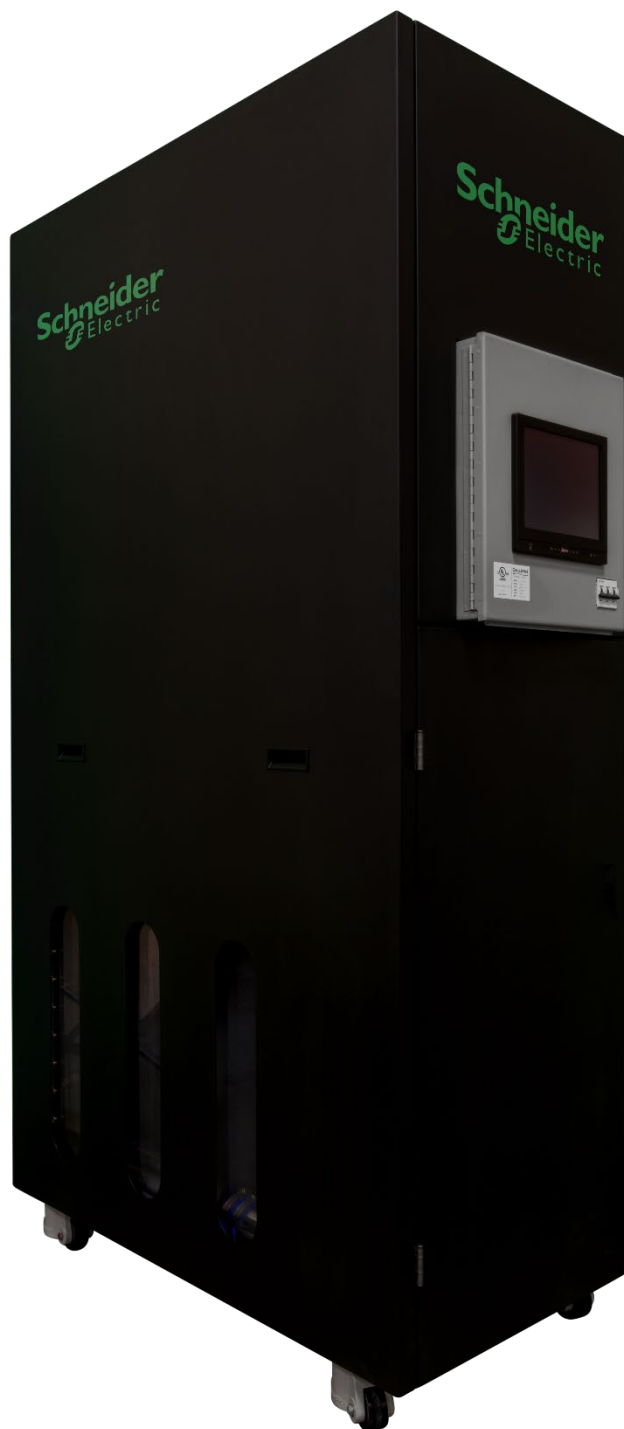


Negative Pressure Liquid Cooling CDU

Cooling innovation and strategy



The **SE LPS System** is a direct-to-chip liquid cooling system that delivers coolant under negative pressure in both directions. The technologies were designed specifically to eliminate the risks associated with liquid cooling while keeping deployment and operating costs low. The LPS system mitigates risk with its patented leak-proof design.

The CDU is a negative pressure system that uses liquid to cool up to 300kW of server heat. The Cooling Distribution Unit (CDU) can use water at 1-55°C (34-131°F) to remove up to 300 kW of server heat (10°C rise). Its innovative design and energy efficiency allow for effective cooling of servers in high density applications.

Key Features

- Pumps liquid with up to 10 lpm air leak with no reduction in performance.
- Touchscreen Controls
- Data logging of key performance parameters
- Remote monitoring via webpage or SNMP
- 4-6 cooling loops for easy hose routing
- 300 lpm cooling flow at .5 bar
- Monitors water temperature and quality, fills, drains, and tests for leaks
- Measures heat removed and facility water flow
- Automatic control of anti-corrosion fluid



1. Pump Chamber

The Chamber is where coolant is stored, supplied to the servers and received from the servers. The system cycles through the main and auxiliary chambers allowing for a steady flow.

2. Heat Exchanger (2x)

Transfers the heat created by the servers to the cooling tower or chiller. The HX are connected in series to minimize the processor temperature on hot humid days with warm cooling tower or dry cooler water.

