CoolChip CDU070 (Liquid to Air)

Operation and Maintenance Guide

Original Instructions

The information contained in this document is subject to change without notice and may not be suitable for all applications. While every precaution has been taken to ensure the accuracy and completeness of this document, Vertiv assumes no responsibility and disclaims all liability for damages resulting from use of this information or for any errors or omissions.

Vertiv recommends installing a monitored fluid detection system that is wired to activate the automatic closure of field-installed coolant fluid supply and return shut off valves, where applicable, to reduce the amount of coolant fluid leakage and consequential equipment and building damage. Refer to local regulations and building codes relating to the application, installation, and operation of this product. The consulting engineer, installer, and/or end user is responsible for compliance with all applicable laws and regulations related to the application, installation, and operation of this product.

Technical Support Site

If you encounter any installation or operational issues with your product, check the pertinent section of this manual to see if the issue can be resolved by following outlined procedures.

Visit https://www.vertiv.com/en-us/support/ for additional assistance.

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1 Important Safety Instructions

Save These Instructions

This manual contains important instructions that should be followed during operation and maintenance of the Vertiv™ CoolChip CDU070 (Liquid to Air).

WARNING! Arc flash and electric shock hazard. Can cause serious injury or death. Building and equipment damage may also result. Disconnect all local and remote electric power supplies and wear appropriate, OSHA approved personal protective equipment (PPE) per NFPA 70E before working within the electric control enclosure. Customer must provide earth ground to unit, per NEC, CEC and local codes, as applicable.

Verify with a voltmeter that power is Off. The controller does not isolate power from the unit, even in the Unit Off mode. Some internal components still require and receive power even during the Unit Off mode of the controller. The factory supplied, optional disconnect switch is inside the unit. The line side of this switch contains live high voltage. The only way to ensure that there is NO voltage inside the unit is to install and open a remote disconnect switch.

Before proceeding with installation, read all instructions, verify that all the parts are included and check the nameplate to be sure the voltage matches available utility power. Follow all local codes.

WARNING! Risk of electric shock. Can cause serious injury or death. Building and equipment damage may also result. Open all local and remote electric power supply disconnect switches and verify that power is off with a voltmeter before working within any electric connection enclosures. The controller does not isolate power from the unit, even in the Unit Off mode. Some internal components require and receive power even during the unit off mode of the controller.

Operation, installation, service, and maintenance work must be performed only by properly trained and qualified personnel and in accordance with applicable regulations and manufacturers specifications. Children must be supervised to ensure they do not play with this product. Opening or removing the covers to any equipment may expose personnel to lethal voltages within the unit even when it is apparently not operating and the input wiring is disconnected from the electrical source.

WARNING! Risk of short circuits and electric shock. Can cause serious injury or death. Building and equipment damage can result from cut insulation or damaged wires. Can cause overheated wiring, smoke, fire, activation of fire suppression systems and EMS personnel, and loss of power to fans. Verify that all wiring connections are tight and that all wiring is contained within the junction box prior to closing and securing the cover.

WARNING! Risk of improper wire sizing/rating and loose electrical connections causing overheated wire and electrical connection terminals resulting in smoke or fire. Can cause serious injury or death. Building and equipment damage may also result. Use correctly sized copper wire only. It is recommended that the power cord for 110 to 120 V is 12 AWG or at least type 60245 IEC 53 or 57, 4 mm² and the power cord for 208 to 240 V is 14 AWG or at least type 60245 IEC 53 or 57, 2.5 mm². Verify that all electrical connections are tight before turning power On. Check all electrical connections periodically and tighten as necessary.

WARNING! Risk of improper wiring, piping, moving, lifting and handling. Can cause serious injury or death. Building and equipment damage may also result. Installation and service of this equipment should be done only by qualified personnel who have been specially trained in the installation of air conditioning equipment and who are wearing appropriate, OSHA approved PPE.

WARNING! Risk of improper moving. Can cause serious injury or death. Building and equipment damage may also result. Use only lifting equipment that is rated for the unit weight by an OSHA certified rating organization. The center of gravity varies depending on the unit size and selected options. The slings must be equally spaced on either side of the center of gravity indicator. Shipping weights and unit weights are specified in SL-80017 Vertiv CoolChip CDU070 Installation and Commissioning Guide. Use the center of gravity indicators on the unit to determine the position of the slings.

WARNING! Risk of top heavy unit falling over when improperly lifted or moved. Can cause serious injury or death. Building and equipment damage may also result. Read all of the following instructions and verify that all lifting and moving equipment is rated for the weight of the unit before attempting to move, lift, remove packaging from or prepare the unit for installation. Unit weights are specified in SL-80017 Vertiv CoolChip CDU070 Installation and Commissioning Guide.

WARNING! Risk of unsecured unit rolling off pallet. Can cause serious injury or death. Building and equipment damage may also result. The unit is on casters. Ensure that the unit and pallet are located on a flat surface before loosening the hardware securing the unit to its shipping pallet.

CAUTION: Risk of contact with extremely hot or cold surfaces. Can cause injury. Verify that all components have reached a temperature that is safe for human contact or wear appropriate, OSHA approved PPE before working with the electric connection enclosures or unit cabinet. Perform maintenance only when the system is de-energized and component temperatures have become safe for human contact.

CAUTION: Risk of contact with sharp edges, splinters and exposed fasteners. Can cause injury. Only properly trained and qualified personnel wearing appropriate, OSHA approved PPE should attempt to move, lift, remove packaging from or prepare the unit for installation.

CAUTION: Risk of improper handling heavy and lengthy parts. Can cause injury. Building and equipment damage may also result. Cabinet panels can exceed 1.5 m (5 ft.) in length and weigh more than 15.9 kg (35 lb). Follow relevant OSHA lifting recommendations and consider using a two person lift for safe and comfortable removal and installation of cabinet panels. Only properly trained and qualified personnel wearing appropriate, OSHA approved PPE should attempt to remove or install cabinet panels.

CAUTION: Risk of improper piping installation, leak checking, fluid chemistry and fluid maintenance. Can cause injury. Building and equipment damage may also result. Installation and service of this equipment should be done only by qualified personnel who have been specially trained in the installation of air conditioning equipment and who are wearing appropriate, OSHA approved PPE.

NOTICE

Risk of piping system corrosion and freezing fluids. Can cause leaks resulting in equipment and very expensive building damage. Heat exchangers and piping systems are at high risk of freezing and premature piping corrosion. Fluids in these systems must contain the proper antifreeze and inhibitors to prevent freezing and premature piping corrosion. When the cooling unit or piping may be exposed to freezing temperatures, charge the system with coolant fluid based on the coldest ambient design temperature. Automotive antifreeze is unacceptable and must NOT be used in any fluid system. Use only coolant fluid solution that meets the requirements of recommended industry practices. Do not use galvanized pipe.

The system coolant fluid must be analyzed by a competent fluid treatment specialist before start up to establish the inhibitor and antifreeze solution requirement and evaluated at regularly scheduled intervals throughout the life of the system to determine the pattern of inhibitor depletion.

The fluid complexity and variants of required treatment programs make it extremely important to obtain the advice of a competent and experienced fluid treatment specialist and follow a regularly scheduled coolant fluid system maintenance program.

Fluid chemistry varies greatly as do the required additives, called inhibitors, that reduce the corrosive effect of the fluids on the piping systems and components.

The chemistry of the coolant fluid used must be considered, because some sources may contain corrosive elements that reduce the effectiveness of the inhibited formulation. Sediment deposits prevent the formation of a protective oxide layer on the inside of the coolant system components and piping. The coolant fluid must be treated and circulating through the system continuously to prevent the buildup of deposits and/or growth of sulfate reducing bacteria. Proper inhibitor maintenance must be performed to prevent corrosion of the system.

Consult fluid manufacturer for testing and maintenance of inhibitors.

Commercial grade coolant fluid is generally less corrosive to the common metals of construction than water itself. It will, however, assume the corrosivity of the coolant fluid from which it is prepared and may become increasingly corrosive with use if not properly inhibited.

Vertiv recommends installing a monitored fluid detection system that is wired to activate the automatic closure of field installed coolant fluid supply and return shut off valves to reduce the amount of coolant fluid leakage and consequential equipment and building damage. The shut off valves must be sized to close off against the maximum coolant fluid system pressure in case of a catastrophic fluid leak.

NOTICE

Risk of no flow condition. Can cause equipment damage. Do not leave the water/coolant fluid supply circuit in a no flow condition. Idle fluid allows the collection of sediment that prevents the formation of a protective oxide layer on the inside of the tubes. Keep unit switched On and water/ coolant fluid supply circuit system operating continuously.

NOTICE

Risk of leaking coolant fluid lines. Can cause equipment and building damage.
Lines and joints must be inspected regularly. Improper installation, application and service practices can result in water leakage from the unit. Water leakage can result in severe property damage and loss of critical data center equipment. Do not locate unit directly above any equipment that could sustain water damage.

Vertiv recommends installing monitored leak detection equipment for the unit and supply and return lines.

NOTICE

Risk of a catastrophic water circuit rupture. Can cause expensive building and equipment damage.

Install an overflow drain pan under the unit with a monitored leak detection system in the pan and shut off valves in the supply and return water lines that automatically close if water is detected by the leak detection system. The shut off valves should be spring return and must be rated for a close off pressure that is the same as or higher than the supply water pressure. If it is not possible to install an overflow drain pan, then a monitored leak detection system should be installed in the base of the unit or under the unit to actuate the shut off valves immediately on a leak detection signal.

The overflow drain pan should have a drain line connected to it that flows to a floor drain or maintenance sink in case of a shut off valve or leak detection system malfunction.

NOTICE

Risk of improper storage. Can cause unit damage. Keep the unit upright, indoors and protected from dampness, freezing temperatures and contact damage.

NOTICE

Risk of improper control circuits. Can cause equipment damage.

When using jumpers for troubleshooting, always remove jumpers when maintenance is complete. Jumpers left connected could override controls and cause equipment damage.

1.1 General

Mechanical and electrical equipment such as Coolant Distribution Units (CDUs) present potential mechanical and electrical hazards. All safety, installation, operation, and maintenance instructions must be adhered to. Any work on or use of the equipment must only be carried out by technically competent personnel who are fully trained. This product is designed to minimize all potential hazards by restricting access through unit casings, doors and covers while equipment is operational. Before carrying out maintenance work, ensure that:

1. Equipment is switched OFF.
2. Equipment and controls are disconnected from the electrical supply.
3. All rotating parts such as pumps and three-way valves have come to rest.

If there is a doubt concerning safety, installation, operation, or maintenance instructions, consult Vertiv representative for clarification and advice. See Appendices on page 67 .

1.2 Installation and Handling

Installation and operation must be conducted in accordance with local and national regulations and normal codes of good practice. When moving or lifting the product, caution must be observed to ensure the safety of personnel. Use only appropriate lifting equipment.

WARNING! This product is supplied with a 1.5 bar (21.7 psi) nitrogen holding charge in the fluid circuit. The nitrogen needs to be vented during the installation process. See SL-80017 Vertiv CoolChip CDU070 Installation and Commissioning Guide for more information.

1.3 Application

This product is to be used indoors only and must be only used for the application it was designed for. This product must not be used in a hazardous environment.

1.4 Warranty

Failure to comply with the Vertiv installation, maintenance and operation instructions may affect the reliability and performance of the unit and invalidate any warranty.

1.5 Electrical Connection

WARNING! This unit is powered by high voltage. Serious injury or death can occur. Power supplied to this product must be provided with an external means of isolation.

Electrical connections must be carried out in accordance with local and national regulations by a qualified electrician. Never make any electrical connections inside the unit or to the unit unless the electricity supply has been switched OFF at the disconnect (isolator).

1.6 Replacement Parts

Any parts replaced during maintenance or servicing must be the same specification as those being replaced and should only be obtained from Vertiv. The use of incorrect replacement parts may affect the operation or reliability of the unit and invalidate any warranty.

1.7 Waste Disposal

Any waste or single use materials must be disposed of in a responsible manner and in strict adherence to local and national environmental regulations. For details, consult local environmental agencies.

1.8 Documentation

Operation and maintenance, maintenance, and installation and commissioning documentation as well as maintenance and service records must always remain with the unit.

2 Agency

2.1 Product Standards and Approvals

Vertiv products installed and operated in compliance with this document, the operation and maintenance guide and installation and commissioning guide conform to the Machinery Directive 2006/42/EC and the EMC directive 2014/30/EU. As manufactured, Vertiv products are designed to comply with an IP20 rating. This product is in compliance with UL 60335.

2.2 RoHS Compliance

Vertiv certifies that this product, manufactured and supplied by Vertiv, is fully RoHS compliant in accordance with EU RoHS Directive 2011/65/EU and revised directive (EU) 2015/863.

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3 Product Description

3.1 General

This document describes the physical and electrical characteristics of the Vertiv™ CoolChip CDU070 (hereinafter referred to as the CoolChip CDU070 or the unit) for operation and maintenance purposes.

The CoolChip CDU070 contains a secondary closed loop circuit that provides a supply of cooling fluid to IT equipment for direct cooling (cold plates at chip level).

The fluid circuit is a low pressure sealed system with the heat removed from the high heat density areas of IT equipment rejected to ambient air via a low pressure drop cooling coil heat exchanger, arranged in a V-format with fan assistance provided by seven axial fans.

The fluid circuit ensures that the cooling fluid in a data center environment can be kept to a minimum volume, is closely controlled for flow, pressure and temperature and can be accurately maintained for fluid quality (with included filtration).

The primary cooling source will be the ambient air of the data center and final heat transfer will depend on the air temperature and flow rate.

3.2 Features and Benefits

- The nominal operating conditions are as follows: fluid outlet temperature is 42 °C (107.6 °F), ambient air temperature is 27 °C (80.6 °F), and the temperature difference between the coolant leaving the unit and the return air entering the coil heat exchanger (ATD, approach temperature difference) is 59°F (15°C)
- Maximum secondary fluid flow rate: 120 l/m (32 gpm)
- 60 kW to 100 kW capacity dependent on ambient operating conditions (approach temperature difference), fan speed, and fluid type
- 1.5 inch hygienic outlet and inlet connections, compatible with PG-25 or water working fluid
- Expansion tank and integrated air vents within fluid circuit
- Approved wetted materials for direct to chip applications
- Fan redundancy (N+1), pump redundancy and field replaceable
- Designed to ASHRAE Liquid Cooling Class W4
- Designed to ASHRAE Air Cooling Class A2 upper limits
- Integrated 50 micron filters (with hot swap function)
- Max airflow approaching 11,100 CMH (6,533 CFM)
- Top and bottom fluid connection, 10 liter stainless steel fluid reservoir and integrated fill pump
- Ability to implement liquid cooling solutions without the need for a primary water supply or other related infrastructure
- Easy installation, maintenance, and retrofit of pipework parts
- Small footprint: 2300 mm x 600 mm x 1200 mm (91 in. x 24 in. x 48 in.)
- Black textured finish to blend in with computer room environment
- International service team to provide professional and all in one services from installation to maintenance and troubleshooting

3.3 Vertiv™ CoolChip CDU070 Model Number Nomenclature

Table 3.1 CoolChip CDU070 Model Number Base Digit Definitions

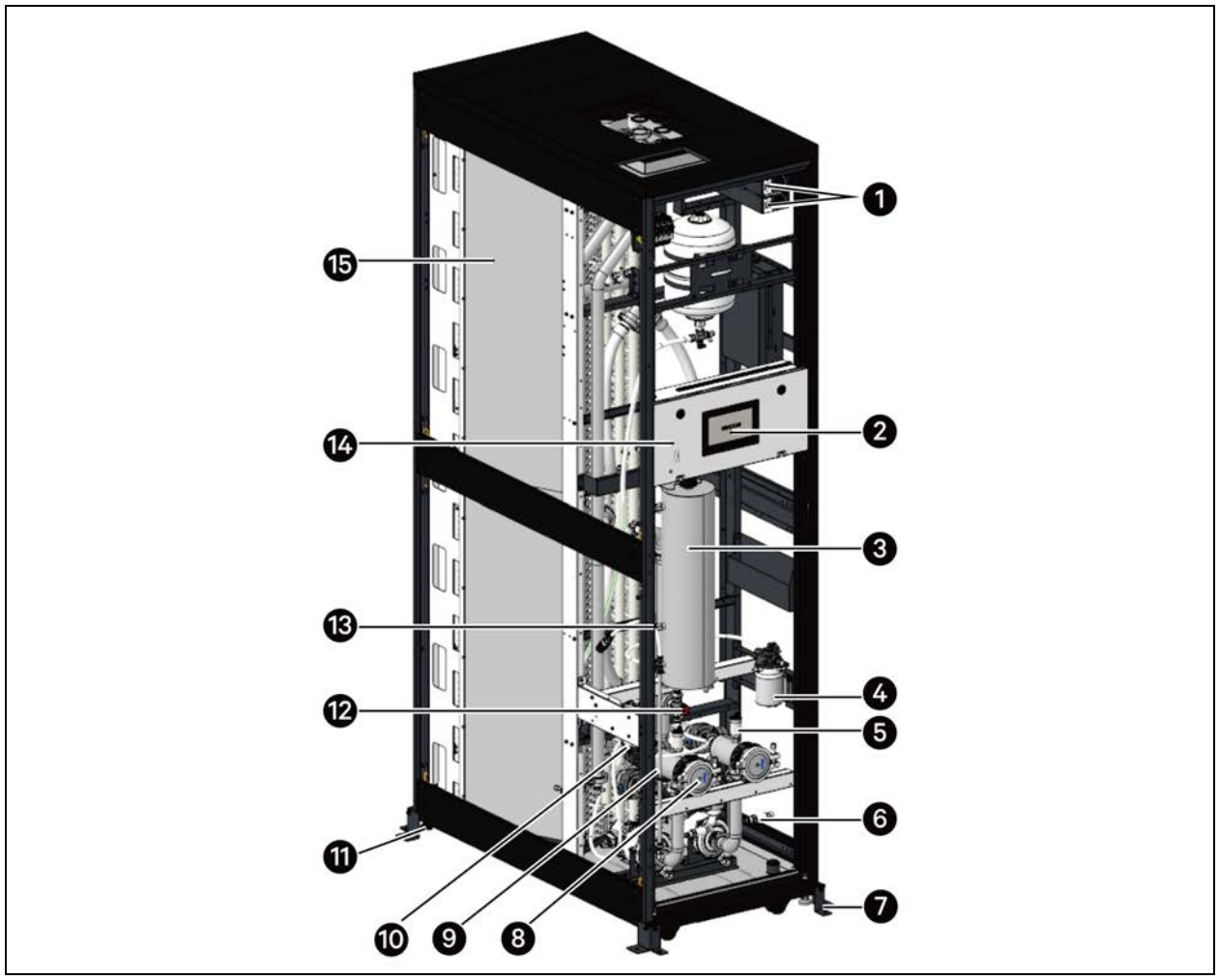
Digit	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Model #	X	D	U	0	7	0	A	B	Q	4	A	0	1	0	0

Table 3.2 CoolChip CDU070 Nomenclature Detail

Digit	Feature	Value	Description
1 to 3	Family name	XDU	Product family
4 to 6	Unit model	070	Base model
7	Cooling type	A	Liquid to air
8	Unit revision	B	Revision B
9	Voltage	Q	110 - 120 V, 208 - 240 V, 1 PH, 50/60 Hz
10	Pressure relief valve	3	3 bar pressure relief valve
		4	4 bar pressure relief valve
11	Controller	A	Standard controller
12	Connection	0	1 1/2" sanitary flange
13	Secondary filtration	1	Fitted (50 µ)
		2	Fitted (25 µ)
14	Place holder	0	Place holder
15	Configuration	0	Standard configuration
		S	Special feature authorization

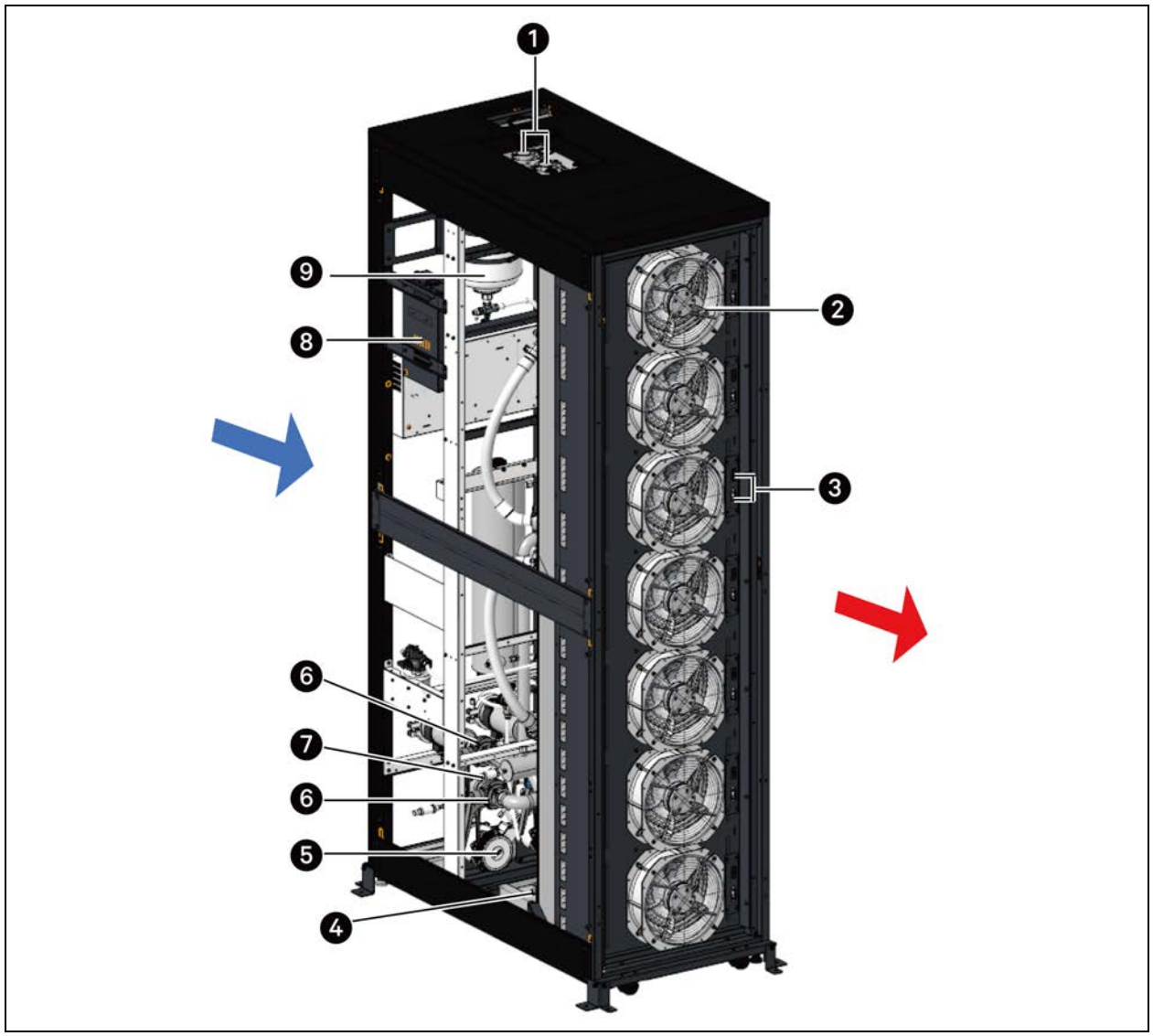
3.4 Product Views

Figure 3.1 Front View of Vertiv™ CoolChip CDU070 (Doors and Side Panels Removed)



