ARMSTRONG

DESIGN ENVELOPE EVERCOOL | INTEGRATED AUTOMATION AND OPTIMIZATION SOLUTION FOR DATA CENTER CHILLER PLANTS | SUBMITTAL

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Job: _____ Representative: _____

_____ Order no.: _____ Date: _____

Engineer: _____ Submitted by: _____ Date: _____

Contractor: _____ Approved by: _____ Date: _____

DATA CENTER DESIGN

UPTIME INSTITUTE TIER CLASSIFICATION

☐ Tier I	☐ Tier II	☐ Tier III	☐ Tier IV

EQUIPMENT REDUNDANCY

☐ N	☐ N+1	☐ N+2	☐ 2N	☐ 2N+1

PLANT CONFIGURATION - WATER-COOLED

CHILLED WATER PUMPS*		WATER-COOLED CHILLERS		CONDENSER PUMPS*		COOLING TOWERS	
TOTAL QUANTITY	CONFIGURATION	TOTAL QUANTITY	CAPACITY PER CHILLER	CONFIGURATION	TOTAL QUANTITY	CONFIGURATION	TOTAL QUANTITY
☐ 1	☐ Headered ☐ Headered - Ring ☐ Dedicated	☐ 1	_____(Tons)	☐ Headered ☐ Headered - Ring ☐ Dedicated	☐ 1	☐ Headered ☐ Headered - Ring ☐ Dedicated	☐ 1
☐ 2		☐ 2			☐ 2		☐ 2
☐ 3		☐ 3			☐ 3		☐ 3
☐ 4		☐ 4			☐ 4		☐ 4
☐ 5		☐ 5			☐ 5		☐ 5
☐ 6		☐ 6			☐ 6		☐ 6

NOTES:
* Pump Type: Single

PLANT CONFIGURATION - AIR-COOLED

CHILLED WATER PUMPS*		AIR-COOLED CHILLERS	
TOTAL QUANTITY	CONFIGURATION	TOTAL QUANTITY	CAPACITY PER CHILLER
☐ 1	☐ Headered ☐ Headered - Ring ☐ Dedicated	☐ 1	_____(Tons)
☐ 2		☐ 2	
☐ 3		☐ 3	
☐ 4		☐ 4	
☐ 5		☐ 5	
☐ 6		☐ 6	

NOTES:
* Pump Type: Single

STANDARD FUNCTIONALITY AND CONSTRUCTION

The Armstrong Design Envelop EVERCOOL is an integrated automation and optimization solution designed for data center chiller plants. It is supplied with all hardware, software and programming required to sequence and optimize the following equipment to meet the Uptime Institute requirements for all tiers of data centers and for better efficiency of the overall chiller plant:

- Up to six (6) chillers
- Up to six (6) variable speed primary chilled water pumps in headered or dedicated configuration
- Up to six (6) variable speed condenser water pumps in headered or dedicated configuration
- Up to six (6) cooling towers with variable speed fans in headered or dedicated configuration
- Associated isolation and by-pass valves

Standard construction

- Multi-colour 15" back-lit touchscreen (not to be directly exposed to sunlight)
- Internal circuit breaker protection
- Two (2) NEMA 12 or IP54 rated panels mounted on a wall rack
- Secure front cabinet door with lock and key

Standard functionality

- Remote or local start/stop mode of operation
- Three level password security:
  - Level 0 view only
  - Level 1 operator view (for equipment operation and field adjustment)
  - Level 2 installer view (for factory/commissioning)
- Automatic sequencing and alternation of chillers, pumps and cooling towers
- Obtain system flow from flow meter or from Design Envelope pumps' sensorless reading
- Sensorless pump speed control of Design Envelop pumps (single type) and Parallel sequencing with best efficiency point staging if pumps are in headered configuration
- Manual or automatic control system (H-O-A selection)
- On-screen menu driven operator interface with:
  - Active-element schematic displays with links to sub-menus for additional plant equipment information
  - Real time display of the statuses and efficiencies of plant and individual components, and the overall plant heat balance calculation
  - Dynamic overview of the hydronic circuit indicating piping configuration
  - Detailed view of each connected piece of equipment
  - Overview of up to 4 zones with actual reading, setpoint, status and deviation of individual zone
  - Capability to view and modify parameters and setpoints of all connected equipment, valves and sensors, and to override equipment operating mode
  - Adjustable PID parameters to control pump speed, bypass valves and cooling valves (ASHRAE 90.1 compliance)
  - Separate displays to view all available live and historical data, including alarms and trends, which can also be downloaded as a csv file
- Standard Modbus RTU communication between EVERCOOL and VFD's (pumps and towers)
- Enable auxiliary equipment through dry contact output for water treatment
- Includes plant optimization module to enhance efficiencies of Design Envelope variable speed condenser water pumps and cooling towers with variable speed fans and to minimize energy and water consumption (requires performance management service)
- Includes performance management service for the first year and available on an annual subscription basis for subsequent years (requires internet connection)

