Operational Qualification Protocol For Building Management System (BMS)

[AHU-01…….**]**

Installed at

Prepared by

INDEX

1. QUALIFICATION PROTOCOL APPROVAL:

Function	Name	Designation	Signature	Date
Prepared By				

Function	Name	Designation	Signature	Date
Checked By				
Checked By				
Checked By				

Function	Name	Designation	Signature	Date
Approved By				

2. IDENTIFICATION OF EXECUTORS:

S.No.	Name of the participant	Design/Dept	Sign and Date

Checked By:
(Sign and Date)

3. VERSION RECORDS:

Title: Building Management System (BMS)				
Version	**Changed Date**	**Section Changed**	**Revision Date**	**Remarks**

4. INTRODUCTION:

The BMS is a distributed control system through computerized, intelligent network of electronic devices to monitor and control the mechanical/electrical field devices to maintain a controlled environment in **……..** DDC is a stand-alone control system and run independent of BMS Process Data Manager. BMS Process Data Manager Failure will not affect the functioning of configured HVAC system. BMS shall have independent control on HVAC operation and data collection as a part of engineering operations and maintenance. Hence this system shall be considered as back end system for the control and operation. This system shall be designed in view to provide more technical data required for operation, maintenance and troubleshooting by engineering department.

The four basic functions of a BMS are: Controlling, Monitoring, Optimizing and Reporting.

5. OBJECTIVE:

The objective of this document is to establish methodology for operational qualification of Building Management System.

This study verifies:

5.1 Each component complies with the design specifications which are supported by technical Datasheet.

5.2 All the components qualify the test procedure to the acceptable criteria.

5.3 BMS shall monitor and record all parameters of AHU's.

6. PURPOSE AND SCOPE :

The Purpose and scope of this Operational Qualification is to

6.1 Demonstrate that the BMS system will perform reproducibly and consistently within its full range of operation.

6.2 Verify that the building management system is adequate to control all the parameters of AHU's mentioned in Input/ Output list.

6.3 Applies only to PC based Automation/Building Management System installed **……**

7. RESPONSIBILITIES:

In order to achieve the objectives for the complete BMS system, following shall be the responsibility of ……...

7.1 The complete system is designed as per the relevant standards, agreed technical specification.

7.2 Technical specifications of all the equipment are as per the tender document.

7.3 Control Philosophy shall be prepared for the complete system.

7.4 Carryout Validation activities after the system is commissioned for intended operations.

7.5 Control Philosophy shall be prepared for the complete system

7.6 To check and verify all the documents submitted as per above are in line with agreed Specification and scope and shall approve all the documents to signify that the vendor has complied with his commitment

7.7 To provide the necessary site clearance and complete the site activities covered in ……

7.8 To participate in the execution of the validation.

8. OVERVIEW OF THE SYSTEM:

The Building management system consists of the following:

8.1 Net workable/Standalone DDC (Direct Digital Control) Controllers

8.2 System Operator Workstation with BMS software

8.3 Field Sensors (analogue/Digital)

8.4 Field Output devices/actuators

The system is modular in nature and permits expansion of both capacity and functionality through the addition of sensors, actuators, and DDC Controller and operator devices. System architectural design eliminates dependence on the network for controlling and storing events. The DDC Controllers are processor based controllers and operates independently by performing its own specified input and output control and historical data collection. These Controllers are capable of functioning on a stand-alone mode i.e. even in case of loss of communication with the central control station, the DDC will function independently. The DDC controllers have fast peer to peer communication of data via the network communication system hence the DDC Controllers are able to access any data or send control commands and alarm reports directly to any other DDC Controllers or combination of controllers on the network without dependence upon a central processing device. The failure of network connection will not interrupt the execution of control strategies at other operation devices.

In case of failure of network or PDM, DDCs will have archiving capacity up to at least 5,000 events. This would enable the DESIGO System to retrieve data from the controller. The field instruments like temperature sensor, differential pressure switch for filter status, differential pressure transducer are connected to the DDC, which gives the signal to the controller. Based on the input signals and the set parameters, the DDC controls the output field devices like chilled water valve, hot water valve, SA Fan etc. to maintain the conditioned area.

The DDC controllers shall interface with sensors, actuators and carry out following functions:

8.5 Individual input/output point scanning, processing and control.

8.6 Direct Digital Controls with proportional, integral, derivative PID and adaptive gain and with any combination is possible.

8.7 Alarm Detection, time, event history, scheduling and communication interface control.

9. OPERATIONAL QUALIFICATION PROCEDURE:

Following points should considered during the Operational Qualification protocol

9.1 The Operational qualification status of the system is checked and approved.

9.2 Any deviation during Operational qualification is recorded in the observed deviation, corrective action and justification report section.