3. Liquid Ring Pump (LRP)

LRP uses water as a seal to provide the required vacuum necessary to propel the coolant. The water seal does not wear out. Redundant pumps optional.

4. Microprocessor Control

The temperature in the fluid reservoir is controlled to maintain the coolant temperature above the dew point in the data center.

5. Water Quality Control

The water quality is monitored and controlled to maintain corrosion and bacterial protection. Automatic fill, drain, air purge and leak test are included and coolant additive is stored onboard.

6. Coolant Handling Manifold

Standard 4-6 cooling loops exiting bottom of CDU. Optional single feed coolant supply for rear door HX applications at either bottom or top.

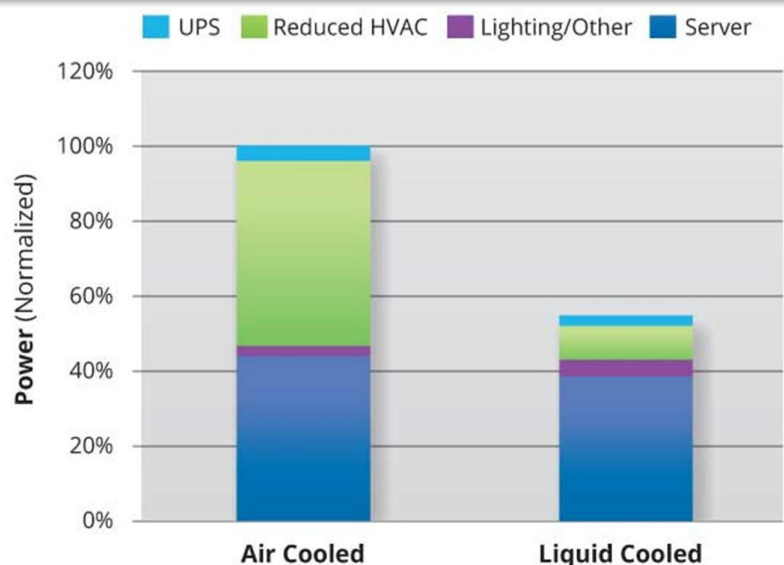
LIQUID COOLING POWER SAVINGS

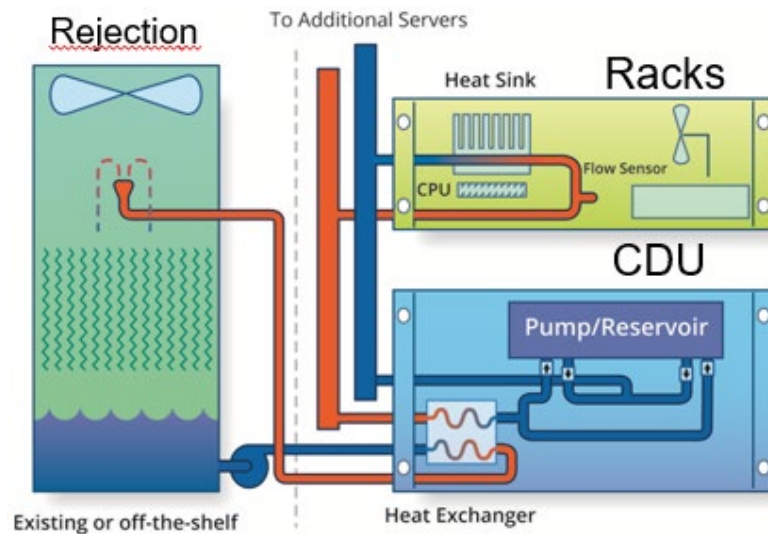
Liquid Cooling Power Savings

SE LPS System is an efficient and low cost liquid cooling system that reduces data center power consumption 3 ways:

- 75-100% reduction in HVAC power
- 75% reduction in server fan power
- 5-10% reduction in CPU power

This example shows a legacy data center power reduction of 45% with the Cool-Flo System. Any data center can bring their Power Usage Efficiency (PUE) down to 1.2 or less plus additional power savings at the server.





⇒ **Retains Air Cooling**

Utilizing standard finned heat sinks modified for liquid cooling, the LPS system can retain the ability to air cool servers and can operate as a standard air-cooled system to minimize down-time.

⇒ **Leak-Proof System**

We use negative pressure on both supply and return so if a leak occurs anywhere air will flow into the system instead of coolant leaking out. Other systems claiming to have negative pressure are negative in one direction and positive pressure in the other.

