Liebert® XDU070 Coolant Distribution Unit (Liquid to Air)

Application and Planning Guide

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.

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Names of companies and products are trademarks or registered trademarks of the respective companies. Any questions regarding usage of trademark names should be directed to the original manufacturer.

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 Safety Instructions

1.1 General

WARNING! This product is supplied with a 2.71 psi (1.5bar) nitrogen holding charge in the fluid circuit. This needs to be vented during the installation process.

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 3-way valves have come to rest.

If there is a doubt concerning safety, installation, operation, or maintenance instructions, contact Vertiv for clarification and advice. See Technical Support/Service in the United States on page 25 .

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.

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 Vertiv's 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. The use of incorrect replacement parts may affect the operation or reliability of the unit and invalidate any warranty. See Technical Support/Service in the United States on page 25 .

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 Low Voltage directive 2014/35/EU, the EMC directive 2014/30/EU and the Pressure Equipment directive 2014/68/EU. As manufactured, Vertiv products are designed to comply with an IP21 rating. This product is cUL listed for the appropriate voltage models and certificates will be made available on request (cUL certificate pending).

2.2 ROHS 3 Compliance

The manufacturer certifies that all products manufactured and supplied are fully RoHS compliant in accordance with EU RoHS 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™ Liebert® XDU070 for application and planning purposes.

The Liebert® XDU070 contains a secondary closed loop circuit that provides a supply of cooling fluid to IT equipment for direct cooling (e.g., 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 7 x 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.

- Fluid outlet 122°F (45°C), EAT 95°F (35°C), ambient air temperature 18°F (10°C) approach
- 26.4 gpm (100 l/m) flow rate
- 60 to 100 kW capacity dependent on ambient operating conditions (approach), fan speed, and fluid type
- 1.5 inch hygienic outlet and inlet connections, OAT PG25 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
- Top and Bottom Fluid Connection, reserve liquid tank and integrated fill pump
- Integrated 50μ Filters (with hot swap function)
- Max airflow approaching 7,000 CFM
- Ability to implement liquid cooling solutions without the need for a primary water supply or other related infrastructure.
- Easy installation, maintenance, and retrofit pipework parts.
- Small footprint: 23.6-inch x 47.2-inch (600 mm x 1,200 mm)
- 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.

3.2 Vertiv™ Liebert® XDU070 Model Number Nomenclature

The Liebert® XDU070 can be configured for voltage options to suit

- Any global location
- Primary/secondary filtration
- Primary top/bottom connections
- Secondary top/bottom connections

Table 3.1 below describes each digit of the model number.

Table 3.1 Liebert® XDU Model Number Base Digit Definitions

Base Model Digit Definitions									
1-6	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
XDU070	A	0	K	3	1	0	2	0	A
Base Model Digits 1-6	Cooling Type Digit A = Liquid to Air	Placeholder digit None=0	Voltage Selection Digit K-120/1Ph/60Hz R=220/3ph-50Hz	PRV Digit 3 - 3 Bar 4 = 4 Bar	Monitoring Digit 1 = Standard	Connection Adapter None = 0 1 - FD83	Secondary Filtrationi 2 = Fitted (50 µ)	Placeholder Digit None = 0	A-Z = Standard Configuration S = Special Feature Authorization

Table 3.2 Liebert® XDU Nomenclature Detail

Base Model Digit 1-6	Liebert® XDU070
Cooling Type Digit 7	A = Liquid to Air
Place Holder Digit 8	None = 0
Voltage Selection Digit 9	K = 120/1 Ph/60Hz R = 22/1Ph/50Hz
PRV Digit 10	3 = 3 bar 4 = 4 bar
Monitoring Digit 11	1 = Standard
Connection Adapter Digit 12	None = 0 1 = FD83
Secondary Filtration Digit 13	2 = Fitted (50µ)
Placeholder Digit 14	None = 0
Digit 15	A-Z = Standard Configuration S = Special Feature Authorization

3.3 Product Views

Figure 3.1 Front View of Vertiv™ Liebert® XDU070 (Doors and Side Panels Removed)

