ADDENDUM & CORRIGENDUM NO. 01

Dated: April 1st, 2024

CONSTRUCTION OF SBP NEW OFFICE BUILDING AT GUJRANWALA

In order to provide necessary clarification to facilitate the prospective bidders, this Addendum No.1 is issued, which shall be included in the Bidding Documents.

The Bidder shall note & take into consideration the following additions / corrections in the Bidding Documents for the subject work issued to them:

These addition/ deletion/ amendments will form an integral part of the Bidding Documents. The Bidder shall acknowledge the receipt of this addendum to the Employer. The addendum, duly signed and stamped, shall be attached with the Volume – I of the Bidding Documents and submitted along with the Bid on or before the due date of submission.

Sr #	Description / Reference / Clarifications Sought by Bidders / Corrections	ADDENDUM
1.	**Volume – I** **Bidding Data** Sub-Clause 15.2.c The Bid Security shall be, at the option of the bidder, in the form of Deposit at Call or Pay Order/Demand Draft, Bankers cheque issued by a Scheduled Bank in Pakistan in favour of the Employer The Bid Security may be encashed by the Employer upon submission of Bid Security. Bid Security in original is required to be submitted with the Financial Bid Envelope.	Delete the Text of clause and replace with following: "The Bid Security shall be, at the option of the bidder, in the form of Deposit at Call/Pay Order/Demand Draft/ Banker's cheque or a Bank Guarantee issued by a Scheduled Bank in Pakistan in favour of the Employer valid for period of validity of Bid itself. The Bid Security may be encashed by the Employer upon submission of Bid Security. Bid Security in original is required to be submitted with the Financial Bid Envelope."
2.	**Volume – I** **Particular Conditions of Contract – Part II** Clause 60.1 (Monthly Statements) Sub-Clause 60.1.c	Add following sub-clause as sub-clause 60.1 c(iv) after 60.1 c(iii) Accordingly, following sub-clauses stands re-numbered: "Above-mentioned bank guarantee(s) shall be returned upon transfer and delivery of imported Plant to the Employer at Site after inspection and issuance of satisfactory certificate by the Engineer."
3.	**Volume – I** **Particular Conditions of Contract – Part II** **Clause 70.1 (Increase or Decrease of Cost)** **Sub-Clause 70.1.1** Original Text: "All provisions of Price Adjustment given in "Standard Procedure and Formula for Price Adjustment, issued by Pakistan Engineering Council in year 2022, amended time to time with due approval of ECNEC/Planning Commission of Pakistan will be used on this Contract. Price Adjustment Ratio and Weightages will be approved by the Engineer."	The original text be replaced as under; "All Provisions of Price Adjustment given in PEC "Standard Procedure and Formula for Price Adjustment (Second Edition), May 2022 as amended time to time shall be used on this Contract."

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Sr #	Description / Reference / Clarifications Sought by Bidders / Corrections	ADDENDUM
4.	Kindly provide the soil investigation report.	Soil Investigation Report has been uploaded on Bank's website
5.	In material base price list C-81, price of tile is mentioned 70,000 per Sqm. Please confirm.	The base price of tile shall be considered as Rs 7000/- per Sqm.
6.	**Volume – IV** **Bill of Quantities** **Civil Works BOQ Item # C-134** Original text: "Front Column of Main Building, Identified as Detail Column-01 in Drawing A-18 Executing entire work of Column-02 having diameter of 2' 2" at top and 2' 5.5" at bottom. Thus providing reinforcement, its placement, pouring concrete, using steel formwork, also casting Gothic type column shapes at top & bottom using concrete and steel form work, Thus completing the entire column excluding paint or any texture. Steel formwork used to have fine finish thus no plaster will be done after pouring of concrete. All execution of above work will be as per direction & approval of engineer in charge.	The original text be replaced as under; "Front Columns of Main Building, Identified as Detail Column-01 in Drawing A-17 Executing entire work of Column-01 having diameter of 2' 2" at top and 2' 5.5" at bottom. Thus, providing reinforcement, its placement, pouring concrete, using steel formwork, also casting Gothic type column shapes at top & bottom using concrete and steel form work, including the cost of molding as per drawing, thus completing the entire column excluding paint or any texture. All execution of above work will be as per direction & approval of engineer in charge.
7.	**Volume – IV** **Bill of Quantities** **Civil Works BOQ Item # C-135** Front Column of Main Building, Identified as Detail Column-02 in Drawing A-18 Executing entire work of Column-02 having diameter of 3'-4" at top and 3' 11.5" at bottom. Thus, providing reinforcement, its placement, pouring concrete, using steel formwork, also casting Gothic type column shapes at top & bottom using concrete and steel form work, thus completing the entire column excluding paint or any texture. Steel formwork used to have fine finish thus no plaster will be done after pouring of concrete. All execution of above work will be as per direction & approval of engineer in charge.	The original text be replaced as under; "Front Columns of Main Building, Identified as Detail Column-02 in Drawing A-17 Executing entire work of Column-02 having diameter of 3'-4" at top and 3' 11.5" at bottom. Thus, providing reinforcement, its placement, pouring concrete, using steel formwork, also casting Gothic type column shapes at top & bottom using concrete and steel form work, including the cost of molding as per drawing thus completing the entire column excluding paint or any texture. All execution of above work will be as per direction & approval of engineer in charge."
8.	**Volume – IV** **Bill of Quantities** **Civil Works BOQ Item # C-136** Providing and fixing best quality 4 drawers fire proof Cabinet 24" deep 400°C 2 hours rating etc. complete as per drawing, Specification & instruction of engineer in charge. (must be imported manufactured by security equipment manufacturer)	The original text be replaced as under; "Providing and fixing best quality 4 drawers fire proof Cabinet 6'x4'x24" deep 400°C 2 hours rating etc. complete as per drawing, Specification & instruction of engineer in charge."

