|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Room Pressure Control System | Supply, Install, Testing and commissioning of Venturi Valve's Accessories (Room Pressure Control System with required RPM, Room Temperature sensors, Door Switches, Humidity sensors) for complete stand-alone operation of VV to control room pressurization and temperature as per drawings and specifications 23 09 10 |  | 23 09 10. |  |
| Room Pressure control devices (As per specifications for stand-alone operation of  VV) for each lab room | 120 Nos |
| Door Switches | 140 Nos |
| Humidity Sensor | 120 Nos |
| Room Temperature Sensor | 120 Nos |
| Additional Cabling for standalone operation of VV | Job |
| Notes   1. Contractor to study whole system as described in drawings and specifications along with executed work at site before bidding for exact scope of work for standalone working of system. 2. Contractor is responsible to maintain required 15Pa∆ using above listed components. Final quantities for Ordering should be as per Approved shop & control drawings. 3. All parts and components should be fully compatible with existing VVs and   installed DDCs. |  |

**1 2 3 4 5 6 7 8 9 10**

**SHEET NAMING CONVENTION**

B1 M X N NN

BUILDING CODE

DISCIPLINE KEY LETTER

(M−MECHANICAL−HVAC)

SHEET MODIFIER

REFEER TO MECHANICAL−HVAC SHEET MODIFIER

SHEET TYPE

REFEER TO MECHANICAL−HVAC SHEET TYPE

FOR PLANS: NN=PROJECT LEVEL ORDER (FROM BOTTOM TO UP) FOR OTHERS: NN=SHEET SEQUENCE NUMBER

**H**

**SHEET TYPES CODES**

# PUNJAB AGRICULTURE, FOOD AND DRUG AUTHORITY'S

SCIENCE ENCLAVE

# B1

**MECHANICAL-HVAC DRAWINGS**

1. ALL HUMIDIFIER SECTIONS SHALL BE INSTALLED IN THE SUPPLY AIR DUCTS

STEAM SUPPLY & RETURN SIZING AND CONNECTIONS TO STEAM HUMIDIFIERS INCLUDING PIPING NETWORK WITH ALL CONNECTIONS, FITTINGS, EXPANSION JOINTS AND ALL ACCESSORIES IS THE RESPONSIBILITY OF THE CONTRACTOR.

1. ALL MOTORIZED VOLUME DAMPERS, MOTORIZED FIRE DAMPERS & MOTORIZED SMOKE

DAMPERS ARE CONNECTED TO BMS.

1. ALL MOTORIZED VOLUME DAMPERS SHOULD BE AIR TIGHT TYPE.
2. PROVIDE 0.8 MM ALUMINUM SHEET CLADDING AS SPECIFIED FOR THE THERMAL INSULATION OF

THE DUCT AND PIPE WORK EXPOSED TO VIEW ( WHENEVER REACHED, CENTRAL PLANT, MECH. ROOMS AND OUTDOOR INSTALLATIONS.)

1. CONTRACTOR IS RESPONSIBLE FOR SIZING, SUPPLYING, AND INSTALLING ELECTRICAL

CABLES AND CABLE TRAYS FROM THE MOTOR CONTROL CENTERS AND / OR MOTOR STARTERS TO ALL HVAC EQUIPMENT.

1. ALL HVAC EQUIPMENT SHOULD BE PROVIDED WITH A DISCONNECTING SWITCH BESIDE THE UNIT.
2. ALL MOTOR CONTROL CENTERS (MCC)s AND MOTOR STARTERS (MS)s SHALL BE IP66 FOR THOSE INSTALLED OUTDOORS OR IN EQUIPMENT ROOMS, ELSE THEY SHALL BE IP54.
3. THE FANS DEDICATED FOR SMOKE REMOVAL SHALL WORK IN CASE OF FIRE THROUGH THE FIRE ALARM PANEL ACCORDING TO A PREDETERMINED FIRE SCENARIO.
4. ALL SMOKE FANS MOTORS INSIDE AIR STREAM SHALL HAVE AN INSULATION CLASS H AS

PER NEMA STANDARDS.

1. ALL STARTERS SHALL BE OPERATED REMOTELY THROUGH THE BUILDING MANAGEMENT SYSTEM.
2. ALL HVAC OPENINGS ON ROOMS EXTINGUISHED WITH A CLEAN AGENT SHOULD BE EQUIPPED WITH A MOTORIZED DAMPER OPERATED THROUGH THE FIRE ALARM PANEL.
3. ALL VARIABLE SPEED/FREQUANCY DRIVES INSTALLED OUTDOORS OR IN EQUIPMENT ROOMS

SHOULD BE INSTALLED INSIDE VENTILATED ENCLOSURES IP66.

1. THE MOTOR CONTROL CENTERS AND MOTOR STARTERS CIRCUIT BREAKERS RATINGS ARE MINIMUM REQUIREMENTS. THE CONTRACTOR IS RESPONSIBLE TO CHECK THE BREAKERS RATINGS BASED ON HIS ACTUAL EQUIPMENT SELECTION AND THEIR RATINGS ARE TO BE

MODIFIED ACCORDINGLY.

1. THE ELECTRICAL LOADS ARE BASED ON DESIGNS EQUIPMENT SELECTIONS AND HVAC

ENGINEERING EQUATIONS. THE CONTRACTOR IS RESPONSIBLE TO VERIFY THESE ELECTRICAL LOADS ACCORDING TO THE SELECTED AND APPROVED EQUIPMENT AND MAKING NECESSARY CHANGES (IF ANY) TO THE ELECTRICAL WORKS WITH NO EXTRA COST.

1. IN CASE OF FIRE, ALL EQUIPMENT SHALL BE SHUTDOWN EXCEPT THOSE DEDICATED FOR SMOKE MANAGEMENT SERVING TO THAT PARTICULAR FIRE ZONES.
2. AIR VALVES SHALL BE OF THE CIRCULAR OR RECTANGULAR TYPE, PRESSURE INDEPENDENT DOUBLE—WALL UNITS DESIGNED FOR ACCURATE MEASUREMENT AND CONTROL OF AIR VOLUMES.
3. AIR VALVES SHALL PROVIDE SUFFICIENT AIR MOVEMENT NECESSARY TO MAINTAIN COMFORT EVEN AT LOW TURN—DOWN RATIO.
4. AIR VALVES SHALL BE SUPPLIED COMPLETE WITH CONTROLLERS AND/OR ACTUATORS AND TEMPERATURE SENSORS AND SHALL BE SUITABLE FOR STAND—ALONE OPERATION UPON DELIVERY TO SITE. WITH PROVISION FOR CONNECTION TO THE BMS SYSTEM.
5. ALL EXHAUST DUCT SERVING FLEXIBLE ARM, GENERAL EXHAUST FROM LAB AND FUME HOOD SHALL BE CONSTRUCTED FROM WELDED SS316 MATERIAL, ALL RELATED DAMPER AND AIR VALVES SHALL ALSO BE CONSTRUCTED FROM WELDED SS316 MATERIAL.
6. ALL SUPPLY AIR DUCT SHALL BE CONSTRUCTED FROM G—90 SHEETS.
7. ALL VALVE LOCATED IN SUPPLY, RETURN AND EXHAUST SYSTEM SHALL BE SUPPLIED WITH TRACKING PAIR TO MAINTAIN THE ROOM PRESSURE @ 15PA ∆P
8. BRANCH DUCT CONNECTION FROM F.H TO MAIN DUCT SHOULD BE STAINLESS STEEL DUCT.
9. PRESSURE CONTROL UNIT SHOULD BE INSTALLED FOR EACH LAB TO CONTROL THE AIR PRESSURE INSIDE THE LAB.

