Exhibit F – Infringement Claim Chart for U.S. Patent No. 6,862,179

Valtrus provides the following infringement claim chart subject to all reservations, objections, statements, and disclaimers set forth herein and in Valtrus' Infringement Contentions, as well as any amendment, supplement, or modification thereof, which are incorporated herein by reference in their entirety. These claim charts also incorporate by reference Valtrus' Complaint.

Valtrus contends that the data centers charted below are representative of other Tierpoint data centers, as set forth in Valtrus' Infringement Contentions.

Valtrus has prepared these infringement claim charts identifying, as specifically as possible at this stage of discovery, where each element of each asserted claim is found within the Accused Products. Valtrus contends that each element of the Asserted Claims is practiced literally by such Accused Products. To the extent Defendant disputes literal infringement, Valtrus contends that any such disputed element is infringed by the Accused Products under the doctrine of equivalents. Valtrus reserves the right to update these charts, upon confirmation through discovery to the extent more information relating to the Accused Products or identification of additional products becomes available, including through inspections of Defendant's data centers.

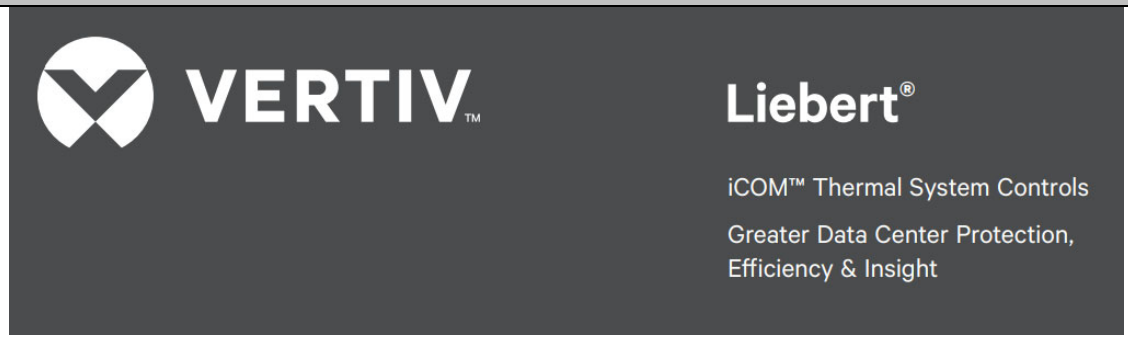
This claim chart is not intended to and does not construe the claims of the Asserted Patents and does not limit Valtrus' contentions. Valtrus specifically reserves the right to modify and supplement this claim chart. This preliminary claim chart is provided to illustrate exemplary information practically available at this stage of discovery.

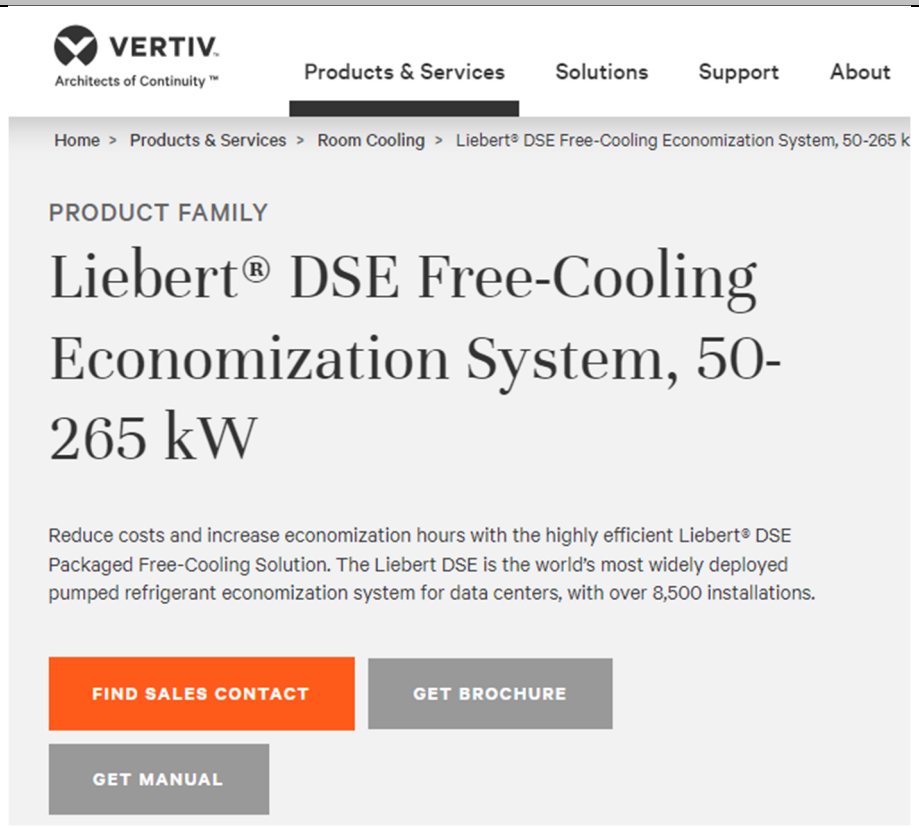
Vertiv Ex. 1007
Vertiv v. Valtrus

Claim Language	Exemplary Evidence of Infringement by TierPoint
[1pre] A method of cooling a plurality of racks in a data center, said method comprising:	TierPoint's data centers use a method of cooling a plurality of racks in a data center. For example, TierPoint uses Vertiv (Liebert) cooling units in the colocation data center. Liebert cooling units are controlled by Liebert's iCOM Intelligent Communication and Monitoring system.  Zayo's CloudLink Provides Cloud Connectivity for TierPoint Data Centers

Claim Language	Exemplary Evidence of Infringement by TierPoint
	 https://www.youtube.com/watch?v=0WWmDBztOyc, at 0:47. Dallas data center has a very reliable and scalable power infrastructure. A total of 11.1 MW of utility power is served to data center to meet the power requirements for the future needs. The data center has power system in true 2N configuration through 4 autonomous power plants. The power density is 250 watts per square feet. Power failure is protected by UPS system in 2N configuration, and automatic transfer of load to 6 x diesel generators in 2N redundancy. The data center tested weekly and routinely run at full load, and 50,000 gallons of fuel storage onsite. The cooling and humidity is data center is controlled through redundant HVAC with Liebert air handlers. Each CRAC unit supported by independent roof mounted condenser. All the data center facilities are monitored 24 x 7 x 365 from facility network operation center. https://cloudandcolocation.com/datacenters/tierpoint-dallas-data-center/

Claim Language	Exemplary Evidence of Infringement by TierPoint
	Facility • 68,000 square feet facility • SSAE 16 SOC 1, Type II • 30 inch raised floors • 300 lbs/sq ft floor load • Single tenant, single-story building • Redundant HVAC with Liebert air handlers • Each CRAC unit supported by independent roof mounted condenser See, *e.g.*, USA Datacenter, Located in Dallas, Texas, https://www.scalahosting.com/network-and-datacenters.html (Last visited December 17, 2024). **TierPoint – Bethlehem 2 Data Center Highlights** • 8 x Liebert HVAC Units in N+1 Configuration See, *e.g.*, TierPoint – Bethlehem 2 Data Center, https://cloudandcolocation.com/datacenters/tierpoint-bethlehem-data-center-2/ (Last visited December 17, 2024).

Claim Language	Exemplary Evidence of Infringement by TierPoint
	 https://www.vertiv.com/49d637/globalassets/shared/liebert-icom-thermal-system-controls-brochure.pdf ("iCOM Brochure").

Claim Language	Exemplary Evidence of Infringement by TierPoint
	 https://www.vertiv.com/en-in/products-catalog/thermal-management/room-cooling/liebert-dse-free-cooling-system-50-165kw/

Claim Language	Exemplary Evidence of Infringement by TierPoint
	At the cooling unit level, the Liebert iCOM unit control provides the highest protection available and optimal performance. • Monitors 380 unit and component points to eliminate single points of failure • Self-healing features avoid passing unsafe operating thresholds • Highly intuitive, full-color, touch screen simplifies operations to save time and reduce human error • Multiple, automated unit protection routines, including lead/lag, cascade, rapid restart, refrigerant protection and valve calibration  **At the supervisory level,** the Liebert iCOM-S system control offers a revolutionary way to harmonize and optimize thermal system performance to optimize capacity across the data center, gain quick access to actionable data, and automate system diagnostics and trending. • Advanced monitoring and at-a-glance reporting on performance metrics and trends for efficiency, capacity and adverse events • Up to 50% system efficiency gains • 30% lower deployment costs • Teamwork modes that prevent conflict between units and allow them to adapt to changes in facility and IT demand to improve efficiency and availability and reduce system wear and tear – saving more than $10,000 per unit per year in energy costs • Simple and easy to deploy — auto-configuration to detect and configure up to 4,800 sensors, eliminating the need for custom integration to building management systems and cutting sensor deployment times in half Liebert iCOM unit control and Liebert iCOM-S system control are available for new Vertiv™ data center cooling units or as retrofits.  iCOM Brochure at p. 3. TierPoint also uses Schneider Electric StruxureWare and Cooling Optimize software to monitor and manage cooling in its data centers.

Claim Language	Exemplary Evidence of Infringement by TierPoint

Reliability / Critical Systems	Utilities	2N A-side and B-side power distribution design
	Generators	Four 2 Megawatt generators each with a 4000 gal diesel belly tank (2N Configuration)
	Uptime Operations	100% Uptime SLA
	Utility Service	Pad mounted 2500kVA transformer for DC100; 2500kVA transformer for DC200
	Electrical	True 2N UPS system
	Mechanical / Cooling	2N redundancy on HVAC units
	BMS Controls	Monitoring of all facility infrastructure to include HVAC and electrical systems
	Life Safety	Dual-Interlock Zoned Preaction Sprinkler System
	Monitoring	BMS temperature & humidity monitoring w/ Eco-Struxureware by Schneider

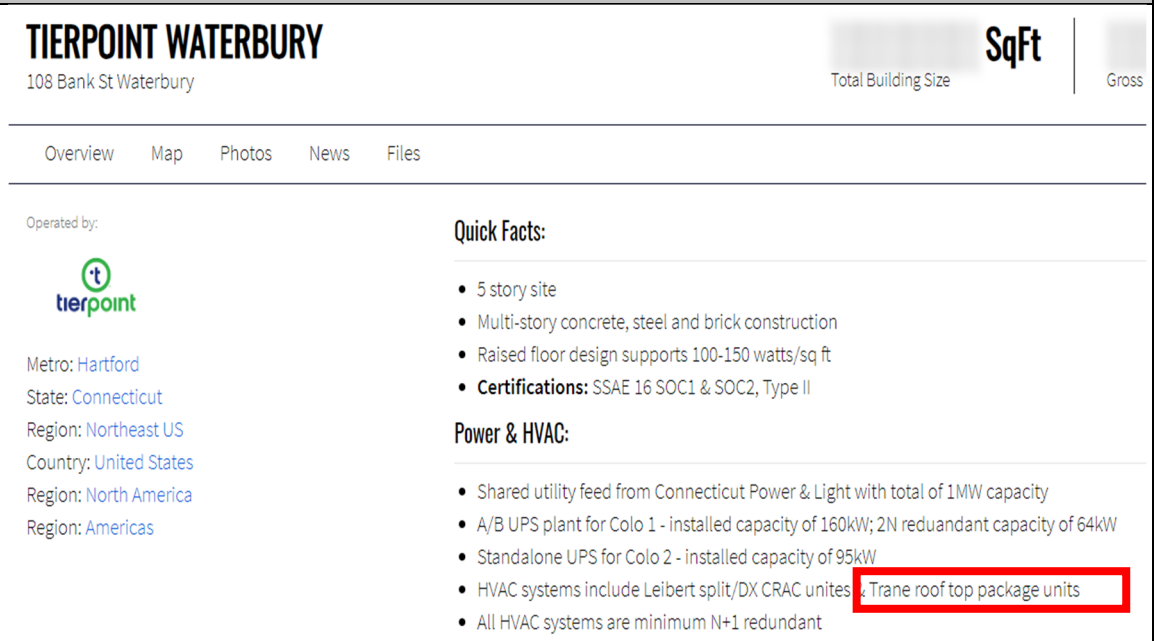
https://web.tierpoint.com/hubfs/data-center/nc-raleigh-rtp-data-center-spec-sheet-tierpoint.pdf

See also:

Reliability / Critical Systems	Utilities	A-side and B-side power distribution design
	Generators	2500 kW - 2N. 15,000 gallons on-site
	Uptime Operations	100% Uptime SLA
	Utility Service	4000A 3P/4W 480/277
	Electrical	UPS redundant systems
	Mechanical / Cooling	N+1 redundancy on HVAC units
	BMS Controls	Monitoring of all HVAC and electrical systems
	Life Safety	Preaction sprinkler & VESDA
	Monitoring	Monitoring and BMS temperature & humidity monitoring through Struxureware

https://web.tierpoint.com/hubfs/data-center/wa-spokane-data-center2-spec-sheet.pdf

For example, TierPoint's data centers use Trane's RTAC chillers to cool a plurality of racks in a data center, as shown below.