Input/Output

- A point schedule detailing analog and digital input and output points description, functions and types, including redundancy, for the following:

  Digital inputs

  - Remote start (through an external system; e.g. BAS)
  - Emergency stop (push button in the mechanical room)
  - Alarm silencer (button or through external system)
  - Refrigerant leak alarm
  - Chillers alarm and status
  - Chilled and condenser water isolation valves open & close feedback
  - Cooling tower inlet & outlet isolation valves open & close feedback
  - Chilled & condenser water pumps differential pressure switch
  - Chilled & condenser water pumps run feedback & alarm
  - Tower sump low level & high level switch
  - Cooling tower fan run feedback & alarm

- Cooling tower recirculation pump run feedback
- Water treatment, solid separator pump & freeze protection run feedback
- Make-up water meter & blow down water meter pulse
- Secondary loop operating status

Digital outputs

- Alarms on controller communication, sensor, refrigerant leak and general system (signal for external system; e.g. BAS)
- General audible alarm (signal for external system, e.g. horn or siren)
- Open & close chilled water isolation valves
- Open & close condenser water isolation valves
- Cooling tower inlet & outlet isolation valves control
- Chillers start/stop signal
- Chilled & condenser water pumps control
- Cooling tower fan & recirculation pumps control
- Enable/disable Armstrong secondary loop controller (for secondary pumps enablement, where applicable)
- Enable/disable water treatment, solid separator and freeze protection

Analog inputs

- Zone differential pressure or zone temperature signals
- Supply and return temperatures for chilled and condenser water
- Chilled and condenser water flow sensors
- Chilled water and cooling tower bypass valves position feedback
- Chiller current/kW sensors
- Chilled and condenser water system dP sensors
- Outside air temperature and humidity

Analog outputs

- Chilled water and cooling tower bypass valves control
- Chilled water temperature setpoint
- Chillers demand limit control
- Chilled & condenser water pumps speed reference
- Cooling tower fan speed reference

- Standard serial port for communication with chillers, pumps and cooling tower fans through Modbus protocol
- Standard serial port for communication with a building automation system (BAS)
- Two terminal blocks (one per panel) for power supply 100-240 Vac/1 Ph/50-60 Hz