HVAC GENERAL NOTES

**MECHANICAL−HVAC SHEET MODIFIERS**

**I** MECHANICAL−HVAC **I**NFORMATION

**S** MECHANICAL−HVAC **S**ITE

**E** MECHANICAL−HVAC **E**LEMENTS

**H** MECHANICAL−HVAC AIR SYSTEM

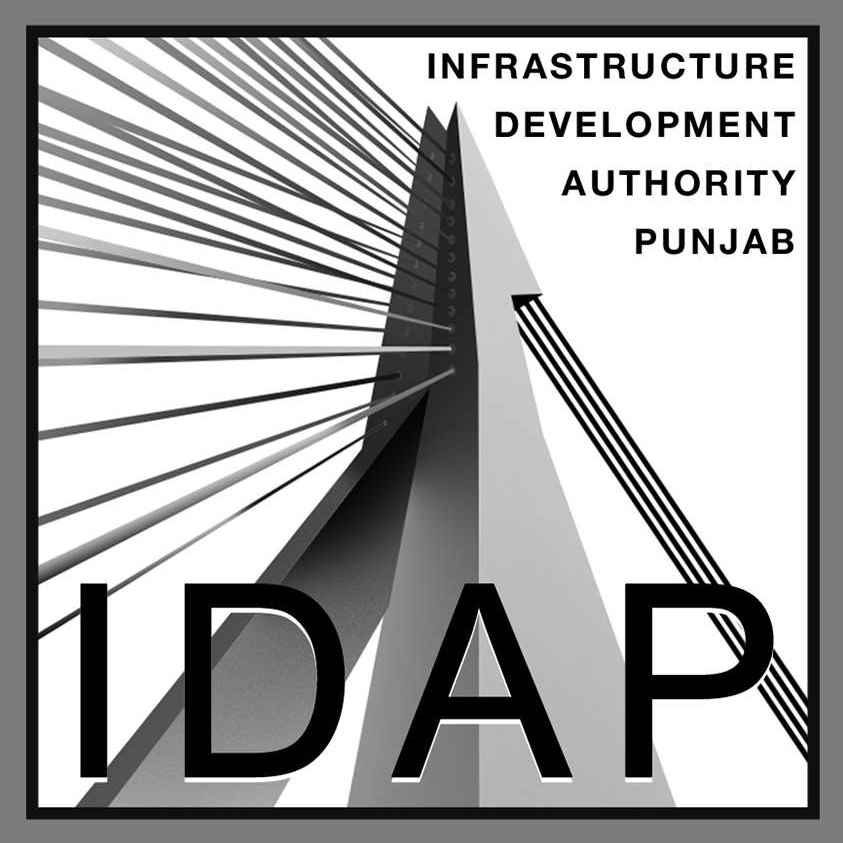
**P** MECHANICAL−HVAC **P**IPING

**H**

|  |  |  |
| --- | --- | --- |
| MECHANICAL−HVAC−SHEET LIST | | |
| SHEET NUMBER | SHEET NAME | SHEET SCALE |

0−MECHANICAL COVER AND GENERAL SHEETS

**INFRASTRUCTURE DEVELOPMENT AUTHORITY OF PUNJAB**

ARC

**OWNER**

INTERNATIONAL DESIGN CONSULTANTS

**AV. ILHA DA MADEIRA, BLOCO 35K 4th FLOOR,**

**LISBON, PORTUGAL**

HKS ARCHITECTS, INC

**500 7th AVENUE,**

**11th FLOOR, NEW YORK,**

**DESIGNER**

|  |  |  |
| --- | --- | --- |
| B1−MI001 | MECHNICAL−HVAC COVER SHEET | NTS. |
| B1−MI002 | LEGEND , GENERAL NOTES , SYMBOLS AND SHEET LIST | NTS. |
| B1−MI003 | MECHANICAL HVAC TERMS AND ABBREVIATIONS | NTS. |

**G**

|  |  |  |  |
| --- | --- | --- | --- |
| **SN.** | **SHEET TYPE** | **SHEET CONTENTS** | **REM.** |
| 0 | **GENERAL** | COVER, AND GENERAL SHEETS |  |
| 1 | **PLANS** | ALL HORIZONTAL VIEWS |  |
| 2 | **ELEVATIONS** | ALL VERTICAL VIEWS | NA |
| 3 | **SECTIONS** | ALL SECTIONAL VIEWS | NA |
| 4 | **LARGE−SCALE VIEWS** | ENLARGED VIEWS RELATED TO SPECIFIC AREA | NA |
| 5 | **TYPES, AND DETAILS** | USED TYPES, AND DETAILS |  |
| 6 | **SCHEDULES, AND DIAGRAMS** | SCHEDULES, AND DIAGRAMS |  |
| 7 | **COORDINATION DETAILS** | COORDINATION VIEWS FOR SPECIFIC AREAS | NA |
| 8 | **3D SHOTS AND ISOMETRICS** | PLANS, ELEVATIONS,SECTIONS AND 3D SHOTS | NA |

**F TYPICAL DETAILS**(INCLUDED AT A0 GENERAL DETAILS AND A4 HANDBOOK / TD− B1−M)

**GENERAL SYMBOLS**

|  |  |
| --- | --- |
| **SYMBOL** | **DESCRIPTION** |
| GRID ID  **01**  GRID LINE  **A** | **GRID ID, AND GRID LINES**  **SITE GRID ID, AND GRID LINES** |
| SECTION ID. SECTION DIRECTION  **A1** **A1**  **B1−ME301** **B1−ME301**  SHEET NO. SECTION CUT LINE | **SECTION MARK** |
| SECTION  DIRECTION WALL SECTION ID WALL SECTION TAIL  **A1**  **B1−ME304**  SHEET NO. SECTION CUT LINE | **WALL SECTION MARK** |
| ELEVATION ELEVATION ID. DIRECTION **A1**  **B1−ME201**  SHEET NO. | **EXTERNAL ELEVATION MARK** |
|  |
| ELEVATION ID.  ELEVATION A3 SHEET NO. DIRECTION  **B1−ME401** | **INTERNAL ELEVATION MARK** |
| ELEVATION LEVEL  ELEVATION NAME LEVEL DATUM  **EL 100.000**  **GROUND FLOOR FFL** | **LEVEL ID (ELEVATIONN**  **, AND NAME)** |
| VIEW NO. VIEW NAME  (AS PER SHEET MODULE)  **A1** GROUND FLOOR PLAN  **B1−AE401** 1/8’’= 1’− 0’’  SHEET NO. USED SCALE | **VIEW LABEL** |
| **MATCH LINE**  **FOR CONTINUATION** SHEET NO.  **REF TO A1 / ME106P2**  VIEW NO. | **MATCH LINE SYMBOL** |
| ELEVATION LEVEL  **EL 105.300 TO−−−−**  TOP OF −−−− (REF TO  ABBREVIATIONS) | **SPOT ELEVATION SYMBOL** |
| SCALE IN FRACTIONAL INCHES  0 1/8’’ 1/16’’ | **GRAPHIC SCALE SYMBOL** |
| KEY NOTE TAG | **ELEMENT KEY NOTE** |
| DETAIL NUMBER  05 50 00 05  STEEL MAINTENEANCE CATWLAIK  DETAIL NAME | **DETAIL TAG** |
| WORKING POINT ID  WP01 | **DATUM POINT, WORKING POINT** |
| DETAIL NO.  AREA TO BE **A3**  DETAILED  **B1−ME401**  SHEET NO. | **LARGE SCALE VIEW CALLOUT MARK** |
| **CL** | **CENTER LINE MARK** |
| ROOM NAME  FLOOR LEVEL  OPEN WARD  DEPARTMENT CODE ROOM NO. | **ROOM ID** |