Claim Language	Exemplary Evidence of Infringement by TierPoint
	 See, e.g., TierPoint Waterbury, Source: https://www.datacentermap.com/usa/connecticut/waterbury/xand-waterbury/ (Last visited October 23, 2024).
[1a] activating a cooling device and opening a controllable partition configured to vary a supply of cooling fluid within a zone of said data center, said zone including at least one associated rack of said plurality of racks;	TierPoint activates a cooling device and opening a controllable partition configured to vary a supply of cooling fluid within a zone of said data center, said zone including at least one associated rack of said plurality of racks. For example, Liebert's iCOM Intelligent Communication and Monitoring fluid economizer system activates the flow of chilled water/glycol, and varies cooling capacity by adjusting a motorized ball valve (controllable partition).

Claim Language	Exemplary Evidence of Infringement by TierPoint

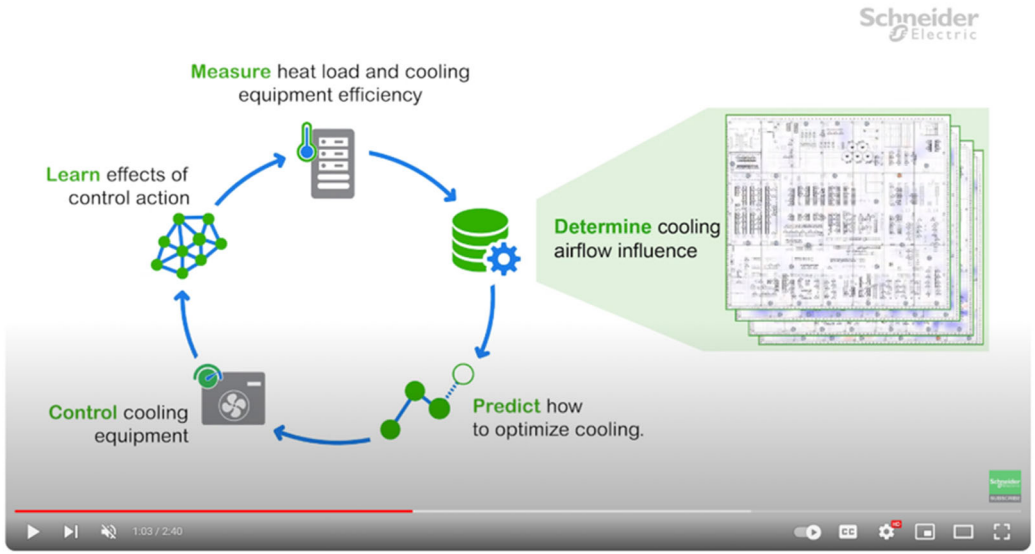
7.1.4 Temperature Control with a Fluid Economizer

When an economizer is installed, the cooling requirement (determined by the temperature proportional band) is addressed first by the economizer's secondary cooling, if the economizer cooling capacity is insufficient, the compressor(s) begin cooling to bring the room air temperature down to the temperature setpoint.

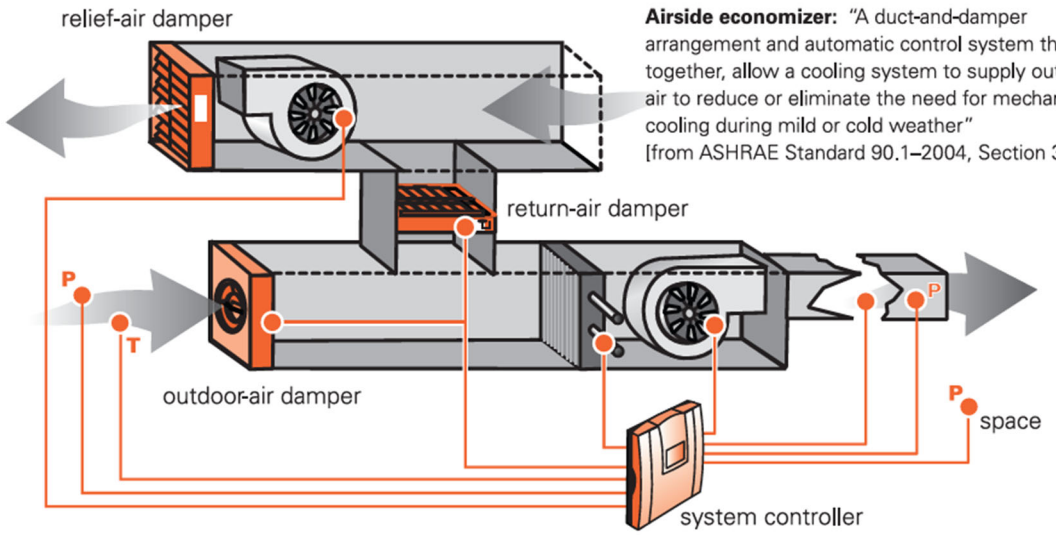
The fluid economizer employs a motorized ball valve that controls the flow of chilled water/glycol to provide a cooling capacity from 0% to 100%.

https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 110.

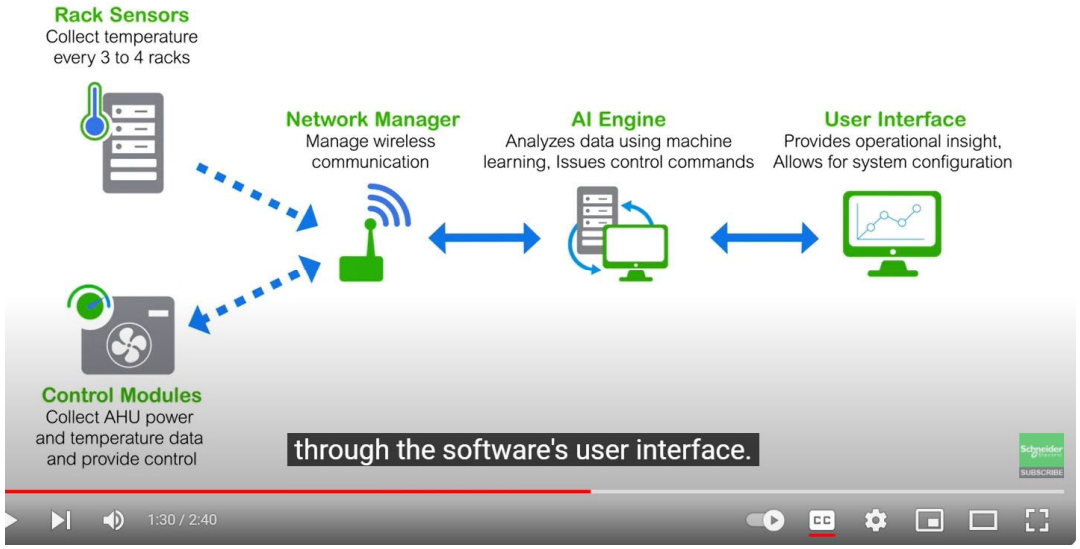
TierPoint also uses Schneider's Cooling Optimize which is a closed-loop system that reacts to real-time data, automatically identifies and eliminates hot spots and helps diagnose potential facility risks.

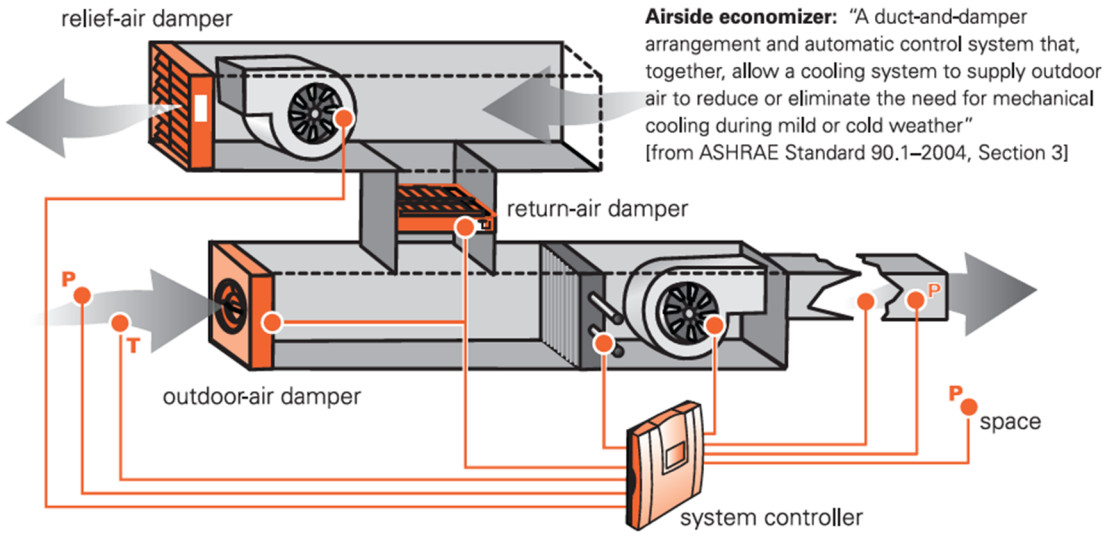


EcoStruxure™ IT Advisor: Cooling Optimize - dynamic, intelligent cooling | Schneider Electric

Claim Language	Exemplary Evidence of Infringement by TierPoint
	https://www.youtube.com/watch?v=yFMS-88wXn8, at 1:03. https://download.schneider-electric.com/files?p_enDocType=Brochure&p_File_Name=998-21764381_EcoStruxure_IT_Advisor_Cooling_Optimize.pdf&p_Doc_Ref=SPD_RMCR-9K5JG4_EN. In yet another example, Tierpoint activates a cooling device (e.g., a free cooling chiller) and opens a controllable partition (e.g., an outdoor air damper) configured to vary a supply of cooling fluid (e.g., cold air) within a zone of said data center.  See, *e.g.*, Keeping cool with outdoor air, Airside Economizers, Trane Engineers Newsletter, Vol. 35-2, https://www.trane.com/content/dam/Trane/Commercial/global/products-systems/education-training/engineers-newsletters/airside-design/admapn020en-0406.pdf.

Claim Language	Exemplary Evidence of Infringement by TierPoint
[1b] sensing the temperature of said at least one associated rack;	TierPoint senses the temperature of said at least one associated rack. For example, TierPoint uses Liebert cooling units and the Liebert cooling unit control system senses temperatures. **13.2 Installing Wired Remote Sensors** Up to 10 remote sensor modules, installed in the monitored racks and connected to the cooling unit, provide control and reference input to iCOM and building-management systems. Using remote, rack sensors combats cooling problems related to recirculation air, uneven rack loading, and air distribution. https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 180. TierPoint also uses Schneider's Cooling Optimize system which utilizes a dense array of temperature sensors to determine exactly where the heat load is within the data center. Data is wirelessly transmitted to network gateways, aggregated, and sent to a purpose-built appliance where it is analyzed by control software. Control commands are then delivered to the cooling equipment. *See* https://download.schneider-electric.com/files?p_enDocType=Brochure&p_File_Name=998-21764381_EcoStruxure_IT_Advisor_Cooling_Optimize.pdf&p_Doc_Ref=SPD_RMCR-9K5JG4_EN.

Claim Language	Exemplary Evidence of Infringement by TierPoint
	 https://www.youtube.com/watch?v=yFMS-88wXn8, at 1:30. In another example, Tierpoint senses the temperature using temperature sensors (e.g., T).

Claim Language	Exemplary Evidence of Infringement by TierPoint
	 See, *e.g.*, Keeping cool with outdoor air, Airside Economizers, Trane Engineers Newsletter, Vol. 35-2, https://www.trane.com/content/dam/Trane/Commercial/global/products-systems/education-training/engineers-newsletters/airside-design/admapn020en-0406.pdf.
[1c] determining whether said sensed temperature is within a predetermined temperature range; and	TierPoint determines whether said sensed temperature is within a predetermined temperature range. For example, TierPoint uses the Liebert iCOM system which is able to identify if the temperature is at the setpoint value, and change the response to the varied flow field based on length of time temperature has deviated, and amount of deviation from setpoint.