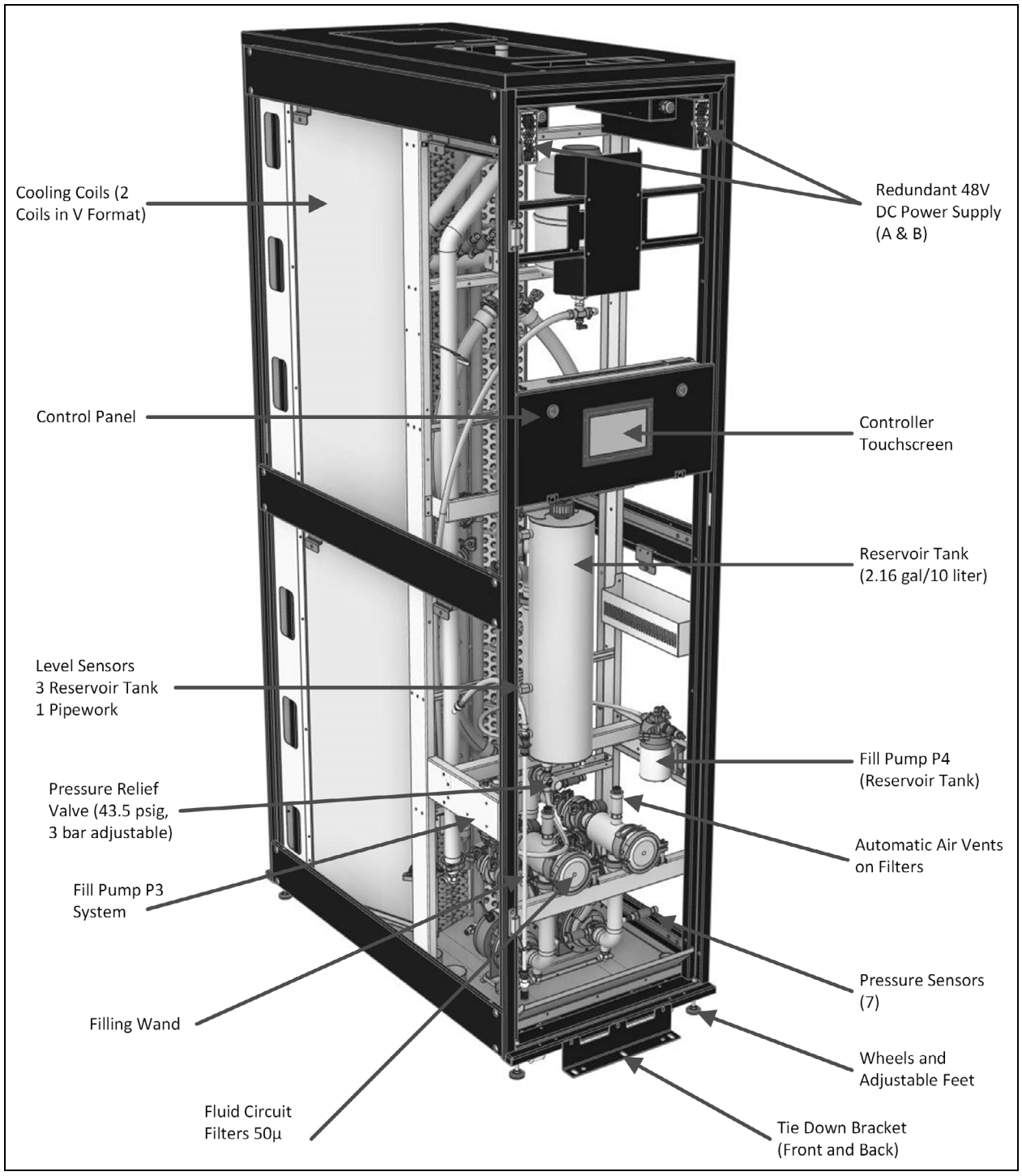
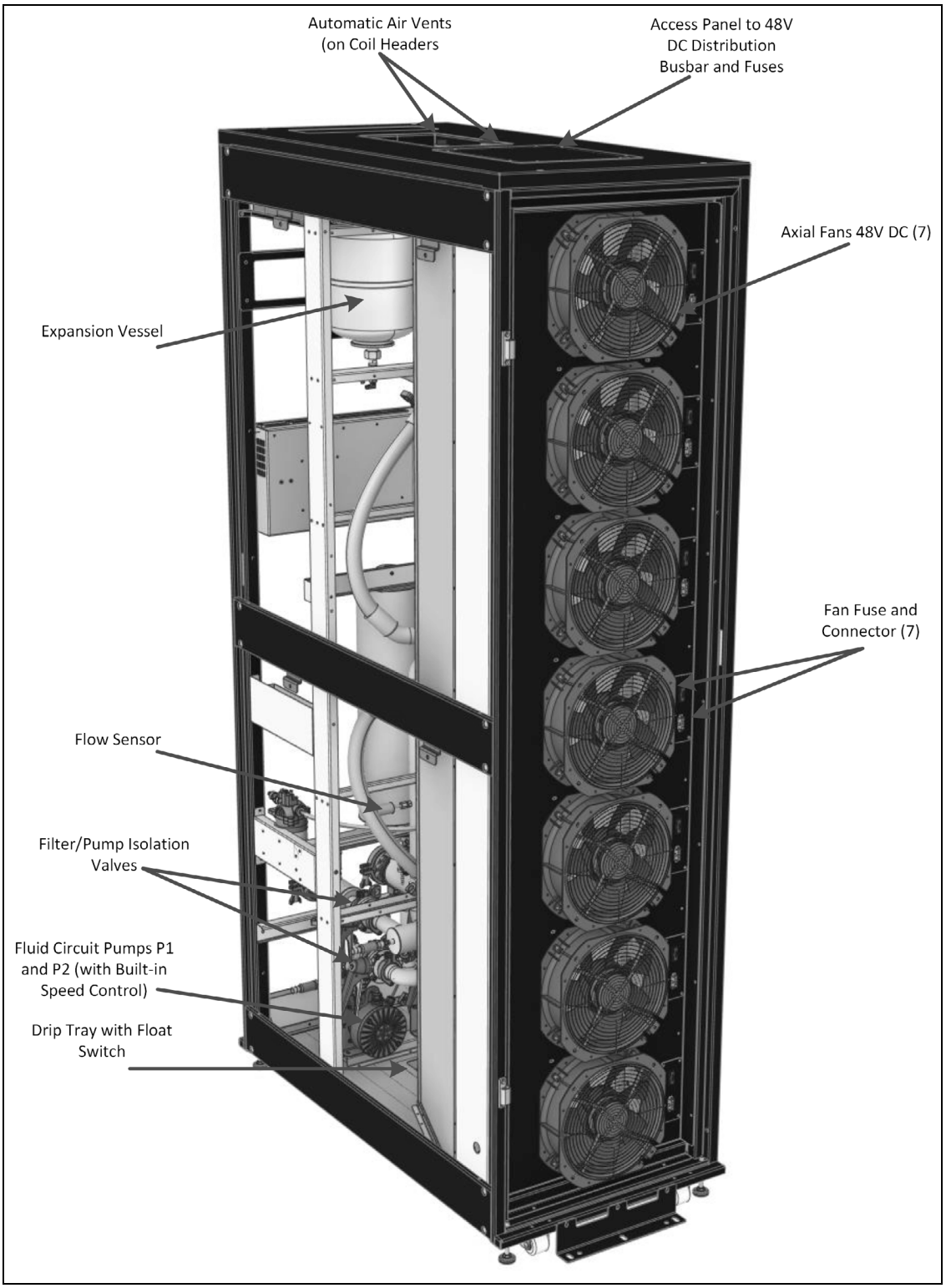


Figure 3.2 Rear View of Vertiv™ Liebert® XDU070 (Doors and Side Panels Removed)



3.4 Spare Parts

It is recommended that the end user holds a kit of essential spare parts to enable the Vertiv™ Liebert® XDU070 to be kept running with minimum of down time. Any parts replaced during maintenance or servicing must be the same specification as those being replaced and should only be obtained from Vertiv. Please contact your local Vertiv representative for Vertiv engineered parts, see https://www.Vertiv.com/en-us/support/ or refer to Technical Support/Service in the United States on page 25

The use of incorrect replacement parts may affect the operation or reliability of the unit and invalidate any warranty.

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4 Technical Data

4.1 Weights and Dimensions

Table 4.1 Vertiv™ liebert® XDU Specifications

Nominal cooling capacity	See **Figure 4.4** on page 16 and **Figure 4.5** on page 17					
Maximum flow – (7X fan performance)	6 fan operation is standard. See **Figure 4.3** on page 15 .					
Maximum airflow (6X fan performance)	Dual units. 5885 cfm (10,000 m^3/hr), based on **Figure 4.3** on page 15 .					
Maximum fluid circuit flow (both single and twin pump operation)	120 l/m (32 gpm) at 4 psi (0.3 bar), based on **Figure 4.1** on page 13 .					
Coolant type	Water, water/glycol or any compatible sensible phase liquid					
Pump redundancy	Single pump (N), dual pumps (N+N) or dual pump run mode					
Secondary coolant temperature range	50 to 131 °F (10 to 55 °C) with dew point control standard					
Maximum Power Consumption	1.7 kW at maximum flow and external pressure drop					
Dimensions	**Height**		**Width**		**Depth**	
	in.	**mm**	**in.**	**mm**	**in.**	**mm**
Standard cabinet	90.6	2300	23.6	600	47.2	1200
Shipping (domestic)	94.5	2400	39.4	1000	55.1	1400
Weight	**Dry**		**Operating**		**Shipping**	
	lbs.	**kg**	**lbs.**	**kg**	**lbs.**	**kg**
Standard Cabinet	899	408	1007	457	1234	560
Fluid Circuit Data	**Gallons**			**Liters**		
Base unit	10.3			39		
Reservoir tank capacity	2.6			10		
Piping connection top or bottom	1.5" Sanitary Flange					
Water filtration	50 µ					
Fan Data	**CFM**			**m^3/hr**		
Maximum air flow 6 fan operation (N+!)	5945			10100		
Maximum airflow 7 fan operation (N)	6533			11100		
Noise level at 10 ft (3m)	< 72 dBA (sound pressure)					
Electrical Data	**FLA**		**WSA**		**OPD**	
115V 1ph 60Hz	16		24		40	
230V 1ph 50Hz	8		20		32	
Dual power feeds (ATS)	Standard feature					
Maximum installed load	3.91 kVA					
Agency approvals and certification	CE, cULus, RoHS					

