FUNCTIONAL TESTING WHOLE OF BUILDING RECORD

PROJECT :		**Page**	**1 of 7**
CLIENT :		**System**	

PRELIMINARY CHECKS

Item	Inspection / Test	Result	Comments / Remarks
1	Pre - commissioning testing completed	Yes□ No□	
2	All software modules specified in the design documentation or the modules required to perform all specified operation functions have been installed and configured to meet UOW's system requirements	Yes□ No□	
3	The latest release version of all software modules has been provided	Yes□ No□	
4	The operator terminal CPU and FPU, memory and hardware resources have sufficient capacity to support the software routines and functions under worst case demand conditions	Yes□ No□	
5	All analogue inputs and outputs and digital inputs and outputs, system reports, screens and menus are fit for purpose and have been programmed	Yes□ No□	
6	Graphics completed and installed	Yes□ No□	
7	Time Schedules enabled and time set as specified	Yes□ No□	
8	The commissioning engineer has the STIP issued by the Project Manager and ensure it is the controlled revision	Yes□ No□	
9	The principal contractor onsite is notified that functionality testing is to commence	Yes□ No□	
10	The Mechanical and Electrical contractors have been notified that functionality testing is about to commence	Yes□ No□	
11	The other trades are aware of any items that may affect them	Yes□ No□	
12	The MUBS and MUBT's associated with pre-commissioning are signed off as complete to ensure both the installation contractor and the commissioning engineer has complete all installation requirements for the installation	Yes□ No□	
13	MUBT-02 Individual system testing has been completed prior to demonstrating this full functional test	Yes□ No□	

If any of the above has not been completed, the commissioning tests shall be suspended and rescheduled

At this time the system is ready for functionality testing. Functionality testing is a detailed method of testing the combination of field devices, DDC hardware and software to ensure the system as a whole achieves the desired outcomes detailed in the Description of Operation for the Building Management System.

Item	Inspection / Test	Result	Comments / Remarks
Control Functional Checks using final BMCS Functional Description (*examples below*)			
Air Handling Unit Supply			
Test 1 – Occupied Mode Summary : The Air Handling Unit will run under the following conditions : 1. When any of the following conditions are enabled: a. When any floor normal hours' time schedule is set to On. b. When any floor afterhours time schedule is set to On. c. When the AHU Optimal Start Pre-heat or Pre-Cool mode is set to On.			
1	Set a scheduled start time for the floor normal hours and confirm the AHU start signal is enabled	Pass□ Fail□	
2	Set a scheduled stop time for the floor normal hours and confirm the AHU start signal is disabled	Pass□ Fail□	
3	Set a holiday exception time and confirm the AHU start signal is disabled (Remote day event from master only)	Pass□ Fail□	
4	Set the Optimal start point (to be commanded by the Optimal Start Block) to On and confirm that the AHU Optimal start is set to On.	Pass□ Fail□	
5	Set the Optimal start point (to be commanded by the Optimal Start Block) to Off and confirm that the AHU Optimal start is set to Off.	Pass□ Fail□	
Test 2 – Supply air temperature - Setpoint reset control Summary: Temperature setpoint will vary depending on zone with cooling/heating demand (based on zone deviation) Zone deviation calculation is calculated as follows: 1. Temperature deviation of each active chilled beam allowing for a 1ºC dead band around the Zone temperature set point of the ACB. e.g. If zone temperature set point is 22.5 ºC and the zone temperature is 25 ºC, then the deviation is 2 ºC (25 – (22.5 + 0.5)) and if the zone temperature is 20ºC, then the deviation is -2 ºC (20 – (22.5 - 0.5)). Where (22.5 + 0.5) is occupancy cooling set point and (22.5 - 0.5) is occupancy heating set point. 2. The average of all the enabled zone temperature deviations of the ACBs being served by each of the AHUs for the floor is calculated. 3. Then the maximum deviation of all enabled floor averages are passed to the AHU, if all enabled floor averages are below zero then the minimum of all the averages for the AHU are passed to the AHU. 4. The AHU takes this deviation and resets the supply air temperature set point between a max limit of 32 ºC (adjustable) and min limit of 13 ºC (adjustable). There is a dead band of 3 ºC in the AHU as well to avoid rapid change between heating and cooling modes and the AHU resets the supply air temperature from 24 ºC to 21 ºC. **NOTE**: In case of loss of reliable zone temperature deviation, the default value of 0 ºC deviation will be used for control.			
1	Modify Heating Zone Deviation Factor to 1.5 ºC Confirm SA setpoint modulates to maximum limit (32 ºC - adjustable)	Pass□ Fail□	
2	Modify Heating Zone Deviation Factor between + 0.5 ºC Confirm SA setpoint modulates to satisfied limit (24 ºC – adjustable)	Pass□ Fail□	

