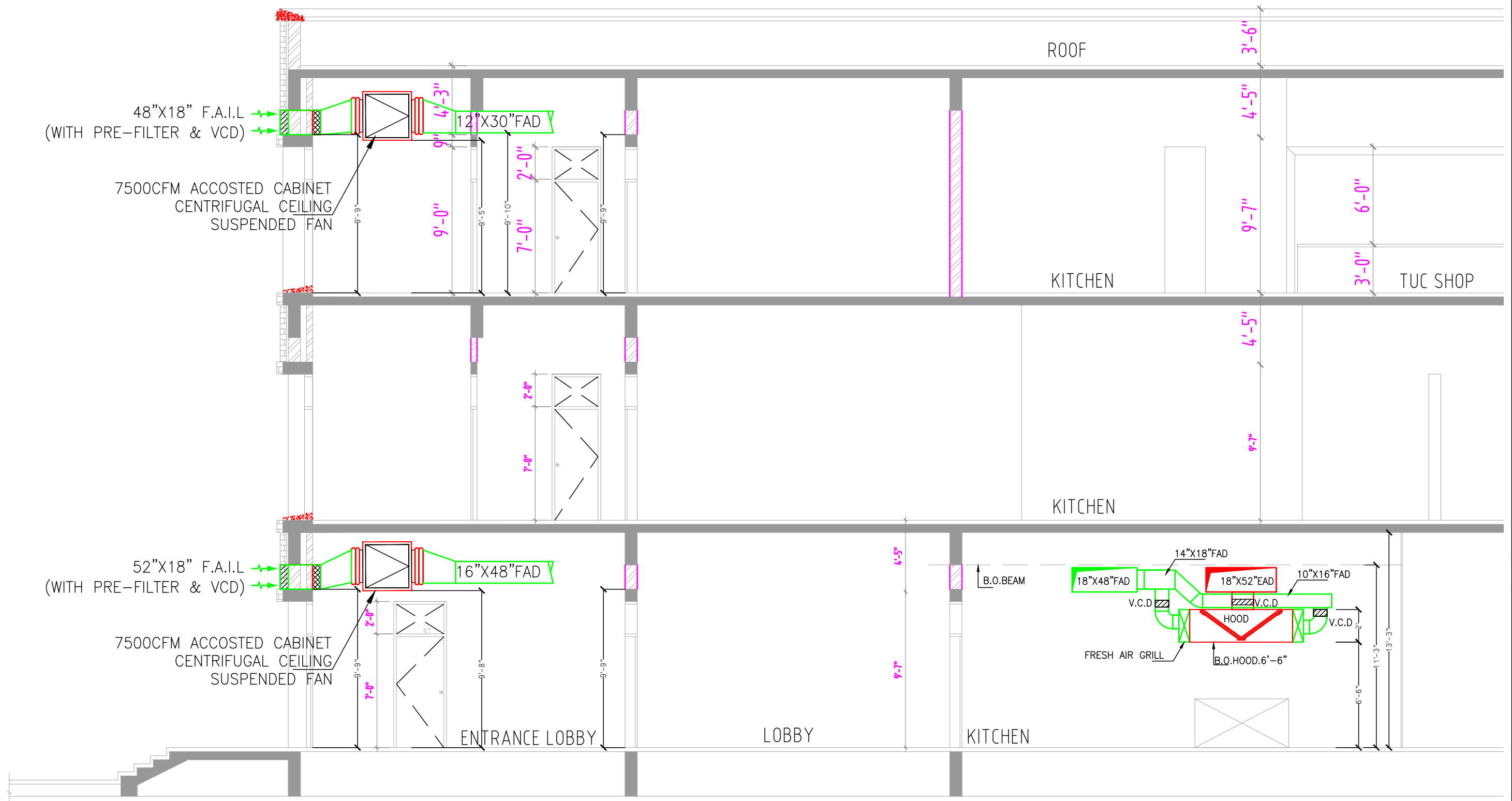
CHECKED BY.

MTF

ZD

DRAWING SHEET.

A-3 PAPER SIZE



SECTION B-B

TENDER DRAWING

PROJECT



SUKKUR IBA UNIVERSITY
DINING BLOCK

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REV.	DT.	DS.
A	28-02-2020	AS PER REVISED ARCHITECT PLAN

DRAWING TITLE.

DINING BLOCK.

PROPOSED SECTION .

PROJECT #. IBA-2020-10

DRAWING #. H-05

DRAWING SCALE. N.T.S

DATE. MARCH-2021

DRAW BY. MTF

CHECKED BY. ZD

A-3 PAPER SIZE

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.

3. PROVIDE ALL REQUIRED ELECTRICAL POWER, MOTOR, STARTERS, LOCAL ON \ OFF CONTROL AND CONTROL INTERFACE AND CONNECTIONS AS REQUIRED FOR SYSTEM OPERATION COORDINATE REQUIREMENTS WITH ELECTRICAL.

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 UNLESS OTHERWISE SPECIFIED, ALL DUCT SIZES AND OTHER DIMEN-
SIONS ARE IN INCHES.

10. FIRE DAMPERS:

10.1 PROVIDE APPROVED FIRE DAMPERS WHERE DUCTS OR AIR GRILLES PENETRATE PARTITIONS AND FLOOR REQUIRED TO HAVE A FIRE RESISTANCE RATING OF 2 HOURS OR MORE.

10.2 PROVIDE ACCESS DOORS ON ALL FIRE / SMOKE DAMPERS.

11. ALL DUCT SIZES MENTIONED ON PLANS ARE CLEAR SIZES, EXCLUDING THE THICKNESS OF INSULATION AND OTHER DUCT LINING.

12. DUCT INSULATION:

12.10 ALL SUPPLY DUCTS BE INSULATED.

12.20 GENERALLY, ALL RETURN DUCTS SHALL NOT BE INSULATED EXCEPT THOSE EXPOSED TO WEATHER, LOCATED NEAR LIGHTING FIXTURES AND THOSE PASSING THROUGH NON-AIR CONDITIONED SPACES.

12.30 FRESH AIR AND EXHAUST DUCTS PASSING THROUGH AIR
CONDITIONED SPACES SHALL BE INSULATED.

13. PROVIDE 12mm SQUARE MESH SCREEN ON ALL BELLMOUTH OPENINGS IN CEILING SPACE.

14 DUCTWORK, FITTINGS, HANGERS AND ACCESSORIES SHALL BE AS
PER SMACNA RECOMMENDATIONS.

15 INSTALL VOLUME DAMPERS ON ALL DUCT BRANCHES AND BRANCH
TAKE-OFFS AND WHEREVER REQUIRED FOR PROPER BALANCING OF AIR.

16 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.

17 COORDINATE GRILLES, DIFFUSERS AND REGISTERS WITH REFLECTED
CEILING PLANS AND LIGHTING PLANS.

18 REFER TO ARCHITECTURAL DRAWINGS FOR DOOR GRILLES AND
DOOR UNDERCUT SIZES AND DETAILS.

19 FAN SYSTEM RESISTANCES STATED IN THE SCHEDULES ARE DESIGN
APPROXIMATIONS ONLY AND SHALL BE CHECKED BY THE MECHANICAL
SERVICES CONTRACTOR PRIOR TO THE FINAL ORDERING OF EQUIPMENT.

20 ALL CHILLED WATER AND CONDENSATE DRAIN PIPES SHALL BE
INSULATED AS PER SPECIFICATIONS.

21 PIPE ALL CONDENSATE DRAIN LINES OF AHU'S TO THE NEAREST
DRAIN POINT PROVIDED UNDER PLUMBING WORKS UNLESS
OTHERWISE SHOWN ON THE DRAWING.

22 PROVIDE SHUT OFF AND BALANCING VALVES IN THE CHILLED
WATER PIPING AT ALL BRANCHES AND WHERE REQUIRED FOR
PROPER BALANCING AND MAINTENANCE.

23 PROVIDE SLEEVES WHERE PIPES PENETRATE WALLS AND SLABS.

24 WHERE SHOW ON PLANS THE ROOM THERMOSTATS SHALL BE
MOUNTED ON THE WALL @ 1.5 METER ABOVE FINISHED FLOOR LEVEL.

25 ROOF MOUNTED EQUIPMENT TO BE TROPICALIZED AND
WATER PROOFED.

26 VIBRATING EQUIPMENT SHALL BE PROVIDED WITH ISOLATORS TO
PREVENT VIBRATION TRANSMISSION.

27 INSTALL ALL EQUIPMENT AS PER MANUFACTURE'S RECOMMENDATIONS.

28 SIZES AND TYPE OF RETURN DIFFUSERS SHALL BE THE SAME AS
THEIR RESPECTIVE SUPPLY DIFFUSER IN THE SAME ROOM SERVED
UNLESS OTHERWISE SHOWN ON THE DRAWING.

29 DESIGN CONDITIONS:

29.1 INDOOR CONDITIONS:
A. SUMMER – 22°C DB / 50%RH

30 THE CONTRACTOR SHALL VERIFY CEILING
TO SUIT HVAC DIFFUSER.

31 THE CONTRACTOR SHALL HAVE THE OPTION TO USE
EXTENSIVELY CIRCULAR DUCTS WHENEVER POSSIBLE.

32 PROVIDE FIRE RETARDANT FLEXIBLE JOINT WHERE DUCTS PASS THROUGH CONSTRUCTION JOINT.

33 THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE DETAILED ARRANGEMENT OF CHILLED WATER PIPING, CONDENSATE DRAINS, VALVES, VIBRATION ISOLATORS, ETC. AT THE AHU CONNECTIONS GIVING DUE IMPORTANCE TO MAINTENANCE ACCESS TO FANS & MOTORS COOLING COILS INCLUDING ITS PULL-OUT AND FILTERS. PROVIDE U-TRAP WITH SUFFICIENT DEPTH AT ALL AHU CONDENSATE DRAINS. PIPE ALL DRAINS TO NEAREST FLOOR OR RAIN WATER DRAIN.

34 CONTRACTOR SHALL PROVIDE WORKING SHOP
DRAWING SHOWING ALL SUPPORTS OF
DUCTWORKS & EQUIPMENT.

35 ALL EQUIPMENT EXPOSED TO WEATHER SHALL
BE SUITABLE FOR OUTDOOR INSTALLATION.

36 ALL AHU/FCU DRAINS SHALL BE PIPED TO
THE NEAREST DRAIN PROVIDE BY
THE PLUMBING CONTRACTOR.

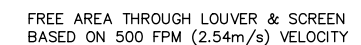
37 CONTRACTOR SHALL PROVIDE WORKING / SHOP
DRAWING SHOWING ALL SUPPORTS OF
DUCTWORKS & EQUIPMENT.