**E**



**D**



**C**

1−MECHANICAL AIR SYSTEM FLOOR PLANS

**G**

**SHEET NOTES CONSULTANT**

|  |  |  |
| --- | --- | --- |
| B1−MH101M | BASEMENT FLOOR AIR SYSTEM SYSTEM MASTER PLAN | 1/16" = 1’−0" |
| B1−MH101P1 | BASEMENT FLOOR AIR SYSTEM SYSTEM PARTIAL PLAN P1 | 1/8" = 1’−0" |
| B1−MH101P2 | BASEMENT FLOOR AIR SYSTEM SYSTEM PARTIAL PLAN P2 | 1/8" = 1’−0" |
| B1−MH102M | GROUND FLOOR AIR SYSTEM SYSTEM MASTER PLAN | 1/16" = 1’−0" |
| B1−MH102P1 | GROUND FLOOR AIR SYSTEM SYSTEM PARTIAL PLAN P1 | 1/8" = 1’−0" |
| B1−MH102P2 | GROUND FLOOR AIR SYSTEM SYSTEM PARTIAL PLAN P2 | 1/8" = 1’−0" |
| B1−MH103M | FIRST FLOOR AIR SYSTEM SYSTEM MASTER PLAN | 1/16" = 1’−0" |
| B1−MH103P1 | FIRST FLOOR AIR SYSTEM SYSTEM PARTIAL PLAN P1 | 1/8" = 1’−0" |
| B1−MH103P2 | FIRST FLOOR AIR SYSTEM SYSTEM PARTIAL PLAN P2 | 1/8" = 1’−0" |
| B1−MH104M | SECOND FLOOR AIR SYSTEM SYSTEM MASTER PLAN | 1/16" = 1’−0" |
| B1−MH104P1 | SECOND FLOOR AIR SYSTEM SYSTEM PARTIAL PLAN P1 | 1/8" = 1’−0" |
| B1−MH104P2 | SECOND FLOOR AIR SYSTEM SYSTEM PARTIAL PLAN P2 | 1/8" = 1’−0" |
| B1−MH105M | THIRD FLOOR AIR SYSTEM SYSTEM MASTER PLAN | 1/16" = 1’−0" |
| B1−MH105P1 | THIRD FLOOR AIR SYSTEM SYSTEM PARTIAL PLAN P1 | 1/8" = 1’−0" |
| B1−MH105P2 | THIRD FLOOR AIR SYSTEM SYSTEM PARTIAL PLAN P2 | 1/8" = 1’−0" |
| B1−MH106M | FOURTH FLOOR AIR SYSTEM SYSTEM MASTER PLAN | 1/16" = 1’−0" |
| B1−MH106P1 | FOURTH FLOOR AIR SYSTEM SYSTEM PARTIAL PLAN P1 | 1/8" = 1’−0" |
| B1−MH106P2 | FOURTH FLOOR AIR SYSTEM SYSTEM PARTIAL PLAN P2 | 1/8" = 1’−0" |
| B1−MH107M | FIFTH FLOOR AIR SYSTEM SYSTEM MASTER PLAN | 1/16" = 1’−0" |
| B1−MH107P1 | FIFTH FLOOR AIR SYSTEM SYSTEM PARTIAL PLAN P1 | 1/8" = 1’−0" |
| B1−MH107P2 | FIFTH FLOOR AIR SYSTEM SYSTEM PARTIAL PLAN P2 | 1/8" = 1’−0" |
| B1−MH108M | SIXTH FLOOR AIR SYSTEM SYSTEM MASTER PLAN | 1/16" = 1’−0" |
| B1−MH108P1 | SIXTH FLOOR AIR SYSTEM SYSTEM PARTIAL PLAN P1 | 1/8" = 1’−0" |
| B1−MH108P2 | SIXTH FLOOR AIR SYSTEM SYSTEM PARTIAL PLAN P2 | 1/8" = 1’−0" |
| B1−MH109M | SEVENTH FLOOR AIR SYSTEM SYSTEM MASTER PLAN | 1/16" = 1’−0" |
| B1−MH109P1 | SEVENTH FLOOR AIR SYSTEM SYSTEM PARTIAL PLAN P1 | 1/8" = 1’−0" |
| B1−MH109P2 | SEVENTH FLOOR AIR SYSTEM SYSTEM PARTIAL PLAN P2 | 1/8" = 1’−0" |
| B1−MH110M | ROOF AIR SYSTEM SYSTEM MASTER PLAN | 1/16" = 1’−0" |
| B1−MH110P1 | ROOF AIR SYSTEM SYSTEM PARTIAL PLAN P1 | 1/8" = 1’−0" |
| B1−MH110P2 | ROOF AIR SYSTEM SYSTEM PARTIAL PLAN P2 | 1/8" = 1’−0" |
| B1−MH111M | UPPER ROOF AIR SYSTEM SYSTEM MASTER PLAN | 1/16" = 1’−0" |
| B1−MH111P1 | UPPER ROOF AIR SYSTEM SYSTEM PARTIAL PLAN P1 | 1/8" = 1’−0" |
| B1−MH111P2 | UPPER ROOF AIR SYSTEM SYSTEM PARTIAL PLAN P2 | 1/8" = 1’−0" |