General sequence of operation

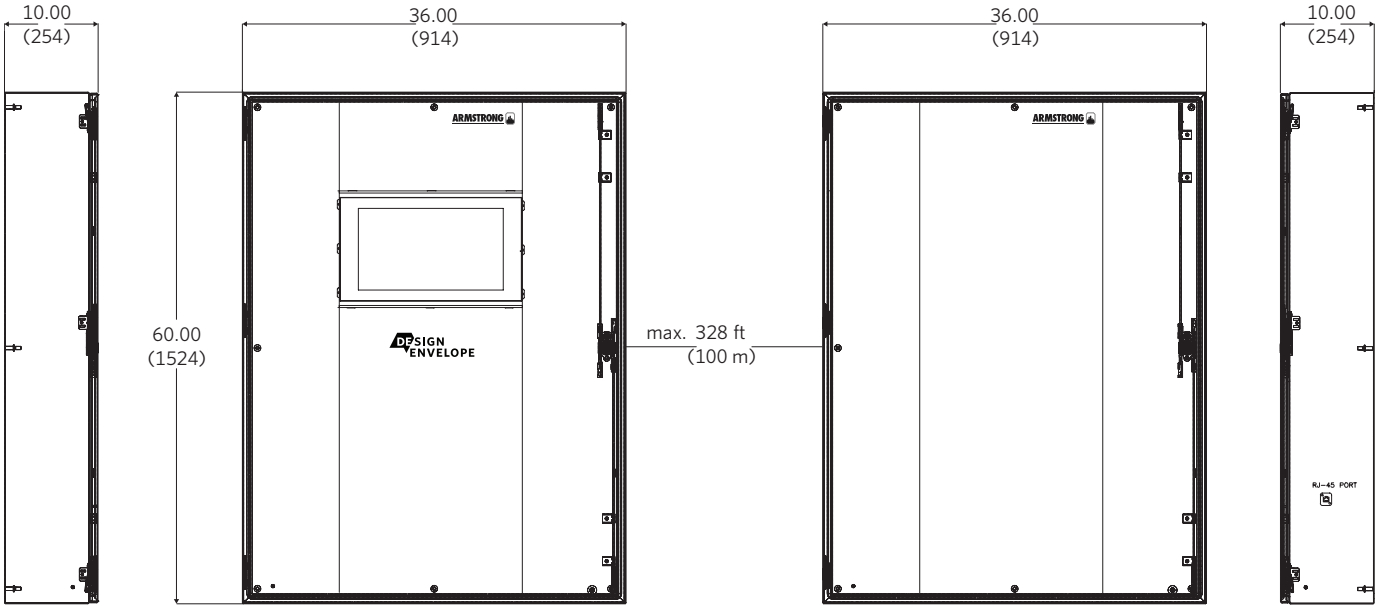
- All plant automation system settings, including the number of chillers, cooling towers and pumps, as well as how they are connected (headered or dedicated) shall be able to modify at the graphic user interface (GUI) after entering the appropriate password.
- The plant automation system shall monitor all redundant sensors and use the average of both. If one of the sensors goes out of range, it's value shall be ignored and the valid sensor reading shall be used. If both sensors fail, fallback sequences shall be used.
- If emergency stop or refrigerant leak is detected, all chillers, pumps and cooling towers shall stop immediately, and the plant automation system shall be locked out of operation until alarm has been manually reset.
- The plant automation system shall determine the most energy efficient combination of operating primary pumps and pump operating speed by Parallel Sensorless™ sequencing with best efficiency point staging, or adjusts the pump speed to maintain the differential pressure or temperature of up to 4 zones at or above setpoint, while maintaining within equipment upper and lower flow limits and meeting system cooling load.
- The plant automation system shall continuously monitor all zone signals to determine an active control zone. Use of a multiplexer for multiple sensor inputs is not acceptable.
- The plant automation system shall automatically disable any zone differential pressure/temperature signals that are not within limits and alert the operator of a possible transmitter failure. If all the differential pressure/temperature sensors fail, the pump speed shall default to a pre-defined percentage of full speed (factory default loaded as 95% of full speed).
- The plant automation system shall sequence the pumps based on a field adjustable interval of operating days with a "**bump-less**" transfer algorithm. The control system incorporates an adjustable PID control loop and embedded logic to prevent hunting, pump flow surge and motor overloading.
- The plant automation system shall determine the optimum numbers of pumps, chillers and cooling towers to operate based on the plant load (thermal energy rejected) or to prevent the flow through the running chillers to exceed their rated maximum (or fall below their minimum), or to exceed the power consumed by the running chillers to exceed their rated maximum, or to prevent the supply temperature to exceed the setpoint by a field adjustable offset.
- Available as an option, the plant automation system shall have the ability to run redundant equipment for improved efficiency (all Duty) or assign as standby equipment.