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Sr #	Description / Reference / Clarifications Sought by Bidders / Corrections	ADDENDUM
9.	**Volume – IV** **Bill of Quantities** **Civil Works BOQ Item # C-143** Providing and fixing best quality 4 drawers fire proof Cabinet 24" deep 400°C 2 hours rating etc. complete as per drawing, Specification & instruction of engineer in charge. (must be imported manufactured by security equipment manufacturer)	The original text be replaced as under: "Providing and fixing best quality 4 drawers fire proof Cabinet 6'x4'x24" deep 400°C 2 hours rating etc. complete as per drawing, Specification & instruction of engineer in charge."
10.	Please provide Matrix of Controls for BMS. Further clarity is required regarding the type of Alarm Signals required and where remote controlling is required.	**Volume-IIA Building Management and Energy Management Control System** Attached at Annexure-A with this Addendum.
11.	List of approved manufacturers required for VRV system	Recommended Manufacturer for VRV system are Daikin, York, LG or Carrier.

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CONSTRUCTION OF S.B.P NEW OFFICE BUILDING

AT GUJRANWALA.

AIR CONDITIONING,VENTILATION,EXHAUST SYSTEM AND ANCILLARY SERVICES SEQUENCE OF OPERATION FOR CONTROLS & BMS - TENDER DOCUMENTS

INSTRUMENTATION

GENERAL DISCRIPTION

All instrumentation shall be mounted such that it can be read from a normal access position. Orientation and sizes of gauges etc. shall be such that the readings can be observed from normal standing position at floor level or fixed walkways etc. Where this is not possible due to mounting height or congestion of services, remote gauges shall be used, mounted in groups on a panel and clearly labelled to identify the function and location of the sensor etc. Instrumentation shall not be installed in any location that protrudes into designated access ways, restricts access, and becomes a tripping or snagging hazard.

CONTROL FUNCTION

The BMS control system shall provide control and monitoring of the following MEP devices:-

Chillers with Primary & Secondary Variable Chilled Water System along with Cooling Towers & Condenser Water Pumps

1. **Chillers with Primary & Secondary Variable Chilled Water System**

The chilled water system consists of water cooled chillers, primary chilled water pumps-constant speed and Secondary Pumps VFD Driven. These pumps shall receive the 'start / stop' command from the BMS only if the 'hand – off – auto' switch of all these pumps is in 'auto' position. The 'run' status and the 'trip' status of the pumps are monitored via volt-free contacts from the motor control centers. The fault signal and the feedback signal from the VFDs of the Secondary Pumps are monitored.

Butterfly valves are located on both condenser & evaporator side of the chiller. Upon call for cooling as sensed by the immersion temperature sensor located in the common chilled water supply line the DDC controller opens the butterfly valve first and then starts the primary pump the limit switch located in the butterfly valve closes to prove the open status of the butterfly valve. On receipt of this signal the DDC enables the chiller to start

When the lead chiller is fully loaded and upon a call for further cooling (as again sensed by the Common Return CHW Temperature sensor) the second chiller is signaled to run by the BMS as per the sequence defined above.

The 'run' and the 'common fault' signal form the chiller shall be made available to the BMS through the volt free contacts from the chiller control panel.