**F**

1−MECHANICAL PIPING SYSTEM FLOOR PLANS

|  |  |  |
| --- | --- | --- |
| B1−MP101M | BASEMENT FLOOR PIPING SYSTEM MASTER PLAN | 1/16" = 1’−0" |
| B1−MP101P1 | BASEMENT FLOOR PIPING SYSTEM PARTIAL PLAN P1 | 1/8" = 1’−0" |
| B1−MP101P2 | BASEMENT FLOOR PIPING SYSTEM PARTIAL PLAN P2 | 1/8" = 1’−0" |
| B1−MP102M | GROUND FLOOR PIPING SYSTEM MASTER PLAN | 1/16" = 1’−0" |
| B1−MP102P1 | GROUND FLOOR PIPING SYSTEM PARTIAL PLAN P1 | 1/8" = 1’−0" |
| B1−MP102P2 | GROUND FLOOR PIPING SYSTEM PARTIAL PLAN P2 | 1/8" = 1’−0" |
| B1−MP103M | FIRST FLOOR PIPING SYSTEM MASTER PLAN | 1/16" = 1’−0" |
| B1−MP103P1 | FIRST FLOOR PIPING SYSTEM PARTIAL PLAN P1 | 1/8" = 1’−0" |
| B1−MP103P2 | FIRST FLOOR PIPING SYSTEM PARTIAL PLAN P2 | 1/8" = 1’−0" |
| B1−MP104M | SECOND FLOOR PIPING SYSTEM MASTER PLAN | 1/16" = 1’−0" |
| B1−MP104P1 | SECOND FLOOR PIPING SYSTEM PARTIAL PLAN P1 | 1/8" = 1’−0" |
| B1−MP104P2 | SECOND FLOOR PIPING SYSTEM PARTIAL PLAN P2 | 1/8" = 1’−0" |
| B1−MP105M | THIRD FLOOR PIPING SYSTEM MASTER PLAN | 1/16" = 1’−0" |
| B1−MP105P1 | THIRD FLOOR PIPING SYSTEM PARTIAL PLAN P1 | 1/8" = 1’−0" |
| B1−MP105P2 | THIRD FLOOR PIPING SYSTEM PARTIAL PLAN P2 | 1/8" = 1’−0" |
| B1−MP106M | FOURTH FLOOR PIPING SYSTEM MASTER PLAN | 1/16" = 1’−0" |
| B1−MP106P1 | FOURTH FLOOR PIPING SYSTEM PARTIAL PLAN P1 | 1/8" = 1’−0" |
| B1−MP106P2 | FOURTH FLOOR PIPING SYSTEM PARTIAL PLAN P2 | 1/8" = 1’−0" |
| B1−MP107M | FIFTH FLOOR PIPING SYSTEM MASTER PLAN | 1/16" = 1’−0" |
| B1−MP107P1 | FIFTH FLOOR PIPING SYSTEM PARTIAL PLAN P1 | 1/8" = 1’−0" |
| B1−MP107P2 | FIFTH FLOOR PIPING SYSTEM PARTIAL PLAN P2 | 1/8" = 1’−0" |
| B1−MP108M | SIXTH FLOOR PIPING SYSTEM MASTER PLAN | 1/16" = 1’−0" |
| B1−MP108P1 | SIXTH FLOOR PIPING SYSTEM PARTIAL PLAN P1 | 1/8" = 1’−0" |
| B1−MP108P2 | SIXTH FLOOR PIPING SYSTEM PARTIAL PLAN P2 | 1/8" = 1’−0" |
| B1−MP109M | SEVENTH FLOOR PIPING SYSTEM MASTER PLAN | 1/16" = 1’−0" |
| B1−MP109P1 | SEVENTH FLOOR PIPING SYSTEM PARTIAL PLAN P1 | 1/8" = 1’−0" |
| B1−MP109P2 | SEVENTH FLOOR PIPING SYSTEM PARTIAL PLAN P2 | 1/8" = 1’−0" |
| B1−MP110M | ROOF PIPING SYSTEM MASTER PLAN | 1/16" = 1’−0" |
| B1−MP110P1 | ROOF PIPING SYSTEM PARTIAL PLAN P1 | 1/8" = 1’−0" |
| B1−MP110P2 | ROOF PIPING SYSTEM PARTIAL PLAN P2 | 1/8" = 1’−0" |

**E**

**D**

5−MECHANICAL TYPES AND DETAILS

|  |  |  |
| --- | --- | --- |
| B1−ME501 | GENERAL DETAILS | NTS. |
| B1−ME502 | GENERAL DETAILS | NTS. |
| B1−ME503 | GENERAL DETAILS | NTS. |
| B1−ME504 | GENERAL DETAILS | NTS. |

6−MECHANICAL−HVAC SCHEDULES AND DIAGRAMS

**C**

|  |  |  |
| --- | --- | --- |
| B1−ME601 | EQUIPMENT SCHEDULES − 1 | NTS. |
| B1−ME602 | EQUIPMENT SCHEDULES − 2 | NTS. |
| B1−ME603 | AIR HANDLING UNITS RISER DIAGRAM−1 | NTS. |
| B1−ME604 | FANS RISER DIAGRAMS−1 | NTS. |
| B1−ME605 | FANS RISER DIAGRAMS−2 | NTS. |
| B1−ME606 | FANS RISER DIAGRAMS−3 | NTS. |
| B1−ME607 | FANS RISER DIAGRAMS−4 | NTS. |
| B1−ME608 | PIPING RISER DIAGRAM−1 | NTS. |
| B1−ME609 | PIPING RISER DIAGRAM−2 | NTS. |
| B1−ME610 | CONTROL DIAGRAM AND SEQUENCE OF OPERATION − 1 | NTS. |
| B1−ME611 | CONTROL DIAGRAM AND SEQUENCE OF OPERATION − 2 | NTS. |
| B1−ME612 | CONTROL DIAGRAM AND SEQUENCE OF OPERATION − 3 | NTS. |
| B1−ME613 | CONTROL DIAGRAM AND SEQUENCE OF OPERATION − 4 | NTS. |
| B1−ME614 | CONTROL DIAGRAM AND SEQUENCE OF OPERATION − 5 | NTS. |



###### DAR ENGINEERING

DAR ENGINEERING



C 2017.05.20 APPROVED FOR COSTRUCTION MEA ASA

1— ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE NOTED.

2— THIS DRAWING IS DIAGRAMMATIC IN NATURE, THE EQUIPMENT SIZES, LOCATIONS, AND ORIENTATIONS ARE INDICATED FOR PRELIMINARY SPACE ALLOCATION AND POSSIBLE INSTALLATION OF SPECIFIC EQUIPMENT, THE CONTRACTOR SHALL MAKE ANY NECESSARY ADJUSTMENTS, COORDINATE THE WORK WITH OTHER TRADES' WORKS AND PRODUCE FABRICATION SHOP DRAWINGS FITTING THE PROPOSED EQUIPMENT & DUCTWORK IN THE AVAILABLE SPACE.

3— THE CONTRACTOR SHALL SUBMIT THESE COORDINATED SHOP DRAWINGS TO THE OWNER FOR REVIEW & ACCEPTANCE PRIOR TO FABRICATION AND/OR INSTALLATION OF DUCTWORK AND/OR EQUIPMENT.

4— ALL HVAC EQUIPMENT PRODUCTS' DATA SHALL BE SUBMITTED SIMULTANEOUSLY WITH THE AIR DISTRIBUTION SHOP DRAWINGS TO ENSURE THE ENTIRE SYSTEM INSTALLATION IS COHERENT AND WORKABLE.

5— THE OUTDOORS PORTION AND MECH. ROOM DUCTS (SAD, RAD) SHALL BE EXTERNALLY INSULATED WITH 50 MM SEMI—REGID FIBERGLASS BOARD WITH ASJ FACING AND 0.8MM ALUMINUM CLADDING. IT SHALL ALSO BE INTERNALLY LINED WITH 13 MM DUCT LINER AS PER THE RELEVANT CONTRACT SPECIFICATIONS.

6— CONCEALED SUPPLY AIR DUCT WITHIN BUILDING SHALL BE EXTERNALLY INSULATED WITH

38MM FIBER GLASS DUCT WRAP INSULATION WITH 0.8MM ALUMINUM ASJ FACEING.