VENTILATION AND EXHAUST AIR FAN								
FAN NO.	FAN (TYP.)	LOCATION	AREA SERVED	TYPE	AIR FLOW (CFM)	EXTERNAL STATIC PRESSURE (INCH WG)	AREA SERVED	REMARKS
1	2	3	4	5	6	7	8	9
1	1*	OPEN ROOF	KITCHEN AREA EXHAUST AIR	CENTRIFUGAL CABINET	12000	3.0	GROUND FLOOR KITCHEN HOOD.	
2	1	OPEN ROOF	KITCHEN AREA FRESH AIR	CENTRIFUGAL CABINET	10500	2.0	GROUND FLOOR KITCHEN HOOD.	
3	1*	OPEN ROOF	KITCHEN AREA EXHAUST AIR	CENTRIFUGAL CABINET	2000	1.5	GROUND FLOOR HALLDOOR HOOD.	
4	1	IN CEILING	STORAGE AREA EXHAUST AIR	BOOSTED INLINE CENTRIFUGAL CABINET CEILING	450	0.5	GROUND FLOOR STORAGE AREA.	
5	1	IN CEILING	KITCHEN AREA FRESH AIR	BOOSTED INLINE CENTRIFUGAL CABINET CEILING	7500	1.0	GROUND FLOOR KITCHEN HOOD.	
6	6	IN CEILING	BATH ROOM EXHAUST AIR	BOOSTED INLINE CENTRIFUGAL CABINET CEILING	400	0.5	BATH RM B.T. (GR+7F+5F)	
7	3	IN CEILING	BATH ROOM FRESH AIR	BOOSTED INLINE CENTRIFUGAL CABINET CEILING	1000	0.5	BATH RM F.AIR (GR+7F+5F)	
8	3	IN CEILING	BATH ROOM EXHAUST AIR	BOOSTED INLINE CENTRIFUGAL CABINET CEILING	1800	0.5	BATH RM F.AIR (GR+7F+5F)	
9	1	IN CEILING	KITCHEN AREA FRESH AIR	BOOSTED INLINE CENTRIFUGAL CABINET CEILING	6000	1.0	FIRST FLOOR KITCHEN HOOD.	
10	3	ON WALL	KITCHEN AREA EXHAUST AIR	CYLINDRICAL CASED AXIAL EXHAUST FAN WITH FILTER LAMBER	2300	0.7	GROUND FLOOR KITCHEN HOOD.	
11	2	IN CEILING	BATH ROOM FRESH AIR	BOOSTED INLINE CENTRIFUGAL CABINET CEILING	800	0.5	BATH RM F.AIR (7F+5F)	
12	2	IN CEILING	BATH ROOM EXHAUST AIR	BOOSTED INLINE CENTRIFUGAL CABINET CEILING	1000	0.5	BATH RM F.AIR (7F+5F)	
13	3	ON WALL	KITCHEN AREA EXHAUST AIR	CYLINDRICAL CASED AXIAL EXHAUST FAN WITH FILTER LAMBER	2300	0.7	FIRST FLOOR KITCHEN HOOD.	
14	3	IN CEILING	KITCHEN AREA FRESH AIR	BOOSTED INLINE CENTRIFUGAL CABINET CEILING	4400	1.5	SECOND FLOOR KITCHEN HOOD F.AIR	
15	3*	IN CEILING	KITCHEN AREA EXHAUST AIR	BOOSTED INLINE CENTRIFUGAL CABINET CEILING	4900	1.5	SECOND FLOOR KITCHEN HOOD F.AIR	
16	1	IN CEILING	KITCHEN AREA FRESH AIR	BOOSTED INLINE CENTRIFUGAL CABINET CEILING	6000	1.0	SECOND FLOOR KITCHEN HOOD.	
17	3	IN CEILING	KITCHEN AREA EXHAUST AIR	BOOSTED INLINE CENTRIFUGAL CABINET CEILING	4100	1.5	SECOND FLOOR KITCHEN HOOD F.AIR	
18	1*	OPEN ROOF	KITCHEN AREA EXHAUST AIR	CENTRIFUGAL CABINET	4600	2.0	SECOND FLOOR KITCHEN HOOD.	
19	2	ON WALL	KITCHEN AREA EXHAUST AIR	CYLINDRICAL CASED AXIAL EXHAUST FAN WITH FILTER LAMBER	2300	0.7	SECOND FLOOR KITCHEN HOOD.	

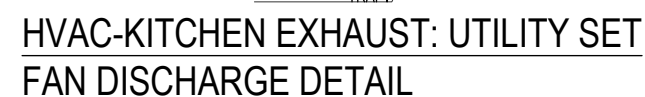
NOTES

- 01- THE FAN MOTOR OF EXHAUST AIR FAN SHALL BE OUT OF AIR STREAM.
- 02- ALL THE KITCHEN EXH. MOTOR SHALL SUITABLE FOR 100 LB.
- 03- ALL FAN MOTORS SHALL BE "E" TYPE "B" OR "INSULATION CLASS F".
- 04- FAN SHALL BE WITH BUILT-IN SPEED CONTROLLER THE MAXIMUM SPEED SHALL BE 100 RPM.
- 05- THE SPEED CONTROLLER SHALL BE WITH VARIABLE MAXIMUM SPEED POTENTIAL TO ADJUST FAN SPEED AS 10% OF THE DESIGNATED SPEED FOR THE SPECIFIED DUTY.
- 06- THE HOASTING FAN SHALL BE WITH GALVANIZED STEEL SHEET WITH DOUBLE THICKNESS PANEL INTERNALLY. BLIND TRICES PREPARED WITH GALVANIZED HOASTING INSULATION.

TENDER DRAWING



SCHEDULE BLADES & FRAMES			
WIDTH	GALV.	STAINLESS	ALUM.
TO 610mm	0.70mm	0.61mm	1.02mm
635 TO 914mm	1.00mm	0.80mm	1.02mm
940 TO 1219mm	1.31mm	0.95mm	1.60mm
1245 TO 1524mm	1.61mm	1.27mm	1.60mm
1548mm & UP	MULTIPLE SECTIONS OF ABOVE		



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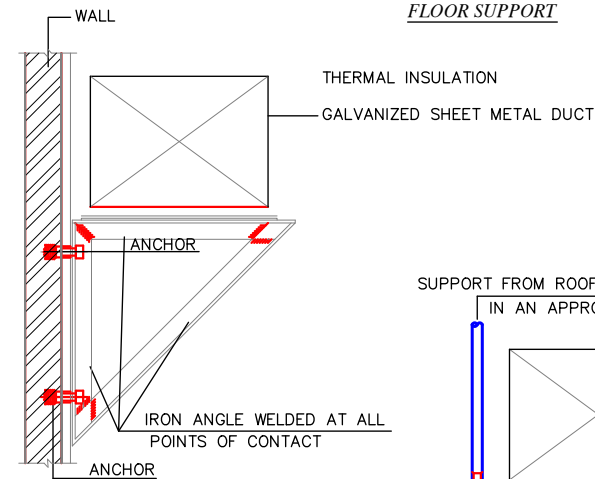
LOW PR. GALV. STEEL DUCT WORK SPECIF.TABLE