Table 4.2 Operating and Storage Conditions

Operating conditions	0° to 104°F (0° to 40°C) ambient 10% to 90% RH (non-condensing)
Storage conditions	'-40° to 158°F (-40° to 70°C) 5% to 93% RH (non-condesning)

4.2 Pipe Connections

Pipe connections for the fluid circuit are made in the roof panel of the cabinet.

The Vertiv™ Liebert® XDU pipe connections are 1.5-in (38.1 mm) sanitary flanges located on the top and bottom of the unit. Flanges are fitted with stainless steel blanking caps to ensure that the pipework remains contaminant-free during transit and for retention of the nitrogen holding charge during transit. The blanking caps need to be removed for installation.

See the Installation and Commissioning Guide for further detail on piping, including schematics indication location of the sanitary flanges and blanking caps.

4.3 Electrical Data

Table 4.3 Supported Electrical Supplies

	Single/Twin Pump Operation		
	Full Load Current (FLC)[1]	Minimum Circuit Ampacity (MCA)[2]	Maximum Overcurrent Protection (MOP)[3]
230v 1ph 50Hz	8A	20A	32A
115v 1ph 60Hz	16A	24A	40A
[1] Maximum running currents.			
[2 and 3]Data plate information for UL certification.			

Maximum installed load: 3.91 kVA

Typical power consumption: 1.7 kW

4.4 Noise

Maximum sound power level is72 dBA.

4.5 Fluid Circuit

Figure 4.1 below shows the flow/pressure differential available at the fluid supply and return connections of the Vertiv™ Liebert®XDU070 based on water for both single and twin pump operation.

Figure 4.1 Available Fluid External Flow/Pressure

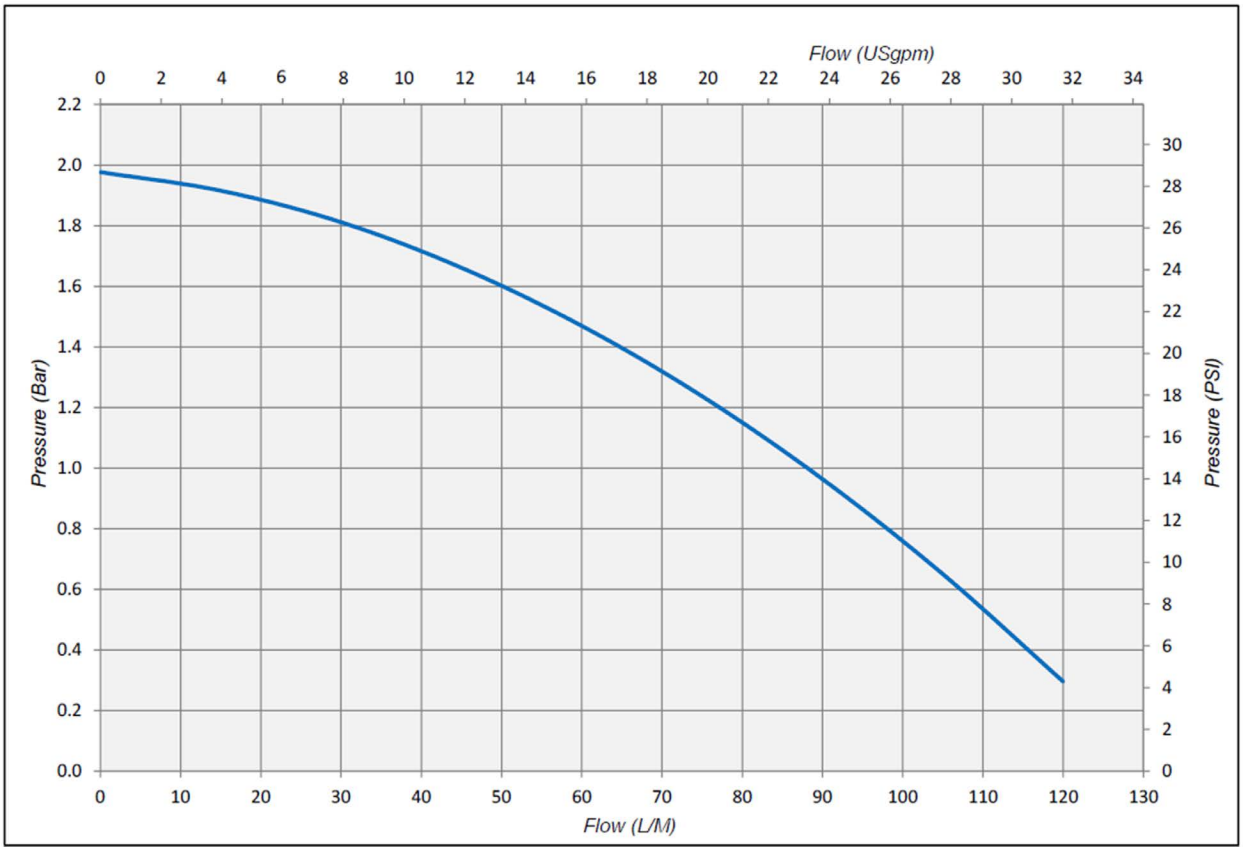
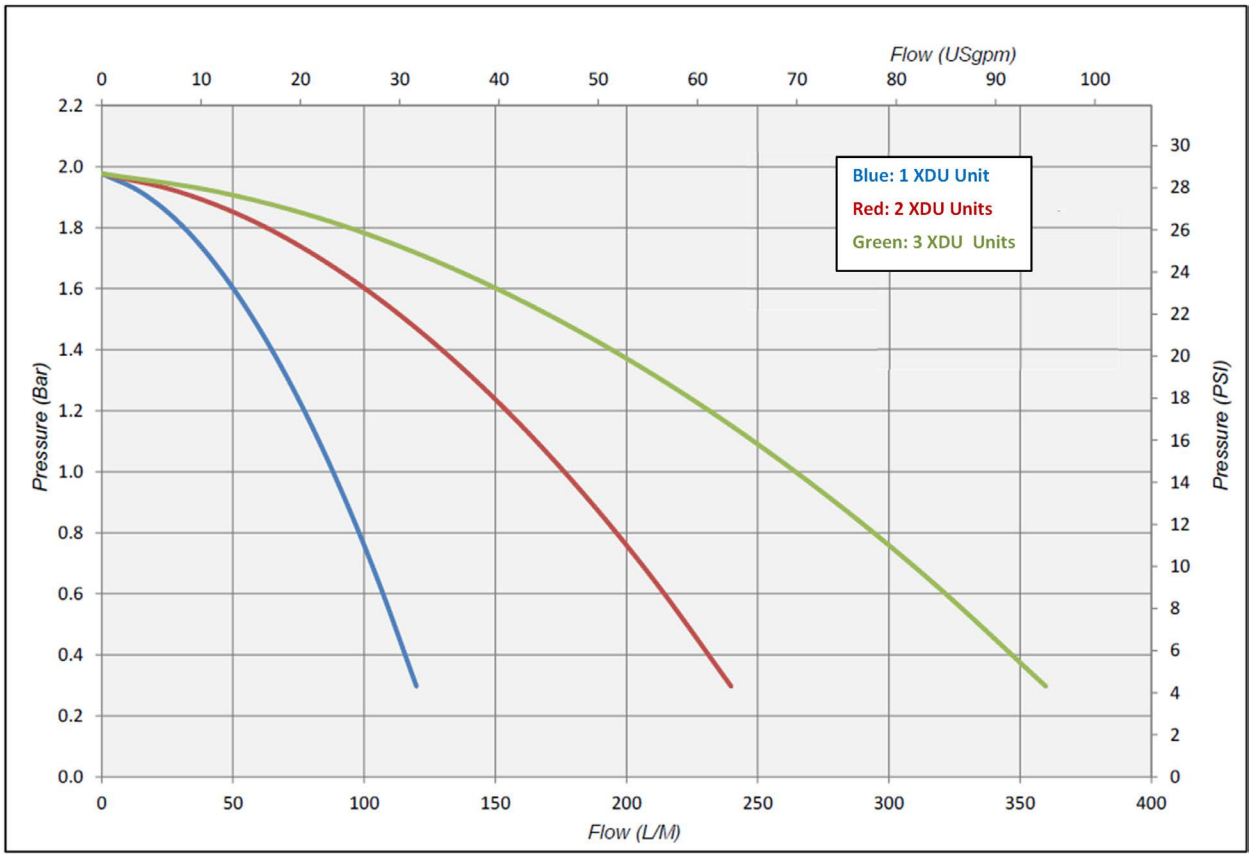