7— PROVIDE AND INSTALL ALL NECESSARY FITTING IN PIPING AND DUCTWORK REQUIRED FOR CONTROL AND MEASURING DEVICES.

8— ALL DUCTS CROSSING CONCRETE EXPANSION JOINTS SHALL HAVE DUCT EXPANSION JOINTS.

9— FOR LOCATION OF FLOOR DRAIN WHERE A/C CONDENSATE DRAIN SHOULD BE COORDINATED WITH DRAINAGE LAYOUT DWG.

10— THE CONTRACTOR TO PROVIDE ALL ADEQUATE VOLUME DAMPERS EVEN IF NOT SHOWN ON DRAWINGS FOR PROPER AIR BALANCING.

11— THE CONTRACTOR SHALL VERIFY ADEQUATE SPACES, COORDINATE WITH OTHER TRADES AND EXECUTE IN ACCORDANCE WITH APPROVED SHOP DRAWINGS.

12— CONTRACTOR IS RESPONSIBLE TO INSTALL ALL NECESSARY ATTENUATORS & VIBRATION ISOLATORS NOT TO EXCEED NOISE LEVELS AS SPECIFIED.

13— THE CONTRACTOR TO PROVIDE FIRE DAMPERS ON ALL DUCT & OPENINGS CROSSING FIRE RATED WALLS & SLABS.

14— ALL FLEXIBLE DUCT USED SHOULD BE FACTORY INSULATED, REINFORCED & SHOULD HAVE FACTORY INSTALLED ROUND VOLUME DAMPERS.

15— ALL DUCT USED FOR SMOKE EXHAUST BETWEEN SMOKE DAMPERS & TO THE EXTERIOR TO BE FIRE RATED AT 300 ° C FOR 1 HR.

16— APPLY SMACNA DUCT CONSTRUCTION SEAL CLASS COMPLIANT WITH SYSTEM PRESSURE.

17— SOUND ABSORBERS SHALL BE SIZED ACCORDING TO NOISE CALCULATION PERFORMED BY THE CONTRACTOR.

18— VOLUME DAMPERS AT FRESH, EXHAUST, SUPPLY AND RETURN DUCTS SHOULD BE PROVIDED :

i— AT EACH TAKE OFF FROM THE MAIN VERTICAL SHAFT. ii— AT EACH DUCT TERMINATION.

iii— AT EACH DUCT BRANCH FEEDING MORE THAN ONE AIR OUTLET.

19— ALL DUCTWORK SEAMS AND JOINTS SHALL BE SEALED AIR—TIGHT USING SHEET METAL DUCT SEALANT, LIKE IRON—GRIP OR APPROVED SUBSTITUTE.

20— MAX. ALLOWABLE DUCT LEAKAGE SHALL NOT EXCEED 2% OF THE TOTAL SYSTEM AIR FLOW

21— PROVIDE ACCESS DOORS (PANELS) FOR EACH DUCT REHEAT COIL, FIRE/SMOKE AND MOTORIZED DAMPERS.

22— THE CONTRACTOR SHALL COORDINATE CEILING DEVICES AND FIXTURES BASED ON HVAC OUTLETS DISTRIBUTION.

1. THERMOSTATS SHOULD BE LOCATED AND INSTALLED INSIDE THE ROOM AT THE FARTHEST DISTANCE AWAY FROM SUPPLY AIR DIFFUSERS FOR ALL AHU'S AND FCU'S.
2. IT IS THE CONTRACTOR RESPONSIBILITY AND LIABILITY TO SYSTEMATICALLY, ACCURATELY AND DILIGENTLY COORDINATE ALL WORKS OF ALL TRADES, AS DEPICTED ON EACH TRADE DRAWING, WITH EACH OTHERS AND WITH ALL PRODUCTS DATA SHEETS BEFORE GENERATING SHOP DRAWINGS FOR FABRICATION, INSTALLATION, PROCUREMENT OF PRODUCTS AND/OR CONSTRUCTON.
3. THE CONTRACTOR IS RESPONSIBLE TO SUPPLY, INSTALLATION, TESTING, COMMISSIONING OF ALL MECHANICAL SYSTEMS IN THIS PROJECT COMPLETES WITH ALL REQUIRED

NECESSARY ACCESSORIES ACCORDING TO THE CODES & STANDARD AS PER THE DRAWINGS SPECIFICATION AND BILL OF QUANTITIES TO COMPLETE THIS SYSTEM.

1. A WEATHER PROOF SHADING SHOULD BE APPLIED ON ALL HVAC EQUIPMENT INSTALLED

ON THE ROOF OR OUTDOORS. SHADING COLOR SHOULD BE APPROVED BY THE ARCHITECT.

1. ALL HVAC EQUIPMENT SHOULD BE PROVIDED WITH A TEMPORARY BY—PASS BRANCH BEFORE THEIR COILS FOR CLEANING AND FLUSHING OF PIPING NETWORK.
2. ALL PIPING NETWORK RISERS SHOULD BE PROVIDED WITH A DIRT LEG AT THEIR LOWEST POINT AND CONNECTED TO THE NEAREST DRAIN POINT THROUGH A SHUTOFF VALVE.
3. AUTOMATIC AIR VENTS EQUIPPED WITH COCK VALVES ARE TO BE PROVIDED ON THE PIPING NETWORK AT ANY CHANGE OF LEVEL AND AT THE HIGHEST POINTS.

HVAC GENERAL NOTES

**SUBMITTALS**

**KEY PLAN**

DRAWINGS− STAGE V

BMA

B

**B B** A

**REV**

2017.04.22

2017.04.13

**DATE**

FINAL DESIGN AND TENDER DOCUMENTS− STAGE IV

DETAILED DESIGN − STAGE III

**ISSUED FOR**

MEA ASA

MEA ASA

**DRW CHK**

BMA BMA

**PM**

**PUNJAB AGRICULTURE, FOOD AND DRUG AUTHORITY'S** SCIENCE ENCLAVE

4''

**BUILDING TITLE**

|  |  |  |
| --- | --- | --- |
| LGF | SS | 005 |

**PROJECT CODE : DB−78 BUILDING CODE : B1**

**SHEET ID** **SHEET CONTENT**

**DISCIPLINE**

2''

Sheet size - ISO A0 (841\* 1189 mm)

**SHEET TYPE**

**SHEET TITLE**

**MECHANICAL−HVAC 0−MECHANICAL COVER AND GENERAL**

**SHEETS**

**LEGEND , GENERAL NOTES , SYMBOLS AND SHEET LIST**

APPROVED:

ASA

DATE:

20/05/2017

BIMM:

MSM

SCALE:

CHECKED:

ASA

**A A**

DESIGNED:

ARCIDC

DATE:

20/05/2017

DATE:

13/04/2017

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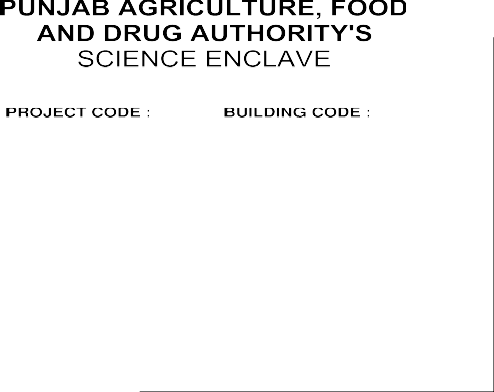
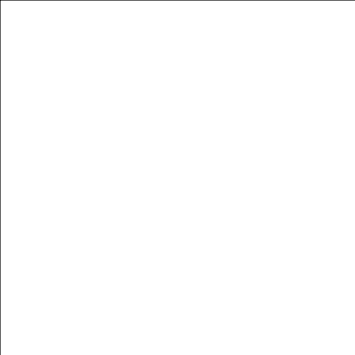
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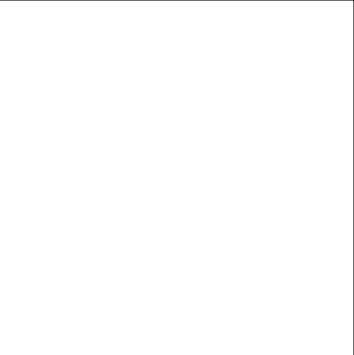
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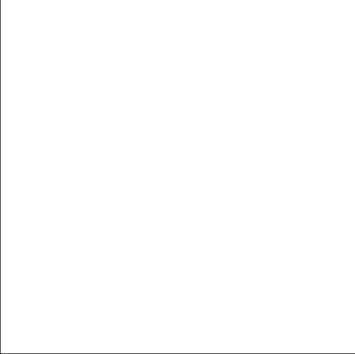




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|  | **A1 CONTROL DIAGRAM AND SEQUENCE OF OPERATION - 5**  **B1-ME614** | | | | | | | | | | | | | | | | | | | |  | **OWNER** | **INFRASTRUCTURE DEVELOPMENT AUTHORITY OF PUNJAB** | | | | | | | | |  |
| **DESIGNER** | ARC  INTERNATIONAL DESIGN CONSULTANTS  **AV. ILHA DA MADEIRA, BLOCO 35K 4th FLOOR,**  **LISBON, PORTUGAL**  HKS ARCHITECTS, INC  **500 7th AVENUE,**  **11th FLOOR, NEW YORK,** | | | | | | | | |
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| **SHEET CONTENT** | **DB-78** | | | | | **B1** | | | |
| **DISCIPLINE** | | **MECHANICAL-HVAC** | | | | | | |
| **SHEET TYPE** | | **6-MECHANICAL-HVAC SCHEDULES AND DIAGRAMS** | | | | | | |
| **SHEET TITLE** | | **CONTROL DIAGRAM AND SEQUENCE OF OPERATION - 5** | | | | | | |
| **SHEET ID** | APPROVED: | | | DATE:  28/02/2018 | BIMM:  MSM | | SCALE:  N.T.S | | |
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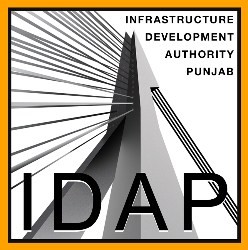
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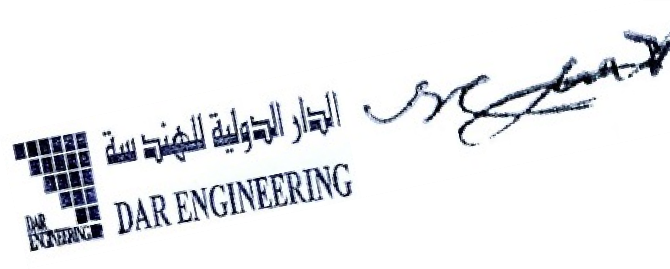
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**SECTION 23 09 10**

**ROOM PRESSURE CONTROL SYSTEM**





SECTION 23 09 10

**ROOM PRESSURE CONTROL SYSTEM CRITICAL ROOM PRESSURE CONTROL SYSTEM**

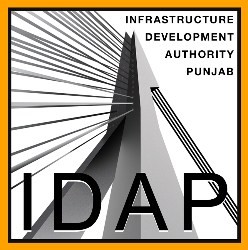
* 1. GENERAL
     1. SUMMARY
     2. This section includes the following
        1. Room Pressure Monitor
        2. Room Volumetric Off-Set Controller
        3. Air Flow Control Device
        4. Thermostat/Humidity Stat
        5. Door Switch
  2. SUBMITTALS
     1. Product Data: - For each type of product indicated, include rated capacities, furnished specialties, sound-power ratings, and accessories.
     2. Shop Drawings: -Detail equipment assemblies and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
     3. Include a schedule showing unique model designation, room location, model number, size, and accessories furnished.
     4. Wiring Diagrams: Power, signal, and control wiring.
     5. Operation and Maintenance Data: For Pressure control units to include in emergency.
  3. QUALITY ASSURANCE
     1. Retain first paragraph below to allow drawing details based on one manufacturer's product to establish requirements and still allow competition. Coordinate with Division 01 requirements.
     2. Product Options: Drawings indicate size, profiles, and dimensional requirements of air terminal units and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements."
     3. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
     4. NFPA Compliance: Install room pressure control units according to NFPA 90A, "Standard for the Installation of Air Conditioning and Ventilating Systems.” COORDINATION
     5. The Contractor shall coordinate layout and installation of Room Pressure Control Units with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression system, and partition assemblies.

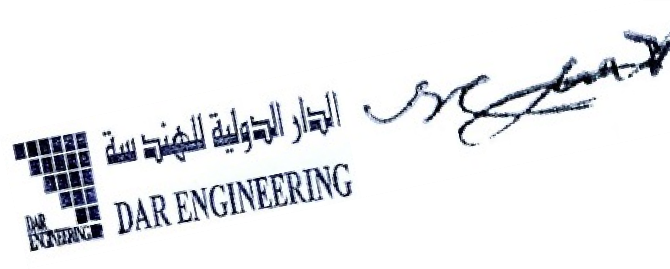
PART-2

* 1. **PRODUCTS**
  2. ROOM PRESSURE MONITORS
     1. Manufacturers: -The Critical Room Pressure Control system shall be Achieve the specifications.
        1. The lab Room Pressure Monitor design shall be field proven with at least Ten (10) years of successful operation in laboratory pressurization applications.
        2. The room pressure control system shall consist of venturi valve airflow control devices equipped with factory mounted volumetric off-set controllers, a room pressure monitor, thermostat or combination thermostat/humidity stat and door switch(s). Primary room pressure control shall be accomplished through a volumetric off-set between the supply and general exhaust air. Trim control shall be based on the actual room

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pressure as measured by the room pressure monitor. The entire room pressure control system shall be supplied by one manufacturer.