Item	Inspection / Test	Result	Comments / Remarks
3	Modify Cooling Zone Deviation Factor between + 0.5 ºC Confirm SA setpoint modulates to satisfied limit (21 ºC – adjustable)	Pass□ Fail□	
4	Modify Cooling Zone Deviation Factor to 1.5 ºC Confirm SA setpoint modulates to minimum limit (13 ºC - adjustable)	Pass□ Fail□	
Test 3 – Cooling Valve Control Summary: Cooling Valve will be modulated to maintain supply air temperature at supply air temperature set point when: 1. The AHU is enabled. 2. The supply fan status is on and the supply static pressure is greater than 10 Pa 3. Supply air temperature > supply air temperature set point 4. The heating valve is not being controlled.			
1	Modify parameters to enable cooling operation (Supply air temp. > Supply air setpoint, unit enabled = on, fan status =on, Supply static pressure > 10 Pa), confirm that the cooling valve is modulating open.	Pass□ Fail□	
2	Modify parameters to disable cooling operation (Supply air temp. < Supply air setpoint, unit enabled = on, fan status =on), confirm that the cooling valve is modulating closed.	Pass□ Fail□	
3	Modify parameters to cause a fan mismatch alarm (fan status =off and supply static pressure < 10 Pa), confirm the cooling valve is modulating closed.	Pass□ Fail□	
4	Modify parameters to turn off AHU (fan status =on, unit enable = off), confirm the cooling valve is modulating closed. **This will be controlled by a rate limiter so that the Cooling valves do not close suddenly putting pressure on the bypass valve in the chilled water system**.	Pass□ Fail□	
Test 4 – Heating valve control Summary: Heating Valve will be modulated to maintain supply air temperature at supply air temperature set point when: 1. The AHU is enabled. 2. The supply fan status is on and the supply static pressure is greater than 10 Pa. 3. Supply air temperature < supply air temperature set point 4. The cooling valve is not being controlled. This mode will be active on early morning Pre-heat and heating mode			
1	Modify parameters to enable heating operation (Supply air temp. < Supply air setpoint, unit enabled = on, fan status =on, Supply static pressure > 10 Pa), confirm that the heating valve is modulating open.	Pass□ Fail□	
2	Modify parameters to disable heating operation (Supply air temp. > Supply air setpoint, unit enabled = on, fan status =on), confirm that the heating valve is modulating closed.	Pass□ Fail□	

Item	Inspection / Test	Result	Comments / Remarks
3	Modify parameters to cause a fan mismatch alarm (fan status =off and supply static pressure < 10 Pa), confirm the heating valve is modulating closed.	Pass□ Fail□	
4	Modify parameters to turn off AHU (fan status =on, unit enable = off), confirm the heating valve is modulating closed.	Pass□ Fail□	
Test 5 – Supply Air Fan Variable Speed Drive control Summary: The supply air fan VSD is commanded via High level control. The AHU modulates the supply fan output between 0% and100% (0 – 10 VDC) to maintain supply air static pressure at supply air static pressure set point. The following conditions have to be met as well: 1. The AHU is enabled. 2. The supply fan is not in alarm.			
1	Modify the parameters to enable supply fan speed increment (supply air static pressure < supply air static pressure set point, AHU is enabled, supply fan status = On), confirm the supply fan VSD output increases.	Pass□ Fail□	
2	Modify the parameters to enable supply fan speed decrement (supply air static pressure > supply air static pressure set point, AHU is enabled, supply fan status = On), confirm the supply fan VSD output decreases to minimum adjustable supply fan VSD output.	Pass□ Fail□	
3	Modify the parameters to enable supply fan speed to hold (supply air static pressure = supply air static pressure set point, AHU is enabled, supply fan status = On), confirm the supply fan VSD output remains constant.	Pass□ Fail□	
4	Modify the parameters to disable the supply fan speed control (AHU is enabled, supply fan status = Off for 30 seconds), confirm the supply fan output is set to minimum VSD output.	Pass□ Fail□	
5	Modify the parameters to disable the supply fan speed control (AHU is disabled), confirm the supply fan output is set to minimum VSD output.	Pass□ Fail□	
Test 6 – Optimum Start/Stop – Pre-heat / Pre-Cool Mode Summary: The early morning Pre-heat and cool condition will engage when the following conditions are met: 1. Unit is disabled. 2. Optimum Start is On. a. The optimum start is a self-learning function that will determine the plant and building thermal performance and calculate the latest possible start time. The optimum start/stop time is calculated based on outside air temperature, occupancy schedule, heat and cool capacity and average zone temperature from all master zones served by AHU. 3. Pre-heat condition is met when outside air temperature is less than heating set point 13 ºC. Under this condition: a. Supply air temperature will be set to maximum 32 ºC (adjustable) and the hot water valve will modulate to maintain the set point. The outside air dampers will be closed. 4. Pre-Cool condition is met when outside air temperature is greater than cooling set point 25 ºC. Under this condition: a. Supply air temperature will be set to run as normal operation.		