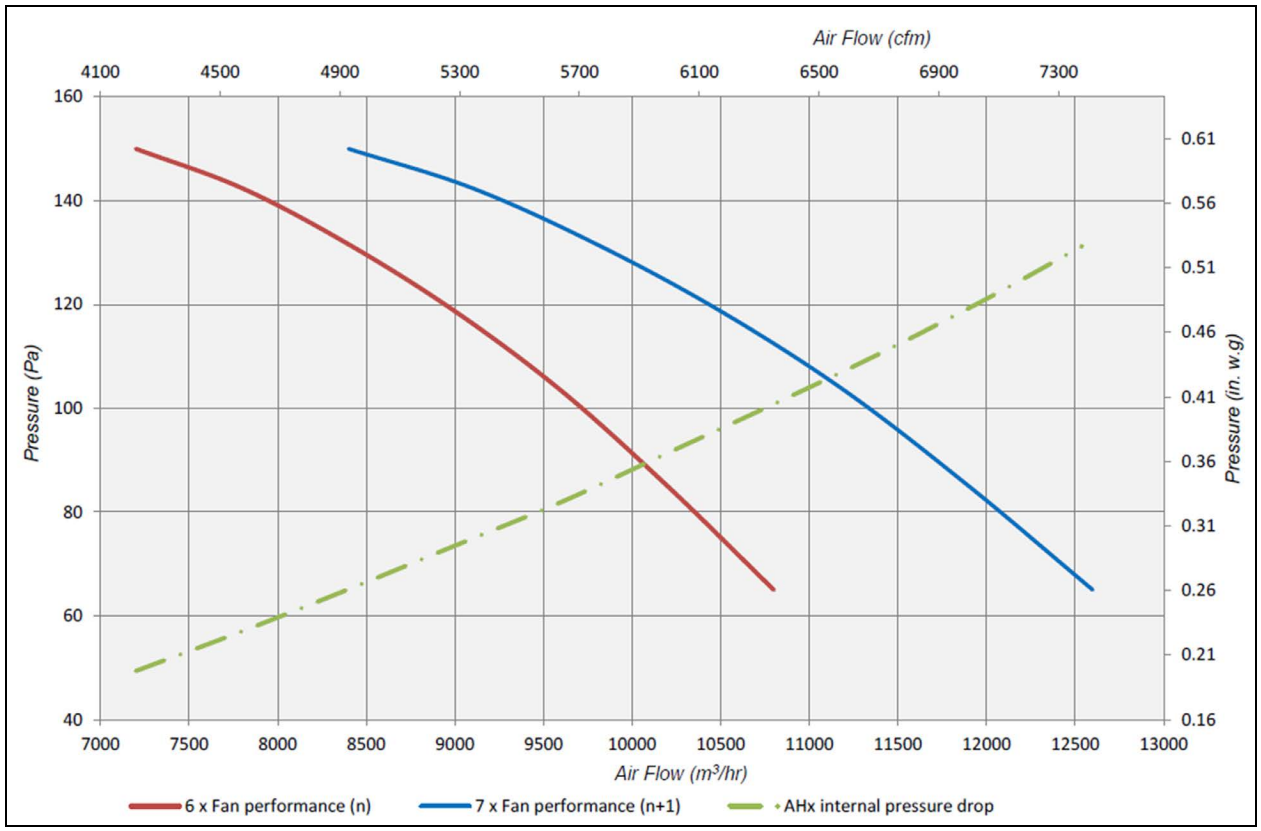
Figure 4.2 Flow/Pressure Graph for Multiple Units in Parallel



4.6 Airside

Figure 4.3 below shows the airflow performance for 6 x fans operating (N) and 7 x fans operating (N+1). The usable area is that shown above the green internal pressure drop curve.

Figure 4.3 Fan Performance with Internal Pressure Drop Curve



4.7 Thermal Performance

Figure 4.4 below shows the cooling capacity performance of the Vertiv™ Liebert® XDU070 unit based on 104°F (40°C) fluid supply temperature, at three alternative fluid flow rates for a range of air inlet temperatures (room air) from 68°F to 95°F (20°C to 35°C), equating to approach temperature differences (ATDs) 68°F to 41°F (20°C to 5°C).