Item	Description	Item	Description
1	Redundant 48 VDC power supply (A and B)	9	Fill wand
2	Touchscreen display	10	Fill pump P3 (System)
3	Reservoir tank (10 liters/2.6 gal)	11	Wheels and adjustable feet
4	Fill pump P4 (reservoir tank)	12	Pressure relief valve 4 bar (58 psi)
5	Automatic air vents on filter	13	Level sensors (three sensors in reservoir tank) (two sensors in pipework)
6	Pressure sensors (quantity is seven)	14	Control panel
7	Tie down bracket (front and back)	15	Cooling coil
8	Secondary fluid circuit filters 50 micron		

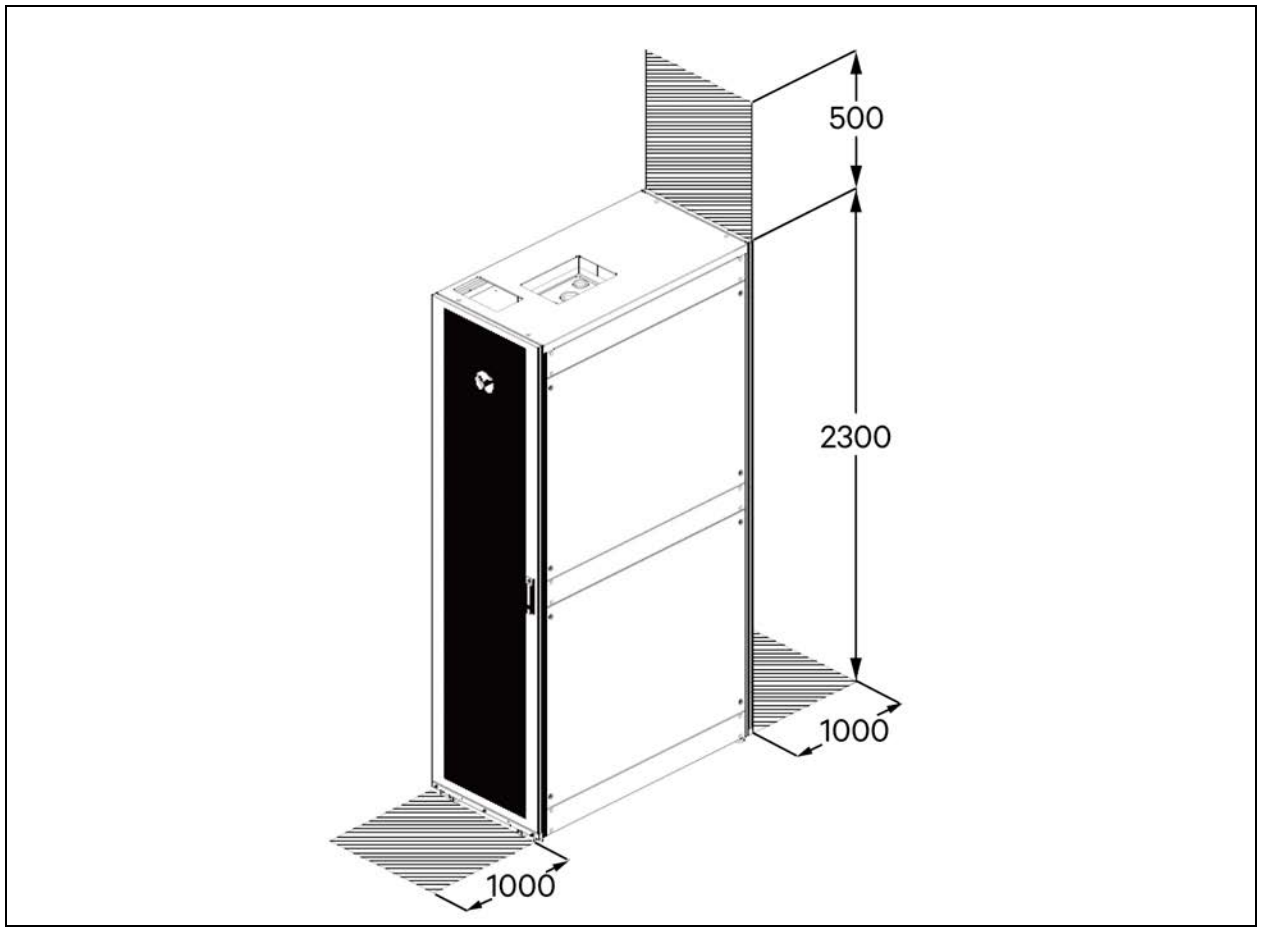
Figure 3.2 Rear View of Vertiv™ CoolChip CDU070 (Doors and Side Panels Removed)



NOTE: The blue arrow indicates the cold air inlet side, and the red arrow indicates the hot air outlet side.

Item	Description	Item	Description
1	Automatic air vents (on coil headers)	6	Filter/pump isolation valves
2	Axial fans 48 VDC (quantity is seven)	7	Pressure sensor
3	Fan fuse and connector	8	Access panel to 48 VDC distribution busbar and fuses
4	Dip tray with float switch	9	Expansion vessel
5	Secondary fluid circuit pumps P1 and P2 (with built in speed control)		

Figure 3.3 Maintenance Space (Unit: mm)



NOTE: To allow proper operation and maintenance of the unit, reserve a certain free space without any obstacles/ obstructions around the unit. Leave 1000 mm (39.4 in) at the front and rear of the unit and 500 mm (19.7 in) at the top of the unit.

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4 Operation

4.1 Controller Overview

The Vertiv™ CoolChip CDU070 controller is designed to monitor and control the supply of cooling fluid to IT equipment in unattended data center environments. Circuit cooling fluid is closely controlled to a defined temperature and at a controlled differential pressure (or flow rate), for optimum heat management.

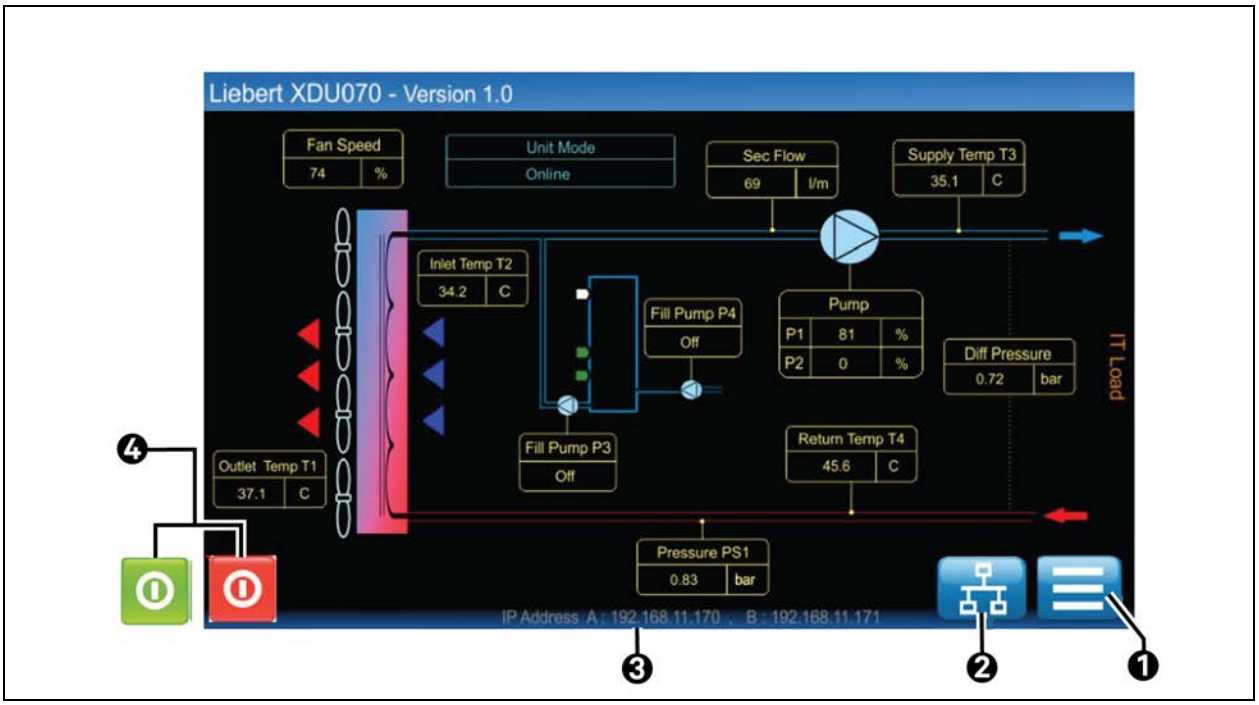
When power is first applied to the unit, the touchscreen illuminates. After a short initialization period during which the company logo is presented, the display defaults to the Home screen, as shown in Figure 4.1 below .

4.2 User Interface

4.2.1 Home Screen

The Home screen displays a schematic representation of the CoolChip CDU070, showing essential temperatures, pressures, flows etc. for both fluid and air path circuits. The product code identification, IP addresses, installed software version, and date/time are also shown.

Figure 4.1 Control Home Screen



Item	Description	Item	Description
1	Menu icon	3	IP address information (tap text to open ethernet and IP communication status screen)
2	CANbus group control status (visible when CANbus communication is configured)	4	Start/stop icon - Changes to green when unit is running

Pressing the Menu icon in the bottom left corner displays the Main menu screen.

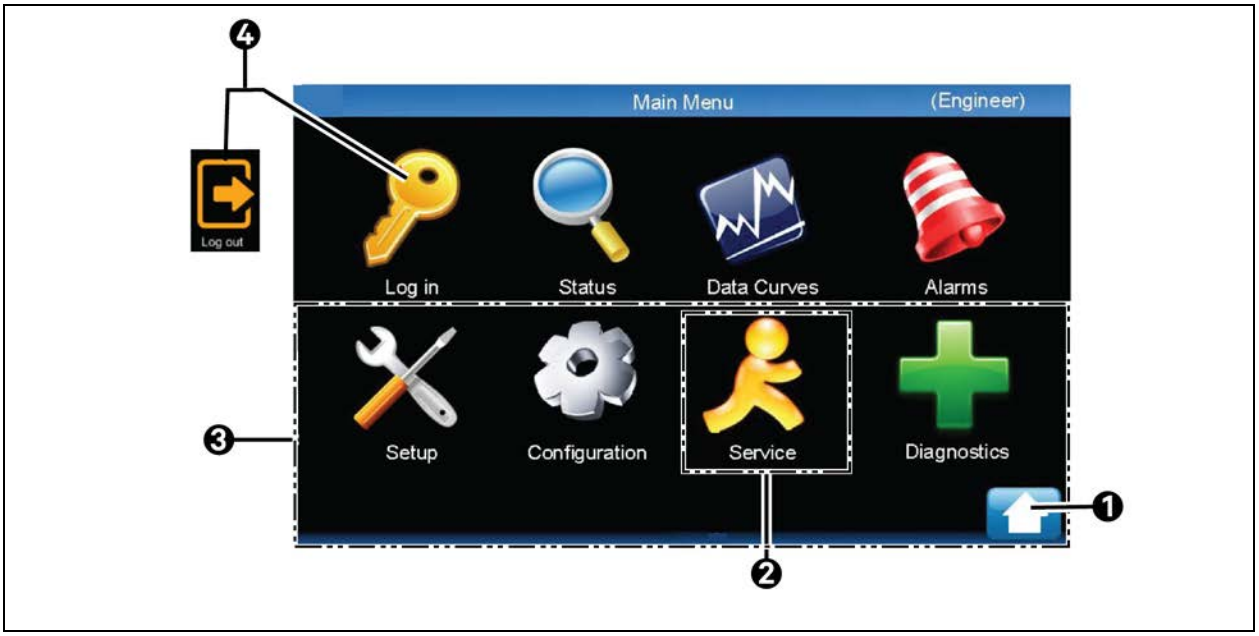
4.2.2 Main Menu

The main Menu screen displays submenu for an increased level of information and access to certain parameters.

NOTE: Some control system menus may not be visible if the user is not logged in. Visibility also depends on the login access level.

The touchscreen display is intuitive and users can easily navigate through the menus. The following explanations are provided for additional information or as a reference for when user is not in front of the unit.

Figure 4.2 Main Menu

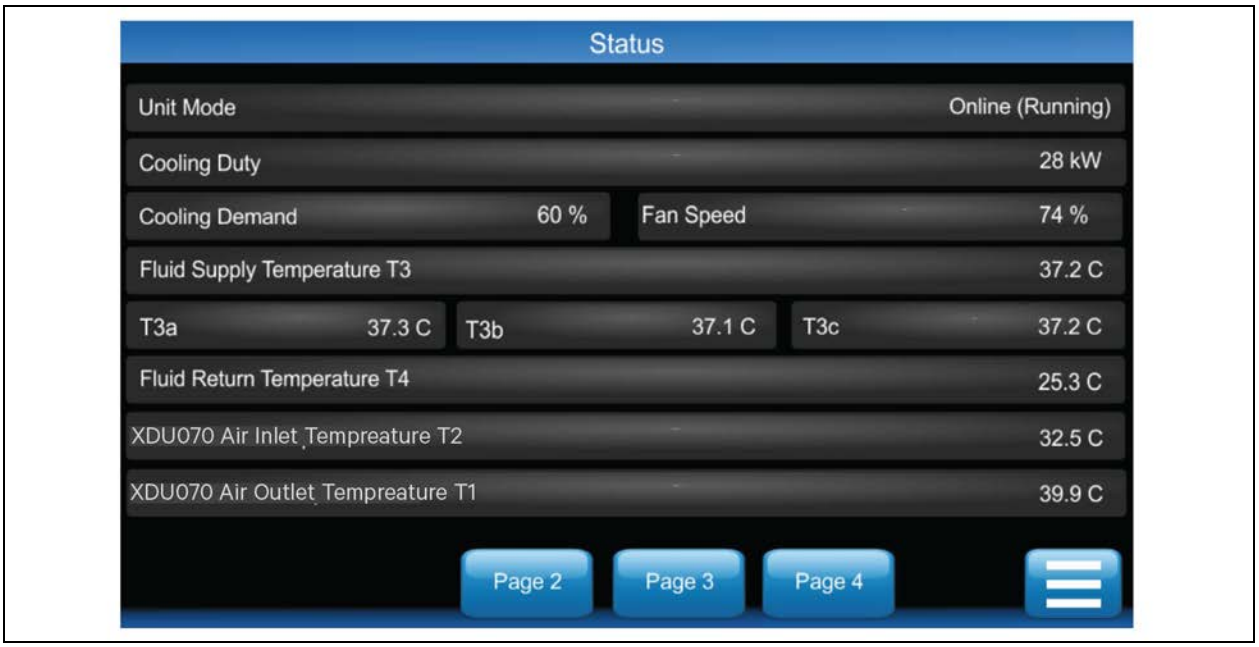


Item	Description	Item	Description
1	Return to the home screen	3	All the icons are visible only when logged in
2	It is visible only when logged in at service or engineer level	4	Login/logout

4.2.3 Status Screen

The Status screen displays comprehensive information on the operating condition of the Vertiv™ CoolChip CDU070 unit.

Figure 4.3 Control System Status Screen



There are four information pages within the Status screen.

Table 4.1 Status Screen Page 1

Item	Value
Unit Mode	• Standby • Online (Running) • Fault • Shutdown
Cooling Duty	___ kW
Cooling Demand	___ %
Fan Spped	___ %
Fluid SupplyTemperature T3	___ °C
T3a	___ °C
T3b	___ °C
T3c	___ °C
Fluid Return Temperature T4	___ °C
Air Inlet Temperature T2	___ °C
Air Outlet Temperature T1	___ °C

Table 4.2 Status Screen Page 2

Item	Value
Pump 1 Speed	___%
Pump 2 Speed	___%
Fluid Flow Rate	___ l/m (___gpm)
Fluid Return Pressure PS1	___bar (___psi)
PS1a	___bar (___psi)
PS1b	___bar (___psi)
Fluid Supply Pressure PS2	___bar (___psi)
PS2a	___bar (___psi)
PS2b	___bar (___psi)
Unit Differential Pressure (PS2-PS1)	___bar (___psi)
Pump Inlet Header Pressure PS4	___bar (___psi)
Filter 1 Outlet Pressure PS3a	___bar (___psi)
Filter 2 Outlet Pressure PS3b	___bar (___psi)
Filter 1 DP(PS4-PS3a)	___bar (___psi)
Filter 2 DP(PS4-PS3b)	___bar (___psi)

Table 4.3 Status Screen Page 3

Item	Value
Pump 1 Hours Run	___ hrs
Pump 2 Hours Run	___ hrs
Fan Runtime 0 to 25%	___ hrs
Fan Runtime 26 to 50%	___ hrs
Fan Runtime 51 to 75%	___ hrs
Fan Runtime 76 to 100%	___ hrs
Elapsed Minutes	___ mins
Controller Firmware Version	____
Unit Serial Number	CTCNxxxx
Controller Hardware Revision	____

Table 4.4 Status Screen Page 4

Item	Value
Pump 1 Comms Status	___
Pump 2 Comms Status	___
Pump 1 Mode	___
Pump 2 Mode	___

Table 4.4 Status Screen Page 4 (continued)

Item	Value
Pump 1 Speed	___ rpm
Pump 2 Speed	___ rpm
Pump 1 Voltage	___ V
Pump 2 Voltage	___ V
Pump 1 Current	___ A
Pump 2 Current	___ A
Pump 1 Temperature	___°C (___°F)
Pump 2 Temperature	___°C (___°F)
Drive 1 Temperature	___°C (___°F)
Drive 2 Temperature	___°C (___°F)

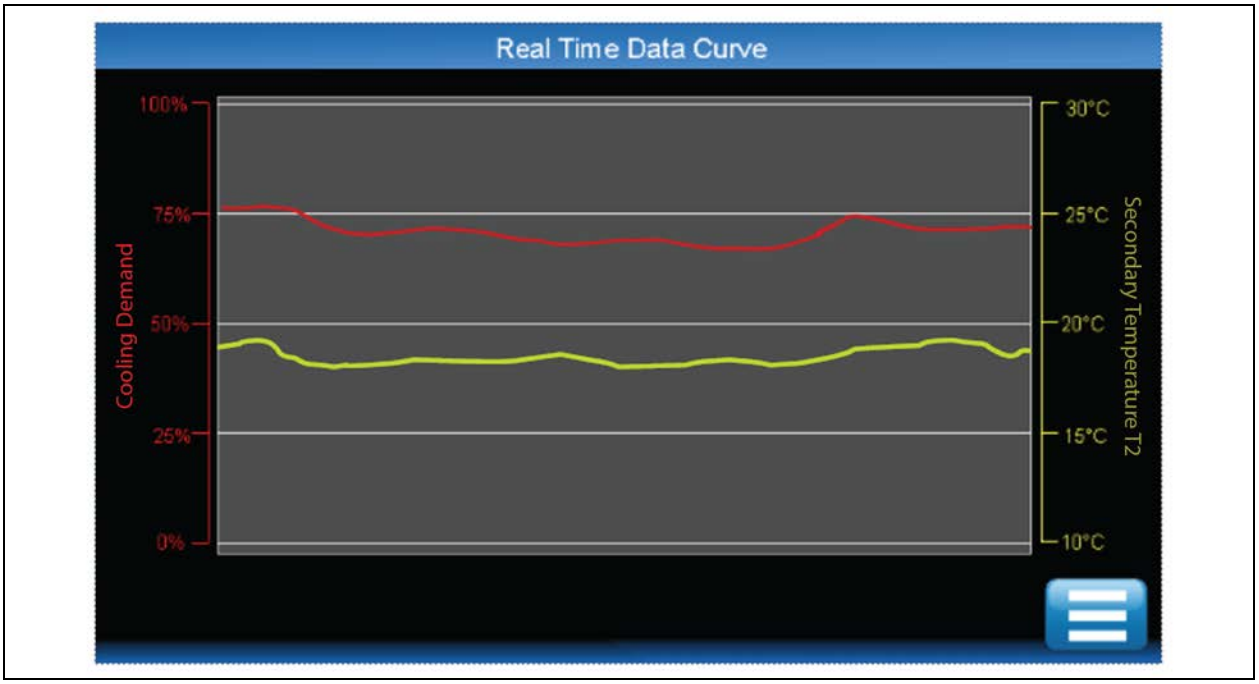
4.2.4 Data Curves

The Real Time Data Curves screen displays a graphical representation of two pieces of variable data:

- A red trace for cooling (fan speed) demand
- A yellow trace for fluid supply temperature T3

Each of these data update in real time. Time span of display is 3 minutes.

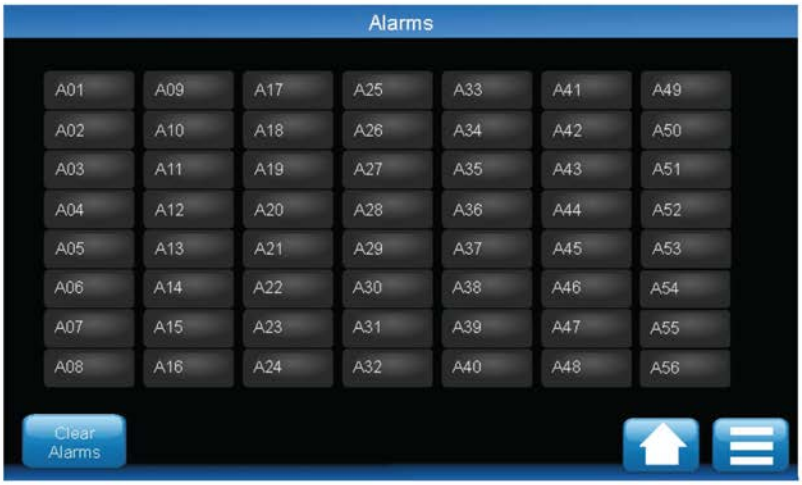
Figure 4.4 Data Curves Screen



4.2.5 Alarms Screen

The Alarms screen can be used to view new or active alarms and to acknowledge these events. Refer to Troubleshooting Alarms on page 45 for a full list of alarms and further information.