Claim Language	Exemplary Evidence of Infringement by TierPoint

Temperature Integration Time

Adjusts amount of cooling/heating based on the length of time the temperature has deviated from the setpoint. The time selected is the amount of time it will take cooling capacity to reach 100%. For example, if three minutes is selected, cooling capacity will increase to 100% in three minutes.

NOTE: Three to five minutes of integration time is adequate for most applications. See Considerations when Using PI Temperature Control on page 28 .

NOTE: Only used when Temperature Control Type is **PI**.

Temperature Proportional Band

Adjusts the activation point of cooling/heating components based on deviation from setpoint by placing half of the selected value on each side of the temperature control setpoint. A smaller number causes faster reaction to temperature changes.

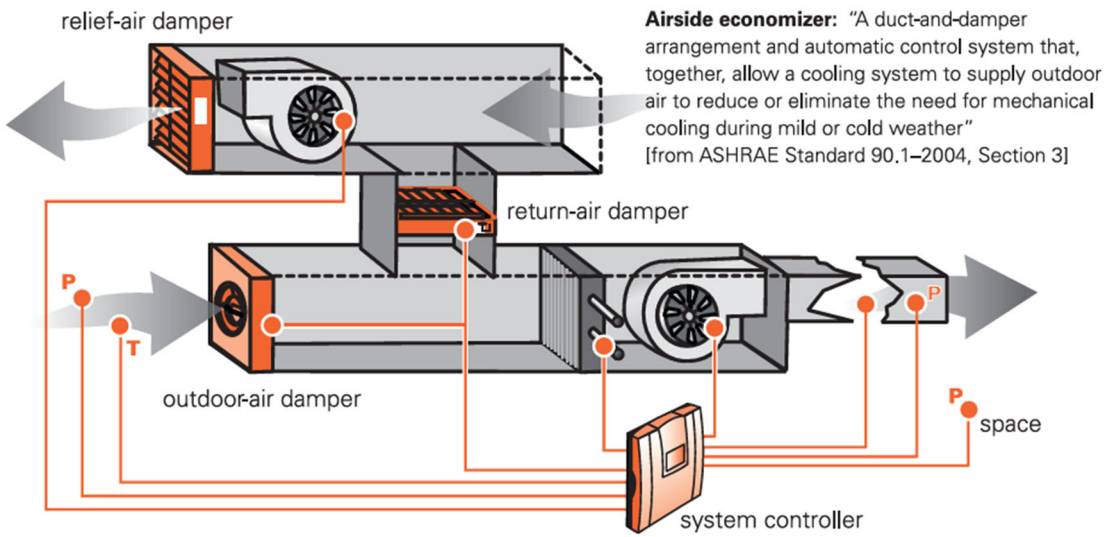
NOTE: Setting this too low causes short cycling of compressors.

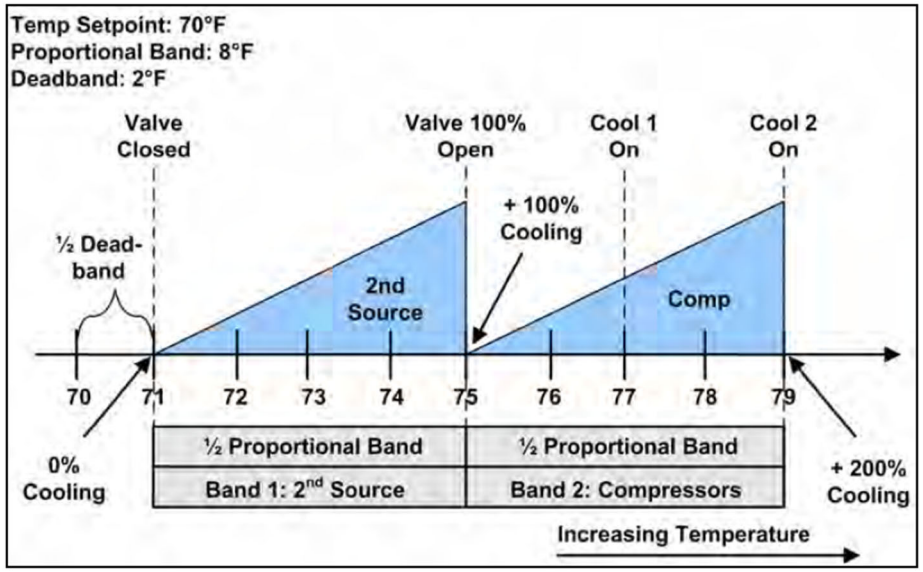
https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 25.

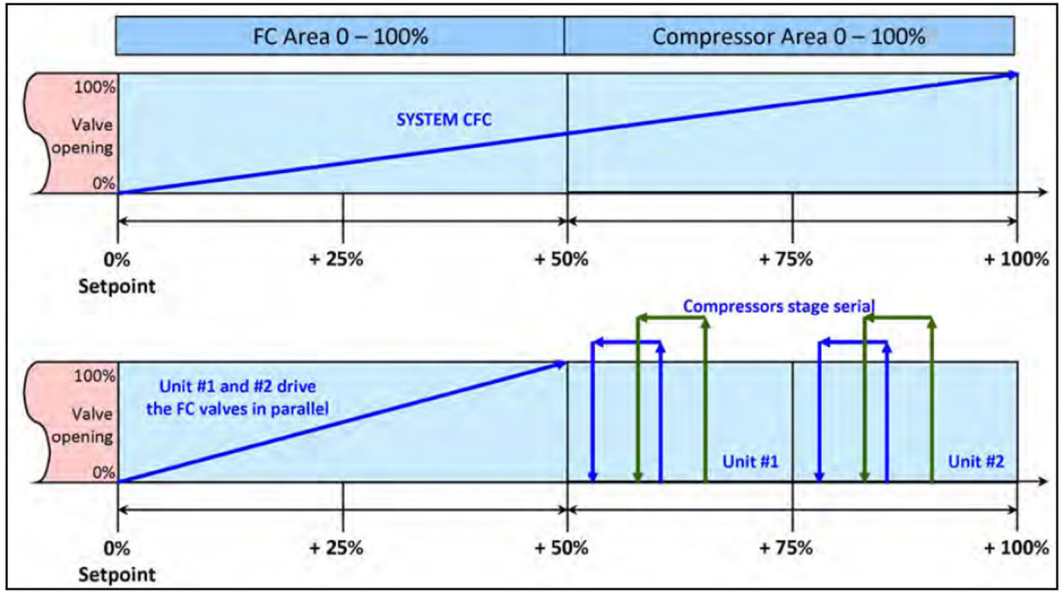
TierPoint also uses Schneider's Cooling Optimize system to determine whether the sensed temperature is within a predetermined temperature range, for example, by using the temperature compliance report.

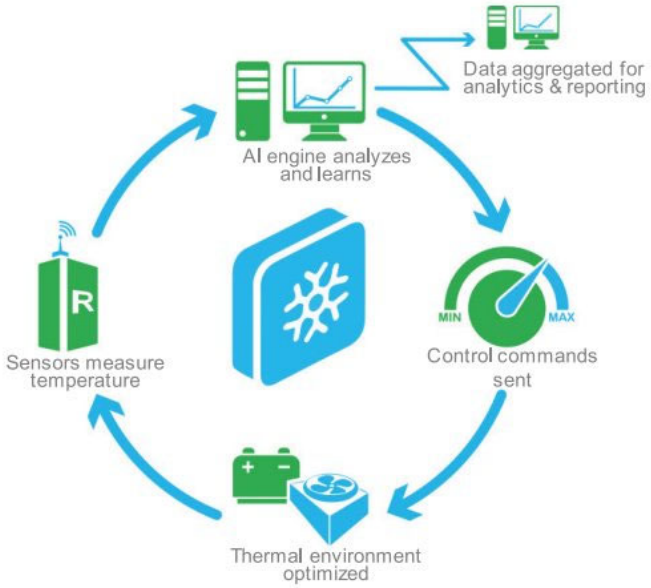
Reports	
Benchmark report	Verifies energy and cost savings, as well as greenhouse gas reductions, achieved through the use of dynamic cooling management.
Temperature compliance report	Identifies if rack temperatures have complied with required set points, and the time period that racks have been in violation of the set point limits, enabling easy detection of potential physical infrastructure irregularities.

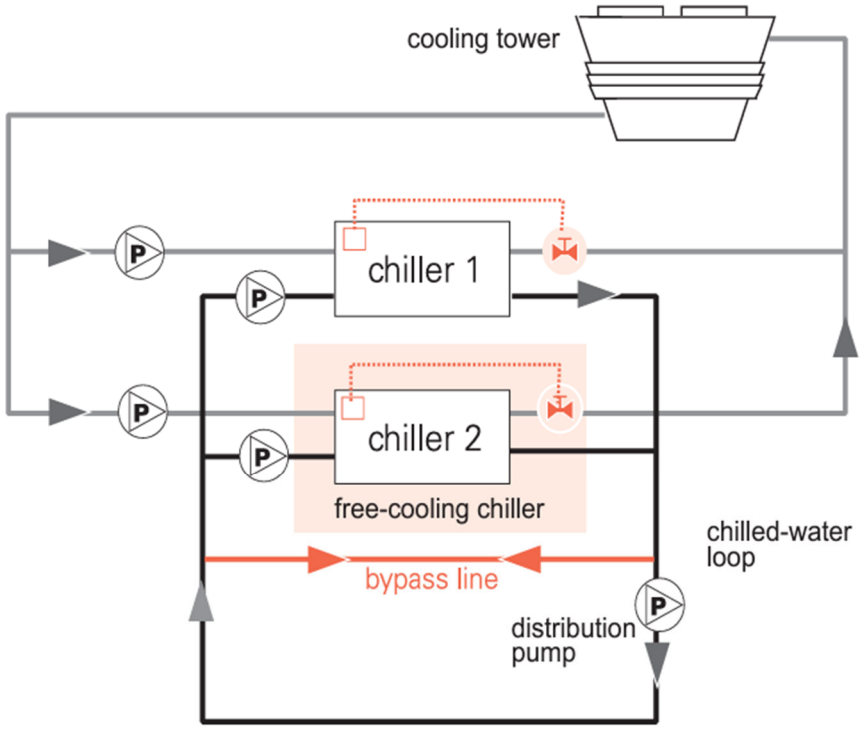
https://download.schneider-electric.com/files?p_enDocType=Brochure&p_File_Name=998-21764381_EcoStruxure_IT_Advisor_Cooling_Optimize.pdf&p_Doc_Ref=SPD_RMCR-9K5JG4_EN.

Claim Language	Exemplary Evidence of Infringement by TierPoint
	In another example, Tierpoint determines whether the temperature is within a predetermined range (e.g., using the system controller).  See, *e.g.*, Keeping cool with outdoor air, Airside Economizers, Trane Engineers Newsletter, Vol. 35-2, https://www.trane.com/content/dam/Trane/Commercial/global/products-systems/education-training/engineers-newsletters/airside-design/admapn020en-0406.pdf.
[1d] manipulating said controllable partition to vary said supply of said cooling fluid to said zone in response to said sensed temperature being outside said predetermined temperature range.	TierPoint manipulates said controllable partition to vary said supply of said cooling fluid to said zone in response to said sensed temperature being outside said predetermined temperature range.

Claim Language	Exemplary Evidence of Infringement by TierPoint
	TierPoint uses Liebert's iCOM system to manipulate the motorized ball valve (controllable partition) from 0% to 100% flow of chilled water/glycol. **7.1.4 Temperature Control with a Fluid Economizer** When an economizer is installed, the cooling requirement (determined by the temperature proportional band) is addressed first by the economizer's secondary cooling, if the economizer cooling capacity is insufficient, the compressor(s) begin cooling to bring the room air temperature down to the temperature setpoint. The fluid economizer employs a motorized ball valve that controls the flow of chilled water/glycol to provide a cooling capacity from 0% to 100%. https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 110. Figure 3.17 Second Cooling Source and Two-Step Compressorized Cooling 

Claim Language	Exemplary Evidence of Infringement by TierPoint
	https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 69, Fig. 3.17. Figure 3.18 Freecooling and Compressorized Operation  https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 70, Fig. 3.18. TierPoint also uses Schneider's Cooling Optimize to adjust cooling output.