The lowest 15.85 gpm (60 l/m) fluid flow shows shortened graph lines as cooling capacities beyond this point will result in fluid return temps in excess of 149°F (65°C), which is deemed to be the maximum limit for the IT load.

Figure 4.4 Thermal Performance for 40°C Fluid—Provisional

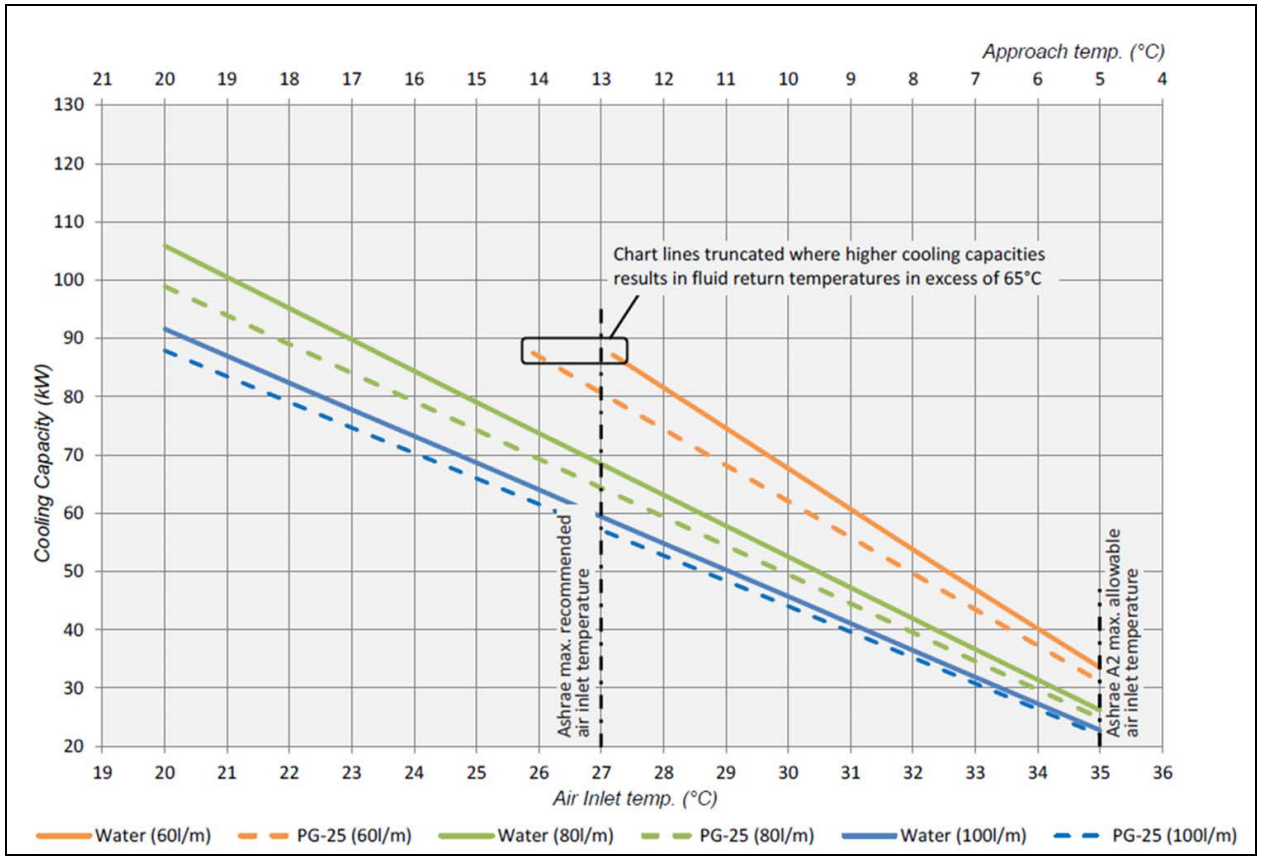
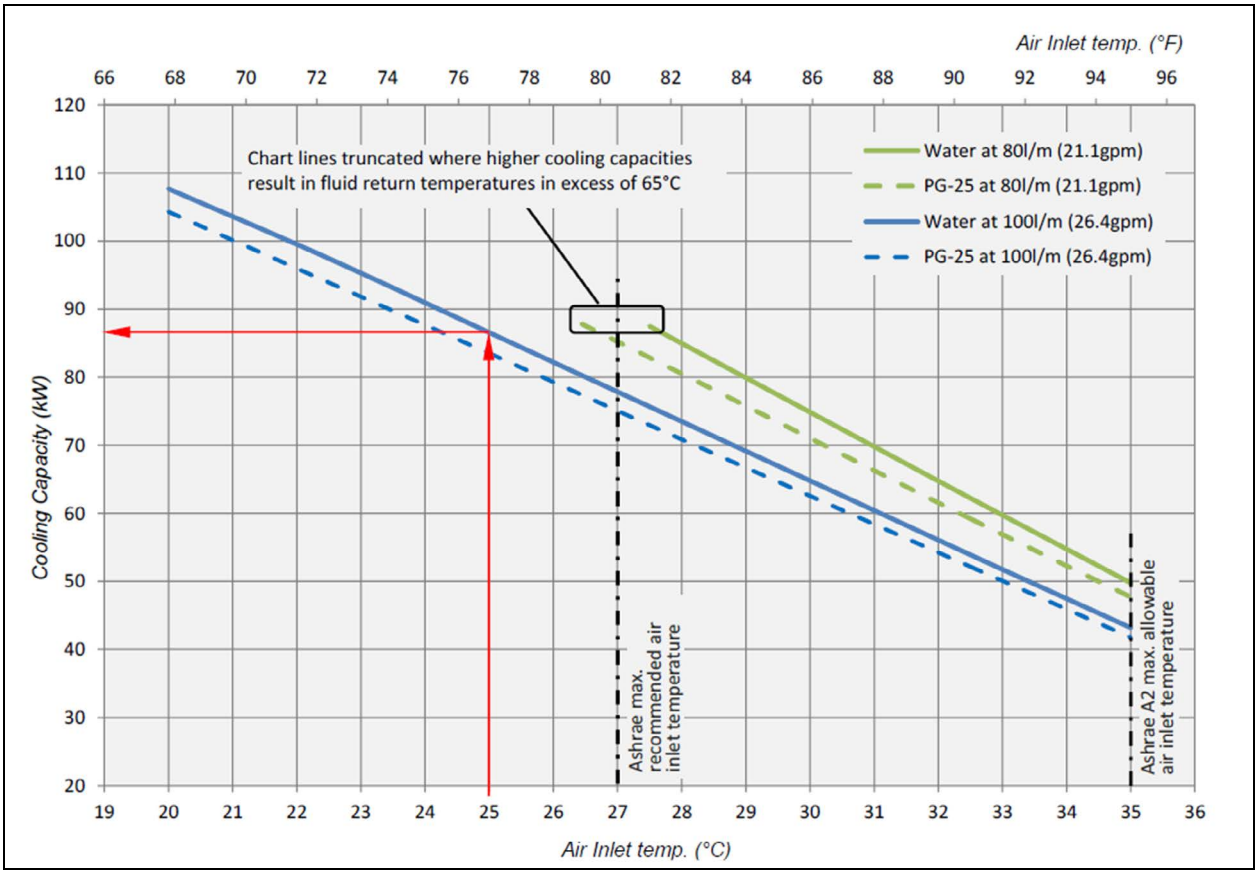


Figure 4.5 below shows the cooling capacity performance of the Vertiv™ Liebert®XDU070 unit based on 113°F (45°C) fluid supply temperature, at two alternative fluid flow rates for a range of air inlet temperatures (room air) from 68°F to 95°F (20 to 35°C), equating to ATDs from 77°F to 55°F (25°C to10°C).