Figure 4.5 Alarms Screen

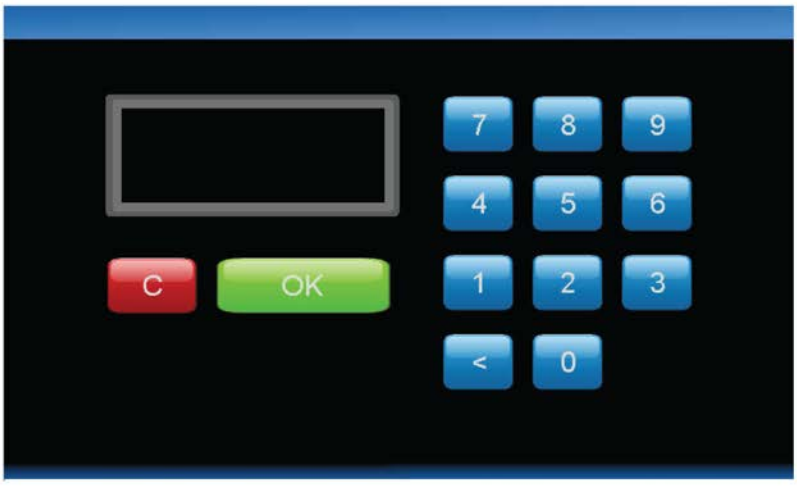


4.2.6 Login Screen

There are 4 levels of access, listed below:

- **No access code (User Level 1)** provides access to the Login, Status, Data Curves and Alarm pages.
- **Code 1234 (User Level 2)** provides read only access to the Setup, Configuration and Diagnostics menus.
- **Code xxxx (Service Level)** provides full read only access to everything and write access to select configuration and service features.

Figure 4.6 Login Screen



NOTE: The engineer login code is available from Vertiv Support.

Entering an invalid code results in an **Access Denied** message.

After you log in, the Logout icon replaces the Login icon on the Main Menu screen.

4.2.7 Setup Screen

NOTE: The Setup screen is only visible after login.

Normally, you will not require access to the Setup Screen. Items within this screen are either set at the factory or during commissioning. However, adjustments need to be made after site upgrades. Each option in the Setup screen is defined in from Table 4.5 below to Table 4.14 on page 24 .

NOTE: Information under Factory Configuration can be viewed with the service and engineer access codes. However, another code is required to make changes that is available on request from Vertiv.

Figure 4.7 Setup Screen

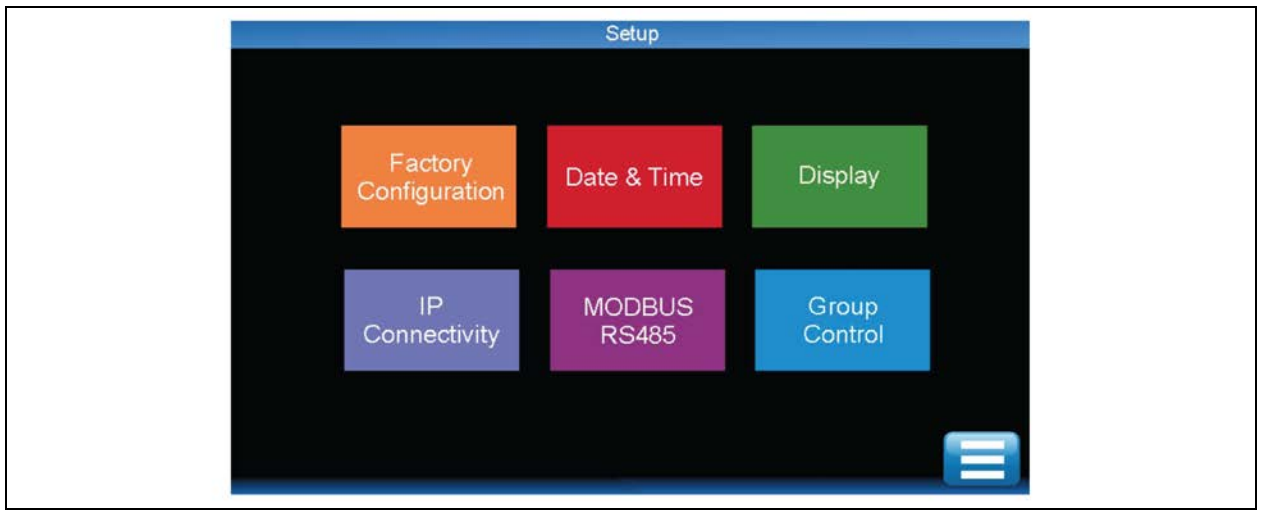


Table 4.5 Setup Screen - Factory Configuration

ID	Title	Description	Range
P001	Fan Model	Select fan type fitted (0 = EBM, 1 = Belong)	0 or 1
P002	Fan Feedback Multiplex Reversal	0 = no, 1 = yes	0 or 1

After tapping Update and entering the password 9756, the Pump Addressing button will appear. Tap this button to enter a new interface, where three types of information will be displayed: the communication status of pump 1 and pump 2 drivers, the effective response frame count, and the communication timeout count. Additionally, there is a Change Address button. Tapping this will open a pop-up window with the following warning:

!!WARNING!!

Ensure only 1 pump is powered and communicating

The pop-up window offers three options: Cancel, Change 1 to 2, and Change 2 to 1.

Before changing the communication address of the water pump, you need to unplug the power terminal of the other water pump; otherwise, an error will occur.

Table 4.6 Setup Screen - Date and Time

ID	Title	Description	Default	Range	Unit
	Date	Adjust date	—	dd/mm/yyyy	—
P021	Date Format	Select preferred format	dd/mm/yyyy	dd/mm/yyyy mm/dd/yyyy yyyy/mm/dd	—
	Time	Adjust time (24-hour clock)	—	hh:mm:ss	—
P022	Daylight Saving	Select the required daylight saving scheme	None	None Europe/UK N. America	—
P023	NTP Synchronization	Select if NTP synchronization is required or not.	Disabled	Disable Enable	—
P024	NTP Server IP Address	IP address of the NTP Server	0.0.0.0	Configurable	—
P025	Time Zone Offset	Select according to location	0.0	-12 to +12	hrs.
P026	NTP Sync Interval	Interval between NTP synchronizations	23	1 to 168	hrs.

Table 4.7 Setup Screen - Display

ID	Title	Description	Default	Range	Unit
P030	Screen Saver / Logout Period	Elapsed time before screen saver launches or display auto logs out	30	0 to 60	mins.
P031	Backlight Period	Elapsed time before screen dims	10	1 to 60	mins.
P032	Temperature Units	Select required temperature display units	°C	°C, °F	—
P033	Pressure Units	Select required pressure display units	bar	bar, psi	—
P034	Flow Rate Units	Select required flow rate display units	l/m	l/m, g/m	—

Table 4.8 Setup Screen - IP Connectivity

ID	Title	Description	Default	Range	Unit
P040	Interface A Enabled	Set to active or not (see below for submenu details)	Enabled	Enabled Disabled	—
P041	Interface B Enabled	Set to active or not (see below for submenu details)	Enabled	Enabled Disabled	—

Table 4.9 Setup Screen - IPv4 Connectivity (Interface A) Submenu

ID	Title	Description	Default	Range	Unit
P050	MAC Address	View MAC address	_ _:_ _:_ _:_ _:_ _:_ _	Read only	—
P051	IPv4	—	Enabled	Enabled Disabled	—
P052	DHCPv4	Select as required	Disabled	Enabled Disabled	—
P053	Static IPv4 Address	Set IP Address	192.168.11.170	Configurable	—
P054	Subnet Mask	Set subnet Mask	255.255.255.0	Configurable	—
P056	Default Gateway	Set gateway address	0.0.0.0	Configurable	—
P057	Preferred DNS Server	Set DNS address	0.0.0.0	Configurable	—
P058	Alternative DNS Server	Set DNS address	0.0.0.0	Configurable	—

Table 4.10 Setup Screen - IPv6 Connectivity (Interface A) Submenu

ID	Title	Description	Default	Range	Unit
P1201	IPv6	—	Disabled	—	—
P1202	SLAAC	Select as required	Disabled	Enabled Disabled	—
P1203	DHCPv6	Select as required	Disabled	Enabled Disabled	—

Table 4.11 Setup - IP Connectivity (Interface B) Submenu

ID	Title	Description	Default	Range	Unit
P060	MAC Address	View MAC address	_ _:_ _:_ _:_ _:_ _:_ _	Read only	—
P061	IPv4	—	Enabled	Enabled Disabled	—
P062	DHCPv4	Select as required	Disabled	Enabled Disabled	—
P063	Static IPv4 Address	Set IP address	192.168.11.171	Configurable	—
P064	Subnet Mask	Set subnet mask	255.255.255.0	Configurable	—
P065	Default Gateway	Set gateway address	0.0.0.0	Configurable	—
P066	Preferred DNS Server	Set DNS address	0.0.0.0	Configurable	—
P067	Alternative DNS Server	Set DNS address	0.0.0.0	Configurable	—

Table 4.12 Setup Screen - IPv6 Connectivity (Interface B) Submenu

ID	Title	Description	Default	Range	Unit
P1211	IPv6	—	Disabled	—	—
P1212	SLAAC	Select as required	Disabled	Enabled Disabled	—
P1213	DHCPv6	Select as required	Disabled	Enabled Disabled	—

Table 4.13 Setup Screen - Modbus RS485

ID	Title	Description	Default	Range	Unit
P070	Modbus Slave Address	Set required address	1	1 to 243	—
P071	Baud Rate	Set required baud rate	9600	9600 to 76800	—
P072	Write Access	Write access to coils and holding registers	No	No Yes	—

Table 4.14 Setup Screen - Group Control

ID	Title	Description	Default	Range	Unit
P081	Unit Address	Unit address	1	1 to 16	—
P082	Number of Units in Group	Number of units in group	1	1 to 16	—
P083	Number of Run Units	Number of run units	1	1 to 16	—
P085	Rotation Frequency	Unit rotation frequency	Weekly	Weekly Monthly Never	—
P086	Rotation Day of Week	Rotation day	Mon.	Sun. to Sat.	—
P087	Rotation Time of Day - Hours	Rotation hours	10	00 to 23	hrs.
P088	Rotation Time of Day - Minutes	Rotation minutes	00	00 to 59	mins.
P089	Unit Receive Timeout Period	Set require unit receive timeout	3000	50 to 10000	msecs.
P090	Unit Transmit Period	Set required unit transmit period	100	20 to 1000	msecs.
P091	Baud Rate Index	Baud Rate Index	2	0 to 3	—
P092	Extended Group Index	Extended Group Index	0	0 = no, 1 = yes	—

4.2.8 Configuration Screen

The Configuration screen is visible only after login and is used to set specific parameters and control functions.

Figure 4.8 Configuration Screen

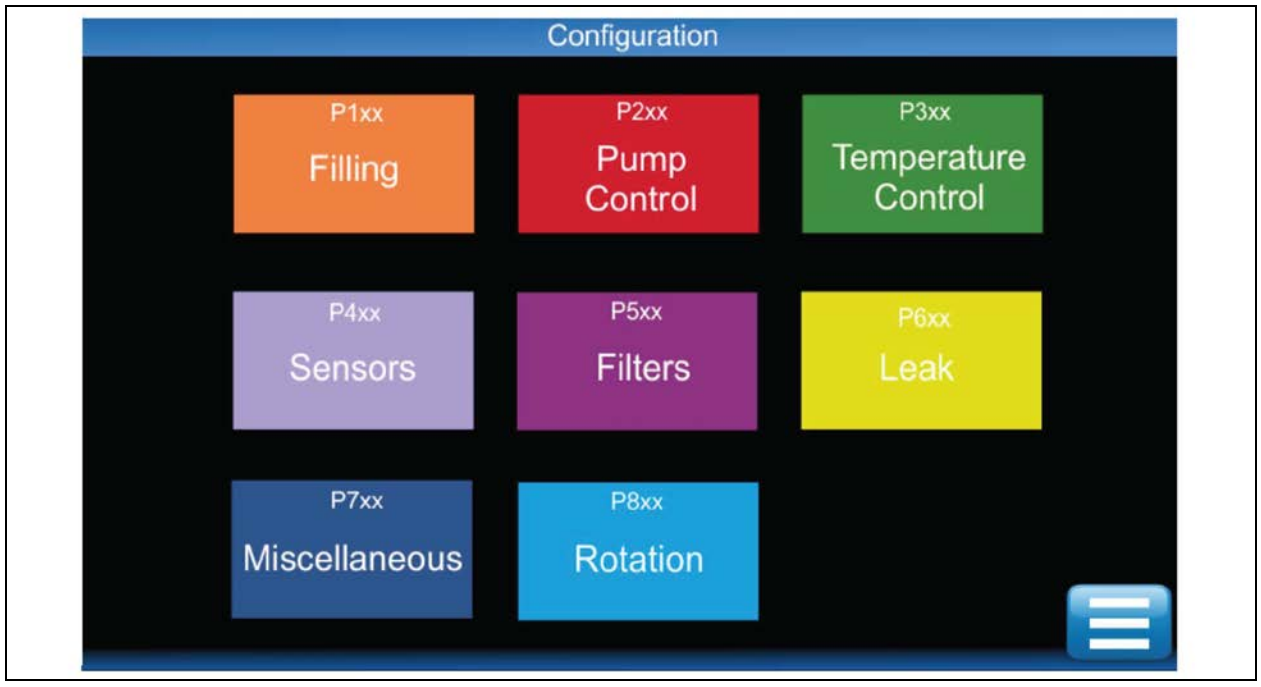


Table 4.15 Configuration Screen - Filling

ID	Title	Description	Default	Range	Unit
P101	Fill Pressure	Start threshold for fill pump	(0.8)	0.3 to 1.0	bar
P102	Fill Hysteresis	Stop hysteresis for fill pump	(0.2)	0.1 to 0.5	bar
P103	Fill Pump Run Period	Fill Pump Run Period	1	1 to 15	minutes
P104	Level Sensor Delay	Level sensor response time, prior to alarm	1	1 to 6	secs.
P105	Fill Start Delay Period	Delay prior to pump start after initiate signal	10	1 to 600	secs
P106	Fill Warning Delay Period	Fill Warning Delay Period	5	0 to 60	secs
P107	Manual Fill Control	Manual Fill Control (0=automatic,1=manual)	0	0 or 1	—

Table 4.16 Configuration Screen - Pump Control

ID	Title	Description	Default	Range	Unit
P201	Control Type	Pump speed flow or diff. pressure (DP) controlled	DP	Flow or DP	—
P202	Flow Setpoint	Set the required fluid flow rate	70	25 to 150	l/m
P203	Differential Pressure Setpoint	Set the required fluid DP	0.9	0.1 to 3.0	bar
P204	Low Flow %	Low flow alarm threshold (% of flow setpoint)	80%	10 to 95	%
P205	Low DP %	Low DP alarm threshold (% of DP setpoint)	80%	10 to 95	%
P206	Low Flow/DP Delay	Time delay prior to low flow/DP alarm	30	1 to 300	secs
P207	Minimum Pump Speed	Set minimum pump running speed	15	10 to 70	%
P209	Maximum Pump Speed	Set maximum pump running speed	100	25 to 100	%
P210	Pump Changeover Delay	Pump changeover period (change from P1 to P2 or P2 to P1)	250	50 to 500	msec
P211	Over-pressure Setpoint	Maximum system pressure, prior to alarm	(2.7)	2.0 to 4.0	bar
P212	Over-pressure Action	Alarm only or shutdown and alarm	Alarm	Alarm or Alarm + shutdown	—
P213*	Startup Speed	Initial pump start fixed speed (0 = Auto)	0	0 to 100	secs
P215*	Loop Refresh Period	Scan period for pump speed control loop	10	1 to 120	secs
P216*	Control Loop Pressure Coefficient	Maximum pump speed control loop pressure	(4.0)	1.0 to 8.0	bar
P217	Failover Pump Speed	Failover Pump Speed	0	0 to 20	%

Table 4.16 Configuration Screen - Pump Control (continued)

ID	Title	Description	Default	Range	Unit
	Adjustment	Adjustment			
P218	Motor Thermal Overload	Motor Thermal Overload	200	0 to 400	degC
*Parameter IDs are only accessible with the engineer login code.					

Table 4.17 Configuration Screen - Temperature Control

ID	Title	Description	Default	Range	Unit
P301	Temperature Setpoint	Set required fluid temperature setpoint	30.0 (86)	10.0 to 55.0 (50 to 131)	°C (°F)
P302*	PID – Control Period	Scan period for fan speed control	1	1 to 30	secs
P303*	PID – Proportional Band	Proportional band	5 (41)	1.0 to 25 (33.8 to 77)	°C (°F)
P304*	PID – Integral Reset	Integral reset time	18	0 to 999	secs
P305*	PID – Derivative	Derivative reset time	5	0 to 999	secs
P306	Minimum Fan Speed	Set minimum fan running speed	15	0 to 70	%
P307	Maximum Fan Speed	Set maximum fan running speed	100	40 to 100	%
P308	Fan Fixed Speed	Fan speed in event of 3 x T3 sensor failure	50	1 to 100	%
P309	Fan Alarm Period	Delay prior to alarm following fan fault	30	0 to 60	secs
P310	Sec Low Temperature Differential	Low temp. alarm offset below setpoint	2.0 (35.6)	1.0 to 10.0 (33.8 to 50)	°C (°F)
P311	Sec High Temperature Differential	High temp. alarm offset above setpoint	2.0 (35.6)	1.0 to 10.0 (33.8 to 50)	°C (°F)
P312	Sec Temperature Reset Hystersis	Low/High temp. alarm reset point	1.0 (33.8)	0.5 to 5.0 (32.9 to 41)	°C (°F)
P313	Sec Temperature Alarm Delay	Sec Temperature Alarm Delay	120	5 to 300	secs
*Parameter IDs are only accessible with the engineer login code.					

Table 4.18 Configuration Screen - Sensors

ID	Title	Description	Default	Range	Unit
P401*	Secondary T3 Temperature Differential	Alarm threshold T3a/b/c temperature differential	1.0 (33.8)	0.1 to 10 to (32.18 to 50)	°C (°F)
P402	Secondary T3 Period	Time delay before T3a/b/c differential alarm	10	0 to 120	secs
P403	Secondary PS1 Pressure Differential	Alarm threshold PS1a-PS1b pressure differential	(0.2)	0.1 to 1.0	bar

Table 4.18 Configuration Screen - Sensors (continued)

ID	Title	Description	Default	Range	Unit
P404	Secondary PS1 Period	Time delay before PS1a-PS1b differential alarm	30	0 to 120	secs
P405	Coolant	Set secondary loop coolant type	PG25	Water PG25	—
*Parameter IDs are only accessible with the engineer login code.					

Table 4.19 Configuration Screen - Filters

ID	Title	Description	Default	Range	Unit
P504	Fluid Filter Dirty Setpoint	Differential pressure alarm threshold for filter dirty	0.5	0.2 to 1.0	bar
P505	Fluid Filter Dirty Hysteresis	Alarm reset from threshold	0.1	0.1 to .05	bar
P506	Fluid Filter Dirty Delay Period	Time delay prior to alarm	60	5 to 7200	secs

Table 4.20 Configuration Screen - Leak

ID	Title	Description	Default	Range	Unit
P601	Fluid Detection Operation-Drip Tray	Alarm only or shutdown and alarm	Alarm	Alarm Alarm+S/D	—
P602	Fluid Detection Operation-Rope	Alarm only or shutdown and alarm	Alarm	Alarm Alarm+S/D	—
P603	Rope Threshold	Set sensitivity of leak rope	50	1 to 65	kohm
P604	Rope Delay Period	Time delay prior to alarm	10	5 to 60	secs
P605	Fluid Detection Operation-Unit	For when both drip tray and rope leak detections are activated. Alarm only or alarm and shutdown	Alarm	Alarm Alarm+S/D	—

Table 4.21 Configuration Screen - Miscellaneous

ID	Title	Description	Default	Range	Unit
P701*	Manual Override Period	Time delay before controls revert to Auto mode	15	0 to 120	mins
P702*	Alarm Delay	Alarm suppression on startup	2	1 to 120	mins
P703*	Post Power Failure Options	Action to be taken following a power failure once power is restored	Run	Run Standby	—
P704*	Data Logging Interval	Interval between data being logged to SD card (0 = 60s, 1 = 30s, 2 = 10s, 3 = 5s)	0	0 1 2 3	—
P705*	Display Lockout	Lockout following failed login	No	No Yes	—
*Parameter IDs are only accessible with the engineer login code.					

Table 4.22 Configuration Screen - Rotation

ID	Title	Description	Default	Range	Unit
P801	Frequency	Frequency of pump changeover	Weekly	Never Weekly Monthly	—
P802	Day of Week	Set day of changeover	Mon.	Sun. to Sat.	—
P803	Time of Day - Hours	Time of changeover (hour)	10	00 to 23	hrs
P804	Time of Day - Minutes	Time of changeover (min)	00	00 to 59	mins

4.2.9 Service Screen

The Service screen is visible only after logging in with the service or engineer login codes. The Service screen can be used to set some parameters and to assist in commissioning.