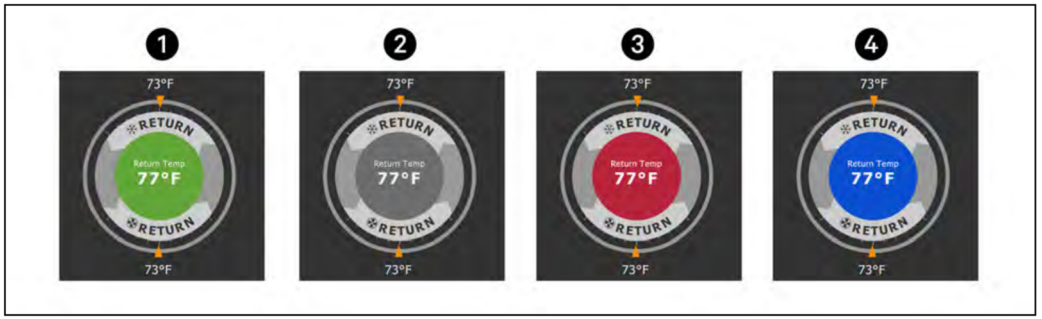
Claim Language	Exemplary Evidence of Infringement by TierPoint
	As IT load changes, the built-in machine learning automatically adjusts cooling output to match the dynamic data center environment.  https://download.schneider-electric.com/files?p_enDocType=Brochure&p_File_Name=998-21764381_EcoStruxure_IT_Advisor_Cooling_Optimize.pdf&p_Doc_Ref=SPD_RMCR-9K5JG4_EN In yet another example, Tierpoint manipulates said controllable partition (e.g., from free cooling to chilled water) to vary said supply of said cooling fluid to said zone in response to said sensed temperature being outside said predetermined temperature range.

Claim Language	Exemplary Evidence of Infringement by TierPoint
	Figure 2. Water economizer piped in parallel with chillers  See, *e.g.*, Free Cooling Using Water Economizers, Trane Engineers Newsletter, Vol. 37-3, https://www.trane.com/content/dam/Trane/Commercial/global/products-systems/education-training/engineers-newsletters/waterside-design/admapn029en_0808.pdf.

Claim Language	Exemplary Evidence of Infringement by TierPoint
[2pre] The method according to claim 1, further comprising:	The Accused Products infringe claim 1. *See supra*.
[2a] determining whether the measured temperature of said at least one associated rack is below or equal to a predetermined minimum set point temperature; and	The Accused Products determine whether the measured temperature of said at least one associated rack is below or equal to a predetermined minimum set point temperature, regardless of which cooling technology is used (Liebert, Schneider, or others). For example, TierPoint uses the Liebert iCOM system which can identify if the rack temperature is below or equal to the predetermined minimum set point value temperature. The Liebert iCOM system defines the minimum temperature. S105 — Temperature User Low Limit: 41 - 104 °F / 5.0 - 40.0 °C; 41 °F / 5.0 °C; Defines the temperature range below setpoint; temperature setpoint cannot be adjusted below this value. If the setpoint value has been adjusted lower than this setting, then the setpoint will automatically default back to its previous setting. S105 — Temperature User High Limit: 41 - 104 °F / 5.0 - 40.0 °C; 104 °F / 40.0 °C; Defines the temperature range above setpoint; temperature setpoint cannot be adjusted above this value. If the setpoint value has been set higher than this setting, then the setpoint will automatically default back to its previous setting. https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 203.

Claim Language	Exemplary Evidence of Infringement by TierPoint

Figure 1.3 Dial Background Colors

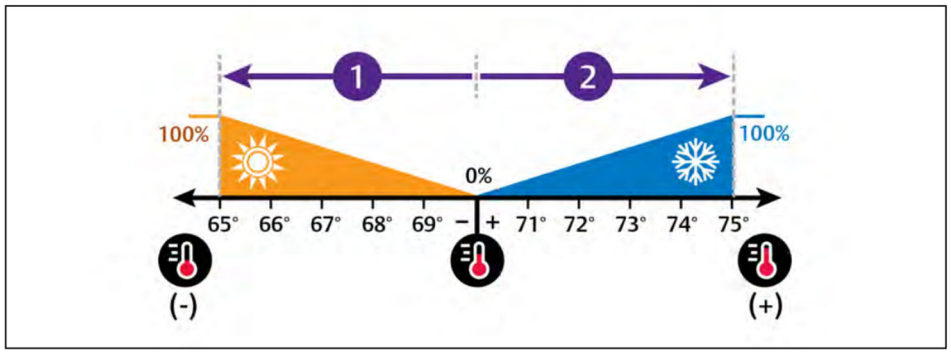


Item	Description
1	Sensor reading is within threshold limits..
2	Unit is powered off.
3	Sensor reading is above threshold limit or the unit is in an alarm condition.
4	Sensor reading is below threshold limit.

https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 5.

The Liebert iCOM system uses temperature control sensors to cool the racks.

Claim Language	Exemplary Evidence of Infringement by TierPoint
	Temperature Control Sensor Selects sensor that controls cooling. Values are: • Supply Sensor: Temperature control is based on maintaining the temperature of the discharge air from the cooling unit. See Supply Sensors on page 158 . • Remote Sensor: Temperature control is based on the temperature reading(s) from wired remote/rack sensor(s). See Wired Remote Sensors on page 156 . • Return Sensor: Temperature control is based on maintaining the temperature of the room air. • Customer input setpoint (remote alarm device) **Temperature Control Type** Control when staging cooling and heating operations. Values are: • Proportional: Percent of cooling/heating determined by the difference between the air temperature sensor reading and the temperature setpoint. • P: Percent of cooling/heating calculated using the temperature proportional band and temperature-integration time settings. See Considerations when Using PI Temperature Control on page 28 . • Adaptive PID: Auto-tuning PID control loop, can be set for cooling. Only available on Liebert® chilled water systems. • Intelligent: Percent of cooling/heating determined by programmed logic that simulates manual human control. https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 25. For example, the Liebert iCOM system calculates the need for cooling or heating of the system. As one example, the Liebert iCOM system can control the temperature using proportional and deadband parameters.

Claim Language	Exemplary Evidence of Infringement by TierPoint
	Temperature Proportional Band Use the proportional and deadband parameters to control how your cooling unit(s) respond based on the calculated need for cooling (or heating). Figure 3.1 on the facing page , illustrates temperature control using: • 70° setpoint • 10° proportional band • No deadband The proportional band is divided evenly on each side of the setpoint: • 0% cooling capacity is required at 70°. • As the air temperature increases, cooling also increases along the proportional band. • If the air temperature reaches 75°, the system operates at 100% cooling capacity. • If air temperature rises to the end of the proportional band or further, the system operates at 100% capacity to bring the temperature down to the setpoint. • If your unit includes reheat, the heating capacity operates in the same way as the air temperature falls below the setpoint. See Reheat Control on page 59 . **Figure 3.1 Temperature Control without a Deadband**  https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 27. The amount of cooling/heating is adjusted based on length of time temperature has deviated, and amount of deviation from setpoint.

Claim Language	Exemplary Evidence of Infringement by TierPoint

Temperature Integration Time

Adjusts amount of cooling/heating based on the length of time the temperature has deviated from the setpoint. The time selected is the amount of time it will take cooling capacity to reach 100%. For example, if three minutes is selected, cooling capacity will increase to 100% in three minutes.

NOTE: Three to five minutes of integration time is adequate for most applications. See Considerations when Using PI Temperature Control on page 28 .

NOTE: Only used when Temperature Control Type is PI.

Temperature Proportional Band

Adjusts the activation point of cooling/heating components based on deviation from setpoint by placing half of the selected value on each side of the temperature control setpoint. A smaller number causes faster reaction to temperature changes.

NOTE: Setting this too low causes short cycling of compressors.

https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 25.

As another example, Schneider's Cooling Optimize system is used to determine whether the sensed temperature is within a predetermined temperature range, for example, by using the temperature compliance report identifying if rack temperatures have compiled with required setpoints.

Reports	
Benchmark report	Verifies energy and cost savings, as well as greenhouse gas reductions, achieved through the use of dynamic cooling management.
Temperature compliance report	Identifies if rack temperatures have complied with required set points, and the time period that racks have been in violation of the set point limits, enabling easy detection of potential physical infrastructure irregularities.

https://download.schneider-

<table>
<tr><th>Claim Language</th><th>Exemplary Evidence of Infringement by TierPoint</th></tr>
<tr><td></td><td>electric.com/files?p_enDocType=Brochure&p_File_Name=998-21764381_EcoStruxure_IT_Advisor_Cooling_Optimize.pdf&p_Doc_Ref=SPD_RMCR-9K5JG4_EN.</td></tr>
<tr><td>[2b] decreasing the supply of said cooling fluid to said zone in response to said at least one associated rack having a measured temperature that falls below or equal said predetermined minimum set point temperature.</td><td>The Accused Products decrease the supply of said cooling fluid to said zone in response to said at least one associated rack having a measured temperature that falls below or equal said predetermined minimum set point temperature, regardless of which cooling technology is used (Liebert, Schneider, or others).

For example, Liebert’s iCOM adjusts the activation points of the cooling fluid based on the sensor value deviation from the setpoint.

<table>
<tr><td rowspan="2">S106</td><td>Temperature Proportional Band</td><td>4 - 200 ℉
2.2 - 111.0 K</td><td>12 ℉
6.7 K</td><td>Adjusts the activation points of compressors/chilled water valves or rate of changed based on the actual sensor values deviation from setpoint. The smaller this number, the faster the compressors/chilled water values will increase capacity. Too small of a number may cause the unit to short cycle compressors or excessively reposition the valve.</td></tr>
<tr><td>Temperature Integral Time</td><td>0.0 - 15.0 min</td><td>5.0 min</td><td>Adjusts the capacity of the units based on time away from setpoint so that accurate temperature control can be maintained. The proportional and integral time settings work together to maintain setpoint. Large p-band and small integral time is typical when controlling to supply air.</td></tr>
</table>

https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 203.

7.1.4 Temperature Control with a Fluid Economizer

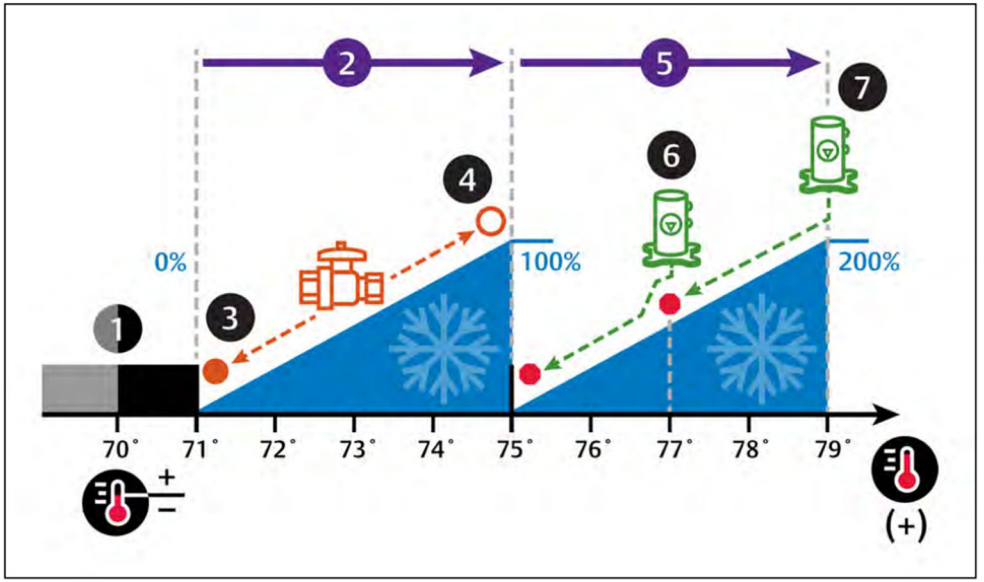
When an economizer is installed, the cooling requirement (determined by the temperature proportional band) is addressed first by the economizer’s secondary cooling, if the economizer cooling capacity is insufficient, the compressor(s) begin cooling to bring the room air temperature down to the temperature setpoint.

The fluid economizer employs a motorized ball valve that controls the flow of chilled water/glycol to provide a cooling capacity from 0% to 100%.

https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 110.</td></tr>
</table>

Claim Language	Exemplary Evidence of Infringement by TierPoint

Figure 7.1 Temperature Control—Fluid Economizer and Example Two Step Compressor Capacity



No.	Description	No.	Description
1	Deadband.	5	½ of proportional band assigned to compressor(s) operation.
2	½ of proportional band assigned to valve operation.	6	Scroll compressor step 1. (Compressor 1 in dual compressor configuration, Unloaded in single compressor configuration.)
3	Fluid control valve closed.	7	Scroll compressor step 2. (Compressor 2 in dual compressor configuration, Loaded in single compressor configuration.)
7	Fluid control valve fully open.		

https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 112.