The 21.1 gpm (80 l/m) fluid flow shows shortened graph lines as cooling capacities beyond this point will result in fluid return temps in excess of 149°F (65°C), which is deemed to be the maximum limit for the IT load and the 15.85 gpm (60 l/m) graph lines have been omitted altogether as not viable.

Figure 4.5 Thermal Performance for 45°C (ASHRAE W4) Fluid Supply Temperature



For example, as shown in Figure 4.5 above , for a fluid supply temperature of 113°F (45°C), with an air inlet temperature of 77°F (20°C) ATD and plain water as the operating fluid at 26.4 gpm (100 l/m), the achievable heat transfer will be 86.5 kW– provisional.

Both Figure 4.4 on the previous page and Figure 4.5 above are based on 10,000m^3/hour airflow, 6 fans running (N) – provisional data.

IMPORTANT! For thermal performance at more specific conditions not covered in this document, please contact the Vertiv sales representative.

4.8 Wetted Materials

For fluid compatibility purposes, all component materials in the fluid circuit are listed in Table 4.4 on the facing page .

Table 4.4 Wetted Materials

Fluid Circuit	
Component	**Materials**
Hygienic fittings	316 St. steel, EPDM seals
Butterfly hygienic valves	• 316 St. steel • EPDM seals
Hygienic seals	EPDM
Pipe work	316 St. steel
Reservoir tank	316 St. steel
Machined pipe fittings	304 St. steel
Main pumps	• 316 St. steel (housing and impeller) • 304 St. steel (canned rotor cup) • Ceramic (shaft and thrust washer) Tecapeek (bush) • EPDM (O-ring seals)
Insert non-return valve (main pumps)	• Acetal (body and valve) • EPDM (O-ring seals) • St. steel (spring)
Fill pump	• Polyamide (body) • EPDM (diaphragm) • Polypropylene (collector plate)
Coil heat exchangers	• Copper • 304 St. steel
Coil hoses	• 316 St. steel (convoluted hose) • 304 St. steel (fittings)
Schrader valves	316 St. steel (body and valve insert)
Pressure sensors	17-4PH (630) St. Steel
Flow meter	• 316 St. Steel • 316 (compression fitting)
Filter	• 304 and 316 St. steel • EPDM (O-ring seals)
Drain valves	• Nickel plated brass • Nylon 6 • EPDM (O-ring seal)

Table 4.4 Wetted Materials (continued)

Fluid Circuit	
Component	**Materials**
Automatic air vent	• Nickel plated brass (body) • St. steel (spring) • Polypropylene (float) • Nitrile (seals)
Pressure relief valve	• Chrome plated brass (body) • EPDM (seal)
Expansion vessel	• 304 St. steel (connector) • EPDM (membrane)
Expansion vessel hose	• EPDM (hose) • St. steel (connections)
Fill quick coupler and hose	• Chrome plated brass (body) • Polysulfone (valve) • EPDM (seal), St. steel (spring)
Fill non-return valve	• 304 St. steel (shell) • 304 St. steel (valve) • Viton (seal) • 304 St. steel (spring)
Fill pump hose barb fittings	Nickel plated brass
Fill pump hose	Reinforced PVC
Push-fit fittings (filling wand)	• Acetal copolymer (body) • Nitrile (seal) • St. Steel (tube grip)
Ultrasonic level sensor	• 316 St. steel (body) • EPDM (O-ring seal)

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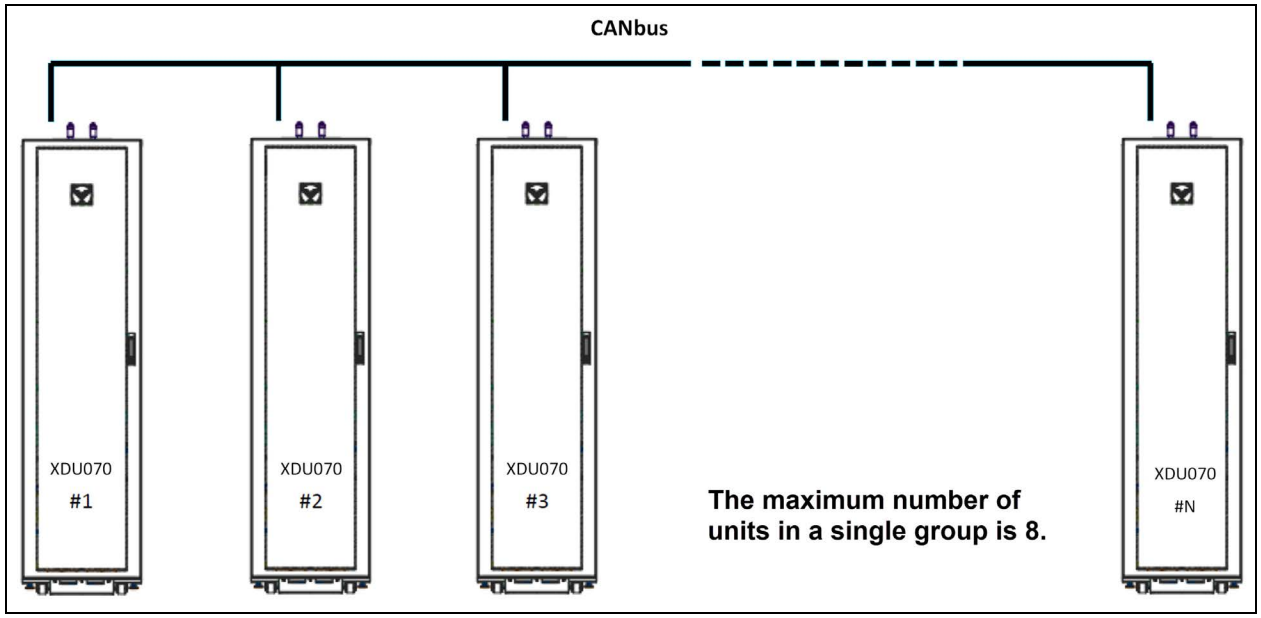
5 Communications

5.1 Group Control

Groups of Vertiv™ Liebert®XDU070 units can be connected using a high speed, robust twisted pair CANbus network in order to provide coordinated control in larger installations and N+X redundancy. The maximum number of units in a single group is 8. Refer to Installation and Commissioning Guide for more information.