Figure 4.9 System Service Screen

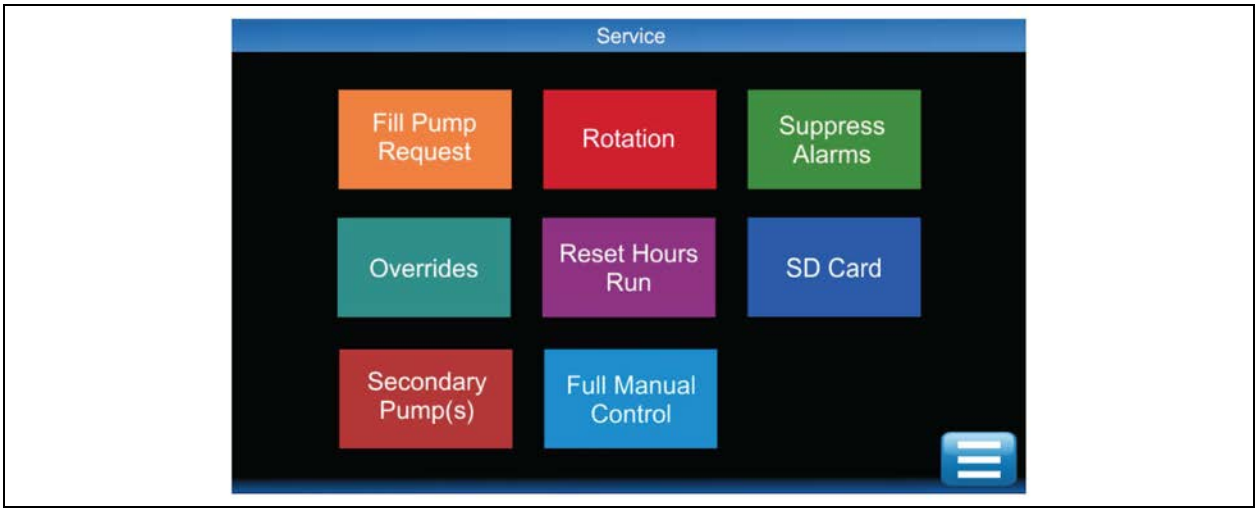


Table 4.23 Service Screen - Fill Pump Request

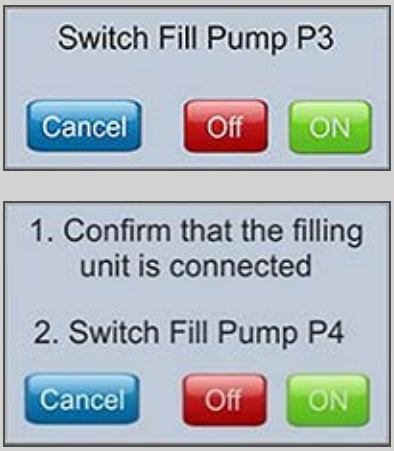
Screen Prompt	Explanation
	The Pump Fill function is used during commissioning only. This allows the fill pumps to run without a time limit. Fill pumps turns off automatically when unit reaches required static pressure or when the reservoir tank is full.

Table 4.24 Service Screen - Rotation

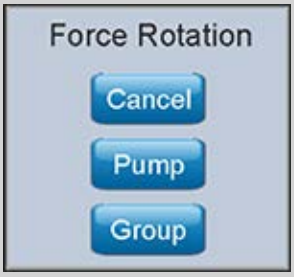
Screen Prompt	Explanation
	The Rotation function is used to force a pump changeover at an unscheduled time or to force a unit changeover when Group Control is active.

Table 4.25 Service Screen - Suppress Alarms

Screen Prompt	Explanation
	The Suppress Alarms function resets the delay timer to stop nuisance alarms breaking through during manual operation. The alarm delay timer is normally activated during startup.

Table 4.26 Service Screen - Overrides

ID	Title	Description	Default	Range	Unit
S101	Pump 1 Speed	Set pump 1 speed (0% = no override)	0	0 to 100	%
S102	Pump 2 Speed	Set pump 2 speed (0% = no override)	0	0 to 100	%
S103	Unit Fill Pump P3	Switch unit fill pump on	Auto	Auto Man	—

Table 4.26 Service Screen - Overrides (continued)

ID	Title	Description	Default	Range	Unit
S104	Reservoir Tank Fill Pump P4	Switch reservoir fill pump on	Auto	Auto Man	—
S105	Fan Speed	Set fan speed (0% = no override)	0	0 to 100	%

Overrides allows for manual control of some functions of the unit for a limited time period (default is 15 minutes) while the unit is running in automatic mode. This function is provided for troubleshooting purpose. If an override is issued while the Vertiv™ CoolChip CDU070 is not in automatic mode, the override is ignored and the value is automatically set to the default.

Table 4.27 Service Screen - Reset Hours Run

ID	Title	Description	Default	Range	Unit
S201	Pump 1 Run Hours	Set pump 1 run hours to zero	—	—	hrs
S202	Pump 2 Run Hours	Set pump 2 run hours to zero	—	—	hrs

Table 4.28 Service Screen - SD Card

Screen Prompt	Explanation
	This function is used to control access to the SD card. Select Unmount to safely remove the SD card. Select Mount following the insertion of the SD card.

Table 4.29 Service Screen - Secondary Pumps

ID	Title	Description	Default	Range	Unit
S401	Pump 1 Service Status	Allows pump to be set for in service or out of service. Selecting out of service prevents running during maintenance.	In Service	In Service Out of Service	—
S402	Pump 2 Service Status	Allows pump to be set for in service or out of service. Selecting out of service prevents running during maintenance.	In Service	In Service Out of Service	—

Table 4.30 Service Screen - Full Manual Control

ID	Title	Description	Default	Range	Unit
S301*	Full Manual Control	Allows full manual control of all functions	Disabled	Disabled Enabled	—
S302*	Pump 1 Speed	Set pump 1 speed	0	0 to 100	%
S303*	Pump 2 Speed	Set pump 2 speed	0	0 to 100	%
S304*	Unit Fill Pump P3	Switch unit fill pump on	Off	Off On	—
S305*	Reservoir Tank Fill Pump P4	Switch reservoir fill pump on	0	0 to 100	%
S306*	Fan Speed	Set Fan Spped	0	0 to 100	%
S307*	Fan Tacho Multiplex	Set fan TACHO multiplex changeover relay	Off	Off On	—
S310*	Simulate Alarm	Simulate Alarm	0	—	—
*Parameter IDs are only accessible with the Engineer login code.					

Full Manual Control provides the ability to control all functions of the unit manually for a limited time period. Selecting Full Manual Control causes the unit to switch off, and the controller is in dumb mode. Manual override requests are possible only when S301 is set to Enabled. If S301 is not set to Enabled, commands are automatically reset to default.

4.2.10 Diagnose Screen

The Diagnostic Screen provides raw information and conversion factors for all Universal Inputs, Resistive Inputs, Digital Inputs, Digital Outputs, and Analog Outputs.

Figure 4.10 Diagnose Screen

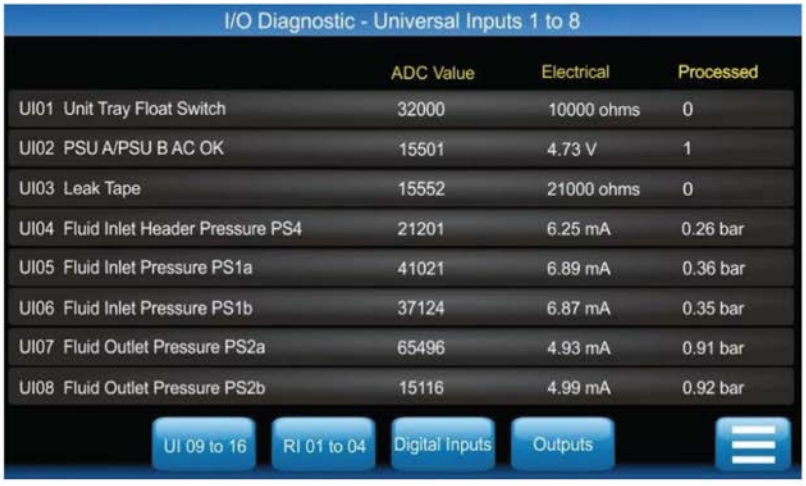


Table 4.31 Diagnose Screen - Universal Inputs 1 to 8

ID	Description	ADC Value	Electrical	Processed
UI01	Unit Tray Float Switch	0	0.00 ohms	0
UI02	PSU A/PSU B AC OK	0	0.00 V	0
UI03	Leak Tape	0	0.00 ohms	0
UI04	Fluid Inlet Header Pressure PS4	0	0.00 mA	0.00 bar (0.00 psi)
UI05	Fluid Inlet Pressure PS1a	0	0.00 mA	0.00 bar (0.00 psi)
UI06	Fluid Inlet Pressure PS1b	0	0.00 mA	0.00 bar (0.00 psi)
UI07	Fluid Outlet Pressure PS2a	0	0.00 mA	0.00 bar (0.00 psi)
UI08	Fluid Outlet Pressure PS2b	0	0.00 mA	0.00 bar (0.00 psi)

Table 4.32 Diagnose Screen - Universal Inputs 9 to 14

ID	Description	ADC Value	Electrical	Processed
UI09	Reservoir Tank High Level	0	0.00 ohms	0
UI10	Reservoir Tank Low Level	0	0.00 ohms	0
UI11	Reservoir Tank Very Low Level	0	0.00 ohms	0
UI12	Fluid Flow Sensor	0	0.00 mA	0 l/m
UI13	Pump P1 Filter Outlet Pressure PS3a	0	0.00 mA	0.00 bar (0.00 psi)
UI14	Pump P2 Filter Outlet Pressure PS3b	0	0.00 ohms	0.00 bar (0.00 psi)
UI15	Air Exit Temperature T1	0	0.00 ohms	0.00 bar (0.00 psi)
UI16	Air Inlet Temperature T2	0	0.00 ohms	0

Table 4.33 Diagnose Screen - Resistive Inputs 1 to 4

ID	Description	ADC Value	Electrical	Processed
RI01	Fluid Supply Temperature T3a	0	0 ohms	0 °C (32 °F)
RI02	Fluid Supply Temperature T3b	0	0 ohms	0 °C (32 °F)
RI03	Fluid Supply Temperature T3c	0	0 ohms	0 °C (32 °F)
RI04	Fluid Return Temperature T4	0	0 ohms	0 °C (32 °F)

Table 4.34 Diagnose Screen - Digital Inputs 1 to 6

ID	Description	State
DI01	Unit Fluid Level Sensor 1	Open
DI02	Unit Fluid Level Sensor 2	Open
DI03	Fan 1 and 2 Speed Feedback	1 or 0
DI04	Fan 3 and 4 Speed Feedback	1 or 0
DI05	Fan 5 and 6 Speed Feedback	1 or 0
DI06	Fan 7 Speed Feedback	1 or 0

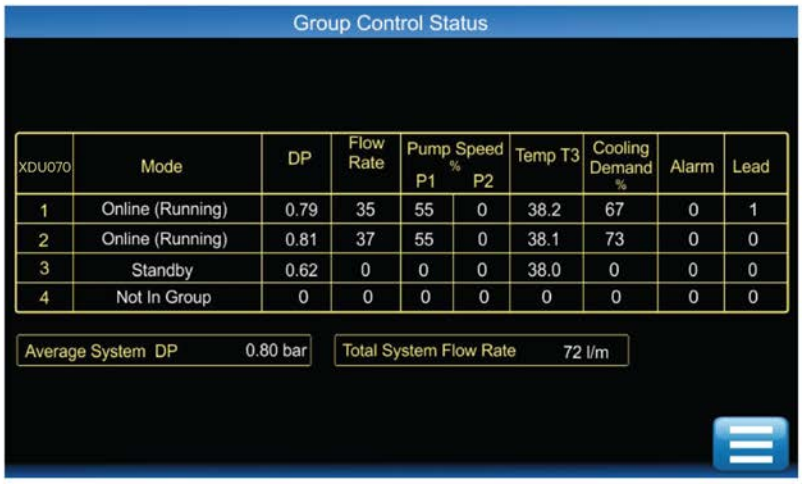
Table 4.35 Diagnose Screen - Digital and Analog Outputs

ID	Description	State
DO02	Unit Fill Pump P3	Off
DO03	PSU Status Multiplex	Off
DO05	Reservoir Tank Fill Pump P4	Off
DO06	Fan Speed Multiplex	Off
AO01	Fan Speed	%

4.2.11 Group Control Status Screen

The CANbus status screen provides information on other Vertiv™ CoolChip CDU070 connected to the CANbus network and configured to operate in group control.

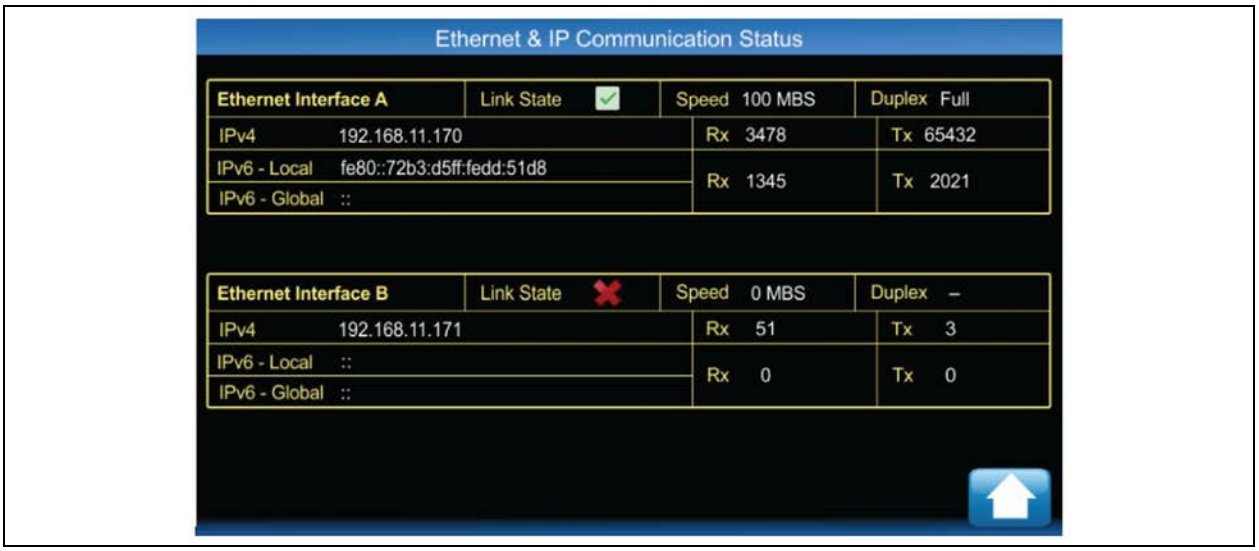
Figure 4.11 Group Control Status Screen



4.2.12 Ethernet and IP Communication Status Screen

The Ethernet and IP Communication screen provides status on the Ethernet link, speed, and duplex status as well as the IPv4 and IPv6 address details and message counts for Ethernet interface A and B.

Figure 4.12 Ethernet and IP Communication Status Screen



4.2.13 Calibration Screen

The touchscreen will enter calibration mode if the screen is pressed 20 times within a 4 second interval. To complete calibration, follow the on screen instructions.

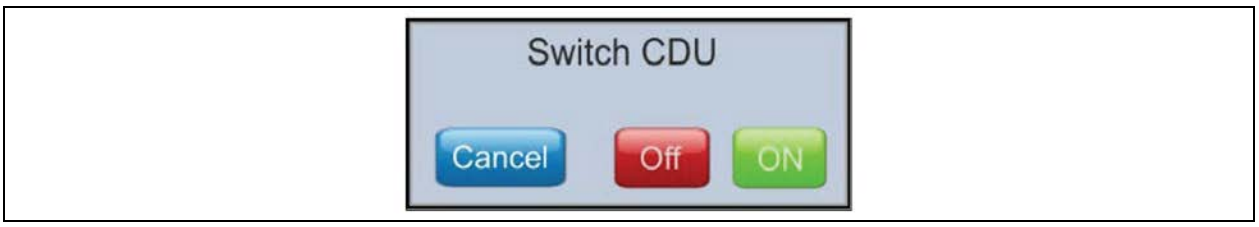
Figure 4.13 Calibration Screen

4.3 Automatic Operation

After commissioning, the unit will be ready to run in automatic mode. Press the Start/Stop icon button on the display Home screen (see Home Screen on page 15), then select the ON button as below.

After the unit is commissioned, it is ready to run in automatic mode. Press the Start/Stop button on the Home screen and select ON from Switch CDU.

Figure 4.14 Switch CDU



4.3.1 Fluid Circuit Operation

When the ON button is pressed, the Start/Stop icon on the Home screen changes from red to green. When the fluid level and static pressure are healthy, either the main pump P1 or P2 starts to increase in speed, (the pump with the least run hours starts to increase in speed.) arrows are displayed on the Home screen for fluid and air circuits to signify that the unit is operational. Both pump speed and fan speed as a percentage of maximum are displayed.

FLUID LEVEL

- If the fluid level switch that is located upstream of the pump inlet header is not made, insufficient water is signified, then neither pump P1 or P2 runs.
- If the fluid level sensor registers no fluid for a period of no more than 1 second, an alarm, A26—Level Sensor No Fluid Detected, is generated. If the unit differential pressure (DP) or flow rate is more than 50% of setpoint, then the unit continues to run. If DP or flow drops below 50% of setpoint, then the unit stops and an alarm, A25—Insufficient Fluid, is generated. This is a latched alarm and it will not be possible to restart the unit until after the even is manually cleared.

The system pressure at the Vertiv™ CoolChip CDU070 inlet (PS1) is continuously monitored to ensure that the system is always pressurized. See Table 4.2 on page 18 .

STATIC PRESSURE

- When the pump is running, a low system pressure below the default of 0.8 bar (12 psi) at PS1 does not stop the main pump from running. After a 10 second (default) delay, it raises the PS1 pressure to a default of 1.0 bar (15 psi). At this point, the fill pump stops. If the reservoir tanks very low sensor is activated while fill pump P3 is running, an A15—Reservoir Tank Empty alarm is generated. Fill pump P3 stops. This is a latched alarm and must be manually cleared but does not stop the unit from running.
- If the inlet pressure drops to 0.2 bar (3 psi—set, non-adjustable) below the fill pump activation threshold for more than 1 minute (set, non-adjustable), an A24—System Low Pressure event is generated. Fill Pump activation threshold has a default value of 0.6 bar (9 psi).

Figure 4.15 on page 39 , Figure 4.16 on page 40 , and Figure 4.17 on page 41 show the unit pressure/level monitoring and fill pump control during initial startup of the unit after commissioning (from a unit offline condition) and during normal running (unit online).

Pump flow/pressure performance (pump speed) can be controlled through either a flow or differential pressure control loop depending on Configuration (see Configuration Screen - Pump Control on page 26).

FLOW CONTROL

Monitors the secondary flow with a calorimetric flow meter. On startup, the control loop increases the pump speed in stages until the flow matches the demand setpoint.

DP CONTROL

Monitors the secondary differential pressure with sensors on the supply and return connections of the CoolChip CDU070. On startup, the control loop increases the pump speed in stages until the DP matches the DP setpoint.

The pump control loop has a default scan time of 10 seconds to avoid control oscillation.

- If Pump 1 fails to reach 90% (default) of the DP/flow demand in the default time period of 100 seconds, it is assumed there is a pump flow/pressure fault. The pump ramps down to a stop. Pump 2 is initialized. At the same time an A33–Pump 1 Low Flow alarm is generated.
- If Pump 2 also fails to reach 0% (default) of the DP/flow demand in within the time limit, a A34–Pump 2 Low Flow alarm is generated.
- The unit then continues to operate with Pump 2 until faults are investigated and alarms are manually cleared.
- The above assumes Pump 1 is the initial operating pump. The reserve would apply if Pump 2 was the operating pump.

During normal healthy running for run/standby pump operation the pumps operate on a duty sharing cycle. For example, every 7 days (default) the operational pump will ramp down to a stop and the standby pump will then start and continue operating for the next 7 days. Changeover default time is set at 10:00 am on a Monday morning and the complete changeover sequence takes approximately 0.25 seconds (default).

NOTE: Each time the unit is stopped and re-started, it selects the initial operating pump that has the lowest accrued run time hours.

The fluid circuit temperature is monitored close to the CoolChip CDU070 supply connection. Three temperature sensors are positioned here to give extended component redundancy (T3a, T3b and T3c). The controller takes an average between all 3 readings as its input value.

- If the difference between the sensors exceeds a default of 33.8 °F (1 °C), then an A28 (A29 or A30)—Secondary Temp T3a (T3b or T3c) Diff. Out of Limits alarm is raised after a default 30 second delay. The controller then only reads and averages the two remaining healthy sensors.
- If any of the T3 temperature sensors go open circuit, then an A03 (A04 or A 05)—T3a (T3b or T3c) Secondary Temperature Sensor Fault alarm is raised with no time delay and the controller only reads and averages the two remaining healthy sensors.