POCKET LOCK

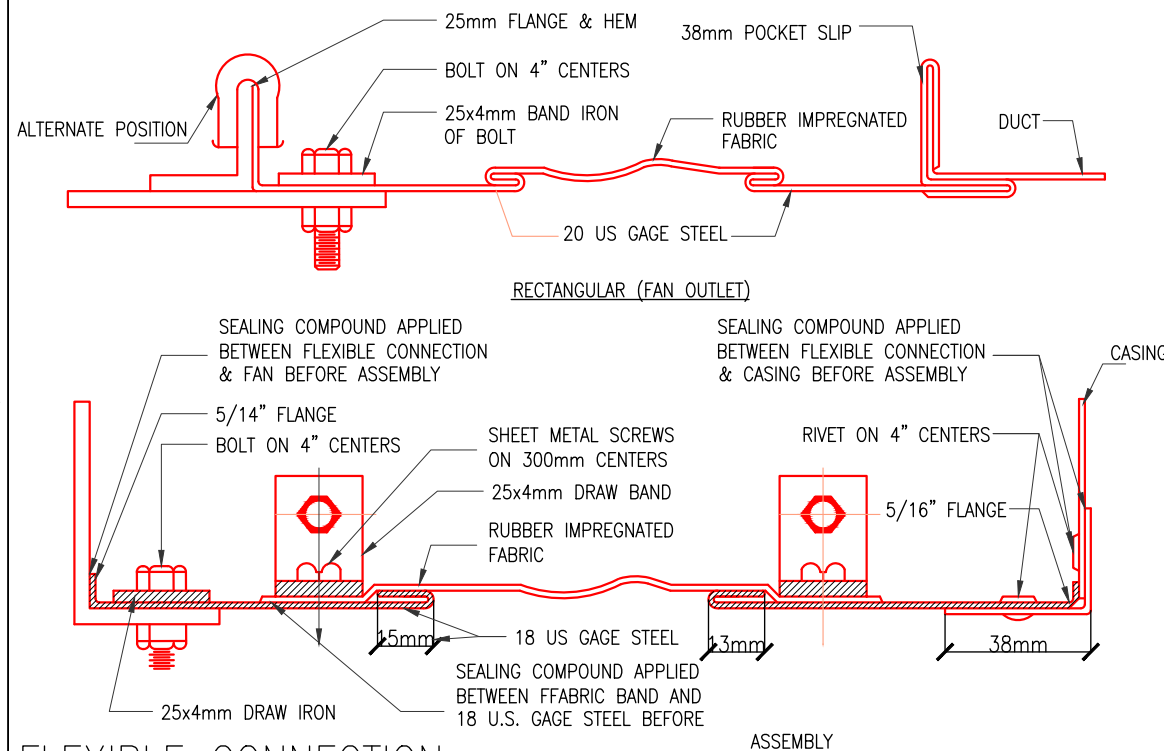


STANDING "S" SLIP

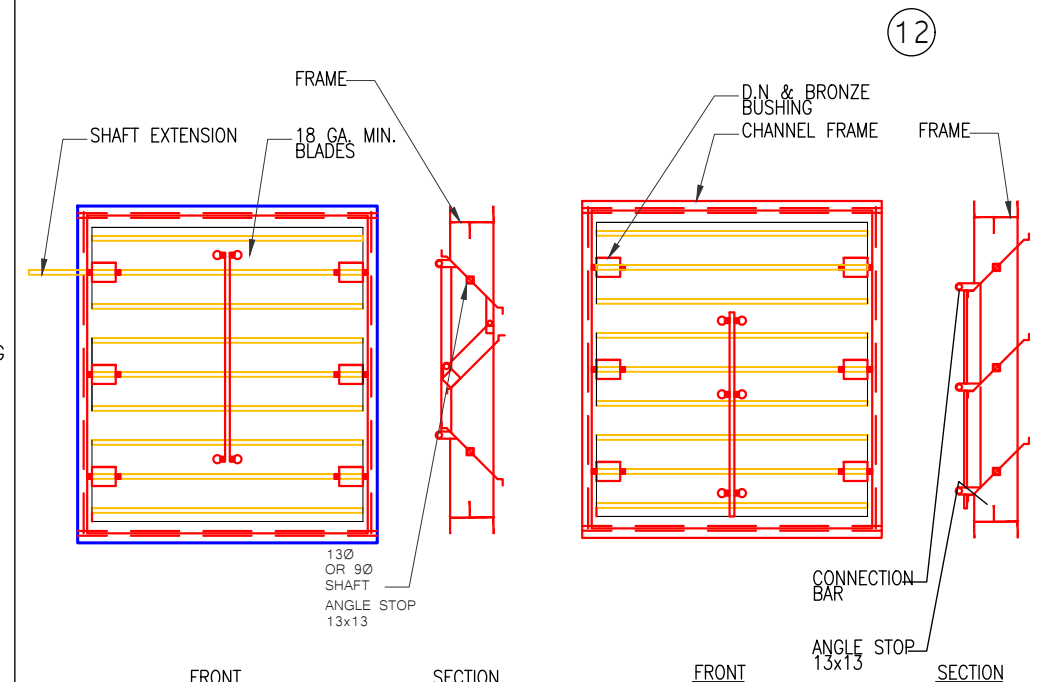


TRAPEZE SUPPORT

METAL GAGE	DUCT DIM. IN INCHES	TRANSVERSE JOINTS		TRANSVERSE BRACING	HANGERS		
GALVANIZED STEEL		CONSTRUCTION	SPACING FEET		ROD. DIA.	SHELF ANGLE	MAX. SPACING
26	UP THRU 12"	1" POCKET LOCK HEMMED "S" SLIP DRIVE SLIP (VERTICAL ONLY)	8'	NONE	3/8"	1-1/2"x1-1/2" x1/8"	8'-0"
24	13" THRU 18"		4'	NONE		OR	
	19" THRU 30"	1" POCKET LOCK HEMMED "S" SLIP 1" BAR SLIP	8'	1"x1"x1/8" ANGLE CENTERED BETWEEN JOINTS		1"x1/8" STRAP	
22	31" THRU 42"	1" POCKET LOCK STANDING "S" SLIP 1" REINFORCED BAR SLIP	4'	NONE	3/8"	1-1/2"x1-1/2" x1/8"	6'-0"
			8'	1"x1"x1/8" ANGLE CENTERED BETWEEN JOINTS			
	43" THRU 54"	1-1/2" POCKET LOCK 1-1/2" STANDING "S" SLIP 1-1/2" REINFORCED BAR SLIP	4' 8'	NONE OR CROSS BREAK 1-1/2"x1-1/2"x1/8" ANGLE CENTERED BETWEEN JOINTS	1/2"	2"x2"x1/8" OR EQUIVALENT CHANNEL	6'-0"
20	55" THRU 60"	1-1/2" REINFORCED BAR SLIP 1-1/2" STANDING "S" SLIP	4'	1-1/2"x1-1/2"x1/8" ANGLES CENTERED BETWEEN JOINTS	1/2"	2"x2"x3/16" OR EQUIVALENT CHANNEL	
	61" THRU 84"	1-1/2" ANGLE REINFORCED POCKET LOCK	8'	1-1/2"x1-1/2"x1/8" ANGLES ON 2'-0" CENTERS BETWEEN JOINTS			
18	85" THRU 96"	1-1/2" REINFORCED BAR SLIP 1-1/2" ANGLE REINFORCED POCKET LOCK 1-1/2" COMPANION ANGLES	4'	1-1/2"x1-1/2"x3/16" ANGLES CENTERED BETWEEN JOINTS	1/2"	3"x3"x1/4"	4'-0"
			8'	1-1/2"x1-1/2"x3/16" ANGLES ON 2'-0" CENTERS BETWEEN JOINTS			
	97" THRU 120"	2" ANGLE REINFORCED POCKET LOCK 2" COMPANION ANGLES	4'	2"x2"x1/4" ANGLES CENTERED BETWEEN JOINTS			
			8'	2"x2"x1/4" ANGLES ON 2'-0" CENTERS			

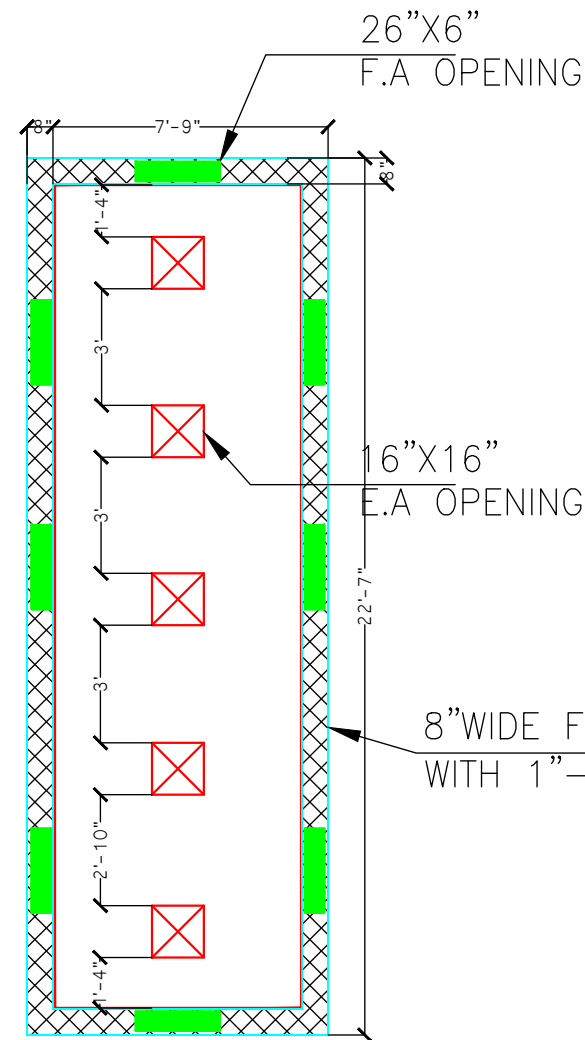


FLEXIBLE CONNECTION



MULTIPLE VOLUME DAMPERS (NTS)

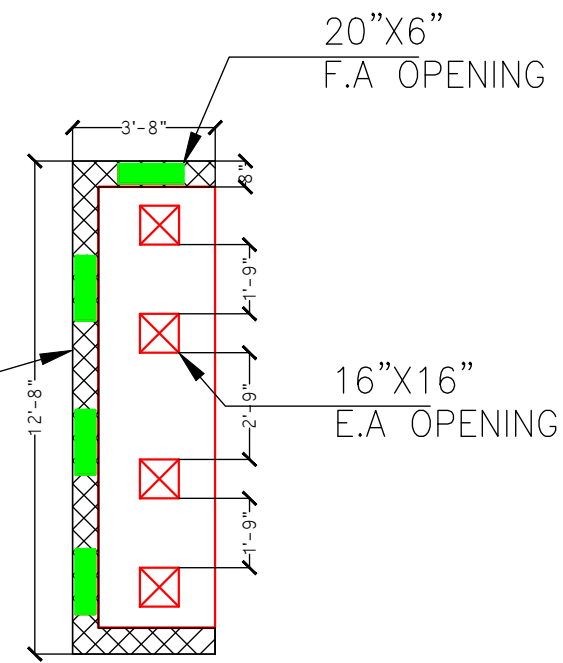
TENDER DRAWING



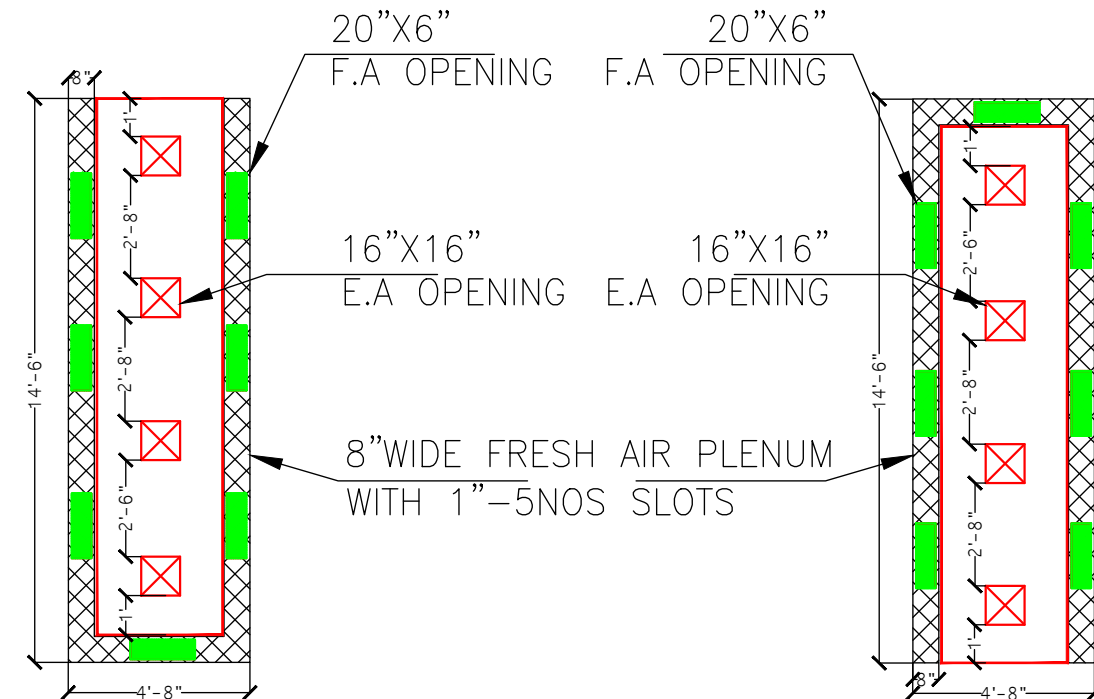
HOOD-01(1QTY)
GROUND FLOOR

NOTE.

- 1-SUPPLIER NEED TO RECONFIRM THE FILERS AREA 'S OF ALL HOODS.
- 2-SHOP DRAWING WITH PROPER CONSTRUCTION DETAIL REQUIRED,WITH GAUGE.
- 3-HOOD MOUNTING HOOKS SHALL BE REQUIRED AS PER HOOD SIZE AND WEIGHT.
- 4-HOOD SHALL BE SS-304
- 5-ALL THE HOODS OPENING SHALL BE WITH PROPER NECK FOR DUCT CONNECTION..