- For each chiller the plant automation system shall have an adjustable field to enter its capacity. The plant load (in Tons and %) is displayed on the touchscreen display and used to Stage On and Off the chillers, in conjunction with the other conditions explained in the previous paragraph.
- The plant automation system shall rotate the lead chiller, lead pump and lead cooling tower on field adjustable intervals of operating days. Should any chiller, VFD/pump or cooling tower fail, the plant automation system shall trigger the corresponding alarm and remove said equipment from the auto sequence and rotation. In place of the failed equipment, the next available chiller, pump or cooling tower shall be operated.
- The chilled water setpoint shall be determined by one of the three options: manual entry on the GUI, calculated based on the load, or provided by an external optimization module or the BAS.
- The plant automation system shall alert the operator if any of the return temperature sensors, supply temperature sensors or flow sensors failed, and maintain the number of chillers in operation (no stage on or off) until the alarm is cleared.
- Even if no chillers are running, as long as the plant automation system is enabled, one pump shall be operated to circulate water.
- The plant automation system shall be capable of interfacing with up to 6 chilled water isolation valves and up to 6 condenser water isolation valves. Digital outputs for opening and closing the valves, and digital inputs for open and close feedback.
- The plant automation system shall modulate the bypass valves to maintain the minimum chilled water flow and minimum entering condenser water temperature required by the operating chillers.
- The condenser pumps shall be sequenced with the chillers if they are variable speed and dedicated to the chillers, or constant speed.
- If variable speed, the condenser pump speed shall be capable of responding to load side demand with sensorless control within equipment upper and lower flow limits.
- If the condenser pumps are variable speed and headered to the chillers, the plant automation system shall determine the most energy efficient combination of operating condenser pumps by Parallel Sensorless™ sequencing with best efficiency point staging.
- The plant automation system shall determine the optimized cooling tower fan speed, within a field adjustable range, based on heat rejection load.
- The plant automation system shall include energy saving algorithms to optimize the operation of the condenser water pumps and cooling towers.
- Automatic operation mode: the plant automation system shall include each of the chillers, pumps and cooling towers that are set in automatic operation mode in the sequence and modulate these equipment automatically to meet the current cooling load with optimum operating efficiency.
- Manual operation mode (for commissioning): When any chillers, pumps or cooling towers is switched to the manual operation mode by the operator, the operation of such equipment shall continue at the same status when operation mode was switched to manual mode until further changes by the operator. The plant automation system shall exclude equipment in manual mode from the automatic operation or sequencing. When operation mode is switched back to auto, the automatic operation mode shall be resumed.

OPTIONAL FEATURES AND DIMENSIONS

CHILLER COMMUNICATION		DIMENSIONS AND WEIGHTS				
		LENGTH	HEIGHT	DEPTH	WEIGHT	ENCLOSURE
Interface	☐ Modbus RTU	72(1828) + max. 328 ft (max. 100 m)	60.00 (1524)	10.00 (254)	200 (91)	NEMA ☐ Type 12
Hardwired (Output 0-10V)	☐					
Hardwired (Output 4-20 mA)	☐					

Notes:
- Dimensions are approximate in inches (mm)
- Weights are approximate in lbs (kg)



OPTIONS

- ☐ OPTI-POINT™ (a self-learning plant optimization module to improve the persistence of plant operation, available as an annual service contract, Internet connection required)
- ☐ Export crating
- ☐ On-site start up by 1 trained Armstrong service provider.

BAS COMMUNICATION

- ☐ Not required
- ☐ Modbus RTU
- ☐ Modbus TCP
- ☐ BACnet™ MS/TP
- ☐ BACnet™ IP

PANEL APPROVAL

☐ UL (Standard) ☐ CSA ☐ CE

INSTRUMENTATION (FOR THE PUMP CONTROL)	TOTAL QUANTITY		FOR PRIMARY PUMP SPEED CONTROL		
	QTY OF ZONES	SENSORS PER ZONE	SENSORLESS	ZONE DP	ZONE RETURN TEMP
☐ Zone dP sensors			N/A	= qty of zones	N/A
☐ Zone return temperature sensors			N/A	N/A	= qty of zones

INSTRUMENTATION (FOR THE SYSTEM)	TOTAL QUANTITY
☐ Primary flow sensor	
☐ Primary supply and return temperature sensors	
☐ Chiller kW sensors*	
☐ Condenser temperature sensors	
☐ Condenser flow sensor	
☐ Outside air temperature & humidity sensor	

* Optional if each chiller already has an integrated kW reading

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