Figure 4.15 Vertiv™ CoolChip CDU070 Pressure and Level Flow Chart (Initial Startup)

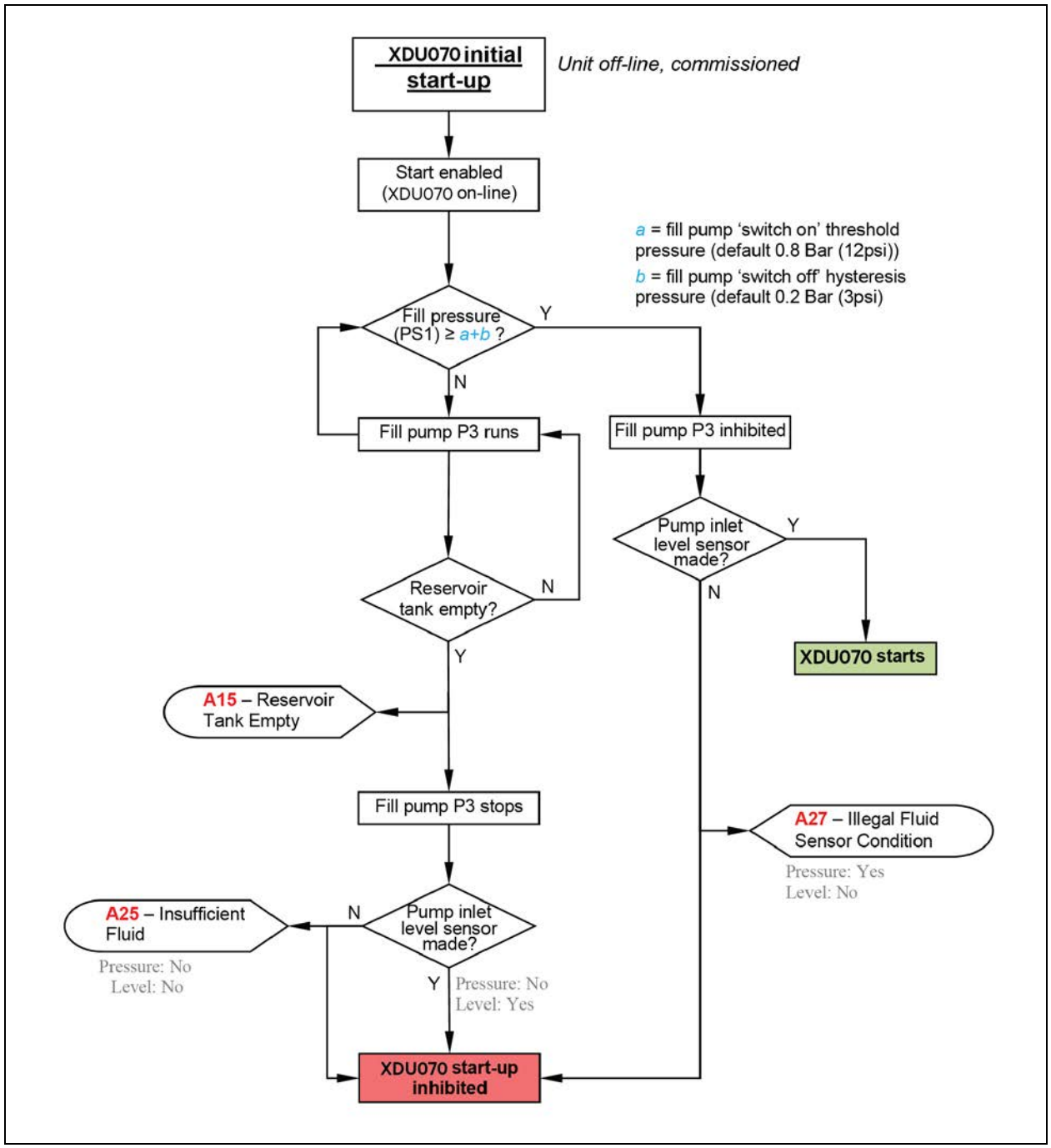


Figure 4.16 Vertiv™ CoolChip CDU070 Fill Pressure and Level Flow Charge (When Running)

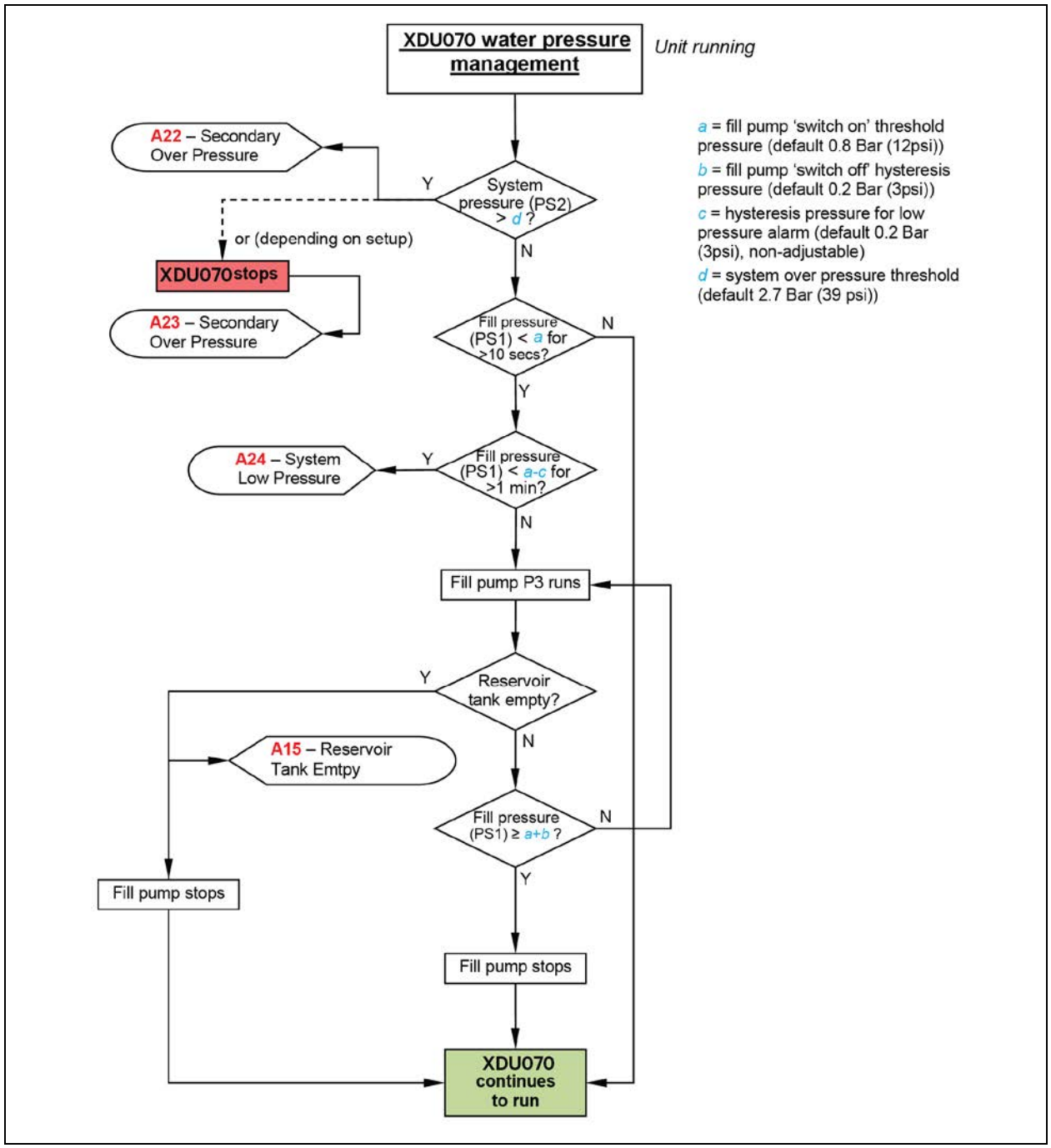
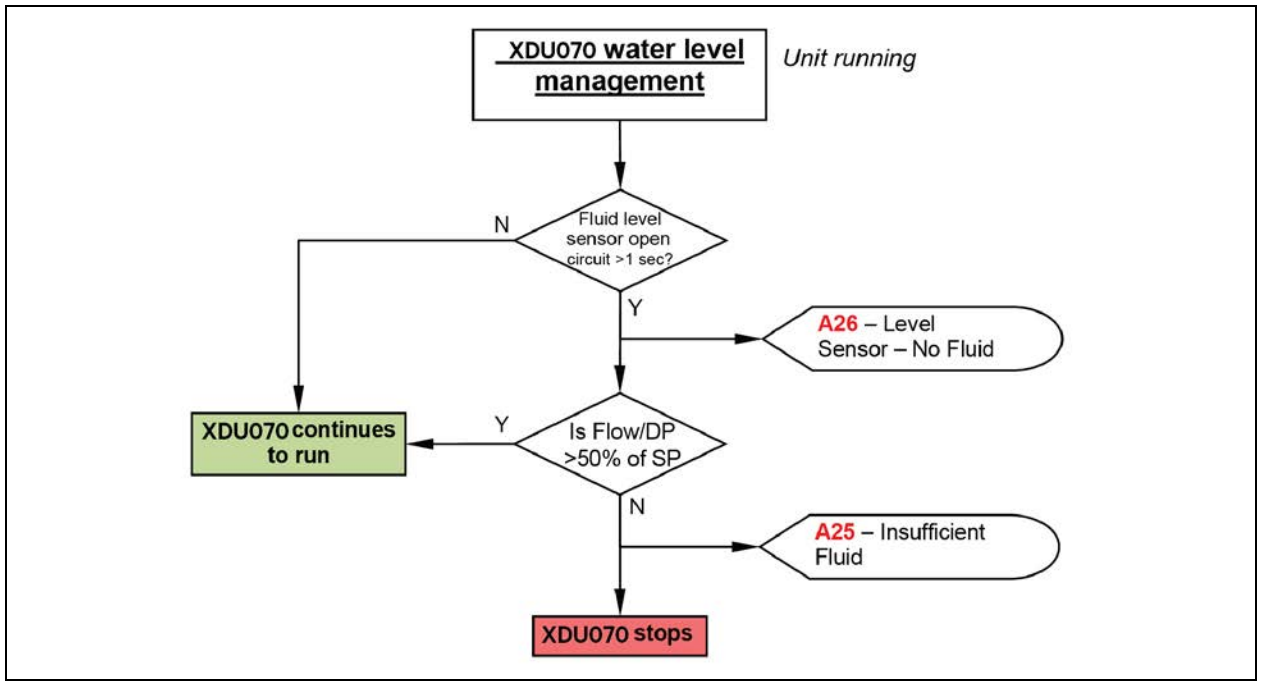


Figure 4.17 Vertiv™ CoolChip CDU070 Water Level Management (When Running)



Temperature sensor (T4) monitors the fluid circuit return temperature and is used in conjunction with the flow rate to calculate the heat transfer duty.

The fluid temperature should correspond to the desired set point. The default fixed setpoint is 30 °C (86 °F). It is used by the control loop to regulate the speed of the air path fans to achieve and maintain the setpoint. The fan speed demand can be monitored on the Home screen or page 1 of the Status screen (Cooling Demand).

High and low temperature alarms are set at a default value of 2 °C (35.6 °F) either side of set point (floating with set point), with a default hysteresis of 1 °C (33.8 °F).

- The high and low temperature alarms are ignored for a period of 20 minutes (default) on startup to allow the system time to settle without generating nuisance alarms.
- If the secondary temperature deviates by more than 2 °C (35.6 °F) below setpoint for 2 minutes or more, a A19—Fluid Low Temp alarm is generated. This alarm will remain until the temperature rises above the hysteresis value.
- If the secondary temperature deviates by more than 2 °C (35.6 °F) (default) above setpoint for 2 minutes or more, a A20—Fluid High Temp alarm is generated. This alarm remains until the temperature falls below the hysteresis value.

The PS3a and PS3b pressure sensors, relative to the unit discharge pressure sensor PS2, monitor the filter differential pressures and provide a pre-warning of potential filter clogging

- If the differential pressure exceeds 0.5 bar (7 psi) for Filter 1, then an A46 —Fluid Filter 1 Dirty alarm is generated.
- If the differential pressure exceeds 0.5 bar (7 psi) for Filter 2, then an A47—Fluid Filter 2 Dirty alarm is generated.

Fluid flow rate is monitored with a calorimetric flow meter in the pump discharge pipework. The flow can be read on the Home screen or on page 3 of the Status screen.

NOTE: Flows below 12 l/m (2.3 US gpm) are outside the range of the flow sensor and are not displayed.

4.3.2 Air Path Circuit Operation

The ambient air temperature T2 is monitored at the inlet to the Vertiv™ CoolChip CDU070 cabinet. The nominal 70 kW cooling performance of the CoolChip CDU070 has been designed on an ambient temperature between 20 °C and 35 °C (77 °F and 95 °F) with a 15 °C (18 °F) approach temperature difference to the fluid outlet temperature.

The temperature PID control loop will be operational from when the Start/Stop button is pressed and the main pump has ramped up to speed. If the fluid circuit temperature starts to rise above the set point, then cooling fan speed will increase to allow more air flow through the cooling coils. The fan speed will modulate from 15% (default minimum) to 100% (maximum air flow). The fan speed can be monitored on the Home screen or page 1 of the Status screen. The fan speed demand signal is constantly compared to the speed feedback signal from each fan to check the healthy operation.

- If the feedback signal is significantly different from the demand signal, then a A35—Fan 1 Fault through to a A41—Fan 7 Fault event will be generated, depending on which fan has failed.

The cooling fan speed is controlled with multiple 0 V to 10 V signals from the controller for enhanced redundancy as:

- Analogue output A01 for fans 1 and 2
- Analogue output A01 for fans 3 and 4
- Analogue output A01 for fans 5 and 6
- Analogue output A01 for fan 7

4.3.3 Temperature Control Loop Adjustment

In most applications, the default PID settings in the controller gives good overall temperature control. If it is found necessary to change this, then it is recommended that the Zeigler-Nichols manual tuning method be used.

NOTICE

Zeigler-Nichols method requires that the system operate under local conditions and initially causes the control loop to temporarily become unstable with wide temperature swing oscillations. It is important to ensure that this does not cause any damage to the equipment being cooled. Login at the engineer level is required to make the necessary changes.

1. Set the Integral Reset Time and Derivative Reset Time (Configuration—Temperature Control screens P309 and P310) to 0 seconds.
2. Increase the Proportional Band (Configuration – Temperature Control screen P303) to a higher value from the default of 5 °C (41 °F) to 25 °C (77 °F).
3. Check that the secondary supply temperature (T3) stabilizes.

NOTE: Temperature stabilizes at a higher temperature than the current setpoint. This offset is eradicated once the integral reset time is added back in.

4. If the temperature control is unstable, raise the proportional band to a higher value until the temperature stabilizes. Otherwise gradually decrease the proportional band in 1 °C (33.8 °F) increments until the supply temperature (T3) starts to oscillate at a constant rate.
5. Measure the frequency of the oscillation time (peak to peak) in seconds (t).

4.3.4 PI Control

For systems that have reasonably steady or slowly changing heat loads, PI control only should be sufficient.

1. Set the Proportional Band to 2.2 x the Proportional Band setting at which the system became unstable.
2. Set the Integral Reset Time to 0.83 x the oscillation time (t).
3. Leave the Derivative Reset Time at 0.

4.3.5 PID Control

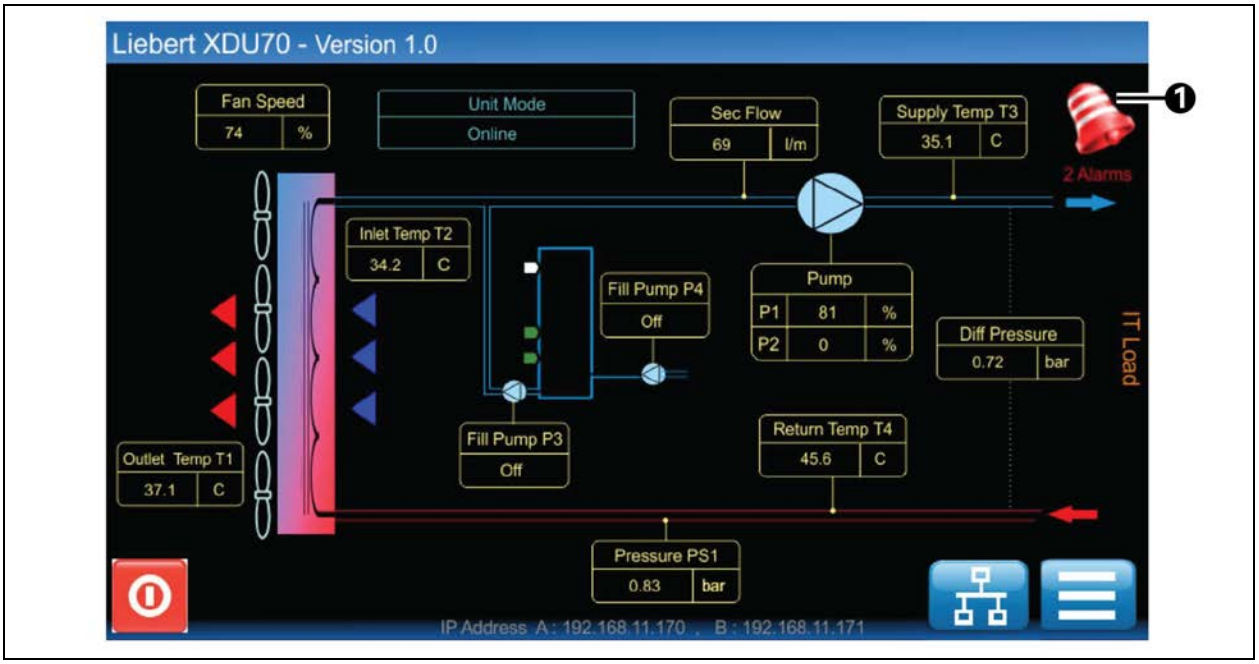
For systems that see high or sudden changing heat loads, PID control is the preferred option.

1. Set the Proportional Band to 1.67 x the Proportional Band setting at which the system became unstable.
2. Set the Integral Reset Time to 0.5 x the oscillation time (t).
3. Set the Derivative Reset Time to 0.125 x the oscillation time (t).

4.4 Alarm Management

When an alarm occurs, a flashing alarm bell icon immediately break through at the top right-hand corner of the Home screen, with the number of active alarms stated below.

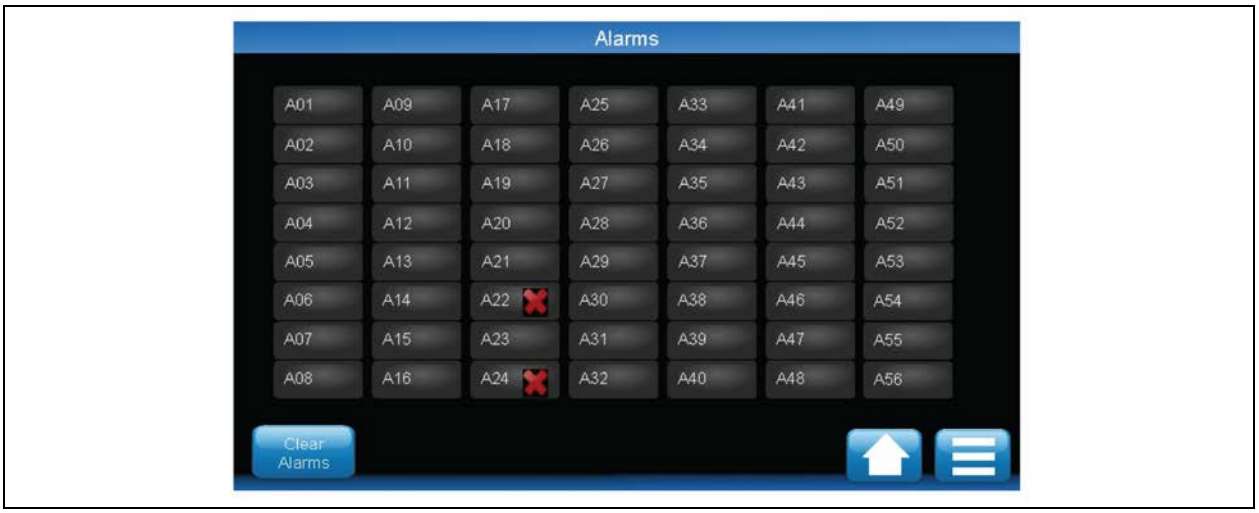
Figure 4.18 Control Screen Alarm Indication



Item	Description
1	A flashing alarm bell icon gives alarm indication.

Pressing the Alarm Bell icon brings up the Alarm page as shown Figure 4.19 on the next page . This page identifies the alarms that are active.

Figure 4.19 Control Screen Active Alarms



Access the alarm descriptions by selecting the columns where the alarms appear.

Some alarms self-clear if the condition is transient. For example, a temperature goes over an alarm threshold then comes back to a healthy condition or when a fault has been rectified such as when a faulty sensor has been replaced.

Latching alarms need to be cleared manually while logged in at the service level or higher by pressing Clear Alarms as shown in **Figure 4.18** on the previous page and **Figure 4.19** above .

Self-clearing and latching alarms are identified in Troubleshooting Alarms on the facing page .

All alarms are automatically logged in an Alarm Log file stored on the controller SD card. Alarms are stored with the time and date they were generated.

Figure 4.20 Control Screen Alarm Identification

4.5 Troubleshooting Alarms

Alarms are events which may cause the unit to shut down and must be investigated immediately.

Severity classifications are:

1. Unit shutdown. Shutdown IT immediately.
2. Urgent alarm. Immediate investigation required, prepare to shutdown IT, if required.
3. Non-urgent alarm. Investigate within 4 working days.
4. Information only. Respond at the next availability or at PPM.

These severity classifications are suggested only, customers may wish to assign their own ratings.

Table 4.36 Code Severity Classifications

Code	Description	Severity	Self-Clear	Latching	Shutdown	Delay
---	No display	3	---	---	---	---
Detail	Display not illuminated. Power failure on display board or controller I/O board.					
Action	Open upper electrical panel door to check that 24 VDC is available at controller I/O board. If there are no LEDs showing on processor board then check I/O board 24 V fuse FS1. If LEDs are on, check for wiring faults between I/O board and display.					
A01	T1 Temperature Sensor Fault	4	✓	---	---	---
Detail	Reading from off coil air temperature sensor T1 is outside the normal range of 23 °F to 165 °F (-5 °C to 74 °C) or disconnected.					
Action	Check sensor connections to the control board, check inline connections, replace sensor.					
A02	T2 Temperature Sensor Fault	4	✓	---	---	---
Detail	Reading from on coil air temperature sensor T2 is outside the normal range of 41 °F to 165 °F (5 °C to 74 °C) or disconnected.					
Action	Check sensor connections to the control board, check inline connections, replace sensor.					
A03	T3a Temperature Sensor Fault	3	✓	---	---	---
Detail	Reading from fluid supply temperature sensor T3a is outside the normal range of 41 °F to 165 °F (5 °C to 74 °C) or disconnected.					
Action	Check sensor connections to the control board, check inline connections, replace sensor.					
A04	T3b Temperature Sensor Fault	3	✓	---	---	---
Detail	Reading from fluid supply temperature sensor T3b is outside the normal range of 41 °F to 165 °F (5 °C to 74 °C) or disconnected.					
Action	Check sensor connections to the control board, check inline connections, replace sensor.					
A05	T3c Temperature Sensor Fault	3	✓	---	---	---
Detail	Reading from fluid supply temperature sensor T3b is outside the normal range of 41 °F to 165 °F (5 °C to 74 °C) or disconnected.					
Action	Check sensor connections to the control board, check in-line connections, replace sensor.					
A06	T4 Temperature Sensor Fault	3	✓	---	---	---
Detail	Reading from fluid return temperature sensor T4 is outside the normal range of 41 °F to 165 °F (5 °C to 74 °C) or disconnected.					
Action	Check sensor connections to the control board, check inline connections, replace sensor.					
A07	PS1a Pressure Sensor Fault	3	✓	---	---	---
Detail	Reading from fluid return pressure sensor PS1a (Fill pressure) is outside the normal range of -1 to 8 bar (-14.5 to 116 psi) and min/max values only will be displayed. **NOTE: For DP control, if system differential pressure is not valid, then pump speed will remain at last known demand.**					

Table 4.36 Code Severity Classifications (continued)

Code	Description	Severity	Self-Clear	Latching	Shutdown	Delay
Action	Check sensor connections to the control board, check inline connections, replace sensor.					
A08	PS1b Pressure Sensor Fault	2	✓	---	---	---
Detail	Reading from fluid return pressure sensor PS1b (Fill pressure) is outside the normal range of -1 to 8 bar (-14.5 to 116 psi) and min/max values only will be displayed. **NOTE: For DP control, if system differential pressure is not valid, then pump speed will remain at last known demand.**					
Action	Check sensor connections to the control board, check inline connections, replace sensor.					
A09	PS2a Pressure Sensor Fault	2	✓	---	---	---
Detail	Reading from secondary supply pressure sensor PS2a is outside the normal range of -1 to 8 bar (-14.5 to 116 psi) and min/max values only will be displayed. **NOTE: For DP control, if system differential pressure is not valid, then pump speed will remain at last known demand.**					
Action	Check sensor connections to the control board, check in-line connections, replace sensor.					
A10	PS3a Pressure Sensor Fault	3	✓	---	---	---
Detail	Reading from fluid filter outlet pressure sensor PS3a (Pump 1 inlet) is outside the normal range of -1 to 8 bar (-14.5 to 116 psi) and min/max values only will be displayed.					
Action	Check sensor connections to the control board, check in-line connections, replace sensor.					
A11	PS3b Pressure Sensor Fault	3	✓	---	---	---
Detail	Reading from fluid filter outlet pressure sensor PS3b (Pump 2 inlet) is outside the normal range of -1 to 8 bar (-14.5 to 116 psi) and min/max values only will be displayed.					
Action	Check sensor connections to the control board, check in-line connections, replace sensor.					
A12	Flow Sensor Fault	4	✓	---	---	---
Detail	Fluid flow sensor output is below 4mA.					
Action	Check sensor connections to the control board, check in-line connections, replace sensor.					
A13	Micro SD Card Fault	3	✓	---	---	---
Detail	The SD card has either been removed or physically damaged.					
Action	Replace the SD card.					
A14	Reservoir Tank Fluid Required	2	✓	---	---	---
Detail	Fluid level in the reservoir tank has dropped to the low level sensor.					
Action	Use external fluid source and engage fill wand and pump P4 to refill the reservoir tank.					
A15	Reservoir Tank Empty	2	✓	---	---	---
Detail	Fluid level in the reservoir tank has dropped to the very low level sensor and unit fill pump P3 operation is inhibited.					
Action	Use external fluid source and engage fill wand and fill pump P4 to refill the reservoir tank.					
A16	Pump 1 Fault	2	---	✓	---	---
Detail	Pump 1 is drawing excessive current, or speed controller has been subjected to over/under voltage. Alarm appears after speed controller has gone into fault condition, Pump 2 will then run.					
Action	Replace Pump 1.					