HOOD-02(1QTY)
2ND FLOOR

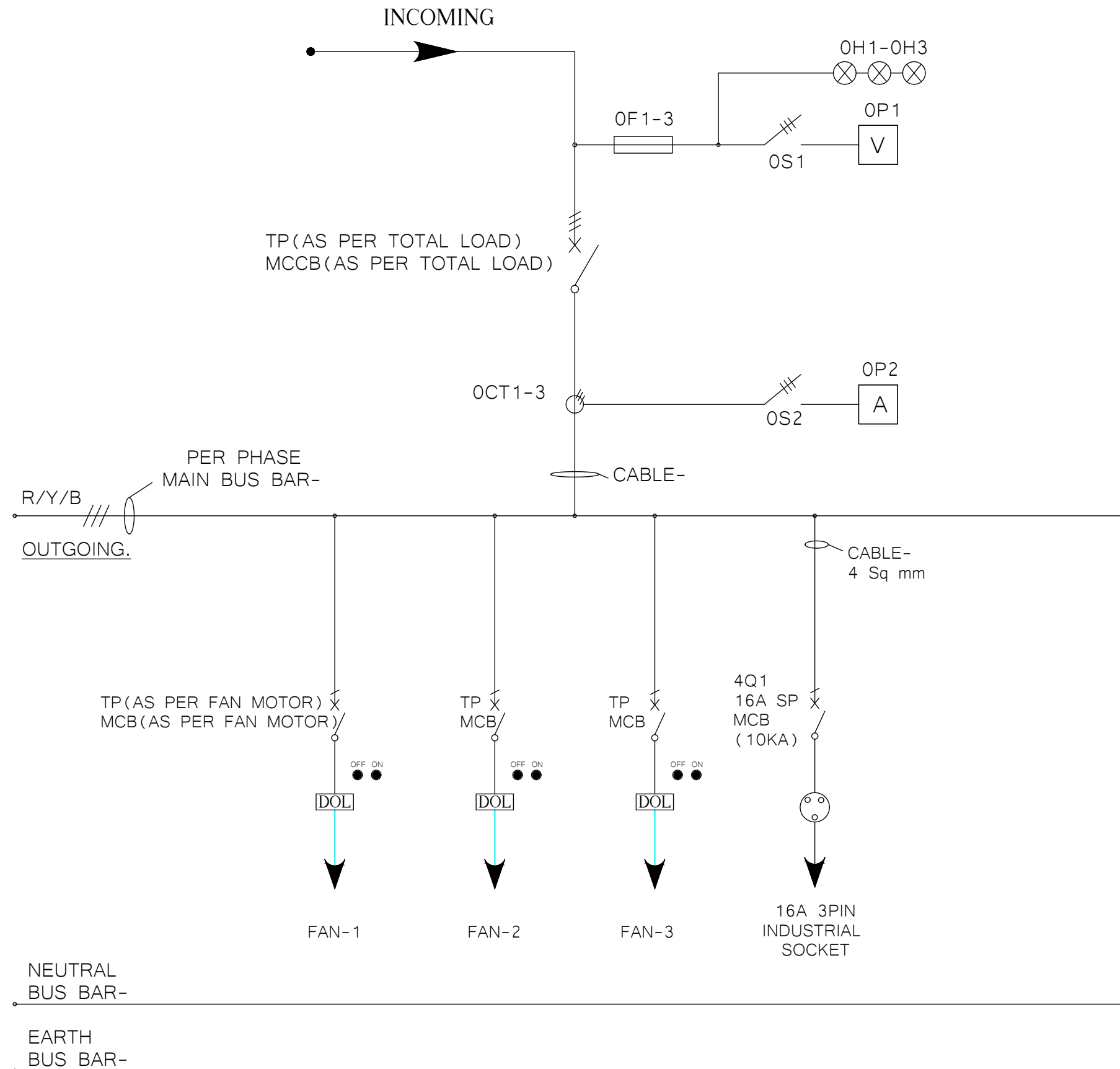


HOOD-03(2QTY)
2ND FLOOR



HOOD-04(1QTY)
2ND FLOOR

TENDER DRAWING

PROJECT	 <div>SUKKUR IBA UNIVERSITY DINING BLOCK</div>	ARCHITECT Habib Fida Ali 4 CH, KHALIQUZZAMAN ROAD, KARACHI 75530 TEL: 5661683,5661684, FAX:92-21-5686891	M&P CONSULTANT.  N.Z ENGINEERS PLOT NO. 70C , M-01 JAMI COMMERCIAL , STREET 9 PHASE-VII, D.H.A KARACHI. Tel: +92 213 5314095 Email: info@nzengineers.net	REV.	DT.	DIS.	DRAWING TITLE. <div>DINING BLOCK.</div> KITCHEN EXHAUST AIR HOOD DETAIL	PROJECT #. IBA-2020-10	DRAWING SHEET.
				A	28-02-2020	AS PER REVISED ARCHITECT PLAN			
				B	05-05-2020	AS PER REVISED ARCHITECT PLAN			
DRAWING #. H-09									
DRAWING SCALE. AS SHOWN									
DATE. MARCH-2021									
DRAW BY. MTF									
CHECKED BY. ZD									
A-3 PAPER SIZE									



TENDER DRAWING

PROJECT	 <div>SUKKUR IBA UNIVERSITY DINING BLOCK</div>	ARCHITECT Habib Fida Ali 4 CH, KHALIQUZZAMAN ROAD, KARACHI 75530 TEL: 5661683, 5661684, FAX: 92-21-5686891	 <div>N.Z ENGINEERS PLOT NO. 700, M-01 JAMI COMMERCIAL, STREET 9 PHASE-VII, D.H.A KARACHI. Tel: +92 213 5314095 Email: info@nzengineers.net</div>	M&P CONSULTANT.	REV.	DT.	DIS.	DRAWING TITLE. <div>DINING BLOCK.</div> TYPICAL M.C.C DETAIL (REFERENCE ONLY)	PROJECT #.	IBA-2020-10	DRAWING SHEET. A-3 PAPER SIZE
									DRAWING #.	H-10	
									DRAWING SCALE.	AS SHOWN	
									DATE.	MARCH-2021	
									DRAW BY.	MTF	
									CHECKED BY.	ZD	



[TENDER DOCUMENTS]

March, 2021.

DOCUMENTS TYPE

VENTILATION SYSTEM FOR
DINING BLOCK, SUKKUR IBA
UNIVERSITY

PROJECT NO- IBA-2020-10

MECHANICAL CONSULTANT.



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

ARCHITECT.

Habib Fida Ali.

VENTILATION SYSTEM WORKS		
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 -----

for and on behalf of

(Employer)

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)

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 & 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 2nd 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 2nd 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) 30%
 - 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	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
9	Bank Statement for Last 3 Years, Minimum turnover of Rs. 200 Million for at least any one year	Mandatory
10	The Interested bidders should have presence / support / branch offices in Karachi.	Mandatory
11	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
12	Annual turnover (Max Points 30) a. 200 Millions (25 Points) b. 200 to 300 Millions (30 Points)	
13	No of similar nature of same or above cost project in 5 Years. (Max Points 15) a. 6 Project (11 Points) b. 7 to 10 Year (13 Points) c. 10 to 15 Year (15 Points)	
14	Total No of employees (Max Points 10) a. 40 Employees (8 Points) b. 50 to 60 (10 Points)	
15	Warranty/Guarantee Terms. (Max Points 30) a. 1 Years' service & Repair Warranty (25 Points) b. 2 Years' service & Repair Warranty (30 Points)	

16	No of similar nature of project in 10 Years with Government & Public sector. (Max Points 5) a. 5 Project (3 Points) b. 6 to 8 Project (5 Points)	
17	Bidder already work with Sukkur IBA University. (10Points)	

- 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	Ventilation Fan	1. S&P (Spain) 2. Green Heck(USA) 3. Loren Cook(USA) Approved Equal
2	Electric Cables & Wires	1. Pakistan Cables 2. Newage Cable Approved Equal
3	Motor Control Center	1. Sunbeam 2. Karemi Electric Approved Equal
4	Concrete Fasteners & anchors	1. Hilti (UK/Germany) 2. Fischers (Germany) Approved Equal
5	Paints	1. ICI (Pakistan) 2. Berger (Pakistan) Approved Equal
6	Aluminum Tape	1. Abro industries (USA) Approved Equal
7	Vapor Barrier Coating	1. Foster (USA) Approved Equal
8	G.I Sheet	1. Pakistan steel 2. Imported
9	Duct Sealant	1. Zahabia Approved Equal
10	Air Devices	1. Steel Craft 2. Mehran 3. EAP 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 CONTRACT01. 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 along with 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, buried 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.

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 Labor, 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 labor 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 Defense 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

- 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 taken.
- 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.

2.1 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 labor 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 the 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 Subcontracts, etc.

- 2.5.1 Wherever hereinafter guarantees of durability, operating capacity, proper functioning or the like are called for, or wherever it is specified that the manufacturer shall furnish detailed drawings, test certificates or performance curves, or that the manufacturer shall supervise the installation of his apparatus, test or adjust it after installation, keep it in repair for a stated period, or render other similar services, the Contractor will be held responsible for the performance of the specified service under the actual conditions of installation. The same shall apply to cases where special adjustment or other services are necessary to ensure the proper and efficient functioning of apparatus, even though not specifically hereinafter called for. It is intended that the entire plant, when finally delivered, shall be ready in every respect for satisfactory and efficient operation, and the Contractor is hereby made responsible for this result.

- 2.5.2 In any case where the Contractor's own employees cannot adequately perform the above described service, he shall stipulate such performance in his contracts with subcontractors, manufacturers, etc., or else subsequently pay them any additional fees required therefore, without passing on any of this cost incurred to the Employer.

2.6 Permits

- 2.6.1 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.
- 2.6.2 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.

2.7 Drawings, Changes and Installation

- 2.7.1 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.
- 2.7.2. 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.
- 2.7.3. 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.
- 2.7.4. 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.
- 2.7.5. The actual location of thermostats, switches, etc., shall be reviewed by the Engineer before installation.
- 2.7.6. 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.
- 2.7.7. 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.
- 2.7.8. 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.

- 2.7.9 Special care shall be taken in areas where pour-gaps take place.

2.8 Shop Drawings

- 2.8.1 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).
- 2.8.2 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.
- 2.8.3 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.
- 2.8.4. Ensure that electrical, structural, reflected ceiling coordination with all applicable trades is complete before submitting drawings for review.
- 2.8.5 Installation of any equipment shall not be commenced until after the shop drawings have been approved by the Engineer.
- 2.8.6 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.
- 2.8.7 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.
- 2.8.8 A coordinated plan and section (running the entire length) for each shaft shall be prepared and submitted as part of shop drawings for approval.
- 2.8.9 The Consultants may call for additional drawing as required for the proper execution of the woks.

