ARMSTRONG

SE-A10 | OPTIMIZER FOR AIR-COOLED CHILLER PLANT |
SUBMITTAL

File No: 90.7673
Date: DECEMBER 17, 2024
Supersedes: NEW
Date: NEW

Job: _____ Representative: _____

_____ Order no.: _____ Date: _____

Engineer: _____ Submitted by: _____ Date: _____

Contractor: _____ Approved by: _____ Date: _____

PLANT CONFIGURATION - HEADERED

AIR COOLED CHILLERS*				PRIMARY CHW PUMPS***		
QUANTITY	# GROUPS	QTY PER GROUP	CAPACITY (TONS) PER CHILLER	# PUMP GROUPS	# DUTY PUMP PER GROUP	STANDBY PUMPS**
☐ 1	☐ 1	1	Grp A: _____	1	1	☐ Yes (+1) ☐ No (0)
☐ 2	☐ 1	2	Grp A: _____	1	2	☐ Yes (+1) ☐ No (0)
	☐ 2	Grp A: 1 Grp B: 1	Grp A: _____ Grp B: _____	☐ 1	1	☐ Yes (+1) ☐ No (0)
				☐ 2	Grp A: 1 Grp B: 1	☐ Yes (+1) ☐ No (0) ☐ Yes (+1) ☐ No (0)
☐ 3	☐ 1	3	Grp A: _____	1	3	No
	☐ 2	Grp A: 2 Grp B: 1	Grp A: _____ Grp B: _____	☐ 1	3	
				☐ 2	Grp A: 2 Grp B: 1	
	☐ 3	Grp A: 1 Grp B: 1 Grp C: 1	Group A: _____ Group B: _____ Group C: _____	☐ 1	3	
				☐ 3	Grp A: 1 Grp B: 1 Grp C: 1	

NOTES:

* Only identical chillers can be grouped together; Group A, Group B & Group C operate singly

** Total number of pumps (i.e. Duty + Standby) ≤ 3

*** Only identical pumps can be grouped together; Pumps in Group A, Group B & Group C associate with chillers in Group A, Group B & Group C accordingly

PLANT CONFIGURATION - DEDICATED

AIR COOLED CHILLERS*					PRIMARY CHW PUMPS	
QUANTITY	CHILLERS TYPE	# GROUPS	CAPACITY (TONS) PER CHILLER	GROUPING OF CHILLERS	# DUTY PUMPS	PUMP TYPE
☐ 1	Identical	1	Chiller 1: _____	N/A	1	☐ Single ☐ dualArm** ☐ Tango** ☐ Twin***
☐ 2	Identical	☐ 1	Chiller 1: _____ Chiller 2: _____	N/A	2	☐ Single ☐ dualArm** ☐ Tango** ☐ Twin***
	Mixed	☐ 1		N/A		
		☐ 2		Chiller 1: ☐ Grp A ☐ Grp B ☐ Common Chiller 2: ☐ Grp A ☐ Grp B ☐ Common		
☐ 3	Identical	☐ 1	Chiller 1: _____ Chiller 2: _____ Chiller 3: _____	N/A	3	☐ Single ☐ dualArm** ☐ Tango** ☐ Twin***
	Mixed	☐ 1		N/A		
		☐ 2		Chiller 1: ☐ Grp A ☐ Grp B ☐ Grp C ☐ Common Chiller 2: ☐ Grp A ☐ Grp B ☐ Grp C ☐ Common		
		☐ 3		Chiller 3: ☐ Grp A ☐ Grp B ☐ Grp C ☐ Common		

NOTES:

* Groups A, B & C operate singly; Common always available to all Groups

** 1 dualArm or Tango = 2 rotating assemblies (considered Duty/Duty)

*** 1 Twin = 2 rotating assemblies (considered Duty/Standby)

STANDARD FUNCTIONALITY AND CONSTRUCTION

The Armstrong SE-A10 is a pre-programmed automation system designed for air-cooled variable primary chiller plant. It is supplied with all hardware, software and programming required to sequence and optimize the following equipment for better efficiency of the overall chiller plant:

- Up to three (3) air-cooled chillers
- Up to three (3) variable speed chilled water pumps in headered or dedicated configuration
- Associated isolation and by-pass valves

Standard construction

- Multi-colour 10" back-lit touchscreen (not to be directly exposed to sunlight)
- Internal circuit breaker protection
- NEMA 4/IP55 rated panel
- 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)
- Selectable on-screen languages: English, French, Korean, Portuguese, Simplified Chinese, Spanish and Traditional Chinese
- Automatic sequencing and alternation of chillers & pumps:
  - In headered configuration, automate up to 3 sizes/types of chillers and pumps
  - In dedicated configuration, automate up to 3 sizes/types of chillers and pumps
  - In both configurations, form up to 3 groups of each type of equipment and operate based on a scheduler
- Obtain system flow from flow meter or from Design Envelope pumps' sensorless reading
- Sensorless pump speed control of Design Envelope pumps (Single, dualArm, Tango or Twin) and Parallel Sensorless™ 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 efficiencies of plant and individual components
  - Dynamic overview of the hydronic circuit indicating piping configuration
  - Detailed view of each connected piece of equipment
  - Overview of 1 zone 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 SE-A controller and pump VFD's
- Performance management service available for annual subscription

Input/Output

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

  Digital inputs
  - Chilled water isolation valves open & close feedback

  Digital outputs
  - Open & close chilled water isolation valves
  - Chillers start/stop signal
  - Enable/disable Armstrong secondary loop controller (for secondary pumps enablement, where applicable)

  Analog inputs
  - One zone differential pressure or zone temperature signals (4-20mA)
  - Supply and return temperatures for chilled water (4-20mA)
  - Chilled water flow sensors (4-20mA)
  - Chilled water bypass valves position feedback (0-10VDC)
  - Chiller current/kW sensors (4-20mA)
  - Outside air temperature (4-20mA)

  Analog outputs
  - Chilled water and cooling tower bypass valves control (0-10VDC)
- Standard communication with pumps through serial Modbus protocol
- Optional communication port for interfacing with a BAS
- One terminal block for power supply 100-240 Vac/ 1 Ph/50-60 Hz

General sequence of operation

- All plant control system settings, including the number of chillers 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 control 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 at one zone at or above setpoint, while maintaining within equipment upper and lower flow limits and meeting system cooling load.
- The plant control system shall continuously monitor all zone signal. Use of a multiplexer for multiple sensor inputs is not acceptable.
- The plant control 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 system found all differential pressure/temperature sensors failure in the building, the pump speed will default to a pre-defined percentage of full speed (factory default loaded as 95% of full speed).
- The plant control 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.
- To meet ASHRAE 90.1 requirement, the plant control system shall obtain the position of the most open cooling valve from the BAS and maintain this valve position at 95% by a PID loop.
- The plant control system shall determine the optimum numbers of pumps and chillers 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.
- For each chiller the plant control system has an adjustable field to enter its capacity. The plant load (in Tons and %) is displayed on the touch screen display and used to Stage On and Off the chillers, in conjunction with the other conditions explained in the previous paragraph.
- The plant control system shall rotate the lead chiller and lead pump on field adjustable intervals of operating days. Should any chiller or VFD/pump fail, the plant control system will trigger the corresponding alarm and remove said equipment from the auto sequence and rotation. In place of the failed equipment, the next available chiller or pump 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 outdoor air temperature, or provided by an external optimization module or the BAS.
- The plant control 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 control system is enabled, one pump shall be operated to circulate water.
- The plant control system shall be capable of interfacing with up to 3 chilled water isolation valves. A digital output opens and closes the valves, and a digital input provides open/close feedback.
- The plant control system shall modulate the bypass valves to maintain the minimum chilled water flow required by the operating chillers.
- The plant control system shall be capable of operating up to 3 chillers of different sizes or types with the following conditions:
  - **A** If the chilled water pumps are in headered configuration, there can be 3 sizes or 3 types of chillers; up to 3 chiller groups can be formed with the condition that only identical chillers (i.e. make & model, size, minimum flow, etc.) can be grouped together.
  - **B** If the chilled water pumps are in dedicated configuration, there can be up to 3 sizes or 3 types of chillers; up to 3 chiller groups can be formed.
- In headered configuration, the plant control system shall allow up to 3 pump groups to be formed if there are 3 chiller groups available, with the condition that only identical pumps (i.e. same make & model, flow, head, etc.) shall be grouped together. Each pump group is associated with the corresponding chiller group, and only pumps in the active pump group is enabled and staged. 1 pump in each pump group shall be allowed as stand-by.
- To operate different sizes/types of chillers, the plant control system shall determine which group of chillers to operate based on either a digital input or a scheduler configurable via the GUI. Only chillers in the active chiller group, and its associated pumps, shall be enabled and staged.
- Automatic operation mode: the plant control system shall include each of the chillers and pumps 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.