Table 4.36 Code Severity Classifications (continued)

Code	Description	Severity	Self-Clear	Latching	Shutdown	Delay
A17	Pump 2 Fault	2	---	✓	---	---
Detail	Pump 2 is drawing excessive current, or speed controller has been subjected to over/under voltage. Alarm appears after speed controller has gone into fault condition, Pump 1 will then run.					
Action	Replace Pump 2.					
A18	Fluid Flow Shutdown	1	---	✓	✓	---
Detail	An A16/A17 – Pump Fault and/or an A31/A32 – Pump Comms Fault has been generated.					
Action	Check running current of pumps, check speed controllers for faults. Faults will need to be rectified and alarms cleared before unit can be started again.					
A19	Fluid Low Temperature	2	✓	---	---	---
Detail	Fluid temperature has dropped by more than 35.6 °F (2 °C) above set point (default). Alarm will cancel when temperature falls to 33.8 °F (1 °C) above set point or lower (default 2 minute delay applies).					
Action	Check operation of fans and amount of load on the system.					
A20	Fluid High Temperature	2	✓	---	---	---
Detail	Fluid temperature has risen by more than 35.6 °F (2 °C) above set point (default). Alarm cancels when temperature falls to 33.8 °F (1 °C) above set point or lower (default 2 minute delay applies).					
Action	Check operation of fans and amount of load on the system.					
A21	Fluid Leak Detected – Drip Tray	2	---	✓	✓	---
Detail	Level float switch in cabinet drip tray has detected a substantial water leak.					
Action	Identify and repair the leak.					
A22	Fluid Over Pressure (Alarm)	2	---	✓	---	---
Detail	Pressure at PS2 has increased above the set value of 2.7 bar (39 psi) (default). This alarm is only active if unit has been configured for alarm only. See **Table 4.16** on page 26					
Action	Most likely cause will be excessive heat build-up in the system. Check for High Temp alarms, check bladder in expansion vessel has not ruptured, relieve pressure at drain point. Remove expansion vessel and replace if required.					
A23	Fluid Over Pressure (Shutdown)	1	---	✓	✓	---
Detail	Pressure at PS2 has increased above the set value of 2.7 bar (39 psi) (default). This alarm is only active if unit has been configured for alarm + shutdown. See **Table 4.16** on page 26 .					
Action	Most likely cause will be excessive heat build-up in the system. Check for High Temp alarms, check bladder in expansion vessel has not ruptured, relieve pressure at drain point. Remove expansion vessel and replace if required.					
A24	System Low Pressure	2	---	✓	---	---
Detail	Pressure at PS1 has dropped more than 0.2 bar (3 psi) (set, non-adjustable) below fill pump activation threshold for more than 1 minute (applicable when unit is running in automatic/online mode).					
Action	Ensure fill pump hoses are free of air locks, reservoir tank has sufficient fluid is properly connected and fill pump P3 is operational. Check system for leaks.					
A25	Insufficient Fluid Level	2	---	✓	---	---
Detail	**On Initial Startup** – if level sensor is not made, fill pressure has not been achieved and reservoir very low level sensor is not registering fluid, then unit will not start.					

Table 4.36 Code Severity Classifications (continued)

Code	Description	Severity	Self-Clear	Latching	Shutdown	Delay
	While Unit is Running – This will be in conjunction with A26—Level Sensor—No Water Detected alarm. If level sensor is not made and flow or DP is < 50% of flow/DP setpoint, then unit will shutdown after a 1 second delay.					
Action	Ensure fill pump hoses are free of air locks, reservoir tank has sufficient fluid is properly connected and fill pump P3 is operational. Check system for leaks. Check auto air vents are open.					
A26	Unit Level Sensor – No Fluid Detected	2	---	✓	---	---
Detail	**While Unit is Running only** – If unit level sensor is open circuit for more than 1 second. then this alarm will be raised, providing flow or DP depending on control function set is >50% of flow/DP setpoint. If flow/DP is below this threshold, then an A25—Insufficient Fluid Level alarm will be raised and unit will shutdown after a 1 second delay.					
Action	Check that water make-up container is properly connected (or fill wand is fully immersed, if used). Check system for leaks. Check there is no trapped air in fill pump hoses and system is fully vented. Check auto air vents are open.					
A27	Illegal Fluid Sensor Condition	2	---	✓	---	---
Detail	**On Initial Startup** – if fill pressure has been achieved, but unit level sensor is not made.					
Action	Ensure circuit is fully vented. Replace level sensor.					
A28	Secondary Temp T3a Diff Fault	2	✓	---	---	---
Detail	Difference between secondary temp. sensor T3a is more than default 33.8°F (1°C) adrift from T3b and T3c, for a period of 30 seconds (default) or more. Controller will read the average of T3b and T3c only.					
Action	Check T3a sensor against temperature sensor resistance chart in Temperature Sensor Graph on page 51 and replace if faulty.					
A29	Secondary Temp T3b Diff Fault	2	✓	---	---	---
Detail	Difference between secondary temp. sensor T3b is more than default 33.8 °F (1 °C) adrift from T3a and T3c, for a period of 30 seconds (default) or more. Controller will read the average of T3a and T3c only.					
Action	Check T3b sensor against temperature sensor resistance chart in Temperature Sensor Graph on page 51 and replace if faulty.					
A30	Secondary Temp T3c Diff Fault	2	✓	---	---	---
Detail	Difference between secondary temp. sensor T3c is more than default 35.6 °F (2 °C) adrift from T3a and T3b, for a period of 30 seconds (default) or more. Controller will read the average of T3a and T3b only.					
Action	Check T3c sensor against temperature sensor resistance chart in Temperature Sensor Graph on page 51 and replace if faulty.					
A31	Pump Drive 1 Comms Fault	2	✓	---	---	---
Detail	Controller unable to communicate with Pump 1 speed controller. Pump 1 will stop and Pump 2 will then run.					
Action	Check all cables and connections. Replace pump.					
A32	Pump Drive 2 Comms Fault	2	✓	---	---	---
Detail	Controller unable to communicate with Pump 2 speed controller. Pump 2 will stop and Pump 1 will then run					
Action	Check all cables and connections. Replace pump.					
A33	Pump 1 Low Flow	2	---	✓	---	---
Detail	Pump 1 has not reached the differential pressure (or flow rate) setpoint and is running at 100% in the specified time limit (default 30 secs). Pump 1 will then stop and Pump 2 will run.					
Action	Check that unit has been set for the correct system flow rate (or DP), check for system blockages, check speed controller for faults, check non-return valve on Pump 2 is not sticking open. Reduce flow setting (or DP).					
A34	Pump 2 Low Flow	2	---	✓	---	---

Table 4.36 Code Severity Classifications (continued)

Code	Description	Severity	Self-Clear	Latching	Shutdown	Delay
Detail	Pump 2 has not reached the differential pressure (or flow rate) setpoint and is running at 100% in the specified time limit (default 30 secs). Pump 2 will then stop and Pump 1 will run.					
Action	Check that unit has been set for the correct system flow rate (or DP), check for system blockages, check speed controller for faults, check non-return valve on Pump 1 is not sticking open. Reduce flow setting (or DP).					
A35	Fan 1 Fault	2	✓	---	---	---
Detail	Fan 2 feedback signal is significantly adrift of demand for a period of 30 seconds (default) or more.					
Action	Check wiring and connections to fan. Replace fan.					
A36	Fan 2 Fault	2	✓	---	---	---
Detail	Fan 2 feedback signal is significantly adrift of demand for a period of 30 seconds (default) or more.					
Action	Check wiring and connections to fan. Replace fan.					
A37	Fan 3 Fault	2	✓	---	---	---
Detail	Fan 3 feedback signal is significantly a drift of demand for a period of 30 seconds (default) or more.					
Action	Check wiring and connections to fan. Replace fan.					
A38	Fan 4 Fault	2	✓	---	---	---
Detail	Fan 4 feedback signal is significantly a drift of demand for a period of 30 seconds (default) or more.					
Action	Check wiring and connections to fan. Replace fan.					
A39	Fan 5 Fault	2	✓	---	---	---
Detail	Fan 4 feedback signal is significantly a drift of demand for a period of 30 seconds (default) or more.					
Action	Check wiring and connections to fan. Replace fan.					
A40	Fan 6 Fault	2	✓	---	---	---
Detail	Fan 6 feedback signal is significantly adrift of demand for a period of 30 seconds (default) or more.					
Action	Check wiring and connections to fan. Replace fan.					
A41	Fan 7 Fault	2	✓	---	---	---
Detail	Fan 7 feedback signal is significantly adrift of demand for a period of 30 seconds (default) or more.					
Action	Check wiring and connections to fan. Replace fan.					
A42	Group Control – Network Fault	2	✓	---	---	---
Detail	Comms failure between units on network.					
Action	Check wiring and terminations.					
A43	Group Control – Insufficient Units Available	2	✓	---	---	---
Detail	Group control cannot bring a redundant unit on-line because it's either in a fault condition, has locally been put into standby mode, or has a communication failure.					
Action	Check status of redundant unit, check wiring and terminations.					
A44	PS1 Difference Out of Limits	3	✓	---	---	---
Detail	Difference between secondary return pressure sensors PS1a and PS1b is more than 0.2 bar (3 psi), (default) for a period of 30 seconds (default) or more. Controller will continue to read just the higher of the 2 values.					

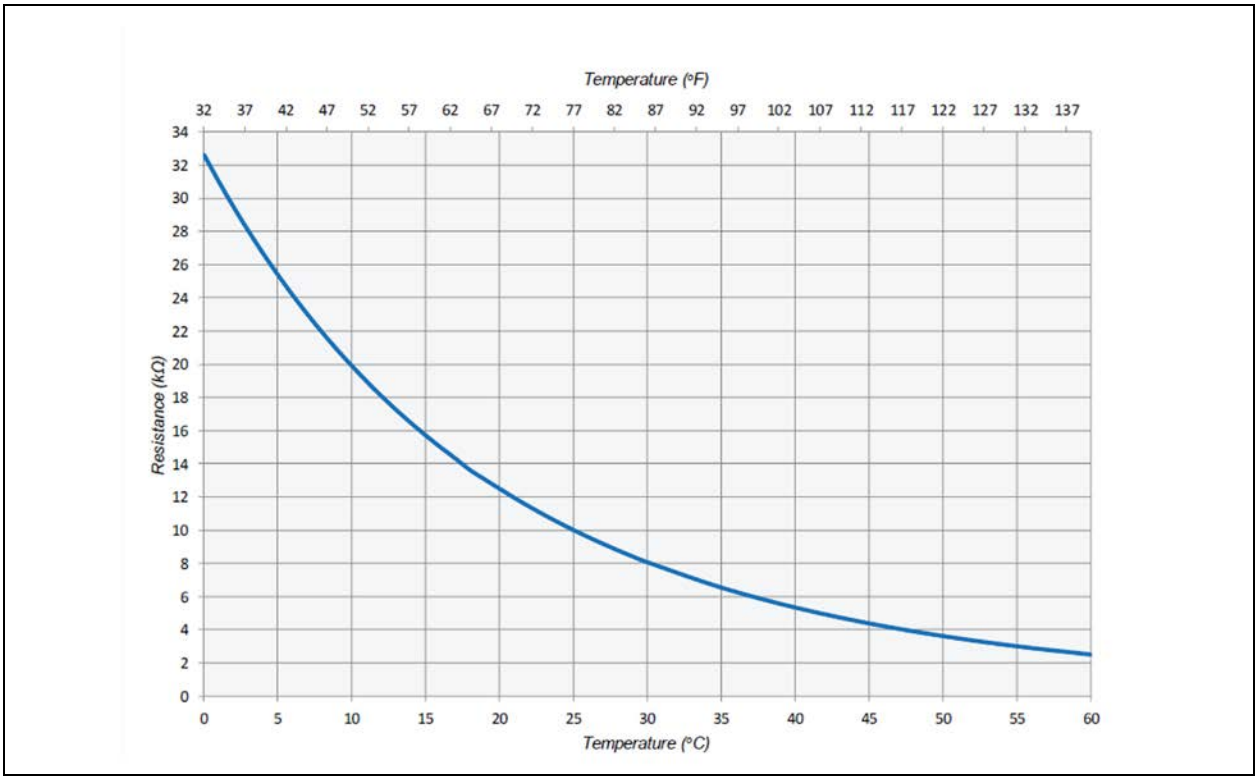
Table 4.36 Code Severity Classifications (continued)

Code	Description	Severity	Self-Clear	Latching	Shutdown	Delay
Action	Replace sensor with the lower reading.					
A45	Fluid Leak Detected	2	---	✓	✓	---
Detail	The water detection rope installed around perimeter of unit drip tray has detected a fluid leak. Alarm may be set for Alarm Only (default), or Alarm + Unit Shutdown.					
Action	Identify and repair leak.					
A46	Secondary Filter 1 Dirty	3	✓	---	---	---
Detail	Differential pressure across pump 1 filter is greater than 0.5 bar (7 psi), indicating that the filter should be cleaned. Default 60 second delay applies.					
Action	Clean filter screen as described in the Fluid Filter Service on page 59 .					
A47	Secondary Filter 2 Dirty	3	✓	---	---	---
Detail	Differential pressure across pump 2 filter is greater than 0.5bar (7 psi), indicating that the filter should be cleaned. Default 60 second delay applies.					
Action	Clean filter screen as described in the Maintenance on page 57 .					
A48	PSU A - AC Fault	3	✓	---	---	---
Detail	PSU failed due to fault on the AC input.					
Action	Check the incoming MCB status, check AC site supply, check wiring and terminations. Replace PSU.					
A49	PSU B - AC Fault	3	✓	---	---	---
Detail	PSU failed due to fault on the AC input.					
Action	Check the incoming MCB status, check AC site supply, check wiring and terminations. Replace PSU.					
A50	PS2b Pressure Sensor Fault	3	✓	---	---	---
Detail	Reading from secondary supply pressure sensor PS2b is outside the normal range of -1 to 8 bar (-14.5 to 116 psi) and min/max values only will be displayed. **NOTE: For DP control, if system differential pressure is not valid, then pump speed will remain at last known demand.**					
Action	Check sensor connections to the control board, check inline connections, replace sensor.					
A51	PS2 Difference Out of Limits	3	✓	---	---	---
Detail	Difference between secondary supply pressure sensors PS2a and PS2b is more than 0.2 bar (3 psi), (default) for a period of 30 seconds (default) or more. Controller continues to read just the higher of the 2 values.					
Action	Replace sensor with the lower reading.					
A52	PS4 Pressure Sensor Fault	3	✓	---	---	---
Detail	Reading from pump inlet header pressure sensor PS4 is outside the normal range of -1 to 8 bar (-14.5 to 116 psi) and min/max values only will be displayed.					
Action	Check sensor connections to the control board, check inline connections, replace sensor.					

4.6 Temperature Sensor Graph

Figure 4.21 below may be used to check the validity of the 10K thermistor used in the unit.

Figure 4.21 Temperature Sensor Resistance Graph

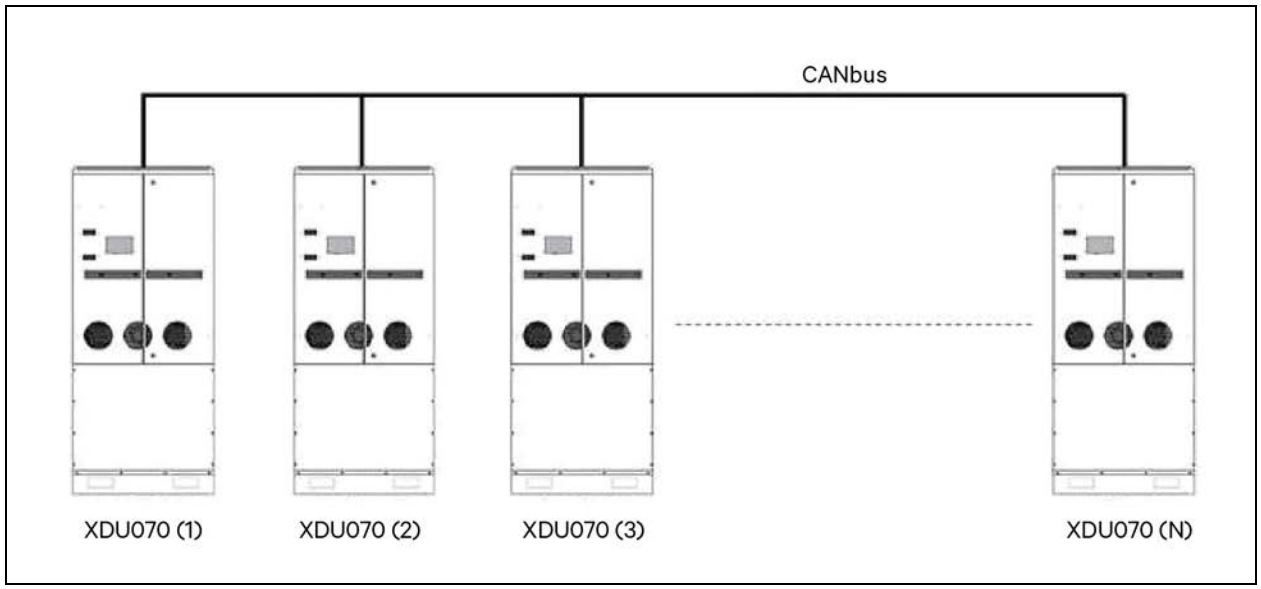


4.7 Group Control

This section is applicable if more than one Vertiv™ CoolChip CDU070 is installed per system.

Groups of up to eight CoolChip CDU070s can be connected using a high speed, robust twisted pair CANbus network in order to provide coordinated control in larger installation and N+X redundancy.

Figure 4.22 Group Control



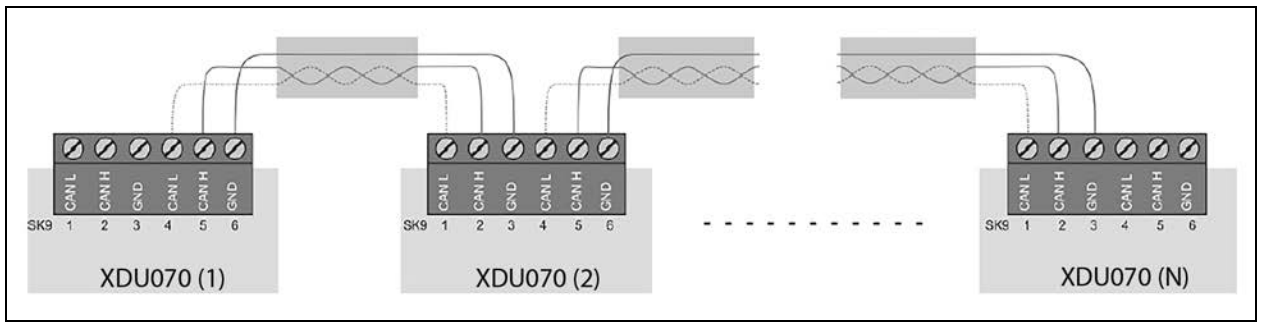
4.7.1 Group Control—Network Cabling

CANbus is used for communication between Vertiv™ CoolChip CDU070 units for group control. CANbus always requires at least 3 conductors: 2 signal wires (CAN H and CAN L) and a 1 signal return path.

The CoolChip CDU070 provides 2 CAN H, 2 CAN L and two ground terminals on sockets SK9, 1, 2 and 3 for In and terminals 4, 5 and 6 for Out.

Beldon 3106A, or equivalent (1 pair+1, shielded 22 AWG) is the recommended cable type to be used and pre-configured cable assemblies are provided with each unit if required.