⇒ **Failure Tolerant**

The system will maintain cooling even with one server open to air. Leaks are a maintenance issue, they do not reduce uptime.

⇒ **Increased Density**

Our liquid cooling can cool up to 300kW of server power in a single server rack.

⇒ **Low Cost and Easy Installation**

The LPS system has no hidden installation cost or delays. Plumbing is only required for the CDU while the racks and servers can be installed by datacenter technicians.

⇒ **Automatic Coolant Evacuation**

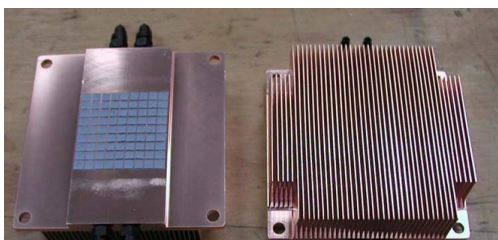
The Cool-Flo No-Drip/Hot Swap Connector automatically evacuates coolant from a server when it is disconnected from a system. The racks can also be drained automatically.

⇒ **Low Cost, High Volume**

The system utilizes low cost plastic tubing and simple connections, minimizing cost and allows data center technicians, not plumbers, to reconfigure racks.

⇒ **Reduced Setup Time**

The CDU automatically fills and drains the system, monitors the coolant and adds or drains coolant as needed. Air purging is automatic to reduce setup time and maintenance effort.



Liquid and Air Cooled Heat Sinks



No drip hot swap connector in PCI Slot

SOFTWARE AND ACCESSORIES

Allows for remote operation (fill, run, drain, purge, test...) via web page. Displays system state and error messages, such as loss of facility cooling. Calculates heat removed, dew point.

Stop	Currently Run	Service
------	---------------	---------

Sub State = Stopping

Status: =

Time Wait = 0

AF	AE	MF	ME	RF	RE	SF	SE	ARFE	ARFU	OV
0	0	0	0	0	0	0	0	0	0	0

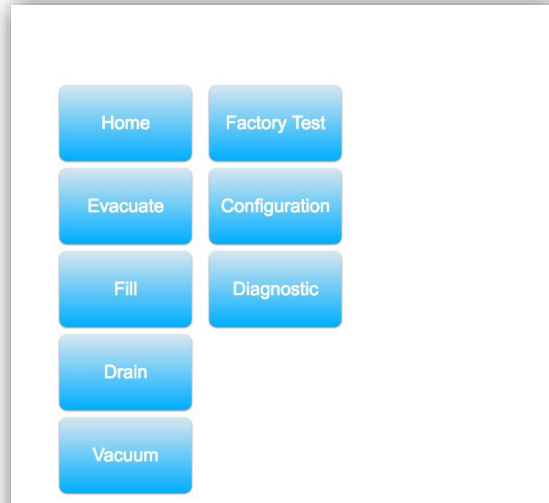
MP	MV	AP	AV	RP	RV	PURGE	TEST	DRAIN	SEP_DRAIN	HXI	AC	FILL	LRP_RUN	LRP_RST	LRP_BIT1	LRP_BIT2
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Name	Value	Raw V	Name	Value	Raw V
Vac(MainPresV)	6.38	3.98	AvgLv(Liter)	0.00	0
Vac(AuxPresV)	6.53	3.96	ResLvIV(Liter)	23.72	0.71
Vac(ResPresV)	6.48	3.96	TDS ppm	-1248.09	0.00
Vac(AmbientPresV)	-0.02	4.94	ThermistorRef	2.37	2.37
DegC(TempAmbientV)	-22.95	4.53	Vcc_V	4.95	4.95
DewPoint	28.70	...	CDU Flow Rate	0.00	...
RHV (%)	28.86	0.29	KW Power	Calc..	...
DegC(TempInPV)	26.00	2.58	Facility Water Flow	Calc..	...
DegC(TempOutPV)	26.52	2.55	Fill Protect Sum	0.00	...
DegC(TempInFV)	26.40	2.56	UpTime	102	...
DegC(TempOutFV)	26.32	2.56			

ChillDyne 1.12.03 Jul 20 2017 20:10:27

Run Mode

Reports data on flow rate, pressure temperature, heat pumped, water quality etc.