9.3 If the observed deviation does not have any major impact on the qualification the final conclusion shall be provided.

9.4 If the observed deviation has major impact on the qualification, deviation shall be reported to the manufacturer for the corrective action and qualification activity shall be redone.

10. ACCEPTANCE CRITERIA:

Operational Qualification shall be considered acceptable when requirements listed in section of this protocol has been fulfilled and all the components of building management system are functioning as per the design specifications.

11. OPERATIONAL QUALIFICATION TEST:

The Operational Testing shall be conducted to verify that all devices connected to System controller operate properly and in accordance with the BMS requirement. The state or value of the specified software variables should be verified. During this Operational testing the following items shall be considered.

11.1 Functionality Test for BMS.

11.2 Alarm Condition for BMS.

11.3 Electronic record

11.4 Access rights

12. BMS Graphics Verification test:

S.No.	Expected Scree Result	Actual Screen Result	Done By/ Date
1.	Verify Home Screen	Full unit screen	
2.	Verify System architecture screen	Full unit screen	
3.	Verify AHU summary screen	Full unit screen	
4.	Verify AHU-GF-01 screen	Full unit screen	

Remarks (if any):	
Checked By: **(Sign and Date)**	**Reviewed By:** **(Sign and Date)**

FUNCTIONALITY TEST FOR AHU UNIT:

12.1 AHU-01:

12.1.1 **AHU ON/OFF CMD and RUN status Challenges.**

Method: The AHU can be switched ON/OFF from the BMS using the button provided in the AHU Graphics or AHU Summary screen only if it is in Auto mode. The SA fan ON condition will be indicated by "ON" status and the fan will be rotating. The OFF condition will be indicated by "OFF" status.

Qualification Item	Specified	Actual Result Pass/ Fail	Checked By / Date
Selection Of AHU:			
Select AHU name from the Summary screen.	Selected AHU's graphics screen should be open.		
AHU Command: AHU "ON / OFF" command			
Put the AHU feeder selector switch in auto mode	After some seconds the AHU should be switched ON.		
Put the AHU feeder selector switch in Neutral mode.	The AHU should be switched OFF in auto mode.		
Put the AHU feeder selector switch in Manual mode and press the push button.	The AHU should start.		
Give the Force ON command from BMS SCADA.	After some seconds the AHU should start.		
AHU Command: **"SCHED" command**			
Click the SCHED button.	AHU should be switched ON and OFF as per pre-defined time period.		

Qualification Item	Specified	Actual Result Pass/ Fail	Checked By / Date
Interlocks:			
Check the AHU Auto / Manual status.	AHU AUTO / MANUAL status should be in AUTO mode.		

AHU Auto / Manual Status

Method: The Auto / Manual status of the AHU is displayed on the screen. The Auto / Manual Status of the AHU is shown as a text.

Qualification Item	Specified	Actual Result Pass/ Fail	Checked By/ Date
AUTO/MANUAL Status			
AHU in AUTO: Put the Auto / Manual selector Switch in Auto.	AHU shows "Auto" status in Green & ON / OFF command is possible from the BMS.		
AHU in MANUAL: Put the Auto / Manual selector Switch in Manual.	AHU shows "Manual" status & ON / OFF command is not possible from the BMS.		

12.1.2 **Modulation of the Chilled Water Valve Actuator:**

Method: The Chilled water valve actuator will modulate based on the return air temperature & humidity. The chilled water valve will modulate towards open condition when the actual value of either RA temperature or RA RH is more than its set point. The chilled water valve will modulate towards close condition when the actual value of RA temperature and RA RH is less than its set point.

Qualification Item	Specified	Actual Result Pass/ Fail	Done By/ Date
RA Temp and RA RH% Vs CHW Valve:			
Set the RA temperature and RA RH% set point higher than the actual.	CHW valve should modulate towards close condition to achieve set Temp. & RH%.		
Set the RA temperature set point lower than the actual and Set the RA RH% set point higher than the actual.	CHW valve should modulate towards open condition to achieve set Temp. & RH%.		

Qualification Item	Specified	Actual Result Pass/ Fail	Done By/ Date
Set the RA temperature set point higher than the actual and Set the RA RH set point lower than the actual.	CHW valve should modulate towards open condition to achieve set Temp. & RH.		
Set the RA temperature or RA RH set point lower than the actual.	CHW valve should modulate towards open condition to achieve set Temp. & RH.		
INTERLOCK			
Observe the AHU-01 ON / OFF status.	AHU-01 status should be in ON condition.		

12.1.3 **Modulation of the Hot Water Valve Actuator:**

Method: The Heater will heat based on the Return air temperature. The Heater will start heating when the actual value of RA temperature is less than its set point. The Heater will stop heating when the actual value of RA temperature is more than its set point.