Figure 4.23 Group Control Wiring Configuration

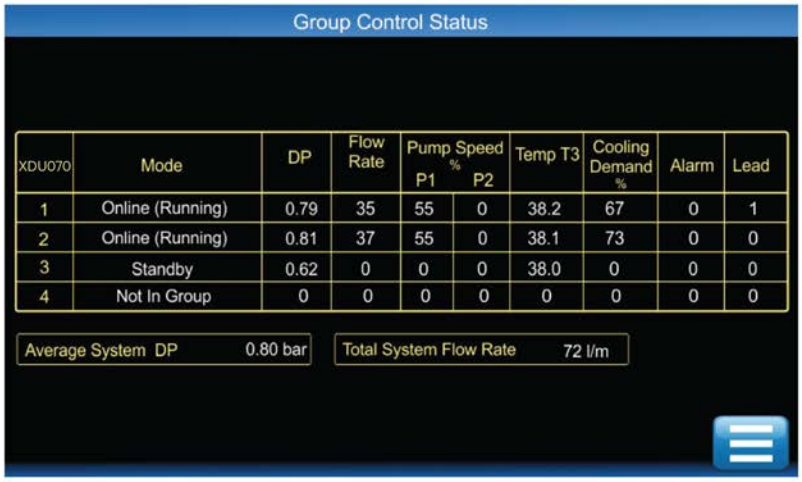


Units become self organizing when in group control. The lead unit is automatically selected which coordinates the running state of each unit in group based on:

- Configured level of redundancy
- System pressure requirements
- Alarm conditions

Changes to the group settings or system settings can be made via any CoolChip CDU070 touchscreen user interface at any time and are automatically synced across the network.

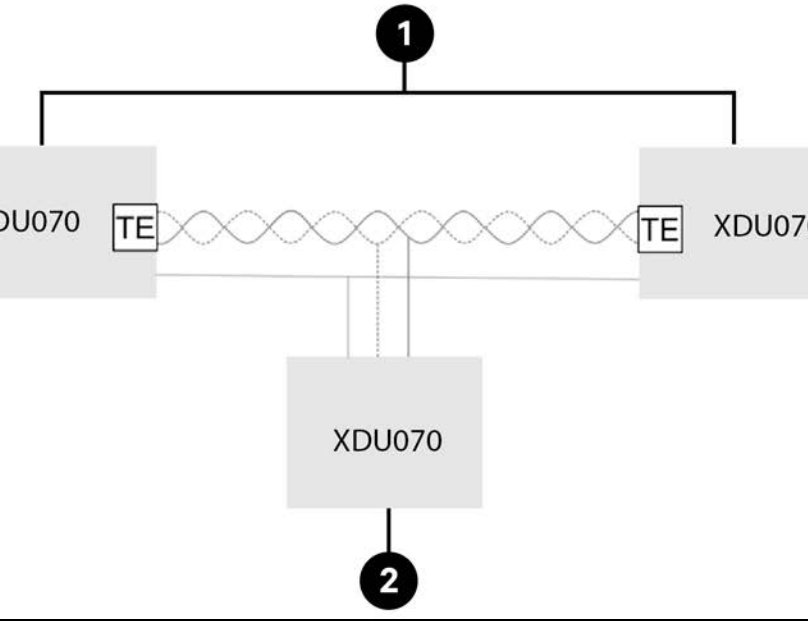
Figure 4.24 Group Control Status Screen



4.7.2 Group Control—Network Termination Resistors

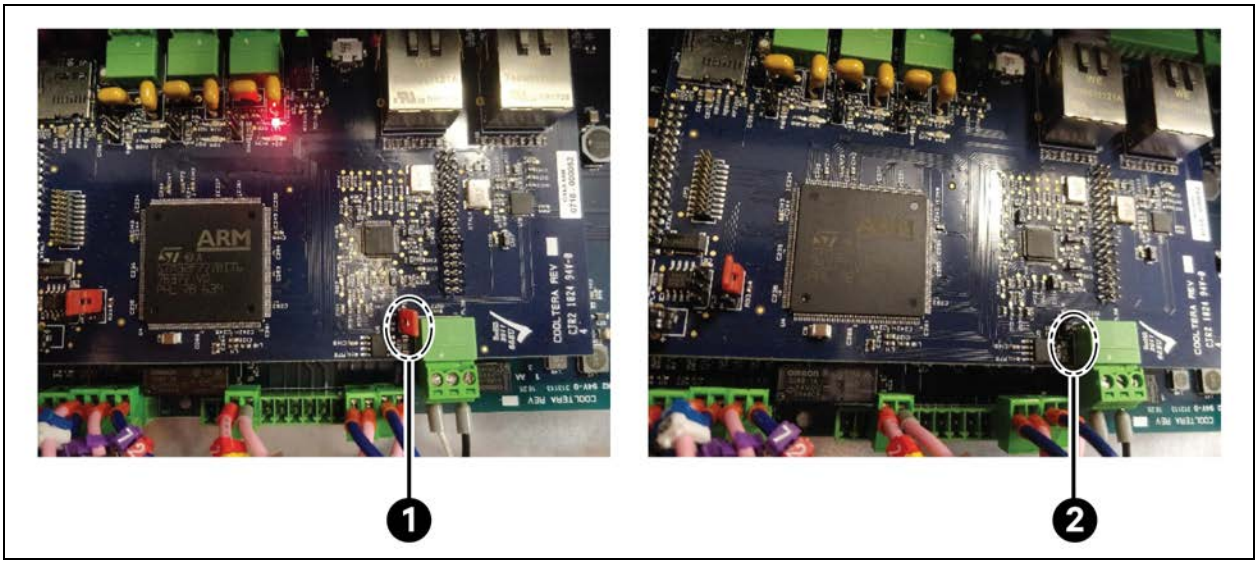
The Vertiv™ CoolChip CDU070 controller includes an onboard 120 ohm resistor which can be activated by fitting a hardware jumper. If only one CoolChip CDU070 unit is installed, the resistor does not require activation. For a two unit installation, both units should have the termination resistors enabled. For three units and above, units 1 and n should have the termination resistors enabled, while units between should be disabled. Failure to disable the middle resistors could result in intermittent communications. See Figure 4.25 below and Figure 4.26 on the next page for the location of the jumper to enable/disable the termination resistor (the jumper is fitted by default and must be removed if not required).

Figure 4.25 CANbus Network Termination Resistors



Item	Description
1	Units with termination enabled
2	Units with termination disabled

Figure 4.26 CANbus Network Termination Resistors



Item	Description
1	Jumper fitted = Termination resistor activated
2	Jumper not fitted = Termination resistor not activated

4.7.3 Group Control—Network Addresses

Each Vertiv™ CoolChip CDU070 must be given a unique address. A CoolChip CDU070 network addresses should be allocated to each unit in ascending order, starting from 1.

The CoolChip CDU070 network address is configured via Setup screen > Unit Address (P081). Configure each CoolChip CDU070 so that it is aware of the other CoolChip CDU070 devices on the network:

- Enter the total number of CoolChip CDU070 units in the networked system via Setup screen > Group Control > Number of Units in Group (P082)
- Enter the number of run units via Setup screen > Group Control > Number of Run Units (P083)

4.7.4 Group Control—Start Sequence from Power Up

1. Power is available when the controller is active.
2. POST (power on system test) and Firmware initializes in less than 1 second—CANbus network activity and RS485 communications with inverters will be established within the 1 second period.
3. When the controller is initialized, it looks for messages from the other CoolChip CDU070s in the Group. Messages from XDUs are transmitted asynchronously every 100 milliseconds, so within 200 milliseconds messages will have been exchanged and the group demand shared.

4. When the group demand is shared, the inverters will be driven to the group demand instantly via RS485 Modbus RTU communication from the controller.
5. The inverters are programmed with 2 seconds ramp up period (2 seconds to 100%), so if the group demand is typically at 65% to 75%, ramp up will take 1.5 seconds. This ramp up period is designed to prevent a secondary discharge pressure over shoot on CoolChip CDU070 (or pump) restart. It is also configurable via the F002 acceleration time parameter on the inverter.
6. Total startup time in Group Control mode is 1 second + 200 milliseconds + 1.5 seconds = 2.7 seconds to the required pump speed, pressure, and flow rate.

4.7.5 Group Control—Controls

When in group control, the lead Vertiv™ CoolChip CDU070 modulates its pump speed to maintain a differential pressure setpoint. The differential pressure setpoint default is an average over all the individual running CoolChip CDU070 differential pressure readings. This can be changed to the differential pressure over all CoolChip CDU070 in the group in Seh1p/Group Control/P094 regardless if they are running. All CoolChip CDU070 units work in parallel and set their pump speeds to be identical with that of the lead CoolChip CDU070.

Each CoolChip CDU070 modulates its own primary (facility) fan speeds to maintain a group wide IT supply fluid temperature setpoint. Each CoolChip CDU070 also locally regulates temperature using the average of its individual temperature sensors.

4.7.6 Group Control—Unit Rotation and Standby Units

Unit rotation can be configured to be weekly, monthly, or never in the Setup screen under Group Control. Upon rotation, one of the standby units is switched on and one of the duty units is switched off. For example, if units 1, 2, 3, and 4 are running and 5 and 6 are off, after rotation units 2, 3, 4, and 5 will run while 1 and 6 off.

In the event that the load exceeds the capacity of the running units and there are standby units, the standby units will not kick in automatically. The configured number of duty units is selected based the max load. If this max load increases, then additional load has been added and the operator should increase the configured number of duty units.

4.7.7 Group Control—Failure Offset

Failure mode enables standby pumps to start in 75 ms and a 2 second ramp up when a CoolChip CDU070 in the group is taken offline. This is to seamlessly maintain system differential pressure if a unit is lost without over/undershoots.

The failure offset is applicable only when a group of three or more CoolChip CDU070 units are configured in N, meaning all CoolChip CDU070 units are set to run with no CoolChip CDU070 redundancy. Additionally, they are configured to activate the standby pump when an CoolChip CDU070 failure or power-off occurs. The pump reduction (or failure) offset is applied to the system pump speed when there is a CoolChip CDU070 failure (shutdown) or the unit is switched off. Starting the standby pumps in the running CoolChip CDU070s will result in more pumps running than when all CDUs are healthy and operational. To avoid spikes in differential pressure, P217 failure Pump Speed offset is applied to the system pump speed at the time of the CDU failure. P217 should be determined at commissioning.

4.7.8 Group Control—Failure Modes

When there is communication failure between units, a new lead CoolChip CDU070 will be established for each new grouping of units. When communication is re-established, the original lead CoolChip CDU070 will take control. See Figure 4.27 on the next page . If only the lead CoolChip CDU070 loses communication, the next CoolChip CDU070 will take over the lead role. When the previous lead CoolChip CDU070 communication is re-established, it will not take over the lead role again. See Figure 4.28 on the next page .

Figure 4.27 General Communication Failure

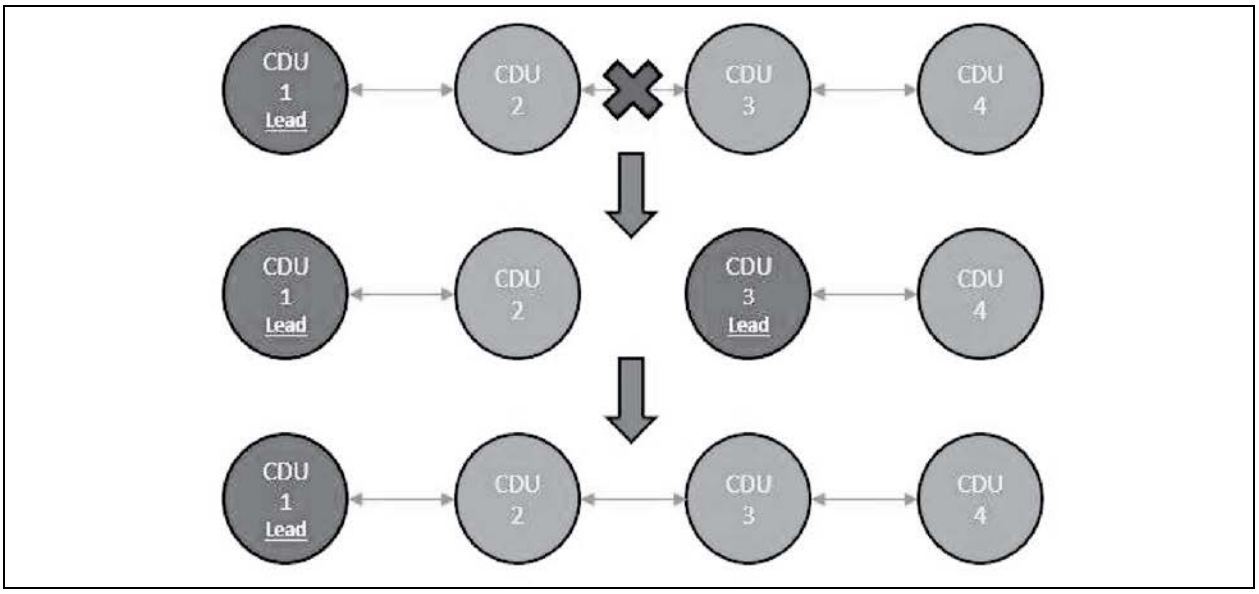
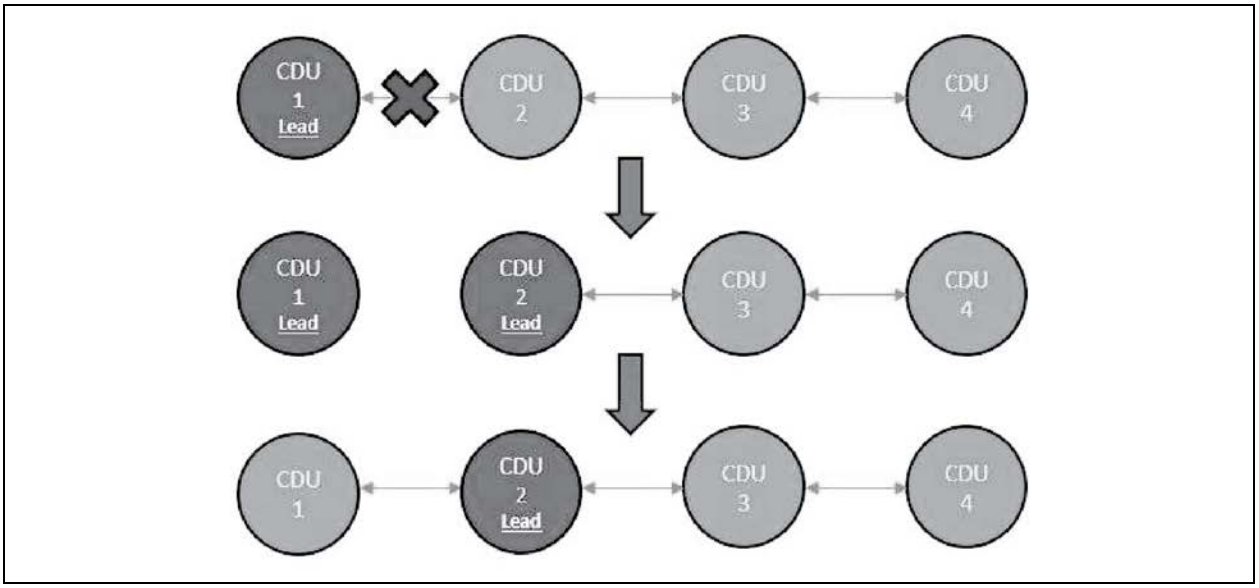


Figure 4.28 Lead Communication Failure



In the event of a sensor failure, all sensors related to control (PS1, PS2 and T2) are redundant at the Vertiv™ CoolChip CDU070 level, so a single sensor failure will not impact the operation or the status of the CoolChip CDU070. So, if the lead CoolChip CDU070 does have a sensor failure it will not result in a change of lead.

5 Maintenance

5.1 General

The Vertiv™ CoolChip CDU070 should be cleaned on a regular basis and checked for leaks and malfunctions. Maintenance should only be carried out by personnel qualified to work on this type of equipment. For information on maintenance or service support, contact Vertiv representative.

5.2 Fluid Specifications

The fluid circuit should be filled with water or PG-25.

Failure to use the recommended cooling fluid may result in decreased system performance and reliability due to corrosion, scaling, fouling and microbiological growth which may invalidate the warranty.

5.3 Planned Preventative Maintenance

Planned maintenance services should be carried out every 6 months following installation and commissioning.

5.3.1 Special Tools/Equipment

- Surface temperature measurement device
- Air temperature measurement device
- Clamp-on ammeter
- Drain tube (supplied with unit)
- Coolant sample kit (for coolant analysis)
- Micro-SD card reader and computer

5.3.2 Visual Checks for Damage and Leakage

- Pipework and hoses
- All temperature, level, flow and pressure sensors
- Expansion vessels and Schrader valves
- Auto air vents and screw cap
- Drain valves
- Pump clamped connections
- Pipe clamped connections
- Cooling coil pipework and connections
- Presence of dust or potential clogging of heat exchanger coils surface
- Check running pump for abnormal noise
- Record any damage to unit

5.3.3 General Settings

- Record unit serial number on maintenance check list.
- Record values from controller display home page.

5.3.4 Controller Checks

Setpoints and alarm actions, group control, download logs.

- Check the sync date and time of the units. NTP may or may not be enabled.
- Check for any current alarms, take appropriate action as detailed in this guide.
- Download complete contents of folder with name of product serial number from micro SD card. This folder contains historic alarm log, system log, parameter log, and data log files.
- Record parameters from the parameter log file that have been changed from default since commissioning (signified by an asterisk adjacent to parameter ID in log file). Verify with customer why values have changed from commissioned value.

5.3.5 Communication Checks

Check with customer that remote communications function correctly with no reported issues.

5.3.6 Sensor Checks

- The accuracy of the temperature sensors installed on the unit is +/-1°C.

  Sensor checks:

  - The accuracy of the air temperature sensors installed on the unit can be verified by comparing their value with a calibrated air temperature sensor.
  - The accuracy of the fluid temperature sensors can be checked by applying a calibrated temperature sensors on the related pipe surface.
- Check pressure and flow sensor readings are consistent with other units in the group (if multiple units) and with commissioned values.

5.3.7 Fluid Checks

- Take secondary circuit fluid sample as directed by fluid management partner and send to approved lab for analysis and report recommendations.
- Take action on any previous fluid report recommendations.
- Check supplementary filling operation with manual override if not automatically engaged when taking fluid sample.
- Check makeup reservoir tank is full, properly connected and breather cap is functional.
- Record fluid filter DP readings (PS3a and PS3b difference with PS2).
- Isolate, remove, and clean fluid filters if necessary, and record new readings.

5.3.8 Functional Checks

May require unit shutdown. Check with customer before continuing.

- Check controller, display and security gateway (if fitted) firmware status and upgrade, if necessary.
- Carry out audible/visual checks on operational pump.
- Override operational pump speed to 100% and record temperature, current, and voltage from Status screen (ensure PS2 does not exceed high pressure alarm setpoint).
- Override redundant pump speed to 100% and record temperature, current, and voltage from Status screen, then set override back to 0%.
- Override fan speed to 100% and record current draw for each fan (clamp-on ammeter).
- Check all the cable connections and terminals for signs of damage/loose wire connection.

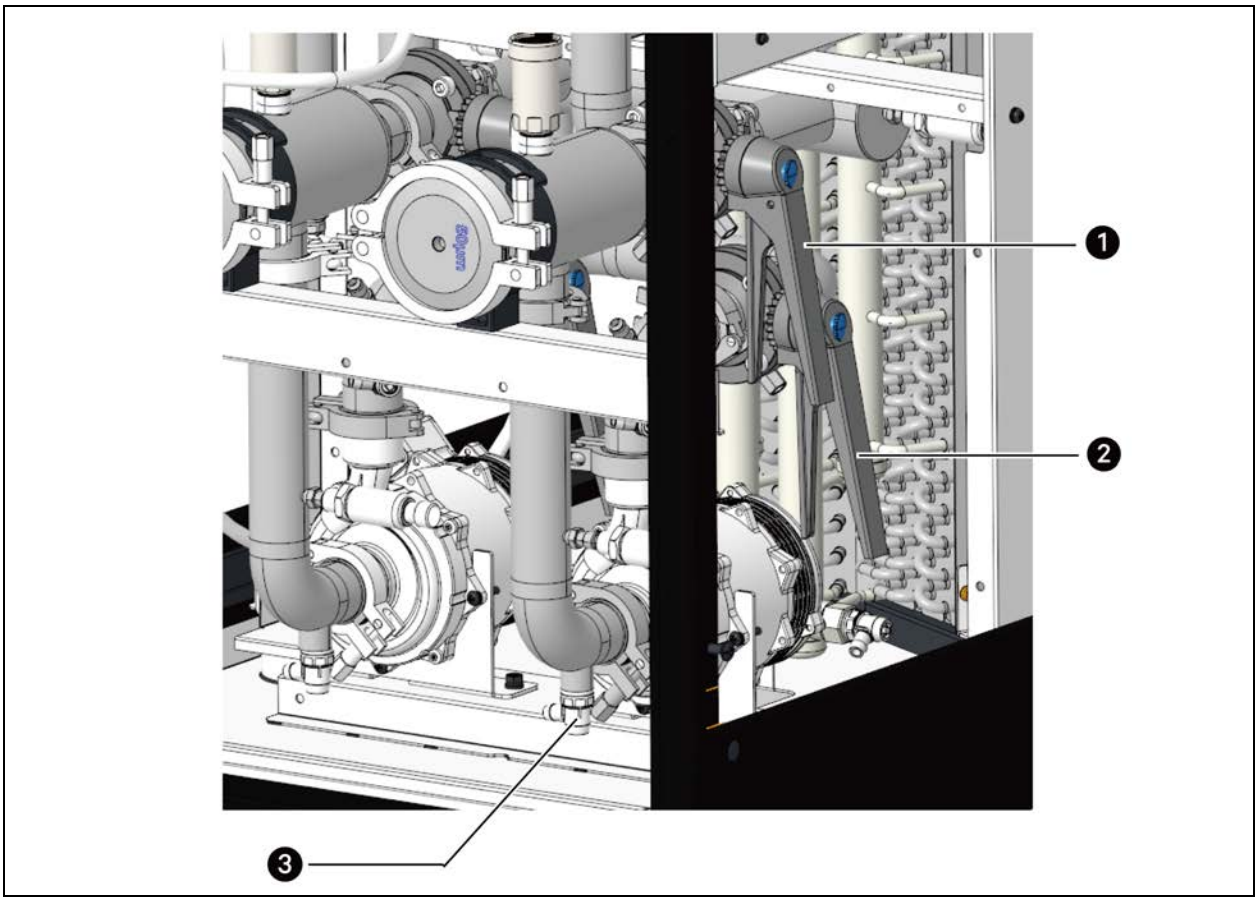
5.4 Fluid Filter Service

This the unit has twin (redundant) pumps and the filter of each pump can be cleaned while the unit is running provided the pump of the filter to be cleaned is put into out-of-service state via the service menu (screen refs. S410/S402).