Claim Language	Exemplary Evidence of Infringement by TierPoint
	As another example, in Schneider's system, the cooling fluid is decreased in response to a temperature falling below the predetermined temperature. 8. **How Row-based Data** Center Cooling Works Schneider Electric – Data Center Science Center Rev 0 8 The figures above help to visualize the effect of row coolers on hot air capture index values and cooling stand-alone IT device. As row coolers are variable capacity devices that are capable of over-supplying cold air to the cold aisle. When the system is in balance, the supply temperature from the cooler is equal to the IT inlet temperature. When ancillary equipment (i.e. stand-alone devices) is initially added outside of the pod, the temperature of the overall room environment increases due to air mixing. Nearby row-based cooling units sense this increase and respond by increasing cooling capacity thereby neutralizing the hot air. This increased cooling capacity is achieved by increased air flow (row coolers increase fan speed) and or lower supply air temperature (row cooler increase chilled water valve flow). These adjustments occur initially but remain unchanged once the data center reaches steady state. The steps describing how the row-based coolers "pick up the ancillary load" are the same even when containment is used. In either case we expect the ancillary equipment to operate at higher temperatures than the row-based racks, because it is not directly coupled to row coolers in their own pod. The further away stand-alone IT gear is from row coolers, the higher their inlet air temperature will be. Should you be concerned about the elevated https://www.slideshare.net/SchneiderElectric/how-rowbased-data-center-cooling-works Active response controls ensure that servers consistently operate at the desired rack inlet setpoint. As temperatures shift, built-in probes detect changes and send a signal to the controller. The cooling output is continually adjusted to accommodate varying loads, determined by the difference between the setpoint and the actual temperature as well as the airflow for each cooling unit. The fluid valve modulates fluid flow into the cooling coil, keeping equipment at the proper temperature, and saving energy by only consuming the amount required to cool the IT heat load.

Claim Language	Exemplary Evidence of Infringement by TierPoint
	Active Response Controls Active response controls ensure that servers consistently operate at the desired rack inlet setpoint. As temperatures shift, built-in probes detect changes and send a signal to the controller. The cooling output is continually adjusted to accommodate varying loads, determined by the difference between the setpoint and the actual temperature as well as the airflow for each cooling unit. The fluid valve modulates fluid flow into the cooling coil, keeping equipment at the proper temperature, and saving energy by only consuming the amount required to cool the IT heat load. **Chiller/CRAC Communications** Uniflair chillers and CRAC units efficiently work together to optimize the system performance according to the different load and operating conditions. When a single modulating chiller is connected to a single internal unit, the CRAC regulates the cooling load according to the discharge air temperature by means of the three-way valve and the chilled water temperature, which is regulated on the chiller and connected via LAN. When connected to more than one chiller, or when one or more large chillers are installed and connected to all internal CRAC units within the same room, internal and external units can communicate in LAN. The CRAC units regulate the load according to the average suction air temperature by means of the three-way valve and the chilled water temperature.

<table>
<tr><th>Claim Language</th><th>Exemplary Evidence of Infringement by TierPoint</th></tr>
<tr><td></td><td>https://www.mobiledatacentre.com/wp-content/uploads/2021/05/Schneider-Electric-Cooling-Solutions-Brochure-29-01-19.pdf, p. 21.

The CRAC airflow can be changed by right clicking a CRAC and selecting properties.

• Cooler airflow in cubic feet per minute (CFM) is assumed to be:
<table><tr><th>Cooler type</th><th>Minimum CFM</th><th>Maximum CFM</th></tr><tr><td>InRow RC (300 mm)</td><td>1450</td><td>2900</td></tr><tr><td>InRow RC (600 mm)</td><td>2760</td><td>6900</td></tr><tr><td>InRow RP (600 mm Chilled Water)</td><td>2760</td><td>6900</td></tr><tr><td>InRow RP (600 mm Air Cooled)</td><td>1920</td><td>4800</td></tr><tr><td>InRow RD (600 mm Air Cooled)</td><td>2000</td><td>5000</td></tr><tr><td>InRow RD (300 mm Air Cooled)</td><td>916</td><td>2300</td></tr><tr><td>InRow RD (300 mm Fluid Cooled)</td><td>916</td><td>2300</td></tr></table>• Rack airflow is by default assumed to be 160 CFM/kW based on the total rack power. This value can be changed by right-clicking a rack and selecting Properties, to change to, for example, 105 CFM/kW for blade server racks.
• CRAC airflow is, by default, assumed to be 6000 CFM. This can be changed by right-clicking a CRAC and selecting Properties.

https://dcimsupportattachments.ecostruxureit.com/140711358/StruxureWare%20Data%20Center%20Operation%20User's%20Guide.pdf (“StruxureWare Manual”) at p. 50.</td></tr>
<tr><td>[3pre] The method according to claim 1, further comprising:</td><td>The Accused Products infringe claim 1. See supra.</td></tr>
<tr><td>[3a] sensing a pressure of a supply of said cooling fluid;</td><td>The Accused Products sense a pressure of a supply of said cooling fluid, regardless of which cooling technology is used (Liebert, Schneider, or others).

For example, in Liebert’s system inlet and outlet refrigerant pressure sensors are used to measure the pressure of the refrigerant.</td></tr>
</table>

Claim Language	Exemplary Evidence of Infringement by TierPoint

Table 4.4 Events Specific to Liebert EconoPhase™

Event	Description
PB1 IN PRES SENS FAIL	Inlet refrigerant pressure sensor failure. Pump shut down. • Event is reset when condition clears.
PB1 IN TEMP SENS FAIL	Inlet refrigerant temperature sensor failure. Pump shut down. • Event is reset when condition clears.
PB1 OUT PRES SEN FAIL	Outlet refrigerant pressure sensor failure. Pump shut down. • Event is reset when condition clears.

https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 94.

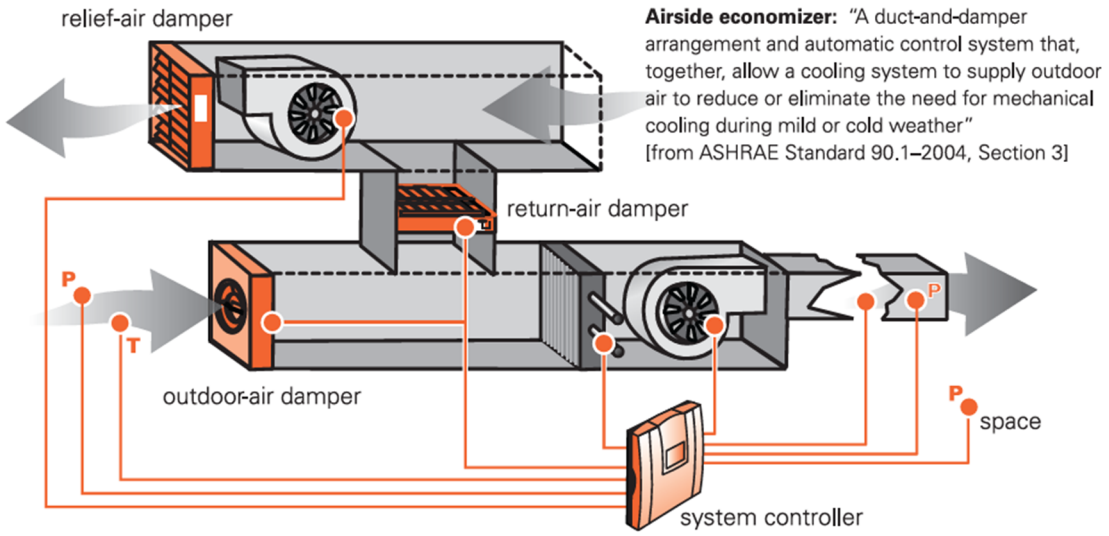
The liquid refrigerant has pressure setpoints.

When your Thermal Management System is a Liebert® DSE system with a Liebert® EconoPhase pumped refrigerant economizer (PRE) and a Liebert® MC or MCV condenser, the EconoPhase screen, **Figure 2.1** on the facing page , shows the operating mode of the system. The DSE System Optimization feature is automatically employed and reduces power consumption significantly because a PRE package consumes about one-tenth the power of the compressors.

EconoPhase operation saves energy by eliminating compressor operation when outdoor ambient temperatures are cool enough, or when the difference between the indoor and outdoor ambient temperature is satisfied. DSE System Optimization further improves efficiency by optimizing liquid refrigerant temperature and pressure setpoints in mid- and high-ambient temperature conditions, thus reducing the operation of condenser fans while maintaining the appropriate heat rejection capacity.

https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 28.

See also:

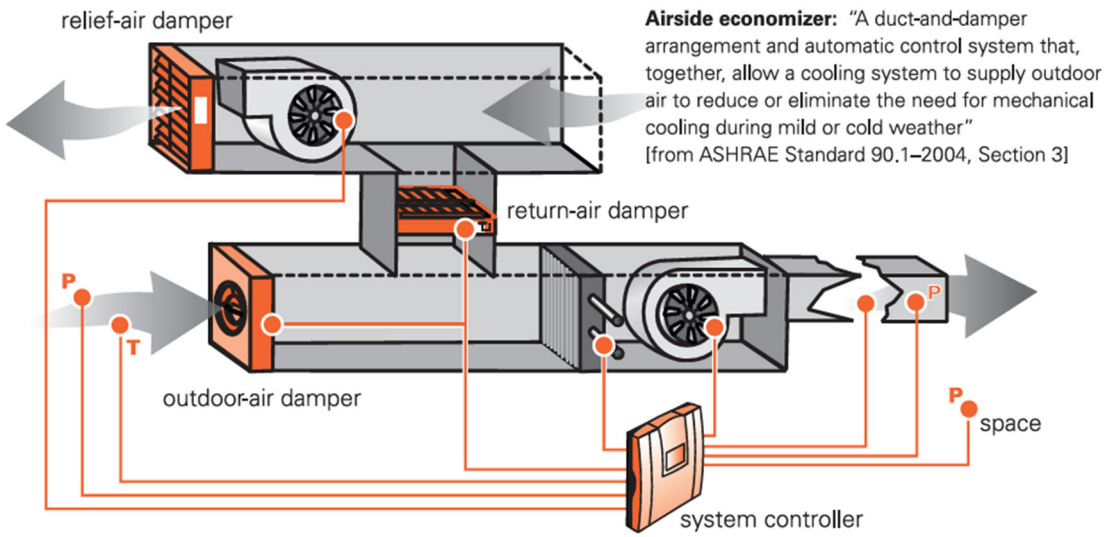
Claim Language	Exemplary Evidence of Infringement by TierPoint
	 See, *e.g.*, Keeping cool with outdoor air, Airside Economizers, Trane Engineers Newsletter, Vol. 35-2, https://www.trane.com/content/dam/Trane/Commercial/global/products-systems/education-training/engineers-newsletters/airside-design/admapn020en-0406.pdf.
[3b] determining whether said sensed pressure is within a predetermined pressure range; and	The Accused Products determine whether said sensed pressure is within a predetermined pressure range, regardless of which cooling technology is used (Liebert, Schneider, or others). For example, Liebert's iCOM system senses the cooling fluid pressure.

Claim Language	Exemplary Evidence of Infringement by TierPoint
	3.3.5 Setting Compressor Options 1. Touch SERVICE, then ☰ > *Options Setup* > *Compressor Settings*. The COMPRESSOR SETTINGS panel displays. 2. Make adjustments as needed and click *Save*. The option settings are updated. • Touch *Cancel* to discard the changes without saving. NOTE: Depending on the type of thermal management unit, included components, and control settings of your system, all of the options listed may not be available on your Vertiv™ Liebert® iCOM™ display. **Compressor Settings Options** **Ball Valve Setpoint Offset** Adjusts sensitivity to compressor discharge pressure or liquid pressure by increasing sensitivity. The higher the added pressure, the more the valve opens. https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 56. **7.1.4 Temperature Control with a Fluid Economizer** When an economizer is installed, the cooling requirement (determined by the temperature proportional band) is addressed first by the economizer's secondary cooling, if the economizer cooling capacity is insufficient, the compressor(s) begin cooling to bring the room air temperature down to the temperature setpoint. The fluid economizer employs a motorized ball valve that controls the flow of chilled water/glycol to provide a cooling capacity from 0% to 100%. https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 110. The Liebert DSE system optimization further improves efficiency by optimizing liquid refrigerant pressure setpoints in mid and high ambient temperature conditions thus reducing the operation of condenser fans while maintaining the appropriate heat rejection capacity.