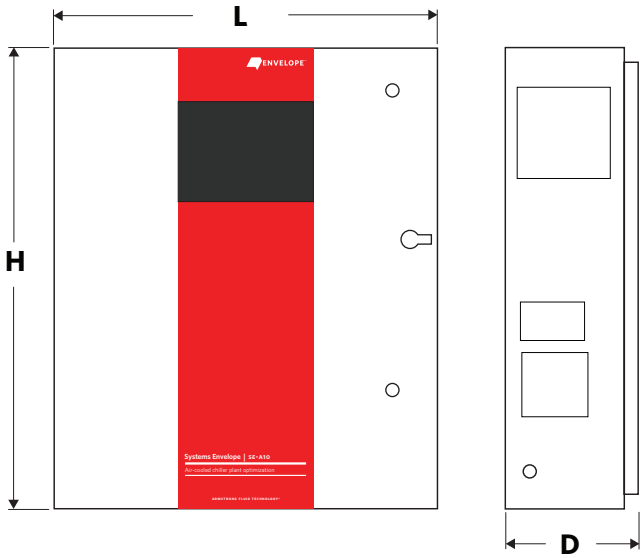
- Manual operation mode (for commissioning): When any chillers or pumps is switched to the manual operation mode by the operator, the operation of such equipment shall continue at the same status when operation mode was switched to manual mode until further changes by the operator. The plant control 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.
- The plant control system shall be capable of scheduling plant in and out of use at times and dates at the operator's discretion.

OPTIONAL FEATURES AND DIMENSIONS

CHILLER COMMUNICATION		DIMENSIONS AND WEIGHTS				
		LENGTH	HEIGHT	DEPTH	WEIGHT	ENCLOSURE
Interface	☐ Modbus RTU ☐ BACnet™	30.0 (762)	24.0 (610)	9.0 (229)	75 (34)	NEMA ☐ Type 4*
Hardwired (Output 0-10V)	☐					
Hardwired (Output 4-20 mA)	☐					

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

* NEMA 4X recommended for outdoor application. Comprises of a stainless steel panel enclosure and a transparent non-metallic hinged inspection window protecting the screen.



OPTIONS

- ☐ ECO*PULSE (performance management service available on a subscription basis, Internet connection required)
- ☐ Export crating
- ☐ On-site start up by 1 trained Armstrong service provider.

PANEL APPROVAL

☐ UL (Standard) ☐ CSA ☐ CE

BAS COMMUNICATION

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

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

INSTRUMENTATION (FOR THE SYSTEM)	TOTAL QUANTITY	RECOMMENDED
☐ Primary flow sensor*		1
☐ Primary supply and return temperature sensors		2
☐ Chiller kW sensors**		= qty of chillers
☐ Outside air temperature sensor		1

* Not required with Design Envelope pumps
** Optional if each chiller already has an integrated kW reading

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