Figure 5.1 Group Control



After each Liebert® XDU070 has been assigned a unique address, the system becomes self-organizing. One Liebert® XDU070 automatically assumes the role of the master and coordinates the running state of the other units based on the configured level of redundancy, the system pressure requirements, and any alarm conditions.

Changes to the group settings (such as the number of run units) or system settings (such as the DP setpoint) can be made via any Liebert® XDU070 touchscreen user interface at any time and changes are propagated to all members of the group.

5.2 Remote Monitoring Control

The Vertiv™ Liebert® XDU070 provides a RS-485 and 2 off 10/100 Ethernet communication ports for external and remote monitoring and control via customer BMS and/or DCIM and/or supercomputer control nodes

RS-485 CONNECTION

MODBUS RTU is supported. The MODBUS register table includes all the important Liebert® XDU070 data points and values. See MODBUS Register Tables on page 31 .

10/100 ETHERNET PORTS

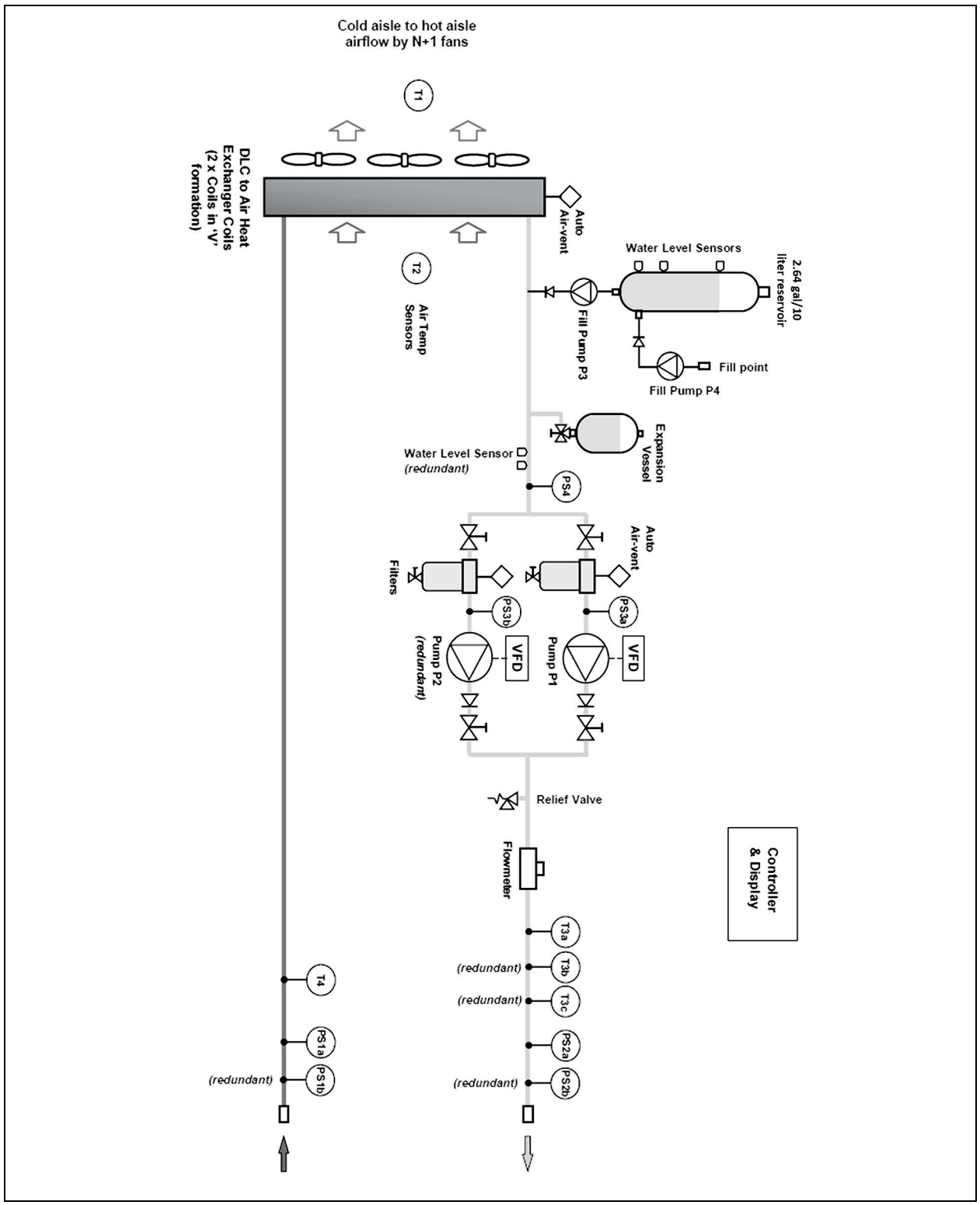
Each port can be configured with its own IP address to enable simultaneous communications with the facility BMS/DCIM and/or supercomputer control nodes.

Standard TCP/IPv4 and IPv6 secure application protocols and services are supported, including:

- SNMPv2/3 (Simple Network Management Protocol)
- HTTP/HTTPS (Web Server)
- SFTP (File Server)
- SSH (Command Line Interface)
- SMTP (Alarm Retransmission via Email)
- NTP (Network Time Protocol)

5.3 Pipe Schematic

Figure 6.1 Pipe Schematic



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Appendices

Appendix A: 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.1 Locations

United States

Vertiv Headquarters

505 N Cleveland Ave

Westerville, OH 43082

Europe

Via Leonardo Da Vinci 8 Zona Industriale Tognana

35028 Piove Di Sacco (PD) Italy

Asia

7/F, Dah Sing Financial Centre

3108 Gloucester Road, Wanchai

Hong Kong

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Appendix B: Warranty Details

B.1 Limited Product and Service Warranty

Extended warranties, service, and maintenance programs are available in most locations, details available upon request. To obtain further details of limited warranty, also after sales service offerings, contact your local sales representative or technical support if you have any questions or problems during unit installation.