* + 1. The Lab Room Pressure Monitors ("Monitor") to measure and/or control the pressure differential between the room and adjacent corridors shall be provided at all locations shown on the drawings or as proposed by lab specialist. Each room shall have its own Monitor capable of stand-alone operation or complete system integration. Each Monitor shall have a touch screen programmable display, , room alarm status indicator, visual and audible alarm annunciator, dual alarm relay outputs, analog output, and serial asynchronous communications port, internal or remote sensor, key lock switch, keypad selection of lab types, alarm silence keypad used to mute the audible alarm, test keypad, and a separate power supply. All of these items shall have the characteristics of and meet the specifications shown below.
    2. Performance Requirements: -
       1. The lab Pressure Monitor shall be capable of measuring ultra-low pressures or flows down to 0.0001” WC with negative standard pressure calibration ranges of 0 to 0.0400"WC, 0 to 0.0600"WC, 0 to 0.1000"WC or 0 to 0.2000"WC. The Room Pressure Monitor shall be factory calibrated with NIST traceable standards and shall have accuracy as follows:
       2. PRESSURE RANGE ACCURACY @ 72° F +5° F a. 0 to .01000"WC + .0001"WC

b. 0 to .04000"WC + .0600"WC

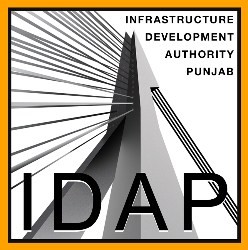
c. 0 to .10000"WC + .0010"WC

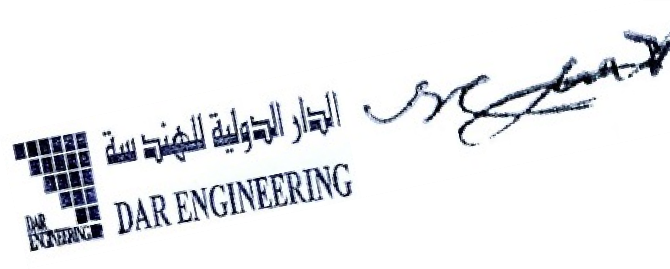
d. 0 to .20000"WC + .0020"WC

* + - 1. Monitor accuracy and displayed resolution shall be achieved by use of 12-bit analog- to-digital and digital-to- analog conversion processes. Internal calculations shall be accomplished using true floating-point math algorithms to ensure the minimum required accuracy and performance.
      2. The lab areas Pressure Monitor shall use thermal anemometry having a small micro area flow path to provide for high sensitivity and the precision accuracy shown in the preceding section. The Sensor shall constantly monitor bi-directional room pressurization using through-the-wall sensing referenced to the central corridor or hall. The air tubing assembly including wall mounted assembly, tubing, fittings, and stainless-steel cover plate for the isolation room shall be provided with the Monitor as a complete unit.
         1. An optional remote sensor/transmitter shall be available as a standard feature in lieu of the internal pressure sensor for applications where the customer so desires.
      3. .The lab areas Pressure Monitor shall provide, selectable from the touchpad on the front of the Monitor and shall be key lock switch protected. The integral key lock switch shall permit authorized selection of room pressurization mode. For No pressure to be maintain the alarms shall be disabled and there will be no indication from the Status Indicators. These Green, Amber, and Red LED's on the FMS Status Panel shall all be de-energized. The Monitor shall store three separate control set points for use in the PID control mode so as to control to a specifically defined pressure for each lab.
      4. The Lab Pressure Monitor shall have an LCD alphanumeric display consisting of four sixteen-character lines to show actual room pressure readings in "WC or in metric units to five decimal places. Systems that require the user to multiply the displayed reading by a factor will be unacceptable. The Monitor shall be capable of displaying both English and Metric readings simultaneously on two separate lines of the display. An eight-character programmable descriptor shall be capable of displaying the room name or the room number associated with the concurrently displayed pressure reading. Where other variables are displayed on the additional display lines included with the Monitor, these shall also include the eight-character descriptor.
         1. Display update time shall be one second maximum. Systems displaying pressure in less than five decimal place readings will be unacceptable.

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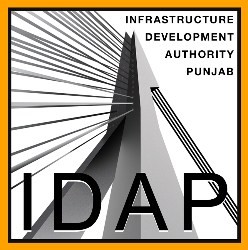


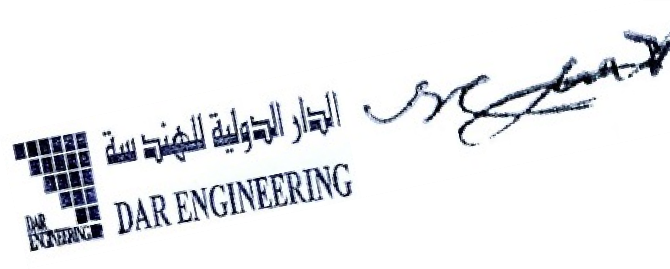


* + - 1. The lab Pressure Monitor shall have an analog output which is field selectable as either a linear signal directly relating to pressure or as a PID floating point control output. Output shall be selectable as either mADC or voltage. This output shall be field scalable to provide the exact offset and span required to yield the best operating results, i.e., compressed span for quick operation.
      2. The Lab Pressure Monitor shall have six (6) analog inputs. One of these shall be dedicated to the room pressure sensor and the other shall be available as an auxiliary or spare input for display of another variable such as room temperature or room humidity. The analog input shall be displayed simultaneously with the room pressure. It shall be field scalable to values suitable to the other variable selected.
      3. The Lab Room Pressure Monitor shall have both audible and visual alarms having adjustable set points. Alarm sequence shall be such that pressure readings and alarm status lights have instantaneous response to insufficient Lab pressure. Audible alarms shall have a programmable time delay which has a resolution of one second to provide a time lag before the audible alarm is activated and latched on. This programmable delay shall be adjustable from instantaneous (no delay) to 600 seconds minimum in one -second increments. An input for an optional door switch shall be provided and can be user selected to activate a second time delay on the audible alarm. The audible alarm shall be muted from the ALARM SILENCE keypad provided on the face of the Monitor. Dual alarm output relays shall be furnished to transmit alarms to remote monitoring equipment. Both alarm output relays and room status indicators shall have user adjustable low and high alarm set points and shall be individually adjustable. Alarm annunciation shall be selectable by the user for Automatic or Manual Reset. Under Automatic Reset, any alarm condition sensed after the time delay will be reset automatically when the alarm condition goes away and pressurization has been restored. That is, the alarm is not latched in and the alarms shall be annunciated only as long as the alarm condition exists. Under Manual Reset and alarm condition sensed after the time delay will be latched or held until someone manually resets it by depressing the ALARM SILENCE keypad after the alarm condition has been corrected and pressurization has been restored. This will allow for logging of the alarm when it is reset. In either Automatic Reset or Manual Reset the audible alarm can be acknowledged, or silenced, at any time, leaving the visual alarm to reflect the actual room status. Dual adjustable alarm output relays shall be SPDT and shall be rated: 0.6A @ 125 VAC and or 2.0A @ 30VDC/VAC. All alarm indicators shall be automatically disabled when No Isolation is selected.
      4. The Lab Pressure Monitor shall have all set points and other programmable variables stored in nonvolatile memory to avoid loss of information due to power outages.
      5. The Lab Pressure Monitor shall have a 220/24 VAC power supply having a fused transformer and mounted in an appropriately rated enclosure shall be furnished as part of the Lab Monitor. Contractor shall mount the isolation power supply in the above ceiling, connect it to the emergency power bus and run low voltage (24VAC) through the wall to the Monitor. Each Lab area Monitor will be connected to its own power supply to provide isolation from the power line and between each Monitor.
      6. The Lab areas Pressure Monitor shall be capable of operating under temperatures from 32° F to 125° F and relative humidity between 10% to 95% non-condensing.
      7. The Lab Pressure Monitor shall be self-contained and capable of standalone operation whether in monitoring only or in control mode. In addition, the Monitor furnished shall provide output signals and alarm contacts which are suitable for connection to:
         1. a central remote monitoring and data logging system,
         2. a central remote monitoring and data logging system which also has control capability,
         3. an existing automation system.
         4. In addition, the Monitor shall incorporate a serial asynchronous communications RS-485 port. The communications port circuits shall be electrically isolated from

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the control electronics of the Monitor to prevent voltage transients on the communications line from damaging the Monitor.