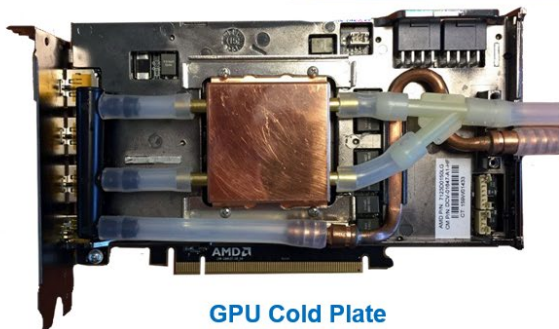


Service Mode

Allows user to evacuate coolant from all the servers, Fill, Drain and conduct a

Dual Xeon Kit

Liquid and air cold plate/ heat sink and no drip hot swap connector. Standard 90mm heat sink design



GPU Cold Plate

Custom Cold plate for 300 watt Fury X GPU, uses OEM VRM cooler



No Drip Hot Swap Connector

Patented technology for automatic draining of server

Guide Specifications:

Summary:

The Cooling Distribution Unit (CDU) is a negative pressure system that uses water at 2-45°C (36-113°F) to cool 300kW or more of server heat. Its innovative design and energy efficiency allow for effective cooling of GPU's and CPUs in high density applications. The system offers significant leak protection since the servers and manifolds are constantly under negative pressure. This means the coolant cannot leak out, only air can leak into the system.

Design Requirements:

Model: CF-CDU300

Cooling Capacity: Up to 300kW of Server Heat Removed at 15°C DeltaT

CDU approach temperature: Delivery at 7°C above facility water temperature at 300 kW

System Flow Rate: 300 lpm @ 0.5 bar Pressure Differential

System Power: 208V 15A Service nominal 2400 Watts at full flow

System ΔP (Vacuum): Max-22in. Hg.; Min-10in Hg.

Manifold to Pump Tubing: Length-30 feet long; ID: 1in; 6 circuits. 36 racks or more.

Microcontroller: Netburner PK70 pump controller and web based touchscreen control

Operating Software: Linux, web page provided with system status.

Optional SNMP interface or custom software to interface with customer BMS

Facility Interface Specifications:

Cooling Water: 2°C to 45°C at 92 gpm (350 lpm) ASHRAE W4 15 psi (1 bar) differential

Tap Water: 2 GPM (7.5 lpm) 20-100 psi (1-6 bar)

Drain Connection: 4 GPM; 2in (50mm)

Quality Assurance:

The CDU will be tested prior to shipment.

All operating modes and flow ratenominal for 1 week.



CDU Specifications CF-CDU300 Dimensions: 24x36x72in

Weight: 1200 lbs (dry)

Frame Details: Constructed out of steel welded for maximum strength. The units come equipped with casters and leveling feet to allow ease of installation and stabilization

Panel Details: Removable panels for full service access

Power: 208 or 380-480 3 phase wye 10/5 amps

Plug: NEMA L16-20

Pumps and Piping:

- The water temperature to the servers is maintained at a temperature above the dew point in the data center based on a temperature and humidity sensor included in the CDU.
- The temperature in the fluid supply reservoir controlled by a PWM modulated HX pump.
- Units equipped with a water filtration system with 100 micron filters.

Heat Exchanger:

- The unit is equipped with two, stainless steel brazed plate liquid/liquid heat exchangers. Facility cooling water flows in a second loop within the CDU through these heat exchangers.
- The heat exchangers are connected in series to minimize the processor temperature.
- The facility side of the HXs are connected using 2" diameter, stainless steel sanitary or copper water pipe.

Controller:

- The unit includes a microprocessor controller touch screen display mounted on the front of the unit for user interface accessibility without removing exterior panels.
- The unit automatically controls the flow through the servers, test the system for leaks, fill, drain and maintain coolant levels.
- The unit monitors the vacuum, pressure, temperature (pump and facility side), total dissolved solids (TDS), dew point, water levels, and coolant levels.

Environmental:

- Unit is designed to operate in ambient conditions 40-105oF (5-40oC), 0-95%RH (non-condensing), 0-6000ft (0- 2000m) elevation.

Service

- Install the unit in accordance with the manufacturer's installation instructions.
- Start-up the unit in accordance with the manufacturer's start-up instructions.
- Test controls, configuration, and communications settings to demonstrate compliance with operational requirements.
- Commissioning services provided by authorized personnel.
- Annual maintenance includes replacement of parts subject to wear to insure long service life.



Schneider Electric SE
35 rue Joseph Monier
92500 Rueil-Malmaison – France
se.com