With reducing load, the 2 port valves in the AHU and FCUs shall move towards the close position thereby increasing the pressure in the supply header line as sensed by the immersion pressure sensor. On Sensing this changes in pressure the DDC Controller shall reduce the speed of the Secondary Pumps via the Variable Frequency Drives.

A bypass (De-coupler) line shall be provided as an interface between the Primary Chilled Water System and the Secondary Chilled Water System. Since the primary pumps are constant flow pumps, with a decreasing load the excessive water quantity passes through the bypass line, increasing the pressure in the line as sensed by the differential pressure sensor. The reduction in flow in the main supply header is sensed by the flow meter provided.

Also once the reduction in flow (as measured by the flow meter) becomes equal to flow across one chiller the BMS disable one chiller, the associated pump and closes the butterfly valve.

The process repeats itself to meet the required conditions.
With increasing load the Chilled water shall move from the bypass line into the Secondary circuit and increases the supply temp as measured by the temp sensor after the bypass on the supply line. When this increase in load

as measured by the flow in the Supply line becomes equal to flow of water across one chiller the BMS opens the butterfly valve, and once the valve is proven open the chilled water pump is started and chiller enabled so as to maintain the desired temperature differential.

The process repeats itself to meet the required conditions.

The return chilled water temperature on both sides of the bypass & supply temperature after bypass are monitored by the BMS. Individual chiller leaving temperatures are also monitored.

2. **Condenser Water Circuit**

The Condenser Water Circuit comprising of Condenser Water Pumps & Cooling Towers.

For the condenser water circuit, the DDC shall control and monitor condenser water pumps and the cooling towers. The condenser pumps shall be constant speed pumps. The "AUTO" position of the H-O-A switch for the pumps is monitored by the DDC to ensure automatic operation only if the switches are in "auto" positions. The DDC shall also monitor the trip & run status.

The BMS shall allow for automatic duty sharing of the condenser water pumps to ensure equal wear and tear.

The cooling towers shall be with variable speed drive fan motors. The "AUTO" position of the H-O-A switch for the fans is monitored by the DDC to ensure automatic operation only if the switches are in "auto" positions. The DDC shall also monitor the variable speed drive trip status and control the cooling tower fan speeds by giving 0-10 v dc outputs for the cooling tower fan motor. The DDC shall also receive the fan speed feedback via 0-10 v dc from the variable speed drive of the cooling tower fan motor.

The cooling towers shall be provided with motorized butterfly valves on both inlet & outlet side. At the start-up, when the cooling demand is established and when all the equipments are in 'auto' mode, the DDC shall first open the motorized butterfly valve on both sides of the cooling tower. A limit switch located in the butterfly valve closes to prove the open status of the butterfly valve. On receipt of this signal, the DDC enables the condenser water pumps and also enables the cooling tower fan motor to start.

The DDC shall also monitor the common condenser water supply and return temperatures. Based on the temperature difference between the condenser water entering and leaving water, the DDC shall first reduce the cooling tower fan motor speed. On further reduction in load if one of the chillers is disabled by the BMS, the temperature difference in the condenser circuit reduces. Based on this, the BMS disables one cooling tower fan and also disables one condenser pump and the corresponding set of cooling tower butterfly valves are closed.

The process repeats itself to maintain the required temperature in the condenser water circuit. For each cooling tower Individual leaving water temperature is monitored.

The cooling tower sump water level shall be monitored via a differential pressure switch. High & low sump level alarms shall be generated via the software in the BMS.

Once the condenser water flow is established, the DDC shall sequence the chilled water circuit to start.

3. TYPICAL CONSTANT AIR VOLUME AIR HANDLING UNITS:

The Constant Air Volume system supplies conditioned constant airflow to the space to maintain temperature based on the set points.

The start /stop of air handling unit is based on time schedule and will be enabled when AHU supply fan starter panel is in Auto position. The Auto status of the starter panel is monitored on the BMS, which is hard wired to the DDC panel.

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Once the AHU is enabled, the fresh air damper shall open and temperature control will enable on receipt of signal from fan DPS. When the AHU supply fan is off the fresh air damper will close and the 2 port chilled water control valve will drive to close position.

In case power fail to DOC, power fail restart logic should be applied. This logic will start the system from beginning, as if the equipment is being started for the first time in the day.

When the system is running in manual mode the temperature control loop shall enable on receipt of signal from DPS (Airflow switch).

