The Chilldyne Cool-Flo® System is a direct-to-chip liquid cooling system that delivers coolant under negative pressure. Chilldyne's technologies were designed specifically to eliminate the risks associated with liquid cooling while keeping deployment and operating costs low. The Chilldyne system mitigates risk with its patented leak-proof design.

About the Cooling Distribution Unit

Chilldyne's liquid cooling system offers all the well-known benefits of liquid cooling without the cost, complexity and risk. Coolant delivered to the servers and manifolds is under negative pressure on both the supply and return so coolant cannot leak out; only air can leak into the system. The Chilldyne Cooling Distribution Unit (CDU) is a negative pressure system that uses liquid to cool up to 300kW of server heat. The Cooling Distribution Unit (CDU) can use cooling tower water at 15-30°C (59-86°F) to remove up to 300 kW of server heat (15°C Rise). Its innovative design and energy efficiency allow for effective cooling of servers in high density applications.

Key Features

- Touchscreen Controls
- Data logging of key performance parameters
- Remote monitoring via webpage
- 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
- (N+1) Redundancy: Back up CDU stays in active idle mode with minimal power and wear

Low Risk

The Cool-Flo System uses a proprietary, negative pressure main pump combined with standard heat sinks modified for liquid cooling to provide a leak-free system.

High Reliability

The Cool-Flo System pistonless pump works with pneumatic ejector technology. This type of pump has very low maintenance and is failure tolerant.

Cost Effective

The Cool-Flo system takes advantage of the negative pressure to utilize inexpensive hardware components, leading to cost-effective implementation.
CDU Standard Components

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 facility 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.

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 on board.

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**Liquid Cooling Power Savings**

Chilldyne's Cool-Flo 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 Chilldyne 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**
Cool-Flo® uses negative pressure on both supply and return so if a leak occurs anywhere air will flow into the system instead of coolant leaking out.

⇒ **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**
With liquid cooling, the power density is only limited by the electricity that can be delivered to the chip. This means shorter connections between servers and higher speed data transfer.

⇒ **Low Cost and Easy Installation**
The Chilldyne system has no hidden installation costs or delays. Plumbing is only required for the CDU while the racks and servers can be installed by data center 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.
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, facility water flow rate.

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 vacuum test to test for any leaks in the system.

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 Chilldyne Cooling Distribution Unit (CDU) is a negative pressure system that uses cooling tower 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 ∆P (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 (50 mm)

Quality Assurance:
The CDU will be tested prior to shipment.
All operating modes and flow rate nominal for 1 week.

Warranty:
Standard: 3 Years Parts and Labor, on site available for extra charge.
Chilldyne 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

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 40-105°F (5-40°C), 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 12 year service life.