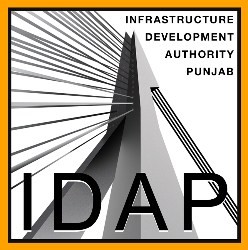
* + - * 1. Sufficient memory space shall be available in the Monitor for storing the software needed for executing building automation compatible communications protocol.
    1. Installation
       1. The Lab Pressure Monitor shall be installed where directed on site by contractor or at a location shown on the drawings, Lab areas. The Monitor shall be mounted at eye level approximately one foot from the door facing.
  1. VOLUMETRIC OFF-SET CONTROLLER
     1. Manufacturers:-
        1. The Volumetric Controller design shall be field proven with at least ten (10) years of successful operation in room pressurization applications.
     2. Each individual room as designated shall have Volumetric Controllers mounted on the venturi airflow control devices. The Volumetric Controllers shall be used to combine airflow components and maintain a volumetric off-set between the supply and general exhaust airflow.
     3. Supply and Exhaust Air
        1. System shall provide one analog input, available with three inputs optionally.
        2. Each input shall be scalable for flow range.
        3. Where multiple inputs for Supply and/or exhaust are provided, they shall be summed to a single linear flow value.
     4. Off-Set
        1. System shall provide means for setting an offset value in cfm as a Setpoint for a PID control output.
        2. CFM offset shall be accomplished by the control output driving the Supply air to the value needed to meet the difference (offset) that is programmed as a Setpoint.
        3. Combine Airflow Sums
           1. The exhaust sums shall be subtracted from the supply sum to yield a "Net airflow”.
           2. The Net airflow shall be used to control an analog output, described in detail further herein.
           3. Analog Outputs (Controlled by Net flow)

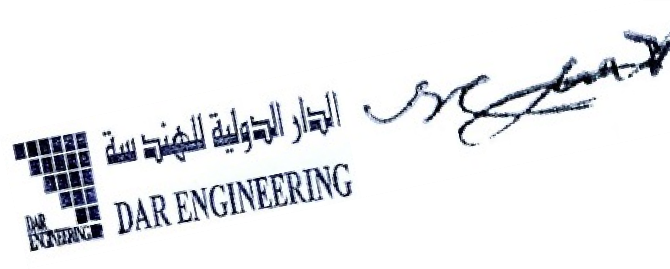
One PID analog output shall be provided to control the supply airflow devices.

* 1. AIRFLOW CONTROL DEVICE
     1. Manufacturers:-
        1. The Venturi valve design shall be field proven with at least ten (10) years of successful operation in room pressurization applications.
     2. The airflow control device shall be a variable air volume (VAV) counter lever design venturi valve. Venturi valves with support struts before the cone are not acceptable.
     3. Valve body shall be formed in a venturi configuration to produce smooth variation in delivered air flow control. Valve shall be pressure independent over a span of 0.6 to 3.0” WC pressure drop across the valve without means of external monitoring devices such as mechanical volume regulators, flow control tubing or duct static measuring devices.
     4. All valves shall be factory calibrated to NIST traceable standards and the CFM modulation range factory set for the maximum and minimum indicated on the schedule. Pressure independent response to changes in duct static shall be no greater than one second to maintain the set airflow. Airflow accuracy shall be within five percent of reading. Airflow turndown ratio shall be no less than sixteen to one. The valve shall require no periodic maintenance. The valve manufacturer shall supply sound power levels and NC rating based

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on ADC equipment test code 1062R3 and ASHRAE standard 36-72 with a reference level of 10-12 watts.

* + 1. Construction
       1. The airflow control device shall be constructed the following:
          1. Supply Valves - Valve housing shall be constructed of 16-gauge aluminum with internal components of aluminum and stainless steel. Critical moving parts shall use Teflon® bushings for reduced friction, smooth operation and extended life. Internal moving parts shall be constructed of 316 stainless steel, except aluminum body valves shall have its cone constructed of aluminum. Valve body shall be formed in a venturi configuration to produce smooth variation in delivered airflow control. All supply devices shall be externally pre-insulated at the factory.
          2. Exhaust Valves - Valve housing shall be constructed of 16-gauge aluminum with internal components of aluminum and stainless steel. Critical moving parts shall use Teflon® bushings for reduced friction, smooth operation and extended life. Internal moving parts shall be constructed of 316 stainless steel, except aluminum body valves shall have its cone constructed of aluminum. Valve body shall be formed in a venturi configuration to produce smooth variation in delivered airflow control. All exhaust devices shall be externally pre-insulated at the factory.
    2. Venturi Valve Actuators
       1. All variable volume valves shall be equipped with a factory installed high speed electronic actuator furnished by the valve manufacturer and mounted on the valve and set up by the valve manufacturer. The actuator shall have a response time of 0.3 to

0.6 seconds for a control stroke of up to 20%. Slower response times shall not be acceptable.

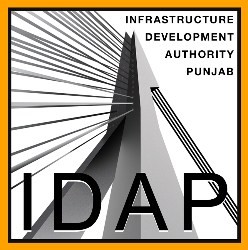
* 1. THERMOSTAT AND COMBINATION THERMOSTAT/HUMIDITY STAT
     1. The thermostat and/or combination thermostat/humidity stat shall be supplied by the critical room pressure control system manufacturer.
  2. DOOR SWITCH
     1. Door switch or switches will be used to increase the volumetric off-set when the door is open. The door switch or switches shall be supplied by the critical room pressure control system manufacturer.

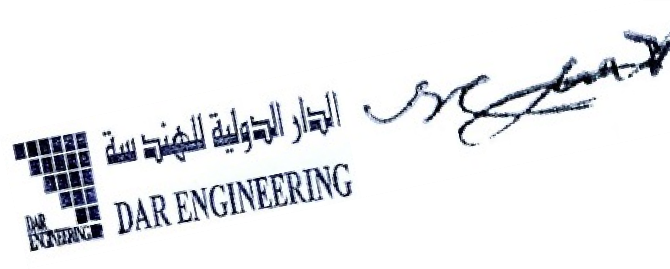
PART-3

* 1. **EXECUTION**
     1. INSTALLATION
        1. Install Lab Pressure Control System. Maintain sufficient clearance for normal service and maintenance.
     2. FIELD QUALITY CONTROL
        1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including connections. Report results in writing.
        2. Perform the following field tests and inspections and prepare test reports:
           1. After installing Room Pressure and after electrical circuitry has been energized, test for compliance with requirements.
           2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
           3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment

Punjab Agriculture, Food and Drug Authority's Section 23 09 10 - 6 Room Pressure Control System .

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* + 1. DEMONSTRATION
       1. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain Pressure control systems.

END OF SECTION

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