2.9 Record Drawings

- 2.9.1 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.
- 2.9.2 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.

2.10 Drawing Submissions

- 2.10.1 Unless otherwise indicated, the Contractor shall provide the following drawings:
- 2.10.1 Seven (5) sets of prints, and one electronic copy in CAD format on disk of builder's work drawings, (to a scale of 1:50).
- 2.10.2. 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).
- 2.10.3. 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.
- 2.10.4 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.
- 2.10.1.5 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.
- 2.10.2 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.
- 2.10.3. 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.
- 2.10.4 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.
- 2.10.5 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.
- 2.10.6 Individual equipment drawings from the various manufacturers will not be accepted in lieu of these composite plant room drawings.
- 2.10.7 All drawings shall be produced on the latest version of AutoCAD available.

2.11 Coordination, Installation, Interference and Setting Drawings

- 2.11.1. 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.
- 2.11.2. 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.

- 2.11.3. 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.
- 2.11.4. 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.
- 2.11.5. Work shall not proceed in areas involved until after final approval of all such drawings has been obtained.
- 2.11.6 These drawings shall include all existing information.

2.12 Contractor's Technical Responsibilities

- 2.12.1. 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.
- 2.12.2 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 contractor's scope of work. The Contractor shall submit technical details as to how the requirements for seismic restraints and supports was worked.
- 2.12.3 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.
- 2.12.4 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.

2.13 Commissioning

- 2.13.1 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.
- 2.13.2 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.

2.13.3 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.

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

2.13.5 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

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

2.13.7 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.

2.13.8 Any Commissioning or testing carried out without being witnessed and approved shall not be considered as complying with the contract's requirements.

2.13.9 Details relating to commissioning, testing, balancing/ adjusting are included in the specifications for the various trades.

2.14 Tests on completion

2.14.1 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.

2.14.2 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.

2.14.3 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.

2.14.4 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.

2.14.5 Operating and Maintenance Instructions

- 2.14.5.1 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.

2.15 Guarantees

- 2.15.1 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.
- 2.15.2 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.
- 2.15.3 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.
- 2.15.4 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.

2.16 Manufacturer's Guarantees

- 2.16.1 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.)

- 2.16.2 The manufacturer's 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.
- 2.16.3 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.
- 2.16.4 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.

2.17 Training

- 2.17.1 The Contractor shall arrange the training of the Employers dedicated O&M Staff. The training shall cover all major equipment and systems.
- 2.17.2 The trainings shall base on the Operation and Maintenance manuals and the equipment and systems themselves.
- 2.17.3 The Contractor shall arrange suitably qualified personnel approved by the Consultants for providing the necessary training.
- 2.17.4 The training shall consist of training in the class room type environment followed by practical demonstration of operating procedures.
- 2.17.5 Training shall continue until O&M personnel are able to operate the equipment.
- 2.17.6 Training shall be carried out prior to commissioning of the systems.

2.19 Spare Parts

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

2.20 Painting

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

2.21 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.

2.22 Identification for MEP systems and Equipment

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.
- 11.0 Equipment subject to expansion or contraction due to heat or handling hot or cold fluids shall be rechecked after operation under design service conditions for a minimum of 24 hours and if necessary shall be realigned.
- 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.

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.

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 Manufacturer recommended set of spare parts for all the contractor supplied equipment for two years operation.
- 4.0 Amongst others, following shall be included without limitation:
 - 3.1 Tong Tester of suitable range with Amp, Volt and ohm scales.
 - 3.2 Phase Tester.
 - 3.3 Sling psychrometric with 140mm long 0-50°C range thermometers.
 - 3.4 Electric motor driven high pressure air blower for cleaning.
 - 3.5 One set each of open end, ring and adjustable spanners.
 - 3.6 One set each of flat and Philips head screw drivers.
 - 3.7 Set of hammers.
 - 3.8 Two pliers with flat and pointed nose.
 - 3.9 One set of cleaning and washing tanks for air filters.

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 Act 1910 and Pakistan Electricity Rules 1937.
- 3.0 The installation in general shall be carried out in conformity with the latest relevant British Standard Specifications and Codes, VDE, IEC and IEE Recommendations and latest edition of Regulations for the Electrical Equipment of Buildings by The Institution of Electrical Engineers, UK as adopted in Pakistan by Pakistan Standards Institution. Any special requirements of Electric Supply Co. and The Electric Inspector shall be complied with. The Contractor shall be responsible for making the required applications, submitting the Test Certificates and for getting the installation passed by The Electric Inspector of the Government.
- 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 trucking 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 trucking 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 Centers (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.
- 12.0 The MCCs shall be of design and construction to provide easy access to all internal components for servicing and replacement. The large size MCCs to have multi panel type construction. The MCC shall have hinged access doors at the front, swing not exceeding 450 mm, and of design that all work of servicing, maintenance, replacement, additions and alterations can be carried out from the front without requiring access from the back.

The back panels shall be bolted and easily removable. The MCC to have protected bus bars and indicator name plates for all items. A pocket shall be provided for keeping electric wiring diagrams.

All circuits shall be numbered and tags fixed with the wires for identification.

The MCCs to be installed outside shall be of weather proof construction.

The motor starters shall comply with the requirements specified elsewhere in the documents.

The main MCC in the central plant room shall have one 30amp 3 phase service outlet with MCB and 4 pole quick disconnect coupling, and two 15 amp 3 pin single phase service outlets with MCB and on-off switch. The MCCs for the air-conditioning units or in the air-conditioning equipment/mechanical plant rooms, etc. shall have one 15 amp 3 pin single phase service outlet with MCB and on-off switch.

Reproducible transparencies and 3 sets of complete detail wiring diagrams for each MCC shall be supplied to the Employer and one plastic coated set to be kept in a pocket in the respective MCC.

- 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.

ELECTRIC MOTORS AND STARTERS

- 1.0 Electric motors shall be of the sizes and types as specified for driving all plant and equipment. The motors shall be of atleast the horsepower specified but shall be of proper horse-power and speed to suit the specific plant and equipment offered by the tenderer. Any adjustment in motor horsepower or speed must be included in the tender and no additional cost will be allowed on this account. The motors and starters shall be heavy duty quiet running type suitable for continuous operation under the site conditions. The minimum motor efficiency and power factor shall be 0.85.

- 2.0 The motors shall be designed for 50 cycle AC supply of following voltage characteristics:

MOTOR RATING	IMPORTED	INDIGENOUS
Fractional HP, 1-phase	220±10%	220±10%
1 HP & above, 3-phase	400±10%	400+5%-10%

- 3.0 All motors shall be constant speed type unless otherwise specified. 3-phase motors, 150 HP and below shall be squirrel cage type and above 150 HP slipring type. Squirrel cage motors 10HP and above shall have 6 winding leads brought to motor terminal block for star-delta starting. Single phase motors shall be split phase type or capacitor start induction run type.
- 4.0 The motors and starters shall be tropicalized and fungus proof. Unless otherwise specified, drip proof ventilated or totally enclosed fan cooled construction with Class IP44 Protection for indoor installation, totally enclosed fan cooled weather proof construction with Class IP54 Protection for outdoor installation or where coming in contact with high humidity air. The motors and starters shall be suitable for operation under site conditions as specified; minimum ambient temperature 45°C and altitude 600m amsl. Where required, motors installed outside shall be provided with sheet metal cover to protect from direct sun.
- 5.0 The motors to have cast iron frame with cast in cooling ribs, integral feet and cast in end shields, protective cover for cooling fan, quiet running ball or roller bearings to meet the specified duty, terminal box and grease nipples in upper part of end shields to be accessible while motor is running. Motors to be suitable for direct or pulley drive.
- 6.0 All motors should be arranged for quiet operation and guaranteed to give the required output and fulfil the requirements of the driven machinery without producing any sound audible outside the machine room.
- 7.0 Motors driving pumps shall be directly connected through flexible couplings, while motors driving fans, compressors, etc shall be belt connected unless otherwise specified. All belt connected motors should have sturdy adjustable bases with arrangement to maintain proper belt alignment and tension and complete with belt guards. All belt connected fan driving motors shall have variable pitch pulley for adjusting the fan speed +5-10% of design selected speed.
- 8.0 The slipring motors shall have inspection windows for access to brushes and slip rings. Rotor connections shall be made thru a cable gland or terminal box. There shall be a

safety control to ensure that the motor cannot be started without the brushes in position.

- 9.0 Single phase motors 0.5 HP and above shall have automatic magnetic direct-on-line starters with hand/off/auto switch, two adjustable overload cutouts, low voltage cutout, and at least one auxiliary contact for electric interlocking circuit. Motors below 0.5 HP rating may be provided with a heavy duty MCB.
- 10.0 Squirrel cage motors 10 HP and below shall have automatic magnetic direct-on-line starters with hand/off/auto switch, three adjustable overload cutouts, low voltage cutout, single phasing preventer, at least two auxiliary contacts for electric interlocking circuits and one ammeter for motors 5 HP and above.
- 11.0 Squirrel cage motors above 10 HP shall have automatic magnetic star-delta type reduced voltage starters with hand/off/ auto switch, three adjustable overload cutouts, low voltage cutout, single phasing preventer, at least two auxiliary contacts for electric interlocking circuits and one ammeter. All three contactors of the starter shall be identical.
- 12.0 Slip ring motors shall have automatic magnetic stator-rotor type starters with hand/off/auto switch, three adjustable overload cutouts, low voltage cutout, single phasing preventer, at least two auxiliary contacts for electric interlocking circuits and one ammeter. The rotor Rheostat, natural air ventilation cooled, should be suitable for at least 8 starts per hour. Electric interlocking control shall ensure that the motor cannot be energized without the Rheostat in starting position. At power supply contactor tripping, the Rheostat shall automatically return to the starting position. The Rheostat operating system shall be step by step ensuring smooth starting to full speed and short circuiting of rotor when full speed achieved.
- 13.0 All starters control circuit and magnetic coils to be suitable for 230 volts 50 cycles 1-phase AC. For motors requiring electric interlocking or remote control or sequence starting control or any other such feature, starters should have necessary auxiliary contacts (normally open and normally closed) providing the desired control arrangement. A separate set of terminals is required for each control circuit. Single phase starters shall have off-on green-red indicator lights and 3-phase starter's off-on-overload green-red-yellow indicator lights.
- 14.0 All starters for equipment not visible from the starters and for remote control operation shall be provided with a pilot light. An off-on switch in the starter control circuit shall be installed near the motor from which the starter is not visible to ensure that the motor cannot be started or electric circuit energized by error. Alternatively a disconnect switch can be provided near the motor.
- 15.0 All motors and starters provided under this contract should be of one manufacturer except for the equipment where special motors and starters are provided as standard component. The Contractor shall submit manufacturers' technical bulletins of motors and starters to the Consultant for approval before supply.
- 16.0 Where single phasing preventer or any other safety devices or controls specified above are not part of standard control panel and/or starters supplied by the equipment manufacturer as standard component, the Contractor shall provide all such safety devices and controls.