To service the fluid filter:

1. Close filter inlet and pump outlet valve to 90 degree position. Pump outlet valve will need to be closed first.
2. Connect hose to drain valve and open valve to remove fluid from filter housing.

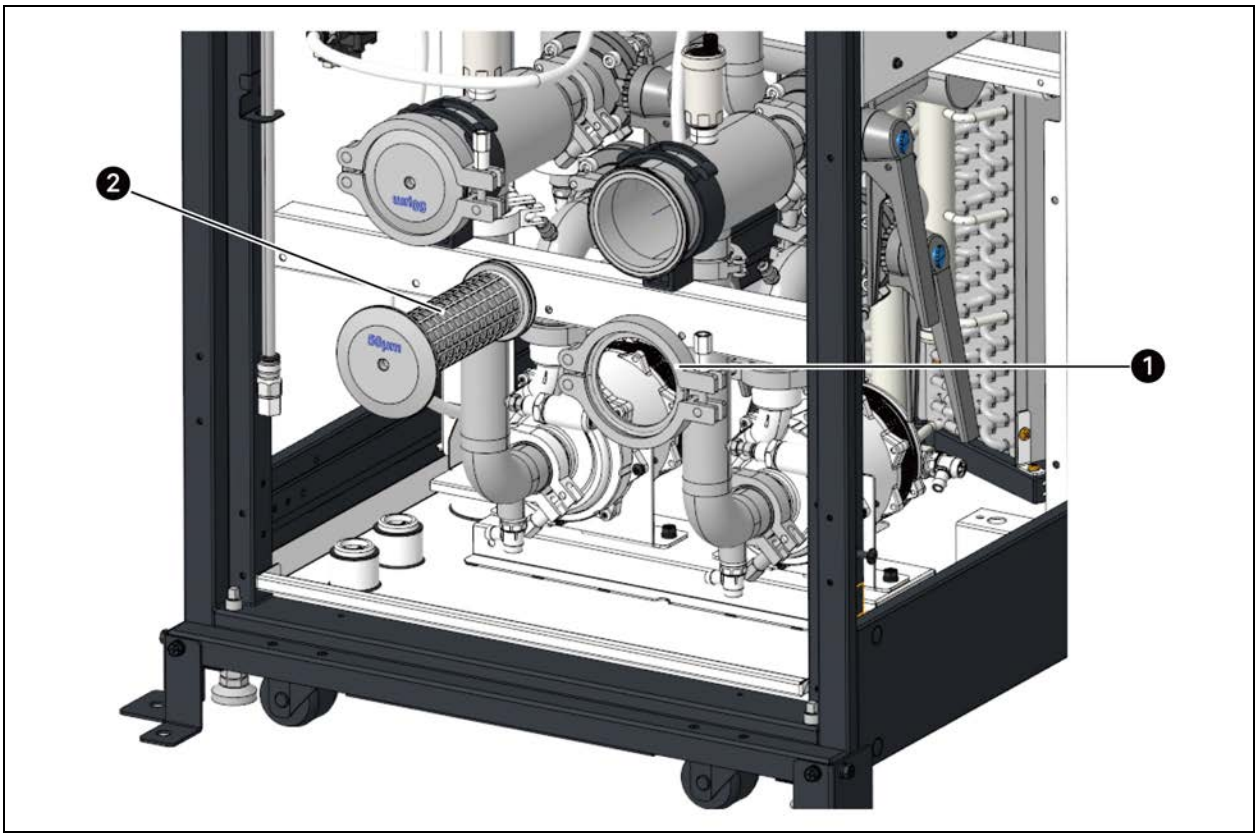
Figure 5.1 Servicing Fluid Filters Demonstrated on Pump B Filter



Item	Description	Item	Description
1	Filter inlet valve	3	Drain valve
2	Pump outlet valve		

3. After draining filter, undo and remove clamp ring.
4. Withdraw filter screen from housing.

Figure 5.2 Servicing Fluid Filters Demonstrated on Pump B Filter



NOTE: Each filter has a seal washer at both the inlet and outlet, with the following codes: 63207728 for the inlet and 63207751 for the outlet.

Item	Description
1	Clamp ring
2	Filter screen

The secondary filters may be removed and cleaned using this procedure:

1. Close isolation valves located on pump inlet and filter of the filter to be serviced. See Figure 5.1 on the previous page . Valve handles should be 90° anti-clockwise for Pump A Filter and 90° clockwise if Pump B filter.
2. Drain the fluid from the filter using the drain valve at the base of the filter housing, with the drain valve key and drain hose provided.

NOTE: It is not necessary to fully drain the filter housing in order to clean the filter. Drain just enough fluid to ensure the level has dropped approximately a cupful in the filter housing.

3. Once drained, undo the clamp ring at the top of the filter housing. The threads of the clamp ring match the threads in the center of the filter housing. Fold the clamp ring into a handle to pull the cap and filter screen (including the automatic vent) out from the top of the filter housing.

NOTE: It may be necessary to break the seal on the top flange of the filter housing by giving the cap flange a gentle tap on the side with a soft faced mallet.

4. The filter screen may now be washed under a running tap however, if possible, a high pressure water jet is preferable for more effective cleaning. Care must be taken not to damage the delicate filter mesh.

NOTICE

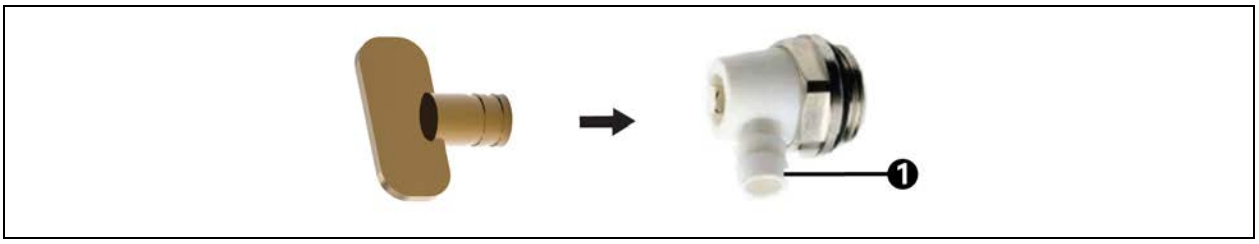
Check the condition of the O-ring seal at the base of the filter screen and the face seal at the top before re-assembling and replace if there are any signs of damage. When opening the valves, open the pump inlet valve initially until all the contained air is purged out of the filter housing through the automatic air-vent, before then opening the filter outlet valve. When the pump inlet valve is opened, the loss of system pressure will most likely automatically start the fill pump P3 to bring the system back to the operating pressure.

5.5 Unit Draining

5.5.1 Fluid Circuit Drain Points

There are 11 drain valve locations around the fluid circuit. Each drain valve can be operated with the drain valve key supplied with the unit. Select a hose with an inner diameter of 10 mm and a length of not less than 3 m and connect it to the drain valve to collect the water in the unit into a suitable container. See Figure 5.4 on the facing page for drain valve locations.

Figure 5.3 Drain Valves

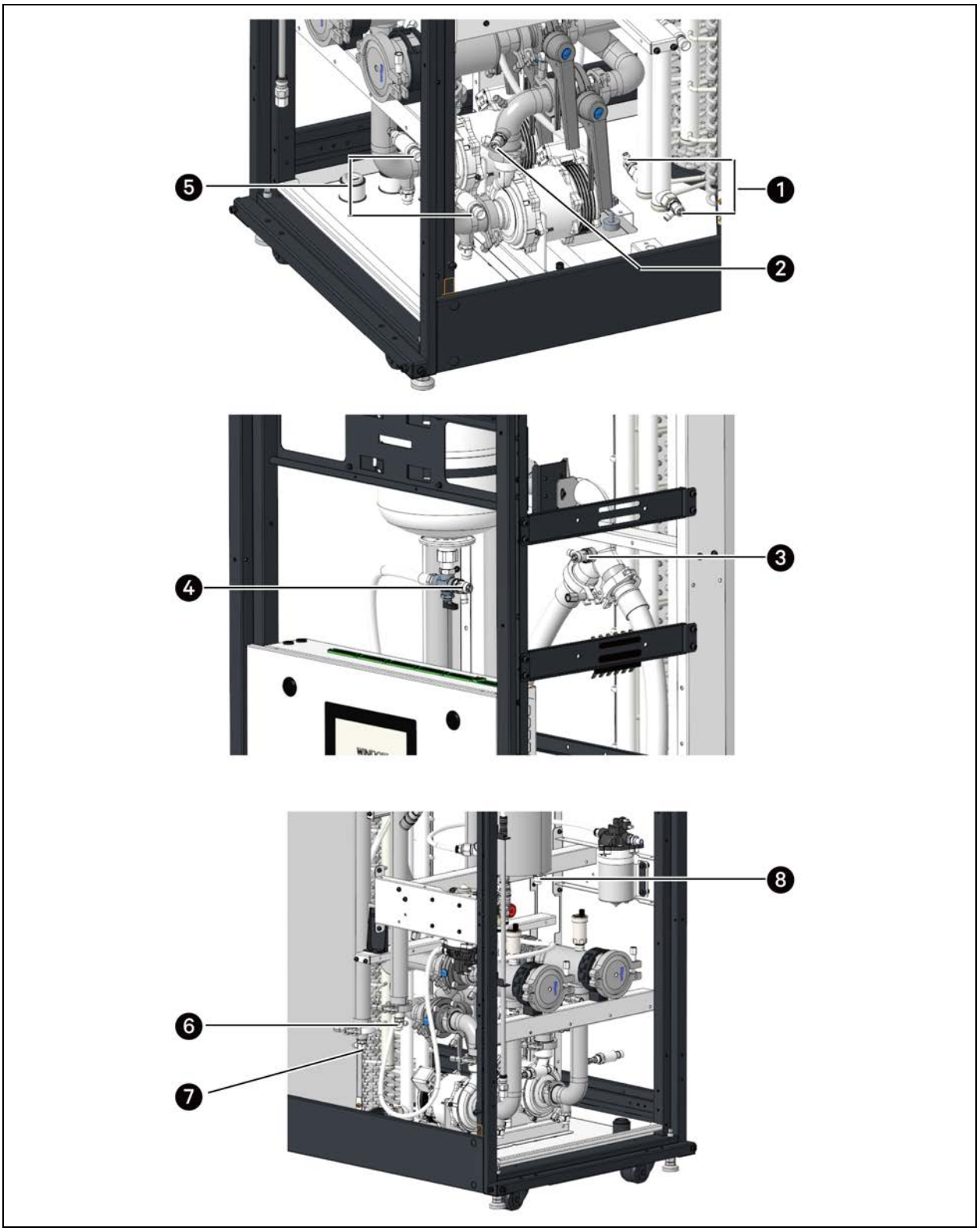


Item	Description
1	Use 3/8 in. bore hose for draining

Valve locations are:

- 1 at the base of each coil inlet header tube (total 2 off)
- 1 on the inlet of each pump/filter outlet (total 2 off)
- 1 at the outlet of each pump (total 2 off)
- 1 at the Y-branch of the return pipe
- 1 at the expansion vessel
- 1 valve at the bottom of the supply pipe
- 1 valve at the bottom of the return pipe
- 1 valve at the bottom of the reservoir tank

Figure 5.4 Drain Valve Locations



Item	Description	Item	Description
1	Coil header drain valves	5	Drain valve on each pump inlet
2	Drain valve on each pump outlet	6	Valve at the bottom of the supply pipe
3	Return pipe Y-branch drain valve	7	Valve at the bottom of the return pipe
4	Expansion vessel drain valve	8	Valve at the bottom of the reservoir tank

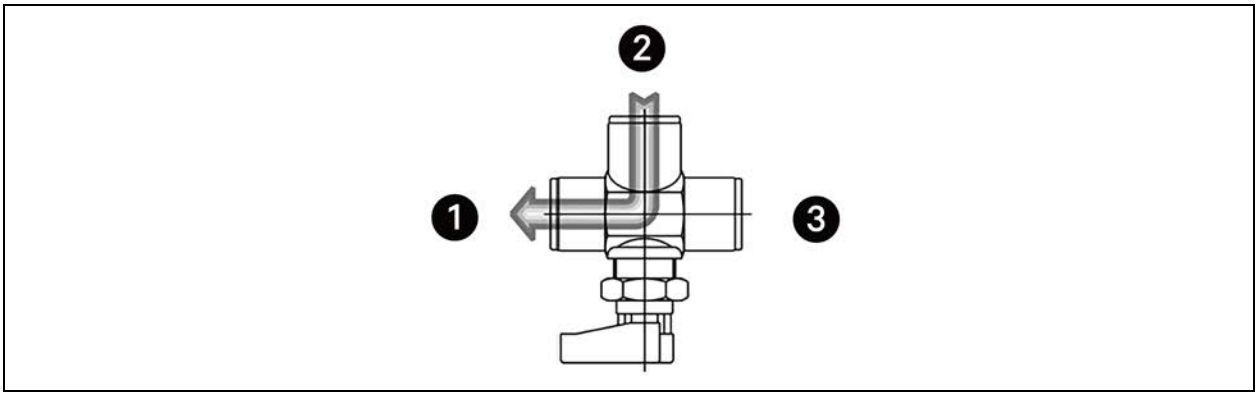
5.6 Maintenance of the Expansion Tank

As a pressure regulating device, the expansion tank needs regular maintenance and can be included in the annual maintenance plan.

Maintenance plan:

1. When the unit is operating normally, the three-way valve is in the state as shown in Three-way Valve When the Unit Is Operating Normally below .

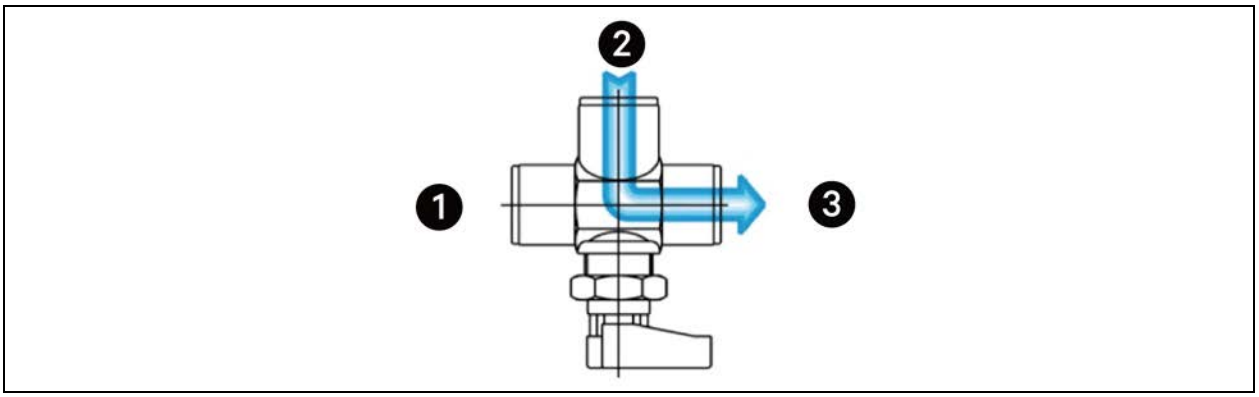
Figure 5.5 Three-way Valve When the Unit Is Operating Normally



Item	Description	Item	Description
1	System	3	Water drain valve
2	Expansion tank		

2. To maintain the expansion tank, connect a hose with an inner diameter of 10 mm and a length of at least 3 m to the drain valve, open the drain valve on the right, drain the water from the expansion tank, and collect the water to a suitable container. The three-way valve is in the state as shown in the figure below.

Figure 5.6 Three-way Valve When Draining Liquid from the Expansion Tank



Item	Description	Item	Description
1	System	3	Water drain valve
2	Expansion tank		

3. Detect the pressure in the expansion tank. Open the protective cover on the top of the expansion tank, connect a tire pressure gauge (measuring range: 0 to 1.5 bar) to the inflation port on the top of the expansion tank, and measure the pressure.
    a. If the pressure in the expansion tank is lower than 0.4 bar, add air or nitrogen until the pressure increases to 0.7 bar.
    b. If the pressure in the expansion tank is higher than 1.0 bar, release air or nitrogen until the pressure returns to 0.7 bar.
4. Remove the tire pressure gauge, install the protective cover on the top of the expansion tank, close the drain valve, and open the manual ball valve and the three-way valve in turn. The three-way valve returns to the state as shown in step 1.

5.7 Replacement of the Fuse

Table 5.1 Fuse Replacement Chart (Miniature Fuses)

Fuses F1 and F2	20 A - 6.3 x 32 mm
Fuses F3	5 A - 6.3 x 32 mm
Fuses F4 and F5	10 A - 6.3 x 32 mm
Fuses F6	15 A - 6.3 x 32 mm
Fuses F7*	4 A - 5 x 20 mm
Fuses F9	500 mA - 5 x 20 mm
Fuses F10 and F16	5 A - 5 x 20 mm
*denotes time lag fuse. The others are fast acting fuses	

5.8 Service Life of Key Components

Table 5.2 Service Life of Key Components

Component	Expected life	Replaced in
Power module	5 years	4 to 5 years
Secondary fluid circuit pump	≥ 2.2 years	2 years
Axial fan	≥ 4.5 years	4 years

Appendices

Appendix A: Technical Support and Contacts

A.1 Technical Support/Service in the United States

Vertiv Group Corporation

24x7 dispatch of technicians for all products.

1-800-543-2378

Liebert® Thermal Management Products

1-800-543-2378

Liebert® Channel Products

1-800-222-5877

Liebert® AC and DC Power Products

1-800-543-2378

A.2 Locations

United States

Vertiv Headquarters

505 N Cleveland Ave

Westerville, OH 43082

Europe

Via Leonardo Da Vinci 16/18 Zona Industriale Tognana

35028 Piove Di Sacco (PD) Italy

Asia

7/F, Dah Sing Financial Centre

3108 Gloucester Road, Wanchai

Hong Kong, China

China

B2 Building, Nanshan Zhiyuan

1001 Xueyuan Avenue

Nanshan District, Shenzhen, China

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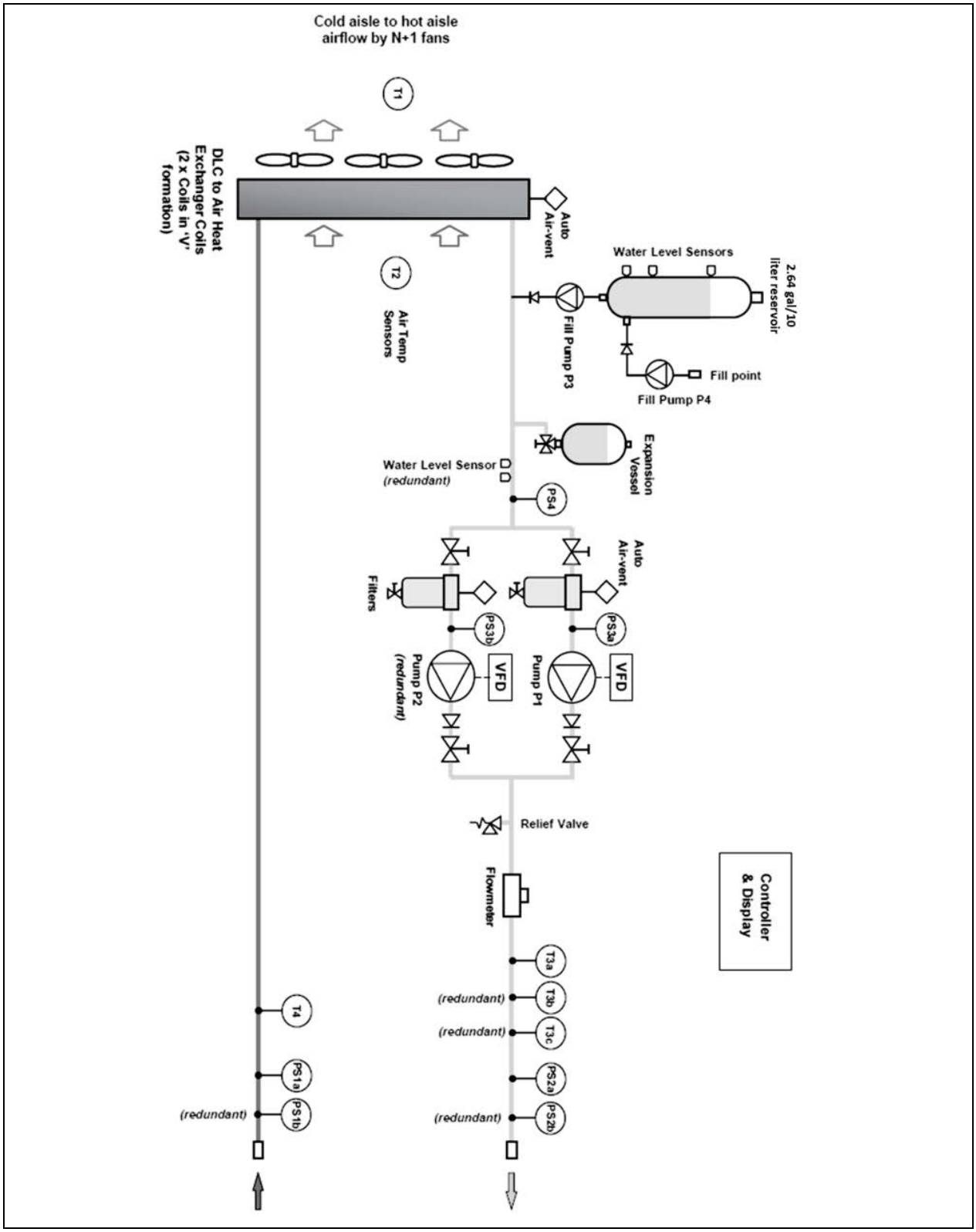
Appendix B: Piping Schematic



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Appendix C: Notes

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Appendix D: Disposal Procedure

Waste materials must be disposed of in a responsible manner in line with environmental regulations.

Decommissioning and disposal of this product should be undertaken by qualified personnel in adherence to local and national safety regulations, particularly for protection of lungs, eyes, and skin from chemicals, dust etc. Approved lifting gear and power tools should be used and access to the work area must be restricted to authorized personnel. The following steps are a guide only and should be adjusted to take into account local site conditions:

1. Disconnect unit from electrical supply.
2. Drain and dispose of any heat transfer fluid through an approved recycling facility.
3. Remove unit to an approved recycling facility.

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