Claim Language	Exemplary Evidence of Infringement by TierPoint
	When your Thermal Management System is a Liebert® DSE system with a Liebert® EconoPhase pumped refrigerant economizer (PRE) and a Liebert® MC or MCV condenser, the EconoPhase screen, **Figure 2.1** on the facing page , shows the operating mode of the system. The DSE System Optimization feature is automatically employed and reduces power consumption significantly because a PRE package consumes about one-tenth the power of the compressors. EconoPhase operation saves energy by eliminating compressor operation when outdoor ambient temperatures are cool enough, or when the difference between the indoor and outdoor ambient temperature is satisfied. DSE System Optimization further improves efficiency by optimizing liquid refrigerant temperature and pressure setpoints in mid- and high-ambient temperature conditions, thus reducing the operation of condenser fans while maintaining the appropriate heat rejection capacity. https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 28.
[3c] varying an output of said cooling device in response to said sensed pressure falling outside of said predetermined pressure range.	The Accused Products vary an output of said cooling device in response to said sensed pressure falling outside of said predetermined pressure range, regardless of which cooling technology is used (Liebert, Schneider, or others). For example, in Liebert's cooling system the low-pressure condition is ignored for a setpoint to avoid false trips due to bubbles in the refrigerant or other misreading of the low-pressure device at compressor startup. The number of times the valve opens and close is adjusted based on added pressure offset.

Claim Language	Exemplary Evidence of Infringement by TierPoint
	Setting Low Pressure Time Delay At compressor start up, a low pressure condition is ignored for a set period to avoid false trips due to bubbles in the refrigerant or other misreading of the low pressure device. **NOTE: The factory-default setting is a three minute delay for air cooled units and a zero to one minute delay for water cooled units.** 1. Touch  then  > *Options Setup* > *Compressor Settings*. 2. Use the *Winter Start Delay* slider to select the number of minutes for the delay, and touch *Save*. **Adjusting Ball Valve Pressure Offset** **NOTE: Only a properly trained and qualified technician should modify the motorized ball valve setting.** The number of times the valve opens and closes is adjusted based on added pressure offset. 1. Touch  then  > *Options Setup* > *Compressor Settings*. 2. Use the *Ball Valve Setpoint Offset* slider to select amount of pressure added to open the valve wider, and touch *Save*. https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 65. The motorized ball valve controls the flow of chilled water/glycol to provide a cooling capacity from 0 to 100%.

Claim Language	Exemplary Evidence of Infringement by TierPoint
	7.1.4 Temperature Control with a Fluid Economizer When an economizer is installed, the cooling requirement (determined by the temperature proportional band) is addressed first by the economizer's secondary cooling, if the economizer cooling capacity is insufficient, the compressor(s) begin cooling to bring the room air temperature down to the temperature setpoint. The fluid economizer employs a motorized ball valve that controls the flow of chilled water/glycol to provide a cooling capacity from 0% to 100%. https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 110. The compressor settings options include adjusting sensitivity to compressor discharge pressure or liquid pressure by increasing sensitivity. **Capacity Change at 0%** Decreases the rate at which cooling capacity changes when close to or at the temperature setpoint to avoid undershooting the setpoint. **3.3.5 Setting Compressor Options** 1. Touch SERVICE, then ☰ > *Options Setup* > *Compressor Settings*. The COMPRESSOR SETTINGS panel displays. 2. Make adjustments as needed and click *Save*. The option settings are updated. • Touch *Cancel* to discard the changes without saving. NOTE: Depending on the type of thermal management unit, included components, and control settings of your system, all of the options listed may not be available on your Vertiv™ Liebert® iCOM™ display. **Compressor Settings Options** **Ball Valve Setpoint Offset** Adjusts sensitivity to compressor discharge pressure or liquid pressure by increasing sensitivity. The higher the added pressure, the more the valve opens.

Claim Language	Exemplary Evidence of Infringement by TierPoint
	https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 56. **Capacity Change at 100%** Increases the rate at which the cooling capacity changes for a quicker reaction of cooling at high temperatures. https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 57. See also:  See, *e.g.*, Keeping cool with outdoor air, Airside Economizers, Trane Engineers Newsletter, Vol. 35-2, https://www.trane.com/content/dam/Trane/Commercial/global/products-

<table>
<tr><th>Claim Language</th><th>Exemplary Evidence of Infringement by TierPoint</th></tr>
<tr><td></td><td>systems/education-training/engineers-newsletters/airside-design/admapn020en-0406.pdf.</td></tr>
<tr><td>[4] The method according to claim 2, further comprising: increasing the supply of said cooling fluid to said zone in response to said at least one associated rack having a measured temperature that exceed said predetermined minimum set point temperature.</td><td>The Accused Products infringe claim 2. See supra.

The Accused Products increase the supply of said cooling fluid to said zone in response to said at least one associated rack having a measured temperature that falls below or equal said predetermined minimum set point temperature, regardless of which cooling technology is used (Liebert, Schneider, or others).

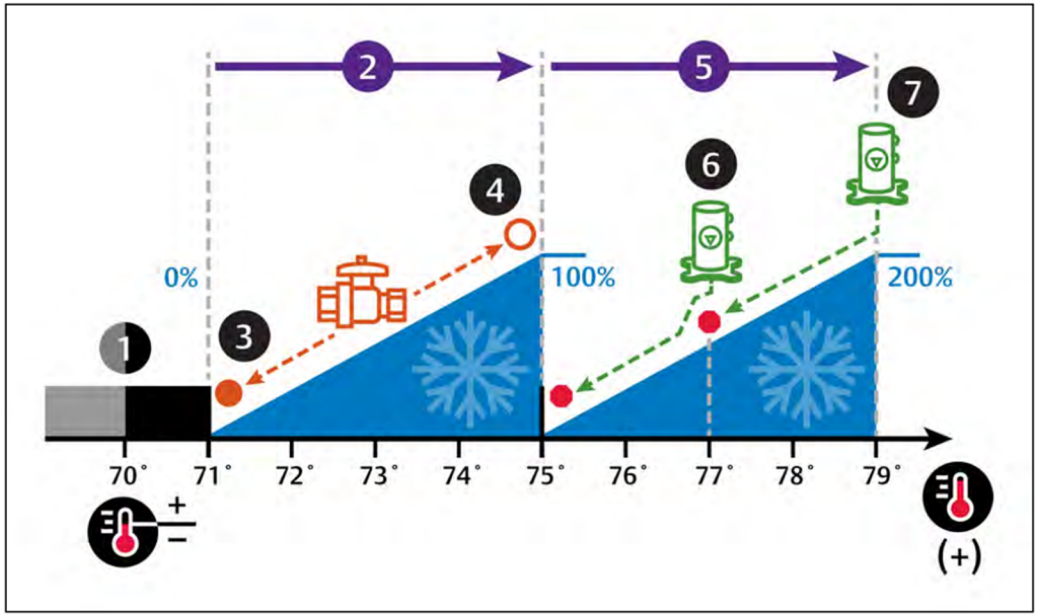
For example, Liebert’s iCOM system adjusts the activation points of the cooling fluid based on the sensor value deviation from the setpoint. Thus, Liebert increases the supply of said cooling fluid to a zone in response to said at least one associated rack having a measured temperature that exceed said predetermined minimum set point temperature.

<table><tr><td rowspan="2">S106</td><td>Temperature Proportional Band</td><td>4 - 200 ℉
2.2 - 111.0 K</td><td>12 ℉
6.7 K</td><td>Adjusts the activation points of compressors/chilled water valves or rate of changed based on the actual sensor values deviation from setpoint. The smaller this number, the faster the compressors/chilled water values will increase capacity. Too small of a number may cause the unit to short cycle compressors or excessively reposition the valve.</td></tr><tr><td>Temperature Integral Time</td><td>0.0 - 15.0 min</td><td>5.0 min</td><td>Adjusts the capacity of the units based on time away from setpoint so that accurate temperature control can be maintained. The proportional and integral time settings work together to maintain setpoint. Large p-band and small integral time is typical when controlling to supply air.</td></tr></table></td></tr>
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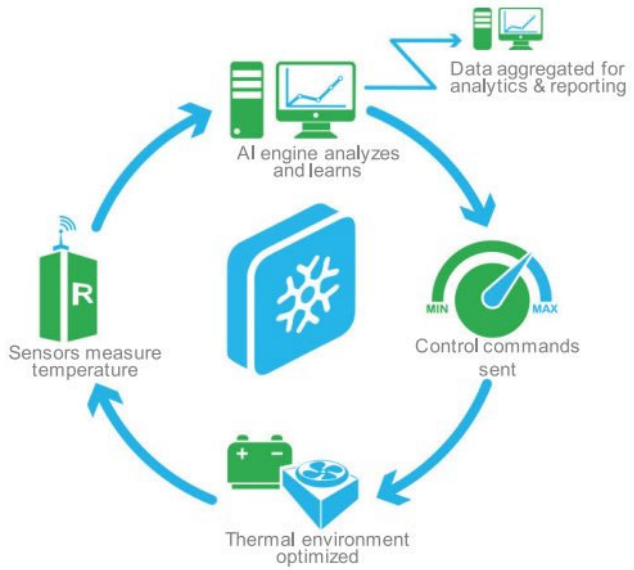
Claim Language	Exemplary Evidence of Infringement by TierPoint
	https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 203. **7.1.4 Temperature Control with a Fluid Economizer** When an economizer is installed, the cooling requirement (determined by the temperature proportional band) is addressed first by the economizer's secondary cooling, if the economizer cooling capacity is insufficient, the compressor(s) begin cooling to bring the room air temperature down to the temperature setpoint. The fluid economizer employs a motorized ball valve that controls the flow of chilled water/glycol to provide a cooling capacity from 0% to 100%. https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 110.

Claim Language	Exemplary Evidence of Infringement by TierPoint

Figure 7.1 Temperature Control—Fluid Economizer and Example Two Step Compressor Capacity



No.	Description	No.	Description
1	Deadband.	5	½ of proportional band assigned to compressor(s) operation.
2	½ of proportional band assigned to valve operation.	6	Scroll compressor step 1. (Compressor 1 in dual compressor configuration, Unloaded in single compressor configuration.)
3	Fluid control valve closed.	7	Scroll compressor step 2. (Compressor 2 in dual compressor configuration, Loaded in single compressor configuration.)
7	Fluid control valve fully open.		

Claim Language	Exemplary Evidence of Infringement by TierPoint
	https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 112. As another example, Schneider's Cooling Optimize is used to adjust cooling output. Schneider's system increases the supply of said cooling fluid to said zone in response to said at least one associated rack having a measured temperature that exceed said predetermined minimum set point temperature. As IT load changes, the built-in machine learning automatically adjusts cooling output to match the dynamic data center environment.  https://download.schneider-electric.com/files?p_enDocType=Brochure&p_File_Name=998-21764381_EcoStruxure_IT_Advisor_Cooling_Optimize.pdf&p_Doc_Ref=SPD_RMCR-9K5JG4_EN.

Claim Language	Exemplary Evidence of Infringement by TierPoint
	The cooling capacity is achieved by increasing airflow via increasing fan speed and/or lower supply air temperature via increasing chilled water flow of row cooler. 8. **How Row-based Data** Center Cooling Works Schneider Electric – Data Center Science Center Rev 0 8 The figures above help to visualize the effect of row coolers on hot air capture index values and cooling stand-alone IT device. As row coolers are variable capacity devices that are capable of over-supplying cold air to the cold aisle. When the system is in balance, the supply temperature from the cooler is equal to the IT inlet temperature. When ancillary equipment (i.e. stand-alone devices) is initially added outside of the pod, the temperature of the overall room environment increases due to air mixing. Nearby row-based cooling units sense this increase and respond by increasing cooling capacity thereby neutralizing the hot air. This increased cooling capacity is achieved by increased air flow (row coolers increase fan speed) and or lower supply air temperature (row cooler increase chilled water valve flow). These adjustments occur initially but remain unchanged once the data center reaches steady state. The steps describing how the row-based coolers "pick up the ancillary load" are the same even when containment is used. In either case we expect the ancillary equipment to operate at higher temperatures than the row-based racks, because it is not directly coupled to row coolers in their own pod. The further away stand-alone IT gear is from row coolers, the higher their inlet air temperature will be. Should you be concerned about the elevated https://www.slideshare.net/SchneiderElectric/how-rowbased-data-center-cooling-works Active response controls ensure that servers consistently operate at the desired rack inlet setpoint. As temperatures shift, built-in probes detect changes and send a signal to the controller. The cooling output is continually adjusted to accommodate varying loads, determined by the difference between the setpoint and the actual temperature as well as the airflow for each cooling unit. The fluid valve (controllable partition) modulates fluid flow into the cooling coil, keeping equipment at the proper temperature, and saving energy by only consuming the amount required to cool the IT heat load.