3.1 AHU TEMPERATURE CONTROL:

The supply and return air duct temperature sensors will sense the supply and return air temperatures and transmits the signal to the DDC controller. The Controller then compares the read values with set point values and accordingly modulates (0-10vdc signal) the 2 port valves via modulating actuator in order to achieve the set point conditions

Set Point Schedule:
Return Air (RA) Temperature : 22 °C
Supply Air (S.A) temperature : 18 °C
Return Air (RA) Temperature : 24 °C
Supply Air (S.A) Temperature :12.4 °C

The remote set point command to vary return air set point as required by BMS operator. The supply air temperature shall be maintained such that when the return air temperature falls, the supply air temperature can be raised, as per above schedule. This shall be programmed via a dynamic setting curve in increments of 0.5 °C RA temperature fluctuation and can be adjusted at the BMS.

3.2 AHU SAFETY CONTROL:

If the return air temperature is more than 28 °C and the supply air temperature more than 20 °C, an alarm shall be activated at the central workstation. In case of smoke detection, the duct smoke detector installed in the return air duct of the AHU and having a hardwired connection with the fire alarm system and hardwired interlock with the fan starter. The fan of the AHU will shutdown upon sensing smoke in ducts.

If the air differential pressure switch across the AHU supply fan will alarm at the DOC on no airflow condition (no-airflow within 120 seconds) the AHU shall shut down. The differential pressure switch also alarm at the DOC when the supply fan is set in the "OFF" position from the DOC and the airflow is detected.

3.3 AHU FILTER STATUS:

The AHU air filter is monitored via differential pressure switch fitted across the filters and in the event of filters become dirty the air differential pressure switch will give volt free signal to the controller and an alarm will be activated on the BMS.

3.4 AHU FIRE ALARM

In the event of fire alarm signal in any zone, AHU's will be shut down if not required to be operated as make up air unit otherwise shall remain operational and the smoke exhaust fan will start and exhausting the smoke in that area, which is via hardwired connection in the MCC panel. When the fire alarm is reset the air handling unit will be enabled automatically based on the program on the reset condition and the fan will run in normal mode. The above operation will be automatically commanded from Fire Alarm Panel.

Also, the BMS will command the AHU supply fan to stop if not required to be operated as make up air unit

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otherwise shall remain operational.

4. TYPICAL VARIABLE AIR VOLUME AIR HANDLING UNITS

The start /stop of air handling unit is based on time schedule and will be enabled when AHU supply fan VFD is in Auto position. The Auto status of the VFD starter is monitored on the BMS, which is hardwired to the DOC panel. Once the AHU is enabled at minimum speed, the fresh air damper shall open and temperature control will enable on receipt of signal from fan DPS. When the AHU supply fan is off the fresh air damper will close and the 2 port chilled water control valve will drive to close position.

In case power fail to DOC, power fail restart logic should be applied. This logic will start the system from beginning, as if the equipment is being started for the first time in the day.

4.1 SYSTEM DESCRIPTION:

The air handling unit is with variable frequency drive providing variable air volume with controlled temperature air supply and controlled demand ventilation to modulate air supply based on the space temperature and the outdoor air supply based on the occupancy.

The controlled demand ventilation is achieved thru the fresh air modulating damper which shall ramp up or ramp down to modulate the outdoor air supply at signal received from the C02 sensor mounted on the AHU return duct

4.2 DEMAND CONTROLLED VENTILATION:

The C02 sensor mounted in the return main air duct of the AHU shall relay the input to the DDC controller. In case, the return air C02 is higher than the setpoint of 500 ppm (adjustable), the DDC controller shall give modulating outputs to the modulating dampers of the treated outdoor air and the exhaust air to ramp up above the minimum positions. In case, the return air C02 is less than the setpoint of 500 ppm (adjustable), the DDC controller shall give modulating outputs to the modulating dampers of the treated outdoor air and the exhaust air to ramp down to the minimum positions . This process shall continue till the return air C02 level reaches 500 ppm (adjustable). In case the C02 level remains above 750 ppm continuously for a period of 5 minutes. an alarm shall be generated by BMS.

4.3 AHU TEMPERATURE CONTROL

The supply and return air duct temperature sensors will sense the supply and return air temperatures and transmits the signal to the DDC controller.

The Controller then compares the read values with set point values and accordingly modulates (0-10 Vdc signal) the 2 port valves via modulating actuator in order to achieve the set point conditions.

Set Point Schedule:

Return Air (RA) Temperature : 22 °C
Supply Air (S.A) temperature : 18 °C
Return Air (RA) Temperature : 24 °C
Supply Air (S.A) temperature : 12.4 °C

The supply air temperature shall be maintained such that when the return air temperature falls, the supply air temperature can be raised. as per above schedule. This shall be programmed via a dynamic setting curve in increments of 0 5 °C RA temperature fluctuation and can be adjusted at the BMS.