Qualification Item	Specified	Actual Result Pass/ Fail	Done By/ Date
RA Temp Vs HW Valve:			
Set the temperature set point higher than the actual.	HW valve should modulate towards close condition to achieve set Temp.		
Set the temperature set point lower than the actual.	CHW valve should modulate towards open condition to achieve set Temp.		
RA Temp Vs HW Valve:			
Observe the AHU ON /OFF status.	AHU status should be in ON condition.		

12.1.4 **The VFD Speed Modulation against the CFM Set Point:**

Method: AHU VFD is varying its speed according to their SA CFM process value and CFM set point. If the actual CFM is lower than the set point, the VFD speed increases and when the actual CFM is higher than the set point then the VFD speed decreases.

Qualification Item	Specified	Actual Result Pass/ Fail	Done By/ Date
Interlocks: AHU "ON" status			
Observe the AHU ON / OFF status.	AHU should be in ON condition.		
SA CFM Vs SA VFD:			
Set the SA Duct CFM set point lower than the Actual.	VFD speed should decrease to achieve the CFM as per the set point.		
Set the SA Duct CFM set point higher than the Actual.	VFD speed should increase to achieve the CFM as per the set point.		

Remarks (if any):	
Checked By: **(Sign and Date)**	**Reviewed By:** **(Sign and Date)**

13. TREND VERIFICATION:

This test verifies that the AHU parameters such as Return Air temperature, Return Air RH,CFM etc. have been recorded in graphical form.

Expected	Observation	Actual Result Pass/ Fail	Done By/ Date
Return Air temperature SP & PV trend should be available for all AHUs			
Return Air RH% SP & PV trend should be available for all AHUs			
AHU CFM SP & PV trend should be available for all AHUs			
CHW CMD trend should be available for all AHUs			
AHU ON/OFF CMD &RUN/TRIP Status trend should be available for all AHUs			

Remarks (if any):	
Checked By: **(Sign and Date)**	**Reviewed By:** **(Sign and Date)**

14. SECURITY LEVEL TEST:

This test is performed to verify that system can be accessed only by the authorized person with the appropriate user name and password.

14.1 TEST OF AUTHORIZED ENTRY TO THE SYSTEM:

This test can be performed for all the users.

Qualification Item	Expected	Observed		Done By/ Date
		Yes	No	
Login with user name and password	The system opens only with the correct matc of user name and password			

14.2 TEST OF USER ACCESS LIMITATION:

S.No.	Privileges	Access Right (Yes/No)				Done by/Date
		Administrator	Manager	Supervisor	Operator	
1.	View Home screen					
2.	View System Architecture screen					
3.	View AHU summary screen					
4.	CFM Set point change					
5.	RA Temp. Set point change					
6.	RA RH Set point change					
7.	AHU On/Off Command					
8.	AHU Manual override CMD					
9.	AHU time schedule control					
10.	CHW actuator Command					
11.	Trend viewer					

Remarks (if any):	
Checked By: **(Sign and Date)**	**Reviewed By:** **(Sign and Date)**

15. TRAINING RECORD:

S.No.	Name of the participant	Area of operation	Sign and Date
Trainer (Sign and Date):			

16. OPERATIONAL QUALIFICATION DEVIATION REPORT:

Document any discrepancies or variations noted during the Operational Qualification execution. Record the corrective actions and the retest document.

Discrepancies:
Corrective Actions:
SATISFACTORILY COMPLETED: YES / NO **SIGNATURE:** **DATE:**

Remarks (if any):	
Checked By: **(Sign and Date)**	**Reviewed By:** **(Sign and Date)**

17. LIST OF ANNEXURES:

S.No.	Annexure no.	Annexure details	Date & sign

Remarks (if any):	
Checked By: (Sign and Date)	Reviewed By: (Sign and Date)

18. LIST OF ABBREVIATIONS:

OQ	Operational Qualification
DDC	Direct Digital Control
AHU	Air Handling Unit
BMS	Building Management System
GA	General Arrangement
RA	Return Air
SA	Supply Air
A/L	Airlock
CHW	Chilled Water
IO	Input/Output
T&RH	Temperature & Relative Humidity
Pa	Pascal
A/M	Auto/ Manual
HVAC	Heating Ventilating Air Conditioning
AHU	Air Handling Unit
Ex unit	Exhaust unit

19. SUMMARY:

20. CONCLUSION:

(Sign/Date): - ——————————

21. CERTIFICATION FOR OPERATIONAL QUALIFICATION:

This Operational qualification document is studied and approved by the Undersigned Authorized Personnel.

Function	Name	Designation	Signature	Date
Executed By		BMS Engineer		

Function	Name	Designation	Signature	Date
Checked By				
Checked By				
Checked By				

Function	Name	Designation	Signature	Date
Approved By				