- 17.0 All motor starters in one Plant Room shall be installed in one Motor Control Centre of type and construction as specified elsewhere, except where these are installed in the equipment control panel by the manufacturer.
- 18.0 Special fire resistant, explosion proof, 2-speed or multi speed motors and starters shall be supplied if specified elsewhere in the documents.

CHARTS AND TAGS

- 1.0 The Contractor shall supply reproducible transparencies and four copies each of charts or diagrams showing outline plans of the structure and describing essential features of all the components of the installed systems for the purpose of identifying location of all control points, valves, etc. for easy operation, maintenance and servicing.
- 2.0 The Contractor shall provide identifying brass tags for all valves, controls etc. with numbers corresponding to those given in the charts or diagrams specified above. The 20g brass tags shall be at least 30mm dia, the numbering shall be stamped and tags fastened to the controls and valves with brass chains and hooks.
- 3.0 The Contractor shall supply reproducible transparencies and four copies each of charts indicating Schedules of daily start-up and shut down, emergency shutdown, Schedules of servicing and maintenance, lubrication points and schedule, and a Chart listing equipment model and serial Nos., conditions of operation, normal settings of automatic and safety controls, data of accessories and motors, manufacturer's name and address and reference Nos. of technical and spare parts catalogues supplied to the Employer.
- 4.0 One set of charts and diagrams shall be mounted in glass frame and permanently fixed according to the Engineer's directions.
- 5.0 The Contractor shall submit to the Consultant for approval the list of charts, diagrams etc. which he proposes to supply. The quality of reproducible transparency sheets shall be as approved by the Consultant.

PAINTING

- 1.0 The Contractor shall paint all equipment, ducting, piping, hangers, bracing and other surfaces exposed to air as specified and he shall also be responsible for all finish painting. The minimum number of coats are specified herein under but sufficient coats shall be given to achieve desired finish.
- 2.0 To the extent possible the Contractor will carry out the painting along with completion of installation particularly in the occupied areas to avoid interference later on with other contractors or Building completion schedule.
- 3.0 Material for painting shall be high grade products of well-known manufacturers and when approved shall be delivered on the site in original unbroken packages bearing the maker's name and brand. Paints of approved color only shall be used for each application.
- 4.0 Unpainted steel and iron and primed hardware shall match the work to which it is attached, unless otherwise directed.
- 5.0 Stainless steel devices shall not be painted.
- 6.0 All surfaces shall be clean, dry and free from dust at the time any coating is applied. Base coats provided by others shall be in good condition and the surfaces well covered by touching any bare or abraded spots. Base coats on works subject to close inspection shall be rubbed smooth.
- 7.0 Interior painting shall not be done when temperature is below 0°C. Enamel shall not be applied when temperature is below 20°C. Exterior painting shall not be done in frosty, foggy or damp weather or when temperature is below 10°C.
- 8.0 All cloth and cotton waste that might constitute fire hazards shall be placed in closed metal containers or destroyed each day. Upon completion of work, all containers shall be removed from the site and destroyed in an approved manner. Paint spots, oil or stains upon adjacent surfaces shall be removed.
- 9.0 All equipment and motors shall be painted with three coats of enamel paint in the factory and shall be carefully cleaned and oiled after installation. In case the original paint has been damaged, fresh coats of enamel paint to match the original paint shall be given.
- 10.0 All duct, pipe and equipment MS hangers and supports shall be thoroughly wire brushed and given one coat of red oxide zinc chromate primer and one coat of synthetic enamel paint after installation. MS hangers and supports visible in the occupied areas, plant rooms and other locations shall be given finish coat of synthetic enamel paint on completion of installation.
- 11.0 The interior of all ducts and outlet boxes at the back of air grilles, registers and diffusers shall be painted with two coats of dull black paint.
- 12.0 All MS ducting, piping and surfaces and unpainted equipment required to be insulated shall be thoroughly wire brushed and applied one coat of black asphalt paint before insulation is fixed.

- 13.0 All uninsulated MS piping, MS ducting and surfaces, MS manufacture and unpainted fan casings, chambers and equipment shall be thoroughly wire brushed, given one coat of red oxide zinc chromate primer and finished with two coats of synthetic enamel paint.
- 14.0 All uninsulated GI ducting and piping concealed or in plant rooms shall not be painted. The visible G.I. ducting and piping in the occupied areas shall be given two coats of synthetic enamel paint.
- 15.0 All 4 oz weight coarse cloth or 8 oz weight canvas jacketed insulated ducting and piping shall be given one coat of anti-fungus fire resistant water repellent emulsion. In locations where the insulated ducting and piping is exposed and visible within the Building, such as plant rooms, working spaces, basements, attics, passages and occupied areas, these shall then be given two finishing coats of synthetic enamel paint.
- 16.0 The ducting and piping shall be painted according to a color code approved by the Consultant for identification. Where full painting is not specified, color code strips shall be painted at intervals. Symbols and flow directional arrows shall also be stenciled according to a Schedule approved by the Consultant.
- 17.0 All wood surfaces coming in contact with the Building structure shall be given a heavy coat of solignum anti termite wood preservative paint. All other concealed wood surfaces shall be given one coat of anti-fungus water repellent primer. All boards made of wood chips, etc. shall be given one coat of anti-fungus water repellent black paint on the inner surfaces. All visible surfaces shall be given dull mat finish with synthetic enamel paint.

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 tenderer shall give a complete List of all the spare parts included in his tender.

CLEANING, TESTING AND ADJUSTING

- 1.0 The Contractor shall during construction properly cap all pipe and duct open ends to prevent the entrance of dirt etc. Each piping and ducting circuit shall be flushed/blown through after completion of installation and again immediately before the testing and commissioning of the Systems, for as long a time as necessary to thoroughly clean that circuit.
- 2.0 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.
- (b) Medium pressure ducts upto 150mm wg, and
- (c) High pressure ducts upto 250mm 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.

- 3.0 All steam and water piping shall be tested with a hydraulic pressure of 1-1/2 time the operating pressure, but not less than 3.5 bar for LP steam and 10 bar for water or at pressures approved by the Consultant, for sufficient time to detect leaks and defects.

Piping for gaseous systems shall be tested with dry air at 1-1/2 time the operating pressure but not less than 3.5 bar.

All leaks and defects shall be made good in a proper workman-like approved manner. If necessary, piping shall be taken down and re-erected and any make shift or temporary repair of leaks will not be permitted. In final test the pressure shall be maintained for at least three hours.

- 4.0 All pneumatic piping shall be tested at a pressure of 1-1/2 time the operating pressure but not less than 2 bar on the low side and 6 bar on the high side. Any leaks shall be made good. In final test the pressure shall be maintained for at least six hours.

- 5.0 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 at least 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 at least 24 hours.

- 6.0 The Contractor shall test all electric motors, electric wiring and earthing and furnish test records to the Engineer.
- 7.0 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.
- 8.0 All water circulating systems shall be properly balanced for the specified flow through each circuit/equipment.

TEST RUNS

- 1.0 The Contractor shall be required to carry out test run(s) as specified in the Memorandum of Tender after the issue of the Certificate of Substantial Completion for the complete works by the Engineer. The period for the test run(s) would be designated in writing by the Engineer. The test run observations shall be recorded in duplicate by the Contractor on printed log sheets approved by the Consultant. The Contractor shall depute an experienced Site Engineer and sufficient skilled labor for taking and recording test run observations. The normal plant operation shall be carried out by the Employer's Operators.
- 2.0 The Employer shall only provide without charge to the Contractor water, electricity and fuel for the test run(s) and the Contractor shall be responsible for the supply of all tools and instruments etc. required to take and record the test run observations.
- 3.0 The log sheets shall be jointly signed by the Employer's Representative and Contractor's Site Engineer. The Contractor shall hand over one set of log sheets to the Employer's Representative every day.
- 4.0 The Contractor's Project Engineer shall check and prepare a summary of observations on printed forms approved by the Consultant in quadruplicate at the end of each test run week. One set each shall be supplied to the Engineer, Consultant and Employer's Representative within one week of the conclusion of the corresponding test run week.
- 5.0 The Engineer shall check the performance of the plant(s) during the test run(s). If the plant(s) performance meets the specified requirements, the Engineer shall issue a Certificate of satisfactory completion of test run(s) to the Contractor.

LOW VELOCITY LOW PRESSURE SHEET METAL DUCTING

01. All sheet metal work for various air systems shall be furnished, installed, completely connected, tested and adjusted.
02. The Contractor shall make shop drawings of all duct work and the same shall include details of all splitters, takeoffs, vanes, dampers, elbows and all other necessary fittings required for the proper operation of the air systems. Shop drawings and other details shall be submitted to the Consultant for approval before fabrication.
03. Exact dimensions and locations of diffusers, registers, grilles and louvers shall be submitted to the Consultant for approval, otherwise any changes directed after installation shall be made by the Contractor without any additional cost to the Employer. For diffusers and registers adequate provision shall be made in the neck connections for installation of deflectors and dampers.
04. All duct openings, diffuser, register and grille necks/ boxes must be tightly closed during construction to keep out rubbish.
05. All ducts passing through walls shall have 20 gauge G.I. sheet sleeves extending 6mm beyond the finished face of the wall on both sides. The sleeves shall be of sufficient size to cover duct insulation or any other duct covering and allow atleast 9mm clearance in the sleeve for free movement of the finished ducting. The clearance shall be filled with fiberglass pads or other approved material at fire walls and similar locations. The Contractor shall be responsible for supplying, locating and setting of all necessary duct sleeves.
06. All sheet metal duct work shall be fabricated from commercial quality prime finish galvanized steel sheets. The specifications for USA and Canadian sources shall be base steel sheets according to ASTM designation A366:62T and zinc coating according to 525-64T, 1.25 oz./sq.ft. and for all other sources base steel sheets cold rolled B.S. 1449:Part 1B:1962 and zinc coating according to B.S. 2989:1958 Class D, 1.25 oz./sq.ft. The zinc coating should be applied uniformly by continuous hot dip method to both sides of the base metal so that the sheet metal can be drawn, formed, lock-seamed and spun without danger of flaking or peeling off the zinc coating.
07. All uninsulated ducts shall be cross broken. Insulated ducts not to be cross broken.
08. All ducting shall be substantially built with approved joints and seams shall be made smooth on the inside and neat on the outside. The duct joints shall be made as air tight as possible. The laps shall be made in the direction of air flow and no flanges shall project inside the ducting.
09. Ducts, the width of the greater dimension of which exceeds 30 inches shall be constructed of not more than four feet sections. Ducts, the width of the greater dimension of which is 30" or less shall be constructed of not more than eight feet sections.
10. All elbows shall preferably be full radius type. If space does not permit, square elbows may be used with double thickness shop fabricated turning vanes riveted with the ducting. Due to space limitations curved elbows with less than a full radius bend may also be used provided single thickness turning vanes are installed in the elbow. Full radius