4.4 AHU DUCT PRESSURE CONTROL

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The static pressure sensor installed 2/3rd down stream on the supply air duct and will be monitor the duct static pressure and transmits the signal (0-10 Vdc) to its respective DDC controller. The controller then compares actual pressure (read value) with set values and accordingly gives an modulating output signal (0-10 Vdc) to the AHU VFD which in turn will modulate to vary the supply air volume to achieve the set point conditions. Monitor the VFD RPM and display in the central.

4.5 AHU SAFETY CONTROL

If the return air temperature is more than 28 °C and the supply air temperature more than 20 °C, an alarm shall be activated at the central workstation. In case of smoke detection, the duct smoke detector installed in the return air duct of the AHU and having a hardwired connection with the fire alarm system and hardwired interlock with the fan starter. The fan of the AHU will shutdown upon sensing smoke in ducts.

The Duct pressure sensor in the 2/3rd down stream of supply duct will alarm at the DOC when the duct pressure changes above high-high level (time limit within 120 seconds) and it will shut down the AHU and initiate maintenance instructions.

The air differential pressure switch across the AHU supply fan will alarm at the DOC on no airflow condition (no-airflow within 120 seconds) and it will shut down the respective AHU. The differential pressure switch also alarm at the DOC when the supply fan is set in the "OFF" position from the DOC and the airflow is detected.

4.6 AHU FILTER STATUS

The AHU air filter (primary and final filters) are monitored via differential pressure switch fitted across the filters and in the event of filters become dirty the air differential pressure switch will give volt free signal to the controller and an alarm will be activated on the BMS.

4.7 AHU FIRE ALARM

In the event of fire alarm signal in any zone, AHU's will be shut down if not required to be operated as make up air unit otherwise shall remain operational and the smoke exhaust fan will start and exhausting the smoke in that area, which is via hardwired connection in the MCC panel. When the fire alarm is reset the air handling unit will be enabled automatically based on the program on the reset condition and the fan will run in normal mode. The above operation will be automatically commanded from Fire Alarm Panel.

Also, the BMS will command the AHU supply fan to stop if not required to be operated as make up air unit. otherwise shall remain operational.

5. Typical Constant Air Volume (or Outdoor) Air Handling Units

These units provide treated cooled and dehumidified fresh air.

These units shall deliver air at room temperature 23°CDB/17°C WB.

These units if specified with heat recovery wheels shall operate to recover heat from toilet exhaust air stream whenever the enthalpy of the toilet exhaust air is 5% lower or 5% higher than the ambient air enthalpy.

These units if specified with run around cycling coils or heat pipe coiling systems shall operate to extract heat from the air prior to the cooling coil whenever the air temperature is above the delivery conditions. Cooling coil control *valve* shall modulate to achieve final delivery dry bulb temperature and operate as a dehumidifier to achieve final moisture content set point (0.0095 kg water per kg dry air). Run around cycling coils or heat pipe then adds dry heat back into air to achieve final delivery conditions.

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The start /stop of air handling unit is based on time schedule and will be enabled when (FAHU or OAHU) supply fan starter panel is in Auto position. The Auto status of the starter panel is monitored on the BMS, which is hard, wired to the DOC panel.

Once the (FAHU or OAHU) is enabled temperature control will enable on receipt of signal from fan DPS.

5.1 FAHU FIRE ALARM

In the event of fire alarm signal FAHU will be shut down if not required to be operated as make up air unit otherwise shall remain operational and the smoke exhaust fan will start and exhausting the smoke in that area, which is via hardwired connection in the MCC panel.

A direct stop command to fan from the BMS operator if not required to be operated as make up air unit otherwise shall remain operational.

5.2 FAHU Temperature Control

The supply air duct temperature sensors will sense the supply air temperatures and transmits the signal to the DDC controller.

The Controller then compares the read values with set point values and accordingly modulate (0-10 V dc signal) the 2 port valves via modulating actuator in order to achieve the set point conditions.

5.3 FAHU Safety Control

The supply air temperature (more than 30 dec.C) will signal an alarm at the central workstation. The duct type smoke detector shall be installed in supply air duct of the FAHU. This smoke detector shall be connected with Fire Alarm network and hard wire interlock with Fan Starter. The FAHU will shut down on sensing smoke in the supply air.

The air differential pressure switch across the FAHU supply fan will alarm at the DDC on no airflow condition (no-airflow within 120 seconds) and it will shut down the respective FAHU. The differential pressure switch also alarm at the DDC when the supply fan is set in the "OFF" position from the DDC and the airflow is detected.