Item	Inspection / Test	Result	Comments / Remarks
1	Modify On the optimum start point and OFF the unit enable point. Ensure the AHU start in unoccupied Mode	Pass□ Fail□	
2	Modify On the normal occupancy time schedule. Ensure the optimum start is terminated	Pass□ Fail□	
3	Modify the parameters to allow for Pre-heat mode (Outside air < heating set point 13 ºC Ensure the SAT is reset to 32 degC and the Heating Valve is modulating open.	Pass□ Fail□	
4	Modify the parameters to allow for Pre-Cool mode (Outside air > cooling set point 25ºC) Ensure the SAT is reset based on normal cooling condition.	Pass□ Fail□	
Test 7 – Economy Mode Summary: The Air Handling Unit will run in economy mode when the following conditions are true: 1. The unit is enabled. 2. The supply fan status is On 3. Outside air temperature > High temperature setpoint (9ºC adjustable) 4. Outside air temperature < High temperature setpoint (18 ºC adjustable) 5. Outside air enthalpy < Return air enthalpy by a differential of 5kj/kg Economy mode will affect the following parameters: a. Outside air damper will modulate to maintain supply air temperature at setpoint b. Once the outside air damper open 100 %, then the cooling valve will modulate in sequence to maintain supply air temperature at setpoint.			
1	Modify parameters to enable economy. OAT < 18 º C and outside air enthalpy < return air enthalpy by a differential of 5kj/kg. Confirm that the outside air damper starts to modulate open while the cooling valve is still shut.	Pass□ Fail□	
2	Modify parameters to disable economy. OAT > 21 º C and outside air enthalpy > return air enthalpy. Confirm that the outside air damper starts to modulate close while the cooling valve is still shut.	Pass□ Fail□	
Test 8 – Carbon Dioxide Control Mode Summary:CO2 control mode is enabled under the following condition 1. The unit is enabled 2. The supply fan status is On 3. The return air CO2 (max of all the floor readings served by the AHU) > return air CO2 Setpoint 4. Carbon Dioxide Control mode will affect the following parameters: 5. Outside air damper will modulate to maintain return air CO2 below setpoint			
1	Modify the unit enable parameter of the AHU Off and then On, Confirm	Pass□ Fail□	
2	Modify the parameters to increase outside air flow. Return air CO2 > return air setpoint, confirm outside air dampers start to open.	Pass□ Fail□	

Item	Inspection / Test	Result	Comments / Remarks
3	Modify the parameters to decrease outside air flow. Return air CO2 < return air setpoint, confirm outside air dampers start to close.	Pass□ Fail□	
4	Modify the unit enable parameter of the AHU Off and then On, Confirm	Pass□ Fail□	
Test 9 – Dehumidification Control Mode Summary: 1. Relative humidity control is achieved by the AHU coil.			
1	Modify the %RH > %RH setpoint (e.g 70% RH). Confirm that the dehumidification control is enabled.	Pass□ Fail□	
2	Check that the chilled water valve modulates open.	Pass□ Fail□	
3	Modify the %RH < %RH setpoint (50% RH). Confirm that the dehumidification control is disabled.	Pass□ Fail□	
4	Check that the chilled water valve modulates closed.	Pass□ Fail□	
Test 10 – Alarms Summary: 1. The AHUs generate the following alarms: Filter status fault, Supply Air Fan Fault, Return Fan Fault, Controller Alarms 2. Test are to carried out with alarm delay and durations set to minimum 3. Set all alarm duration to 60 seconds for the test.			
1	Ensure the AHU command is On and supply air fan status is On. Modify the supply air fan command to On and confirm receipt of the alarm when the supply air fan status is off. The supply air fan status will be set to on when the supply air static pressure is greater than a setpoint (10 Pa adjustable).	Pass□ Fail□	
2	Ensure the AHU status is on and return air fan status is on. Modify the return air fan status to OFF and confirm receipt of the alarm	Pass□ Fail□	
3	Ensure the AHU status is on; command the Filter status to alarm. Confirm receipt of the alarm.	Pass□ Fail□	
Test 11 – Fire Mode Summary: In fire mode the AHU will be disabled and all the outputs will return to their relinquish default (no power is supplied to any of the points) a. Hot water valve 0% open b. Chilled Water Valve 0% open c. Supply fan output 0% d. Supply fan command = Off			

Item	Inspection / Test	Result	Comments / Remarks
1	Ensure the AHU status is on and command the fire trip point to ON Confirm the above conditions are met.	Pass□ Fail□	
Other examples headings using the Final Functional description; • **Floor VAV Control** • **Car Park System** • **Chilled Water System** • **Cooling Tower System** • **Heating Water System** • **Tenant Condenser Water System** • **Water Cooled DX Packaged Air Conditioning Units** • **Ventilation Systems**			
Test 1 – Summary : The XXX will run under the following conditions : 1. When any of the following conditions are enabled: a. A			
1		Pass□ Fail□	

BMCS Technician :			Date :	
Witnessed By :			Date :	
Witnessed By :			Date :	
Witnessed By :			Date :	
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