- elbows of widths 40"-60" shall have one and over 60" shall have two single thickness turning vanes. Minimum throat radius of any curved or square elbow shall be 3 inches.
11. Wherever necessary in duct work, casings or sheet metal partitions, suitable access doors and frames shall be provided to permit inspection, operation and maintenance of valves, controls, fire dampers, filters, bearings, traps or other apparatus concealed behind the sheet metal work. Access doors shall also be provided at distance not exceeding 23m for duct cleaning. All such doors shall be of double construction, of not less than 20 gauge G.I. sheet metal and shall have sponge rubber gasket around the entire perimeter to make the joint airtight. They shall be hung on heavy flat hinges and shall be secured in the closed position by means of wing type catches. In no case shall access to any of the items of equipment requiring inspection, adjustment or servicing require the removal of nuts, bolts, screws, wedges or any other screwed or loose device.
 12. The supply and return air duct connections with the fans and equipment shall be made through heavy duty air tight pre-fabricated flexible duct connector to prevent transmission of vibrations. The flexible duct connector will have 75mm 24g G.I. sheet, 150mm of fabric and 75mm 24g G.I. sheet. The fabric shall be fixed with G.I. sheets with double-lock grip. The fabric shall be non-combustible heavy glass fabric double coated with fire retardant neoprene to become fully water proof and air tight of approx. 30oz weight per sq.yd. The flexible connector shall be Duro-Dyne Super Metal Fab or approved equal.
 13. The ducts shall be adequately supported from hangers firmly fixed and generally suspended from the building structure with the help of concrete inserts, rawal bolts or shooting bolts. The hangers and supports shall not pierce the insulation which shall be suitably protected and reinforced at that location. The bottom support shall be 30x6mm M.S. flat or 25x3mm angle for ducts up to 12" width, 30x3mm angle upto 30" width, 40x3mm angle up to 72" width and 50x5mm angle upto 96" width. Hangers shall be spaced on average 3 meter center with a hanger no further than 300mm on each side of any changes of direction. Ducting passing through building expansion joints shall be supported on either side of joint. The hangers for horizontal ducts shall be 9mm round rods for ducts upto 30" width, 12mm round rods or 40x3mm M.S. flat upto 72" width and 40x5mm M.S. flat upto 96" width. The vertical ducts shall be supported at each floor with M.S. angle or channel supports resting on slab and bolted with the duct bracing or MS flat straps riveted with the duct. Perforated band or wire shall not be used in any case for supporting the ducts.
 14. The low pressure ducting with static pressures upto 50mm wg and velocities upto 10mps, shall be fabricated according to the following schedule:

Rectangular Ducting

14.1 DUCT GAGUES

To 8" larger dimension	26 gauge (all four sides)
9"-27" larger dimension	24 " "
28"-51" " "	22 " "
52"-81" " "	20 " "
Above 81" " "	18 " "

- 14.2. The ducts shall be fabricated with following type of joints or as approved:

(a) Longitudinal. Pittsburg lock, double seam, or grooved seam.

(b) Circumferential (all four sides):

Duct larger dimension

To 23" Drive slip

24" - 42" 1" high pocket lock or standing seam

43" - 72" 1-1/2" high pocket lock or standing seam

73" - 96" 1-1/2" high reinforced pocket lock or standing seam

14.3. The bracing for ducting shall be as follows:

Duct larger dimension	Size of bracing MS angle
upto 23"	None
24"-30"	Joints at 4' center without bracing or joints at 8' Centers with 25x25x3mm bracing between joints.
31" - 42"	25x25x3mm bracing @ 4ft centers
43" - 72"	40x40x3mm " @ 4 "
73" - 84"	40x40x3mm " @ 2 "
85" - 96"	40x40x5mm " @ 2 "

The 2' centers bracing would be located at joints and between joints.

The bracing shall be carried around all four sides, bracing angle frame welded at 4 corners and riveted with the ducts at maximum 150mm centers.

14.3. Special joints, bracing and hangers as specified by the Consultant shall be used for ducts with larger dimension over 96".

15. The ducting and air dampers shall be furnished to comply with these specifications and latest edition of SMACNA Duct Construction Standards. Where there is a conflict between the two, these specifications will prevail.

AIR DAMPERS

01. In all duct work the Contractor shall furnish and install dampers (VCD) for proper control of volume and balancing of air distribution systems. These dampers shall be separate from any other dampers provided with supply and return air diffusers, registers and grilles.
02. A multi leaf opposed blade type damper shall be installed in each zone supply air duct near the multi-zone type air handling unit outlet to adjust the supply air cfm of each zone.
03. Dampers shall be of rigid construction, free of all rattling and vibrations with edges crimped or creased for stiffness.
04. All dampers shall have through rods, not less than 12mm diameter fastened to blade with two or more yokes with set screws. There shall be a steel washer at each end of damper rod.
05. Damper blades shall be of same material as duct work but two gauge heavier. Damper blades of 18 gauge and lighter shall have the edges double hemmed. Damper blades larger than 900mm length shall have 'V' crease in middle in which damper rod shall be located.

06. Dampers less than 200mm wide (90 degrees to damper rod) may have through damper rod with bent handle and position indicator. Dampers wider than 200mm shall have through damper rod with quadrant and lever with lock screw with position indicator at one end, damper lever shall be fastened to rod with set screws. On insulated duct work, quadrants shall be mounted on metal saddles finishing flush with insulated surface. The quadrant and lever unit shall be factory fabricated, made of heavy gauge steel electro galvanized, Thermic model UNXLD or as approved. Bearing at handle end shall be of cast iron or brass with set screws, bearing at opposite end shall be of brass with close fitting rod hole; bearings shall be riveted to duct.
07. Dampers less than 200mm wide may be single leaf, 200mm and wider, multi-leaf opposed blade type. Damper bearings and linkages to be suitable for operation by automatic damper actuators.
08. Two position full open-full close dampers (OCD), to be provided where specified or shown on the drawings, shall be of construction as specified above for VCDs except that a quadrant with two position indicator shall be provided for operating the damper.

VENTILATION AND EXHAUST BLOWERS AND FANS

01. Ventilation and/or exhaust blowers and fans shall be installed as shown on the drawings. The size and capacity of the fans and blowers shall be as specified in the Schedule of Equipment. In these specifications the words fan and blower shall be synonymous. The fans shall be heavy duty and quiet running suitable for continuous operation.
02. 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.
03. 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.
04. 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.
05. 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.
06. Fans used for exhaust shall be provided with rain protection hood or louvers with insect screen on the exhaust side.

07. Rain protection hood or louvers with insect screen (where inlet air filters are not installed) shall be provided at the Building air inlet opening for the ventilation fans.
08. The fans shall be connected to the ducting with heavy duty fabric flexible connectors as specified elsewhere.
09. The propeller and axial type fans used for ventilation/ exhaust shall be mounted inside a fan chamber to allow radial flow into and from the impeller tips. Fan chamber shall be flanged at both ends with bolt holes and fitted with external electric terminal box and inspection door for easy access to all components for servicing and maintenance.
10. The propeller type fans shall be direct driven by totally enclosed fan motors.
11. The centrifugal fans shall be either aero foil 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, V-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.
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.
12. The axial flow blowers shall only be used where noise level is of secondary importance. The blower shall have adjustable pitch blades and preferably short length steel housing. Long casing if provided shall have a removable access door to facilitate internal inspection and servicing of the fan. The fan shall preferably be direct coupled to electric motor. Alternatively it may be V-belt driven with motor mounted outside the casing.
13. The roof extractor/ventilator fans shall be low silhouette type with heavy gauge weather proof construction. The parts shall preferably be of non-ferrous construction and all ferrous parts should have anticorrosion treatment with weather resistant baked enamel finish. The housing should be weather tight but easily removable for inspection and servicing and it shall be provided with a hood hinged to the housing with lock hasp providing easy access to all components, and a bird screen. The fan wheel may be propeller or axial flow or aero foil or backward curved centrifugal type with direct connected motor. In case of centrifugal type the motor shall be in a separate compartment not coming in contact with the exhaust air and it shall be cooled by ambient air. In case there are any corrosive fumes in the exhaust air, only such type of fans shall be used.
14. The tenderer shall give the following information for each type of fan:
 - (a) Capacity in cfm and operating static pressure in mm wg, rpm, fan HP requirement and motor HP.
 - (b) Overall dimensions and operating weight.
 - (c) Manufacturer's performance guarantee certificate and technical bulletins.

EQUIPMENT COMPLIANCE SHEET

S.NO.	DESCRIPTION	VENDORS OFFERED
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A.	GENERAL	
1.	Make	
2.	Origin	
3.	Model	
4.	Air quantity (cfm)	
5.	Overall dimensions (LxWxH) (inchesxinchesxinches)	
6.	Operating weight (Kg)	
7.	Vibration isolators	
8.	Noise Level (db at a distance of 3.28 feet from fan)	

B.	FAN & FAN MOTORS	
1.	Make	
2.	Origin	
3.	Type of fan	
4.	Material of fan	
5.	Number of fan(s) and fan speed (rpm)	
6.	Fan wheel dia (inches)	
7.	Motor Make	
8.	Motor Origin	
9.	Type of motor	
10.	Type of drive	
11.	Fan external static pressure (in. w.g.)	
12.	Fan total static pressure (in. w.g.)	
13.	Electrical characteristics	
14.	Fan motor HP	