5.4 FAHU Filters

The air filters (both primary and final filters) are monitored via differential pressure switch fitted across the filters and in the event of filters become dirty the air differential pressure switch will give volt free signal to the controller and an alarm will be activated on the BMS.

5.5 FAHU Fresh Air Temperature and Humidity

The temperature and humidity sensors mounted in the fresh air intake will monitor and display the (ambient Air) temperature and humidity on the BMS

The temperature and humidity sensors mounted in the fresh air supply will monitor and display the fresh air temperature and humidity on the BMS and provides the feedback signals to modulate operation of cooling and dehumidification coils.

6. Typical Variable Air Volume Fresh Air (or Outdoor) Air Handling Units

These units provide treated cooled and dehumidified fresh air.

These units shall deliver air at room temperature 18°CDB/14°C WB.

These units are with heat recovery wheels shall operate to recover heat from toilet exhaust air stream whenever the enthalpy of the toilet exhaust air is 5% lower or 5% higher than the ambient air enthalpy.

These units with run around cycling coils and heat pipe coiling systems shall operate to extract heat from the air prior to the cooling coil whenever the air temperature is above the delivery conditions. Cooling coil control *valve* shall modulate to achieve final delivery dry bulb temperature and operate as a dehumidifier to achieve final moisture content set point (0.0095 kg water per kg dry air). Run around cycling coils or heat pipe then adds dry heat back into air to achieve final delivery conditions.

The start /stop of the fresh air handling unit is based on time schedule and will be enabled when supply fan VFD is in Auto position. The Auto status of the VFD starter is monitored on the BMS, which is hardwired to the DOC panel. Once the AHU is enabled at minimum speed, the fresh air intake damper shall open and temperature control will enable on receipt of signal from fan DPS.

When the fresh air supply fan (System) is OFF, the two port chilled water valves shall modulate to the full closed position. This can be initiated by the following conditions

6.1 Fan Speed

The fan is designed as variable speed in order to serve AHUs with outdoor preconditioned air-under the requirements of the controlled demand ventilation.

The supply fan should operate to vary the amount of supply air and as well the exhaust fan to *vary* the amount of the exhaust air and therefore. 2 Nos. variable frequency drivers are required, one for the supply fan and one for the exhaust fan.

6.2 FAHU Temperature Control

The supply air duct temperature sensors will sense the supply air temperatures and transmits the signal to the DDC controller. The Controller then compares the read values with set point values and accordingly modulate (0-10 V dc signal) the 2 port valves via modulating actuator in order to achieve the set point conditions.

6.3 FAHU Safety Control

The supply air temperature (more than 25 deg.C) will signal an alarm at the central workstation. The duct type smoke detector shall be installed in supply air duct of the FAHU. This smoke detector shall be connected with Fire Alarm network and hard wire interlock with Fan Starter. The FAHU will shut down on sensing smoke in the supply air.

The air differential pressure switch across the FAHU supply fan will alarm at the DDC on no airflow condition (no-airflow within 120 seconds) and it will shut down the respective FAHU. The differential pressure switch also alarm at the DDC when the supply fan is set in the "OFF" position from the DOC and the airflow is detected.

6.4 FAHU Duct Pressure Control

The static pressure sensor installed 2/3rd down stream on the supply air duct and will be monitor the duct static pressure and transmits the signal (0-10vdc) to its respective DDC controller. The controller then compares actual pressure (read value) with set values and accordingly gives an modulating output signal (0- 10Vdc) to the FAHU VFD which in turn will modulate to vary the supply air volume to achieve the set point conditions. Monitor the VFD RPM and display in the central.

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6.5 FAHU Filters

The FAHU air filters (both primary and final filters) are monitored via differential pressure switch fitted across the filters and in the event of filters become dirty the air differential pressure switch will give volt free signal to the controller and an alarm will be activated on the BMS.

6.6 FAHU Fire Alarm

In the event of fire alarm signal in that zone, FAHU's will be shut down if not required to be operated as make up air unit otherwise shall remain operational and the smoke exhaust fan will start and exhausting the smoke in that area, which is via hardwired connection in the MCC panel. When the fire alarm is reset the air handling unit will be enabled automatically based on the program on the reset condition and the smoke exhaust fan will stop running. The above operation will be automatically commanded from Fire Alarm Panel.

Also, the BMS will command the FAHU supply fan to stop if not required to be operated as make up air unit otherwise shall remain operational.

7. STAIR CASE AND LIFT PRESSURIZATION FANS

The BMS shall also allow the operator to run these fans only for maintenance purposes as per the time program or operator override from the DDC controller.

