

BMS SYSTEM FOR THE REMOTE MONITORING AND CONTROL OF THE CUSTOMER CHW ETS FROM THE DCPs WITH FIBER OPTIC LINK

- A BMS system is to be installed in each building ETS room to facilitate remote monitoring and control of the CHW ETS system from the District cooling plant
- The proposed BMS system by the contractor for the ETS Room should be approved by South Energy.
- The BMS system for the ETS room will be of the make and supplier specified by South Energy to maintain consistency for integration and long term maintenance and operation of the system.
- Suitable compatible makes are Johnson Controls, Siemens, and Honeywell etc. with BACnet protocol structure.
- The BMS should support open protocol communication structure to enable it to communicate with the remote monitoring system at the DCP. **The communication protocol should be BACnet/IP.**
- The BMS system DDCs will be housed in a separate enclosure with a reliable UPS power supply.
- The connectivity to the remote monitoring station in the DCP plant will be through Fiber optic cable pair. The building developer / contractor is responsible to install & test fiber optic cable from the DDC panel to the CHW valve chamber outside the building. The fiber pair is to be spliced to the main BMS fiber ring cable there by the building developer / contractor. Optic Fiber Test Certificate must be submitted to South Energy.
- Media converter is required in the DDC panel to link the DDC Ethernet remote communication port to the FO cable.
- It is the responsibility of the building developer/contractor to configure and avail all the points as per South Energy requirements from ETS room BMS.

- The building developer/contractor shall be responsible along-with the South Energy team for testing, commissioning and integration of the ETS Room with the plant.
- It is the responsibility of the building developer/contractor to make sure all the required points are available and reliable all the time and necessary maintenance of the ETS Room BMS shall be carried out.

CHW Pipe Leak Detection system: (if provided)

- CHW Pipe Leak detection panels for the various parts of the CHW network will be placed in some of the customer's building ETS rooms as required. These panels will be remotely monitored in the BMS through Volt free contacts from the Leak detection system to the BMS panels.
- The operation, maintenance and upkeep of the leak detection panels will be the responsibility of DS. Only power supply for these panels will be from the customer building.

Control / Monitoring Points:

The following points are required to be monitored by the DDC controller to achieve control and provide feedback to the DCS operations:

- Individual line pressure (sensor) on the primary and secondary side of the PHEX.
- Individual line inlet and outlet temperatures (sensor) on the primary and secondary side of the PHEX.
- Flow status on the supply line to the building.
- Motorized (flow control) PICV valve control command & Feedback.

- The following BTU meter parameters shall be communicated with the plant
 - Flowrate
 - Temperatures
 - MWH readings
 - Volt free contacts for CHW pipe leak detection and panel healthy status.(if provided)
 - PID tuning parameters.
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- The building developer/contractor shall coordinate with SE before finalizing the point name or Device ID for ETS Room devices.
 - The control philosophy will be that as per the changes in the building cooling load, a variation in the building side chilled water flow or CHW temperature will take place. The variation in the AC load will result in the change of heat transfer rate across the Plate heat exchangers (PHEX) and will eventually reflect as a change in the return chilled water temperature on the district cooling side. This change in temperature will be immediately sensed through the temperature transmitter (TT) located on the return CHW pipe of the district cooling side of the PHEX in the ETS room. Upon receiving the signal from the TT, the DDC will signal the control valve (PICV) located on the return CHW pipe of the DCS side to modulate accordingly till the time that the return CHW temperature on the DCS side comes to the set-point temperature. (Refer the schematic diagram for the ETS room control schematics : ref: DWG/DWC-DS/DCS/ETS/Con-Sch Rev-1)
 - There must be a Manual and Auto mode of control for the PICV and the SCADA/HMI must mention on the screen in which mode the PICV is been controlled.

- Auto mode control must be as per the control philosophy mentioned above.
- In Manual mode operation, the operator at the DCP should be able to override the PICV command.
- Since an abrupt change in the PICV command can cause harm to the valve or actuator, the transfer between manual and auto mode must be bump less.
- The PICV Feedback must not have any difference with the PICV command. In such cases, an alarm should be generated to notify the operator.
- The PICV position and feedback must be expressed in %.
- The Temperatures displayed on the HMI or workstation should be having one decimal place.
- PID tuning parameters must be available only for admin & not for the operators to change.
- It is noted that the Heat exchanger output may not be linear with the valve operation, however control will be achieved through the modulating PICV valve controlled by the BMS.
- The remote HMI workstation at the DCP requires the above monitoring and control logic to be programmed in the ETS room BMS DDC panel.
- The choice of sensors and transmitters are to be of high reliability and to be guaranteed for the readings for a long period.
- One BTU meter shall be installed in the return line to the district cooling plant. This BTU meter along with the Sub-meters shall be integrated with the DCP station.