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Appendix C: Notes

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Appendix D: MODBUS Register Tables

D.1 Discrete Inputs

Table D.1 Vertiv™ Liebert® XDU070 Discrete Inputs

Register Number	Register Description	Alarm Code
1	Alarm (0 = Inactive, 1 = Active)	-
2	Alarm : T1 Temperature Sensor Fault	A01
3	Alarm : T2 Temperature Sensor Fault	A02
4	Alarm : T3a Temperature Sensor Fault	A03
5	Alarm : T3b Temperature Sensor Fault	A04
6	Alarm : T3c Temperature Sensor Fault	A05
7	Alarm : T4 Temperature Sensor Fault	A06
8	Alarm : PS1a Pressure Sensor Fault	A07
9	Alarm : PS1b Pressure Sensor Fault	A08
10	Alarm : PS2 Pressure Sensor Fault	A09
11	Alarm : PS3a Pressure Sensor Fault	A10
12	Alarm : PS3b Pressure Sensor Fault	A11
13	Alarm : Flow Sensor Fault	A12
14	Alarm : microSD Card Fault	A13
15	Alarm : Reservoir Tank Fluid Required	A14
16	Alarm : Reservoir Tank Empty	A15
17	Alarm : Pump 1 Fault Alarm : Pump 1 Fault	A16
18	Alarm : Pump 2 Fault	A17
19	Alarm : Sec Pump Flow Shutdown	A18
20	Alarm : Secondary Water Low Temp	A19
21	Alarm : Secondary Water High Temp	A20
22	Alarm : Fluid Detected – Drip Tray	A21
23	Alarm : Secondary Over Pressure	A22
24	Alarm : Secondary Over-pressure Shutdown	A23
25	Alarm : System Low Pressure	A24
26	Alarm : Insufficient Water Level	A25
27	Alarm : Level Sensor – No Water Detected	A26
28	Alarm : Illegal Water Sensor Condition	A27
29	Alarm : Sec Temp T3a Diff Fault	A28

Table D.1 Vertiv™ Liebert® XDU070 Discrete Inputs (continued)

Register Number	Register Description	Alarm Code
30	Alarm : Sec Temp T3b Diff Fault	A29
31	Alarm : Sec Temp T3c Diff Fault	A30
32	Alarm : Pump 1 Communications Fault	A31
33	Alarm : Pump 2 Communications Fault	A32
34	Alarm : Pump 1 Low Flow	A33
35	Alarm : Pump 2 Low Flow	A34
36	Alarm : Fan 1 Fault	A35
37	Alarm : Fan 2 Fault	A36
38	Alarm : Fan 3 Fault	A37
39	Alarm : Fan 4 Fault	A38
40	Alarm : Fan 5 Fault	A39
41	Alarm : Fan 6 Fault	A40
42	Alarm : Fan 7 Fault	A41
43	Alarm : Group Control – Network Fault	A42
44	Alarm : Group Control – Insufficient Units Available	A43
45	Alarm : PS1 Difference Out of Limits	A44
46	Alarm : Fluid Detected - Rope	A45
47	Alarm : Pump 1 Filter Dirty	A46
48	Alarm : Pump 2 Filter Dirty	A47
49	Alarm : PSU A AC Fault	A48
50	Alarm : PSU A DC Fault	A49
51	Alarm : PSU B AC Fault	A50
52	Alarm : PSU B DC Fault	A51
53	Alarm : Leak Unit (Tray + Rope)	A52
54	Status: Fill Required	--

Access to the Discrete Inputs table is provided by MODBUS function code 02 – Read Input Status.
For all discrete input registers which contain an alarm status, a value of 1 indicates the presence of the alarm condition, whilst a value of 0 indicates the healthy (no alarm) condition.

Table D.2 Input Registers

Register Number	Description	Units	Scaling	Data Type
1	Mode 0 = not configured 1 = shutdown – remote start/stop 2 = shutdown - network 3 = full manual control 4 = standby 5 = online (running) 6 = online (filling) 7 = filling 8 = shutdown – fault 9 = group standby	n/a	1	Unsigned
2	Group Control Mode 0 = Standalone 1 = Primary 2 = Secondary 3 = Independent (due to network fault)	n/a	1	Unsigned
3	Pump 1 Speed	%	1	Unsigned
4	Pump 2 Speed	%	1	Unsigned
5	Fan Speed	%	1	Unsigned
6	Cooling Demand	%	1	Unsigned
7	Air Exit Temperature T1	°C	0.1	Unsigned
8	Air Inlet Temperature T2	°C	0.1	Unsigned
9	Fluid Supply Temperature T3a	°C	0.1	Unsigned
10	Fluid Supply Temperature T3b	°C	0.1	Unsigned
11	Fluid Supply Temperature T3c	°C	0.1	Unsigned
12	Fluid Supply Temperature T3	°C	0.1	Unsigned
13	Fluid Return Temperature T4	°C	0.1	Unsigned
14	Fluid Return Pressure PS1a	Bar	0.01	Unsigned
15	Fluid Return Pressure PS1b	Bar	0.01	Unsigned
16	Fluid Return Pressure PS1	Bar	0.01	Unsigned
17	Fluid Supply Pressure PS2	Bar	0.01	Unsigned
18	Unit Differential Pressure (PS2 – PS1)	Bar	0.01	Unsigned
19	Pump 1 Filter Inlet Pressure PS3a	Bar	0.01	Unsigned
20	Pump 2 Filter Inlet Pressure PS3b	Bar	0.01	Unsigned

Table D.2 Input Registers (continued)

Register Number	Description	Units	Scaling	Data Type
21	Pump 1 Filter Differential Pressure (PS3a – PS2)	Bar	0.01	Unsigned
22	Pump 2 Filter Differential Pressure (PS3b – PS2)	Bar	0.01	Unsigned
23	Secondary Flow Rate	l/m	1	Unsigned
24	Secondary Duty	kW	1	Unsigned
25	Pump P1 Runtime	Hours	1	Unsigned
26	Pump P2 Runtime	Hours	1	Unsigned
27	Controller Uptime	Mins	1	Unsigned
28	System (Group) Average Secondary Differential Pressure	Bar	0.01	Unsigned
29	System (Group) Total Secondary Flow Rate	l/m	1	Unsigned
30	Controller Software Version Number Format is x.yy where x = major version number, yy = minor version number	n/a	0.01	Unsigned
Access to the Input Register table is provided by MODBUS function code 04 – Read Input Registers.				

Table D.3 Coils

Register Number	Description
1	Remote Shutdown To switch on the AHx write OFF. To switch off the AHx write ON. .
By default, the coil table is read-only. Read-write access may be enabled via P072 Write Access parameter, accessible via the touchscreen UI. Read access to the Coil table is provided by MODBUS function code 01. Write access to the Coil table is provided by MODBUS function code 05.	

Table D.4 Holding Registers

Register Number	Description	Units	Scaling	Data Type
1	Secondary Temperature Setpoint (P301)	°C	0.1	Unsigned
2	Secondary DP Setpoint (P203)	Bar	0.1	Unsigned
3	Secondary Flow Setpoint (P202)	l/m	1 l/m	Unsigned
By default, the holding register table is read-only. Read-write access may be enabled via the P072 Write Access parameter, accessible via the touchscreen UI. Read access to the Holding Register table is provided by MODBUS function code 03 – Read Holding Registers. For write access, MODBUS function code 06 - Preset Single Register is supported. An attempt to write a holding register value when read-only access is active will result in an exception code being returned.				

Appendix E: 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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