The BMS shall provide an enable / disable signal to the local control panel based on the program or operator override from the DDC controller. This will only possible when the hand-off- auto switch is in 'auto' position. The 'Run' status of the fan shall be monitored on BMS via the Airflow Switch and auxiliary contact in the control panel. The 'overload trip' status of these fans shall also be monitored by the BMS vial volt free contacts from the control panel. However, the Fire Alarm System shall have override control of these fans.

The DDC controller shall monitor the status of Dampers and in case of Fire Alarm signal as transmitted to it by fire Alarm Panel, the DDC Controller shall close the Dampers.

7.1 Exhaust Fan (Constant Speed)

The constant speed exhaust fans are complete with a built-in auto-changeover and duty sharing control panel if are of twin arrangement, supplied completely tested and pre-wired with an integral control panel ready for installation and operation by the equipment supplier. BMS will operate the constant speed exhaust fan during the occupancy period as per the schedule.

An alarm signal initiated by any fire alarm zone will command the exhaust fans to stop if the fan is not used for smoke exhaust or make up air during fire.

For duty and standby arrangement each fan is monitored separately but with automatic changeover and duty sharing control panel.

8. WATER SUPPLY PUMP SETS

A dedicated control panel will operate these pumps.

The pump control panel will transmit VFC signals to the DDC controller to monitor the Common fault and Run status. On receipt of these signals, the DDC controller will generate the respective status/alarm indication at the BMS.

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9. WATER TANKS

The water tank is partitioned. The levels of both partitions are indicated to the BMS via level transducers. The high and low level alarms shall be monitored via software.

Energy Monitoring Unit:

EMUs shall be provided for all the HV and LVMDB's as shown on single line diagrams. These shall be communicating on the MOD bus protocol and integrated directly with the BMS. EMU shall provide voltage, currents for each phase. EMU shall also transmit to BMS other relevant parameters such as frequency, power factor, active power, reactive power, instantaneous Kw, harmonic analysis etc. provide separate harmonic analyzer if required. ACBs shall operate with BMS using MOD bus protocol.

Transducers are provided in the power feeders to specific areas as shown on electrical single line diagrams. These shall be connected to BMS to compute the energy consumption respective areas.

10. GENERATOR PANEL:

The Generator shall be integrated to BMS via software.

The fuel levels in Main Fuel Tank & Daily Fuel Tank shall be monitored. The volt free contacts shall be transferred to BMS and High & Low alarms shall be generated. The tanks shall have inbuilt level sensors

11. LIFTS / ESCALETTERS

A dedicated control panel will operate Lifts / Escalators. The control panel will transmit VFC signals to the DDC controller to monitor the following status:

- Lift Run status
- Cabin Call Alarm
- Common Fault Alarm

12. FIRE ALARM INTERFACE:

Complete Fire Alarm system shall be integrated to BMS using BACnet protocol.

Fire Fighting System Interface:

Complete Fire Alarm system shall be integrated to BMS using BACnet protocol.

DATA POINT SCHEDULE

Contractor to ensure that respective systems provides the soft/hard interface units for the BMS interface as per BMS requirements below. Also, BMS vendor to make sure all specific interphase units mentioned in the project specification for the respective system are also interfaced.

1. Chillers

Chiller start / stop
Chiller run status
Indication of manual switch position
Chilled water temperatures IN / OUT
Condenser water temperatures IN / OUT

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Chiller trip alarm
Butterfly valve open / close

2. **Cooling Towers**

Cooling towers start / stop
Cooling tower run status
Indication of manual switch position
Condenser water temperatures IN / OUT
Cooling tower trip alarm
Cooling tower fan speed
Butterfly valve open / close

3. **Chilled Water Primary Circuit (Typical)**

H-O-A Selector Switch
Pumps Start / Stop Command
Pump Run Status
Pump Trip Alarm

4. **Chilled Water Secondary Pump (Typical)**

HOA selector switch status
Pump/VFD Enable/Disable
Pump/VFD Run status
Pump/VFD Trip Status
VFD Speed Feedback
VFD Speed Control
Differential pressure sensor

5. **Fresh Air AHU with Thermal Wheel (Typical)**

Fresh Air Damper Open/Close Command
Fresh Air Damper Open/Close Status
Extract Air Damper Open/Close Command
Extract Air Damper Open/Close Status
Pre-Filter Dirty Alarm
Bag Filter Dirty Alarm
HOA Switch Auto Status (Supply & Extract)
Fan Start/Stop Command (Supply & Extract)
Fan Run Status (supply & extract)
Fan Trip Status (supply & return)
On Cooling Coil Temperature (DB/WB)
Off Cooling Coil Temperature (DB/WB)
Heat Recovery Wheel Start/stop command
Heat Recovery Wheel Run status
Heat Recovery Wheel Trip status
Temperature (DB/WB) of Air after Heat Recovery Wheel