GRILLES, REGISTERS, DIFFUSERS AND LOUVERS

01. The Contractor shall install where shown on the drawings all air devices, grilles, registers and diffusers, of sizes and types as specified, or of equivalent jet areas and cfm capacities as approved by the Consultant.
02. The Contractor shall check and confirm with the air devices manufacturer that proposed grilles, registers and diffusers shall meet the capacity and "throw" requirements without draft, dead spots and noise. Any changes or alternatives shall be notified to the Engineer/Consultant for approval.
03. The air devices shall be neatly finished. The corner joints will be invisible hairline butts. A sponge rubber gasket shall be provided around the perimeter for tight fit against adjoining structure.
04. All diffusers shall be furnished with multi louver type volume damper in neck, controlled from face of the diffuser.
05. All wall type supply air grilles and registers shall have horizontal and vertical adjustable deflecting bars and registers shall also have opposed blade volume control dampers adjustable from face with a removable key. Registers and grilles shall have a minimum of 75% free area.
06. All return/exhaust air grilles shall be of the fixed bar type to match supply outlets and have a minimum of 75% free area. Return/exhaust air registers with opposed blade volume control dampers adjustable from the face are to be installed where shown on the drawings.
07. Door louvers, where shown on the drawings, for return/ exhaust air shall be supplied by the Contractor if so specified on the drawings, otherwise these will be arranged by the Employer.
08. Slot or Linear type diffusers of aluminum construction suitable for ceiling or side wall installation shall be provided where shown on the drawings. Continuous installation where shown will be with keyed-together sections assuring invisible hairline butts for neat appearance. The diffusers shall be installed with plenums and flexible ducting connection between the plenums and sheet metal ducts. Supply, return and exhaust air diffusers to have volume control dampers at the back adjustable from diffuser face. Dummy diffusers for continuous installation to have blank-off baffles at the back. Slot type diffusers will have 3/4" slot. Supply air diffusers to have adjustable air pattern controller.
The Linear diffusers to have removable cores to provide access to dampers and accessories and firmly locked with framing with quick opening concealed latches. The removable core has fixed vanes to provide an air path parallel to the ceiling or wall. Slot type diffusers to be similar to T&B Imperialize Series 6000, 3/4" slot with E margin, linear type diffusers to be T&B Imperialize Series EL, or approved equal.
09. The air devices shall be of MS or Aluminum construction as specified with approved color finish. Aluminum air devices may be with anodized or powder coated finish. MS air devices shall be thoroughly cleaned, given anticorrosion chemical treatment, coating of primer and powder coated or baked enamel paint finish as specified.

10. Fresh air intake and exhaust discharge louvers shall be installed where shown on the drawings. The louvers shall have fixed blades, angled to provide adequate weather protection and a free area of not less than 70%. They should be constructed, unless otherwise specified, of aluminum (anodized or powder coated finish as specified) with vertical supports as necessary to ensure complete rigidity. In case of MS construction they shall be thoroughly cleaned, given anticorrosion chemical treatment, one coat of chlorinated rubber based primer and finished with chlorinated rubber based low temperature baked paint of approved color.
11. Wooden frames in the walls for fixing air devices shall be arranged by the Employer according to the drawings supplied by the Contractor unless the work is specified to be the Contractor's responsibility. Frames for fixing air devices in the false ceiling/boxing shall be arranged by the Contractor unless specified to be the Employer's responsibility in which case the Contractor shall supply the necessary drawings. The frames shall be of same material and appearance as the main framing for false ceiling/boxing.
12. Unless otherwise specified, all grilles, registers, diffusers and louvers shall be of local manufacture of design and quality as approved by the Consultant.

AIR FILTERS

01. Each air system shall have its own air filters.
02. The air filters shall be of type, efficiency classification cfm capacity and sizes as given in the Schedule of Equipment.
03. The unit air filters shall be permanent, cleanable/ washable type. The filter media shall be a blend of natural fibers bonded by a synthetic rubber latex resulting in a firm mat like form with high dust holding capacity. The filter media shall be held in a metal frame. The filters can be cleaned by vacuuming or backwashing. The filters shall be selected for face velocity not exceeding 400fpm.

The average synthetic dust weight, ASHRAE Standard 52-76, shall not be less than 70%.

Unless otherwise specified in the Schedule of Equipment, filters of following thickness shall be used.

(a) Fresh Air Intakes: 50mm thick with initial resistance 3mm wg.

04. In case of Air handling Units and Fresh Air Inlets, if specified in the Schedule of Equipment, as alternative, 50mm thick viscous oil type permanent cleanable (washable) filters are to be installed. The filter media shall be composed of corrugated strips of screen wire or sheet metal placed on edge to the air flow. The corrugations shall be tapered to form a series of pyramid shaped pockets to prevent dust laden air from drifting through the filters. Expanded metal shall be placed on both sides of cleaning media to add strength and for mechanical protection. The filters shall be selected for face velocity not exceeding 450fpm with initial resistance 3mm wg.
05. The unit filters shall be mounted in air tight preferably flat otherwise angular filter box of galvanized steel or aluminum sheet so that they can be removed from either end for replacement and cleaning.

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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
1	2	3	4	5	6	7	8
EXHAUST AND VENTILATION SYSTEM							
1	Supply, Installation, Testing & Commissioning of Ventilation fans as per specification & drawing. (Isolation breakers, vibration isolators shall be finalized as per manufacturer specifications.)	Nos.					
i.	Centrifugal Cabinet Type Kitchen Exhaust Air Fan-01	1					
ii.	Centrifugal Cabinet Type Kitchen Fresh Air Fan-02	1					
iii.	Centrifugal Cabinet Type Kitchen Exhaust Air Fan-03	1					
iv.	Accosted inline Centrifugal Cabinet Type Kitchen Exhaust Air Fan-04 (Storage Area)	1					
v.	Accosted inline Centrifugal Cabinet Type Kitchen Fresh Air Fan-05 (Kitchen Area)	1					
vi.	Accosted inline Centrifugal Cabinet Type Exhaust Air Fan-06 (Bath Room)	6					
vii.	Accosted inline Centrifugal Cabinet Type Fresh Air Fan-07 (Bath Room)	3					
viii.	Accosted inline Centrifugal Cabinet Type Exhaust Air Fan-08 (Bath Room)	3					
ix	Accosted inline Centrifugal Cabinet Type Fresh Air Fan-09 (Kitchen)	1					
x	Cylindrical Cased Axial Type Exhaust Air Fan-10 (Kitchen)	3					
xi	Accosted inline Centrifugal Cabinet Type Fresh Air Fan-11 (Bath Room)	2					
xii	Accosted inline Centrifugal Cabinet Type Exhaust Air Fan-12 (Bath Room)	2					
xiii.	Cylindrical Cased Axial Type Exhaust Air Fan-13 (Kitchen)	3					

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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
1	2	3	4	5	6	7	8
xiv.	Accosted inline Centrifugal Cabinet Type Fresh Air Fan-14 (Kitchen)	3					
xv.	Accosted inline Centrifugal Cabinet Type Exhaust Air Fan-15 (Kitchen)	3					
xvi.	Accosted inline Centrifugal Cabinet Type Fresh Air Fan-16 (Kitchen)	1					
xvii.	Accosted inline Centrifugal Cabinet Type Exhaust Air Fan-17 (Kitchen)	3					
xviii.	Centrifugal Cabinet Type Exhaust Air Fan-18 (Kitchen)	1					
xix.	Cylindrical Cased Axial Type Exhaust Air Fan-19 (Kitchen)	2					
xx.	Industrial type Air curtain (5'-0")	2					
xxi.	Propeller exhaust plastic body fan with louvers	1					
2	Supply, Installation, Testing & Commissioning of Medium pressure G.I. Sheet Metal ducting (Machine Made) as per SMACNA & ASHRAE Standards for air ducting, plenums and other sheet fabrications including splitter dampers, take off, vanes elbows and other necessary fittings with galvanized hanger supports as per specification and drawings.	Sq.ft.					
i.	20 Gauge	1300					
ii.	22 Gauge	3500					
iii.	24 Gauge	1800					
3	Supply & Installation of Air Devices with damper (Tuttle & Bailey standards) Complete with all respect as per specification and drawings.	Nos.					
a.	Fresh & Exhaust Air Grill						

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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
1	2	3	4	5	6	7	8
i.	22" x 16" F.A.G	15					
ii	9" dia E.A.R	42					
iii	9" dia F.A.D	14					
4	Supply & Installation of S.S Supply Air slot Grill with S.S Plenum Complete with all respect as per specification and drawings.	R.ft					
i	8"-3 Slot	61					
ii	6"- 3 Slot	120					
a.	Fresh Air Intak Louvers	Nos.					
i.	52" x 18" F.A.I.L (with V.C.D + Pre filter)	5					
ii	48" x 18" F.A.I.L (with V.C.D + Pre filter)	4					
iii	14" x 16" F.A.I.L (with V.C.D + Pre filter)	6					
iv.	48" x 42" F.A.I.L (with V.C.D + Pre filter)	1					
b.	Exhaust Air louvers	Nos.					
i	48" x 18" E.A..L	3					
ii	16" x 10" E.A..L	1					
iii	16" x 14" E.A..L	5					
iv	14" x 12" E.A..L	6					
c.	Volum Control Damper (V.C.D.)	Nos.					
i.	16" x 10"	8					

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			COST OF SUPPLY	COST OF INSTALLATION	COST OF SUPPLY	COST OF INSTALLATION	TOTAL COST
1	2	3	4	5	6	7	8
ii.	14" x 8"	21					
iii	12" x 8"	6					
iv	12" x 12"	21					
5	Supply, Installation, Testing & Commissioning of MCC complete with cable tray, isolation Switch for indoor & hanger supports etc. for Equipment as per Specification and drawings.	Nos.					
i.	MCC-01(Ground Floor)	1					
ii.	MCC-02(First Floor)	1					
iii.	MCC-03(Second Floor)	1					
iv.	MCC-04(Second Floor)	1					
v.	E.S.P(Electric supply point)	26					
vi.	I.B (Electric isolation bracker)	14					
6	Supply, Installation, Testing & Commissioning of Complete Electric power & control wiring complete with cable tray, isolation Switch for indoor & hanger supports etc. for Equipment as per Specification and drawings.	1 Lot.					
7	Supply, Installation, Testing & Commissioning of of SS-304 Kitchen Hood canopy type complete with Grease filter hanger supports as per drawing.	Nos.					
i.	14'-4"X 4'-4"X 2'-0"	3					
ii	22'-7"X 7'-9"X2'-0"	1					
iii	12'-8"X 3'-8"X 2'-0"	1					

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			COST OF SUPPLY	COST OF INSTALLATION	COST OF SUPPLY	COST OF INSTALLATION	TOTAL COST
1	2	3	4	5	6	7	8
8	Equipment foundation, lifting & shifting charges from Ground floor to foundation pads as per specification and drawings.	1 Job.					
9	Cost of testing, Starting up, commissioning, balancing, adjusting and handling over of the complete System.	1 Job.					
10	Three Month Test Run of Equipment.	1 Job.					
28	COST OF ANY OTHER ITEM WHICH IS MISSING AND NECESSARY TO COMPLETE THE JOB. (DETAIL MUST BE ATTACH)	---					
TOTAL COST OF EXHAUST AND VENTILATION SYSTEM (RS.)							

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.
- 10 Abbreviation used in the BOQ are as follows:
a) Sq. Ft. Square Feet, (b) R. Feet. Running Feet, (c) Ton Ton weight, (d) No. Number, (e) Lot Complete package/lump sum.