Claim Language	Exemplary Evidence of Infringement by TierPoint
	Active Response Controls Active response controls ensure that servers consistently operate at the desired rack inlet setpoint. As temperatures shift, built-in probes detect changes and send a signal to the controller. The cooling output is continually adjusted to accommodate varying loads, determined by the difference between the setpoint and the actual temperature as well as the airflow for each cooling unit. The fluid valve modulates fluid flow into the cooling coil, keeping equipment at the proper temperature, and saving energy by only consuming the amount required to cool the IT heat load. **Chiller/CRAC Communications** Uniflair chillers and CRAC units efficiently work together to optimize the system performance according to the different load and operating conditions. When a single modulating chiller is connected to a single internal unit, the CRAC regulates the cooling load according to the discharge air temperature by means of the three-way valve and the chilled water temperature, which is regulated on the chiller and connected via LAN. When connected to more than one chiller, or when one or more large chillers are installed and connected to all internal CRAC units within the same room, internal and external units can communicate in LAN. The CRAC units regulate the load according to the average suction air temperature by means of the three-way valve and the chilled water temperature.

<table>
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The CRAC airflow can be changed by right clicking a CRAC and selecting properties.

• Cooler airflow in cubic feet per minute (CFM) is assumed to be:
<table><tr><th>Cooler type</th><th>Minimum CFM</th><th>Maximum CFM</th></tr><tr><td>InRow RC (300 mm)</td><td>1450</td><td>2900</td></tr><tr><td>InRow RC (600 mm)</td><td>2760</td><td>6900</td></tr><tr><td>InRow RP (600 mm Chilled Water)</td><td>2760</td><td>6900</td></tr><tr><td>InRow RP (600 mm Air Cooled)</td><td>1920</td><td>4800</td></tr><tr><td>InRow RD (600 mm Air Cooled)</td><td>2000</td><td>5000</td></tr><tr><td>InRow RD (300 mm Air Cooled)</td><td>916</td><td>2300</td></tr><tr><td>InRow RD (300 mm Fluid Cooled)</td><td>916</td><td>2300</td></tr></table>• Rack airflow is by default assumed to be 160 CFM/kW based on the total rack power. This value can be changed by right-clicking a rack and selecting Properties, to change to, for example, 105 CFM/kW for blade server racks.
• CRAC airflow is, by default, assumed to be 6000 CFM. This can be changed by right-clicking a CRAC and selecting Properties.

https://dcimsupportattachments.ecostruxureit.com/140711358/StruxureWare%20Data%20Center%20Operation%20User's%20Guide.pdf (“StruxureWare Manual”) at p. 50.</td></tr>
<tr><td>[5] The method according to claim 3, wherein said step of varying said cooling device output includes determining whether said measured pressure falls below or equals a predetermined minimum set point pressure.</td><td>The Accused Products infringe claim 3. See supra.

In the Accused Products, the step of varying said cooling device output includes determining whether said measured pressure falls below or equals a predetermined minimum set point pressure, regardless of which cooling technology is used (Liebert, Schneider, or others).

For example, in the Liebert DSE system, the optimization further improves efficiency by optimizing liquid refrigerant pressure setpoints in mid and high ambient temperature conditions thus reducing the operation of condenser fans while maintaining the appropriate heat rejection capacity.</td></tr>
</table>

Claim Language	Exemplary Evidence of Infringement by TierPoint
	When your Thermal Management System is a Liebert® DSE system with a Liebert® EconoPhase pumped refrigerant economizer (PRE) and a Liebert® MC or MCV condenser, the EconoPhase screen, **Figure 2.1** on the facing page , shows the operating mode of the system. The DSE System Optimization feature is automatically employed and reduces power consumption significantly because a PRE package consumes about one-tenth the power of the compressors. EconoPhase operation saves energy by eliminating compressor operation when outdoor ambient temperatures are cool enough, or when the difference between the indoor and outdoor ambient temperature is satisfied. DSE System Optimization further improves efficiency by optimizing liquid refrigerant temperature and pressure setpoints in mid- and high-ambient temperature conditions, thus reducing the operation of condenser fans while maintaining the appropriate heat rejection capacity. https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 28. For example, the compressor settings options include adjusting sensitivity to compressor discharge pressure or liquid pressure by increasing sensitivity. **3.3.5 Setting Compressor Options** 1. Touch SERVICE then ☰ > *Options Setup* > *Compressor Settings*. The COMPRESSOR SETTINGS panel displays. 2. Make adjustments as needed and click *Save*. The option settings are updated. • Touch *Cancel* to discard the changes without saving. **NOTE: Depending on the type of thermal management unit, included components, and control settings of your system, all of the options listed may not be available on your Vertiv™ Liebert® iCOM™ display.** **Compressor Settings Options** **Ball Valve Setpoint Offset** Adjusts sensitivity to compressor discharge pressure or liquid pressure by increasing sensitivity. The higher the added pressure, the more the valve opens.

Claim Language	Exemplary Evidence of Infringement by TierPoint
	https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 56. **Capacity Change at 100%** Increases the rate at which the cooling capacity changes for a quicker reaction of cooling at high temperatu https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 57. The motorized ball valve controls the flow of chilled water/glycol to provide a cooling capacity from 0 to 100%. **Capacity Change at 0%** Decreases the rate at which cooling capacity changes when close to or at the temperature setpoint to avoid undershooting the setpoint. **7.1.4 Temperature Control with a Fluid Economizer** When an economizer is installed, the cooling requirement (determined by the temperature proportional band) is addressed first by the economizer's secondary cooling, if the economizer cooling capacity is insufficient, the compressor(s) begin cooling to bring the room air temperature down to the temperature setpoint. The fluid economizer employs a motorized ball valve that controls the flow of chilled water/glycol to provide a cooling capacity from 0% to 100%. https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 110. At compressor start up, the low-pressure condition is ignored for a setpoint to avoid false trips due to bubbles in the refrigerant or other misreading of the low-pressure device. The number of times the valve opens and closes is adjusted based on added pressure offset.

Claim Language	Exemplary Evidence of Infringement by TierPoint
	Setting Low Pressure Time Delay At compressor start up, a low pressure condition is ignored for a set period to avoid false trips due to bubbles in the refrigerant or other misreading of the low pressure device. **NOTE: The factory-default setting is a three minute delay for air cooled units and a zero to one minute delay for water cooled units.** 1. Touch  then  > *Options Setup* > *Compressor Settings*. 2. Use the *Winter Start Delay* slider to select the number of minutes for the delay, and touch *Save*. **Adjusting Ball Valve Pressure Offset** **NOTE: Only a properly trained and qualified technician should modify the motorized ball valve setting.** The number of times the valve opens and closes is adjusted based on added pressure offset. 1. Touch  then  > *Options Setup* > *Compressor Settings*. 2. Use the *Ball Valve Setpoint Offset* slider to select amount of pressure added to open the valve wider, and touch *Save*. https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 65.
[6] The method according to claim 4, further comprising: decreasing an output of said cooling fluid from said cooling device in response to said decrease in cooling fluid supply to said zone exceeding said increase in cooling fluid supply to said zone.	The Accused Products infringe claim 4. *See supra*. The Accused Products decrease an output of said cooling fluid from said cooling device in response to said decrease in cooling fluid supply to said zone exceeding said increase in cooling fluid supply to said zone, regardless of which cooling technology is used (Liebert, Schneider, or others). For example, Liebert's iCOM system adjusts the activation points of the cooling fluid based on the sensor value deviation from the setpoint. Thus, Liebert decreases an output of said cooling fluid from said cooling device in response to said decrease in cooling fluid supply to said zone exceeding said increase in cooling fluid supply to said zone.

Claim Language	Exemplary Evidence of Infringement by TierPoint

S106	Temperature Proportional Band	4 - 200 ℉ 2.2 - 111.0 K	12 ℉ 6.7 K	Adjusts the activation points of compressors/chilled water valves or rate of changed based on the actual sensor values deviation from setpoint. The smaller this number, the faster the compressors/chilled water values will increase capacity. Too small of a number may cause the unit to short cycle compressors or excessively reposition the valve.
	Temperature Integral Time	0.0 - 15.0 min	5.0 min	Adjusts the capacity of the units based on time away from setpoint so that accurate temperature control can be maintained. The proportional and integral time settings work together to maintain setpoint. Large p-band and small integral time is typical when controlling to supply air.

https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 203.

7.1.4 Temperature Control with a Fluid Economizer

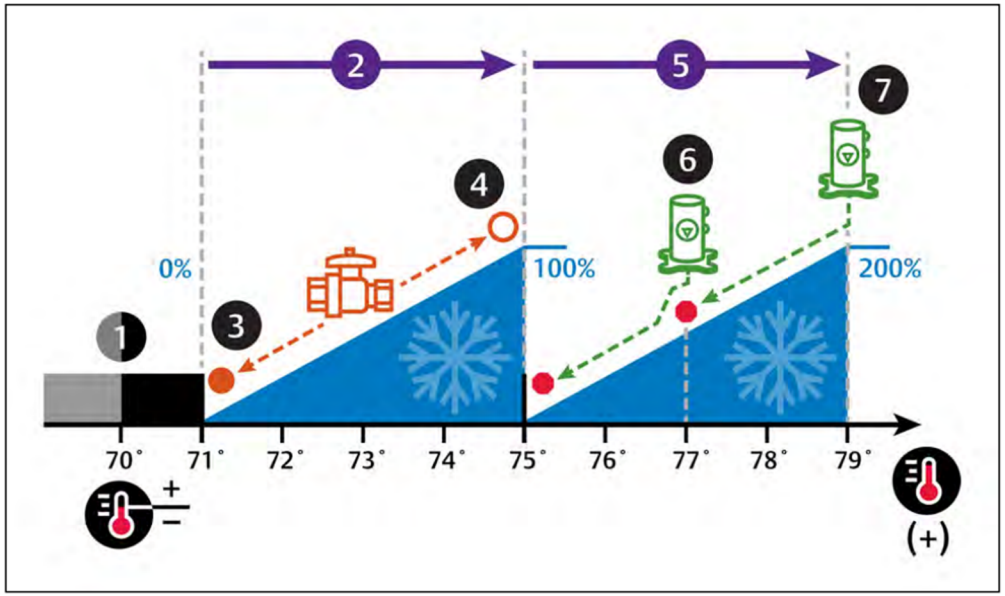
When an economizer is installed, the cooling requirement (determined by the temperature proportional band) is addressed first by the economizer's secondary cooling, if the economizer cooling capacity is insufficient, the compressor(s) begin cooling to bring the room air temperature down to the temperature setpoint.

The fluid economizer employs a motorized ball valve that controls the flow of chilled water/glycol to provide a cooling capacity from 0% to 100%.

https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 110.

Claim Language	Exemplary Evidence of Infringement by TierPoint

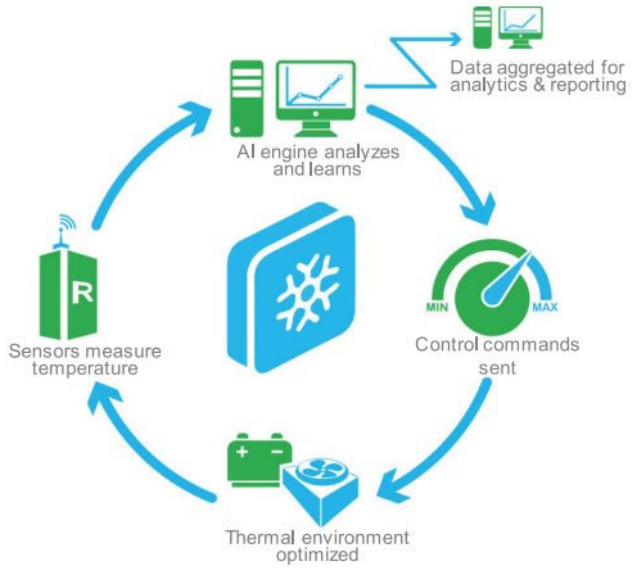
Figure 7.1 Temperature Control—Fluid Economizer and Example Two Step Compressor Capacity



No.	Description	No.	Description
1	Deadband.	5	½ of proportional band assigned to compressor(s) operation.
2	½ of proportional band assigned to valve operation.	6	Scroll compressor step 1. (Compressor 1 in dual compressor configuration, Unloaded in single compressor configuration.)
3	Fluid control valve closed.	7	Scroll compressor step 2. (Compressor 2 in dual compressor configuration, Loaded in single compressor configuration.)
7	Fluid control valve fully open.		

https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 112.