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Heating Coil Status
Heating Coil Trip Alarm
Supply Air Temperature (DB/WB)
Return Air Temperature (DB/WB)
C.W. Control Valve Modulating Command
Fire Alarm Signal

6. **Constant Speed Recirculating AHU's (Typical)**

Fresh Air Damper Open/Close Command
Fresh Air Damper Open/Close Status
HOA switch auto status
Fan start/stop command
Fan run status
Fan trip status
Pre-Filter Dirty Alarm
Bag Filter Dirty Alarm
C.W. Control Valve Modulating Command
Supply Air Temperature (DB/WB)
Return Air Temperature (DB/WB)
Fire alarm signal
Off Cooling Coil Temperature (DB/WB)
Heating Coil Status
Heating Coil Trip Alarm

7. **Recirculating Air Handling Unit With VFD VAV (Typical)**

Fresh Air Damper Open/Close Command
Fresh Air Damper Open/Close Status
HOA switch auto status
Supply Fan VSD Enable/Disable
Supply Fan VSD Speed Control Command
Supply Fan VSD Speed Feedback
Supply Fan VSD Trip Status
Supply Fan Run Status
Pre-Filter Dirty Alarm
Supply Duct Pressure
Return Air Temperature (DB/WB)
Supply Air temperature (DB/WB)
C.W. Control Valve Modulating Command
Fire Alarm Signal
Off Cooling Coil Temperature (DB/WB)
Heating Coil Status
Heating Coil Trip Alarm

8. **Extract Air / Makeup Air Fan (Typical)**

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HOA switch auto status
Fan start / stop command
Fan run status
Filter status
Fan trip status
Motorized damper status

9. **Smoke Extract Air Fans (Typical)**
HOA switch auto status
Fan run status
Fan trip
Fire alarm
Motorized Damper status
Fire / Smoke Damper Status

10. **Staircase Pressurization Fans (AHU - Typical)**
HOA switch auto status
Fan Start/ Stop Command
Fan run status
Fan VFD Speed Control Command
Fan VFD Speed Feedback
Fan trip status
Motorized Fire Damper On/Off Damper status

11. **Water Supply Pump system (Typical)**

Pump Selection Status
HOA switch auto status
Water pump run status
Water tank levels
Pump start/ stop Command
Water supply pump trip status
High / Low Water Level Alarm

12. **Fire Reservoir Monitoring**

Tank level indication
High / Low Water Level Alarm

13. **Diesel Tank (Above Ground) Monitoring**

Tank level indication
High / Low Fuel (Diesel) Level Alarm

14. **Fire Pump Set**

Power On
Electrical Fire Pump Run Status

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Electrical Jocky Pump Run Status
Diesel Fire Pump Run Status
Battery Healthy Status
Stand pipe Loop Pressure monitoring
Wet fire riser top Pressure monitoring
Low Water pressure Alarm

15. Generator Fuel System

Daily Tank Fuel Level
Main Tank Fuel Level
High / Low Fuel (Diesel) Level Alarm

16. Electrical LV Panel Monitoring

Energy Monitoring for HV, LV MDBs (Typical)
Energy Monitoring for Generator Panel
LV Incomer status
LV Outgoing status
LT Panel Busbar Temperature Monitoring
LT Room temperature Monitoring
LT Room Fire/Smoke detection
Interface complete data/status from Novec 1230 clean agent operating panel

17. Lift Monitoring

Lifts (Typical)
Lift Run Status
Cabin Call Alarm
Common Fault Alarm

18. Fire Alarm System

Interface complete data/status from Fire Alarm Panel

19. Communicating FCU for Detailed & Common areas

LON dedicated controller for each FCU with return sensor control / room control unit

BMS network shall be established using the Structured Cabling System. This shall be supplied by the specialist structured cabling system vendor, as part of the MEP contractors scope of work. This shall be Level 4 type or higher as per latest standards for LON systems and Cat – 6, UTP for BACnet systems. Cables. F.O. Cables, Active Components, Termination, etc shall be provided for a high speed network connection.

The proposed Structured cabling system vendor shall be same as the vendor for telecommunication System.

BMS submittal without the design of BMS Structured Cabling System shall not be acceptable. Cable selections shall meet individual requirements as set out by the protocols.

- End of Section -

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