- The BTU meter to be installed is to be of a reputed make (like KAMSTRUP, Landis & Gyr, Siemens etc) with a long term guarantee of the readings. (At least 5 years).
- An agreement will be signed between DS and the CHW customers for the provision of CHW supply with several terms and conditions included for the BMS system setup, maintenance and operation.
- Some items of the CHW supply agreement, relevant to the ETS BMS system implementation, operation and maintenance are listed below for understanding and implementation :

Metering and Testing:

Installation and Maintenance - On or before the Start Date the Customer shall, at its own expense, supply and install the Metering Equipment and ETS control BMS system in accordance with above guidelines, thereafter and throughout the Supply Period (and any Extension Period) the Customer shall maintain the above Equipment in good condition, all at its sole cost, risk and expense and in accordance with the above guidelines.

Right of Access - For the purposes of fulfilling its obligations pursuant to Clause 0 the Supplier-DS (and its employees, agents and representatives) shall have right of access at all times to the Customer Premises and the Metering Equipment. The Customer shall ensure such access and shall further ensure that such access may be obtained safely at all times.

Meter Readings - The readings of the Metering Equipment for billing purposes shall be recorded by the Supplier-DS, at the end of each month or at such time as otherwise mutually agreed between the Parties. If requested, copies of the meter readings shall be provided to the Customer within 5 Business Days of request.

Inaccuracy - If either Party becomes aware of, or should reasonably have been aware of, any inaccuracy in the meter readings or defect in the

Metering Equipment, then it shall forthwith notify in writing the other Party of such inaccuracy or defect (as the case may be).

Testing and Calibration - The Customer shall test and calibrate the Metering Equipment for accuracy every two years, or at any time within 30 days after a written request by the Customer in the event that the Customer reasonably believes that the measurements from the Metering Equipment are inaccurate by more than 2%. The following shall apply to all such tests:

- (a) at the Customer's option, testing of the Metering Equipment may be witnessed by a representative of the Customer;
- (b) metering measurement accuracy of the Metering Equipment (or any part thereof) between 98% and 102% shall be deemed acceptable;
- (c) In the event that the Metering Equipment are found to be operating outside the parameters provided in Clause 0(b) above, the Metering Equipment shall be immediately repaired, calibrated or replaced at the Supplier DS's cost and expense.
- (d) Upon completion of any examination, maintenance, repair, calibration or replacement of any Metering Equipment, such equipment shall be sealed by the Supplier DS.

Reconciliation for Inaccurate Readings - In the event that the Metering Equipment (or any part thereof) are found to be inaccurate the amount of Chilled Water delivered to the Customer for the period during which such inaccurate measurement were made shall be determined by the Parties jointly preparing an estimate of the reading on the basis of the available information (including the assumption that if the duration of metering inaccuracy cannot be reasonable estimated, such duration shall be deemed to have persisted for 50% of the time between the last meter reading and the discovery of the inaccuracy). Following such determination, adjustments shall be made to the amounts payable under the next invoice

submitted in accordance with Clause **Error! Reference source not found.** To account for any under or over payment which may have been made.

Measurement Disputes - In the event of any dispute in relation to the accuracy of the Metering Equipment, any reading therefrom, any estimate of the reading pursuant to Clause 0 or any other matter in connection with the Metering Equipment (a “Measurement Dispute”) then either Party may at any time refer such dispute to determination in accordance with Schedule 6.

Representations and Warranties

Supplier Warranties - The Supplier DS warrants and represents that:

- (a) it has good and merchantable title to the Chilled Water delivered to the Customer, free and clear of all encumbrances and claims;
- (b) it has secured approvals from all relevant regulatory bodies, made any filings or reports, as required, pertaining to (i) the construction, operation and maintenance of the District Cooling Generating Facilities and (ii) the acquisition and transportation of Chilled Water on the Supplier DS's transmission pipeline;
- (c) it is in compliance in all respects with all applicable laws (including, without limitation, those regulating or affecting any spillage, discharge or release of any hazardous waste into or upon any of its land, air, surface water, ground water or improvements located thereon); and
- (d) In performing its obligations under this Agreement, it shall operate in accordance with Good Industry Practice and all relevant governmental rules and shall seek to minimise costs.

Customer Warranties - The Customer warrants and represents that it will take all economically reasonable steps to ensure that the Chilled Water supply is used efficiently and effectively and will avoid excessive use or wastage of cooling.

SCHEMATIC DIAGRAM AND FIBER ROUTE