As another example, Schneider's Cooling Optimize is used to adjust cooling output. Schneider's system decreases an output of said cooling fluid from said cooling device

Claim Language	Exemplary Evidence of Infringement by TierPoint
	in response to said decrease in cooling fluid supply to said zone exceeding said increase in cooling fluid supply to said zone. As IT load changes, the built-in machine learning automatically adjusts cooling output to match the dynamic data center environment.  https://download.schneider-electric.com/files?p_enDocType=Brochure&p_File_Name=998-21764381_EcoStruxure_IT_Advisor_Cooling_Optimize.pdf&p_Doc_Ref=SPD_RMCR-9K5JG4_EN. The cooling capacity is achieved by increasing airflow via increasing fan speed and/or lower supply air temperature via increasing chilled water flow of row cooler.

Claim Language	Exemplary Evidence of Infringement by TierPoint
	8. **How Row-based Data** Center Cooling Works Schneider Electric – Data Center Science Center Rev 0 8 The figures above help to visualize the effect of row coolers on hot air capture index values and cooling stand-alone IT device. As row coolers are variable capacity devices that are capable of over-supplying cold air to the cold aisle. When the system is in balance, the supply temperature from the cooler is equal to the IT inlet temperature. When ancillary equipment (i.e. stand-alone devices) is initially added outside of the pod, the temperature of the overall room environment increases due to air mixing. Nearby row-based cooling units sense this increase and respond by increasing cooling capacity thereby neutralizing the hot air. This increased cooling capacity is achieved by increased air flow (row coolers increase fan speed) and or lower supply air temperature (row cooler increase chilled water valve flow). These adjustments occur initially but remain unchanged once the data center reaches steady state. The steps describing how the row-based coolers "pick up the ancillary load" are the same even when containment is used. In either case we expect the ancillary equipment to operate at higher temperatures than the row-based racks, because it is not directly coupled to row coolers in their own pod. The further away stand-alone IT gear is from row coolers, the higher their inlet air temperature will be. Should you be concerned about the elevated https://www.slideshare.net/SchneiderElectric/how-rowbased-data-center-cooling-works Active response controls ensure that servers consistently operate at the desired rack inlet setpoint. As temperatures shift, built-in probes detect changes and send a signal to the controller. The cooling output is continually adjusted to accommodate varying loads, determined by the difference between the setpoint and the actual temperature as well as the airflow for each cooling unit. The fluid valve (controllable partition) modulates fluid flow into the cooling coil, keeping equipment at the proper temperature, and saving energy by only consuming the amount required to cool the IT heat load.

Claim Language	Exemplary Evidence of Infringement by TierPoint
	Active Response Controls Active response controls ensure that servers consistently operate at the desired rack inlet setpoint. As temperatures shift, built-in probes detect changes and send a signal to the controller. The cooling output is continually adjusted to accommodate varying loads, determined by the difference between the setpoint and the actual temperature as well as the airflow for each cooling unit. The fluid valve modulates fluid flow into the cooling coil, keeping equipment at the proper temperature, and saving energy by only consuming the amount required to cool the IT heat load. **Chiller/CRAC Communications** Uniflair chillers and CRAC units efficiently work together to optimize the system performance according to the different load and operating conditions. When a single modulating chiller is connected to a single internal unit, the CRAC regulates the cooling load according to the discharge air temperature by means of the three-way valve and the chilled water temperature, which is regulated on the chiller and connected via LAN. When connected to more than one chiller, or when one or more large chillers are installed and connected to all internal CRAC units within the same room, internal and external units can communicate in LAN. The CRAC units regulate the load according to the average suction air temperature by means of the three-way valve and the chilled water temperature.

<table>
<tr><th>Claim Language</th><th>Exemplary Evidence of Infringement by TierPoint</th></tr>
<tr><td></td><td>https://www.mobiledatacentre.com/wp-content/uploads/2021/05/Schneider-Electric-Cooling-Solutions-Brochure-29-01-19.pdf, p. 21.

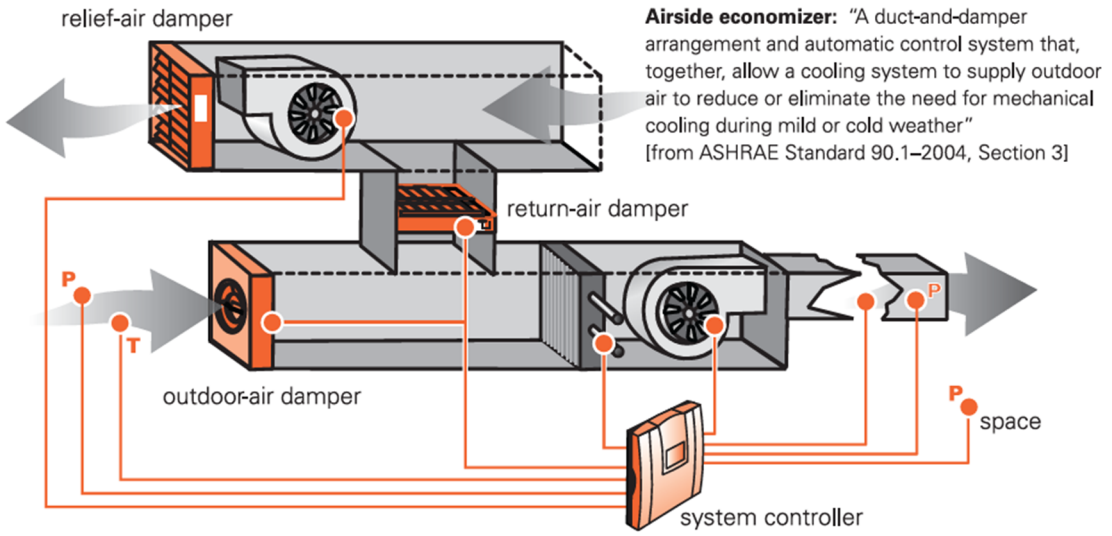
The CRAC airflow can be changed by right clicking a CRAC and selecting properties.

• Cooler airflow in cubic feet per minute (CFM) is assumed to be:

<table><tr><th>Cooler type</th><th>Minimum CFM</th><th>Maximum CFM</th></tr><tr><td>InRow RC (300 mm)</td><td>1450</td><td>2900</td></tr><tr><td>InRow RC (600 mm)</td><td>2760</td><td>6900</td></tr><tr><td>InRow RP (600 mm Chilled Water)</td><td>2760</td><td>6900</td></tr><tr><td>InRow RP (600 mm Air Cooled)</td><td>1920</td><td>4800</td></tr><tr><td>InRow RD (600 mm Air Cooled)</td><td>2000</td><td>5000</td></tr><tr><td>InRow RD (300 mm Air Cooled)</td><td>916</td><td>2300</td></tr><tr><td>InRow RD (300 mm Fluid Cooled)</td><td>916</td><td>2300</td></tr></table>
• Rack airflow is by default assumed to be 160 CFM/kW based on the total rack power. This value can be changed by right-clicking a rack and selecting Properties, to change to, for example, 105 CFM/kW for blade server racks.
• CRAC airflow is, by default, assumed to be 6000 CFM. This can be changed by right-clicking a CRAC and selecting Properties.

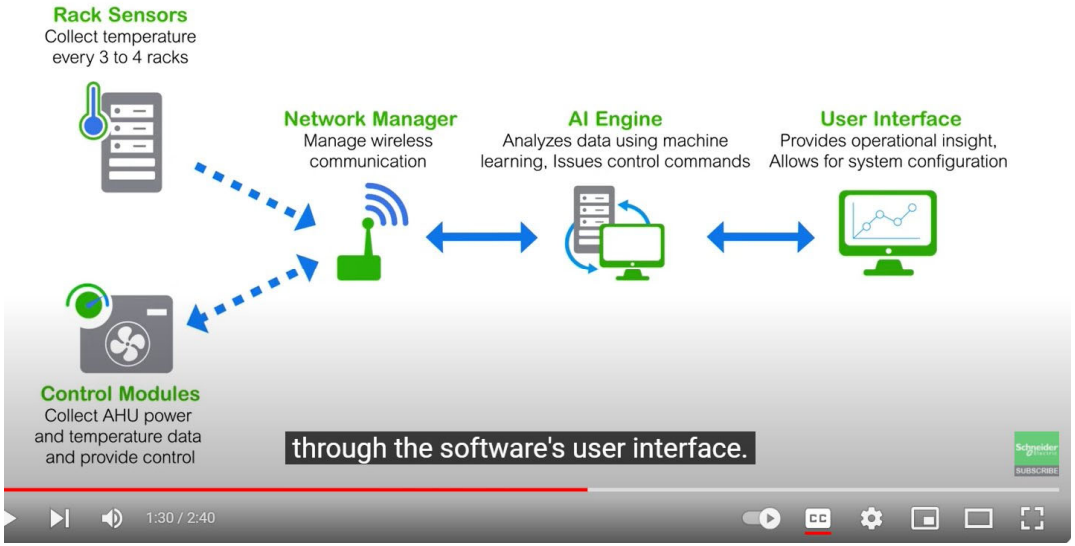
https://dcimsupportattachments.ecostruxureit.com/140711358/StruxureWare%20Data%20Center%20Operation%20User's%20Guide.pdf (“StruxureWare Manual”) at p. 50.

See also:</td></tr>
</table>

Claim Language	Exemplary Evidence of Infringement by TierPoint
	 See, *e.g.*, Keeping cool with outdoor air, Airside Economizers, Trane Engineers Newsletter, Vol. 35-2, https://www.trane.com/content/dam/Trane/Commercial/global/products-systems/education-training/engineers-newsletters/airside-design/admapn020en-0406.pdf.
[9pre] The method according to claim 4, further comprising:	The Accused Products infringe claim 4. *See supra*.
[9a] receiving temperatures from a movable device configured to detect at least one environmental condition at various locations of said data center;	The Accused Products receive temperatures from a movable device configured to detect at least one environmental condition at various locations of said data center.

Claim Language	Exemplary Evidence of Infringement by TierPoint
	For example, remote sensors are installed in the monitored racks which provides temperature data to the Liebert iCOM system. **13.2 Installing Wired Remote Sensors** Up to 10 remote sensor modules, installed in the monitored racks and connected to the cooling unit, provide control and reference input to iCOM and building-management systems. Using remote, rack sensors combats cooling problems related to recirculation air, uneven rack loading, and air distribution. https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 180. **9.4 Wired Remote Sensors** Wired, remote, rack sensors can function as control sensors and subsequently, provide input individually at the unit level or at the system level for temperature control and teamwork functions. Each wired remote rack sensor has two thermistors/probes. In Individual Sensor mode, the higher temperature reading or the average temperature reading of the two probes can be used. In Unit Sensors mode, some or all of the rack sensor's temperature readings are considered for higher (maximum) or average calculation. For example, setting three sensors as control and average for unit mode, averages the three highest temperature readings. https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 164. As another example, Schneider's Cooling Optimize system utilizes a dense array of temperature sensors to determine exactly where the heat load is within the data center. Data is wirelessly transmitted to network gateways, aggregated, and sent to a purpose-built appliance where it is analyzed by control software. Control commands are then delivered to the cooling equipment.

Claim Language	Exemplary Evidence of Infringement by TierPoint
	A DCIM product module Cooling Optimize utilizes a dense array of temperature sensors to determine exactly where the heat load is within the data center. Data is wirelessly transmitted to network gateways, aggregated, and sent to a purpose-built appliance where it is analyzed by control software. Control commands are then delivered to the cooling equipment. **Manageability** Intelligent thermal management: Rack-level temperature data is wirelessly transmitted to network gateways, aggregated, and analyzed by intelligent software, which individually regulates the on/off settings and fan speeds in the cooling equipment. https://download.schneider-electric.com/files?p_enDocType=Brochure&p_File_Name=998-21764381_EcoStruxure_IT_Advisor_Cooling_Optimize.pdf&p_Doc_Ref=SPD_RMCR-9K5JG4_EN, pp. 1, 2.

Claim Language	Exemplary Evidence of Infringement by TierPoint
	 https://www.youtube.com/watch?v=yFMS-88wXn8, at 1:30.
[9b] determining whether at least one of said sensed temperatures and received temperatures are within a predetermined temperature range; and	The Accused Products determine whether at least one of said sensed temperatures and received temperatures are within a predetermined temperature range, regardless of which cooling technology is used (Liebert, Schneider, or others). For example, the Liebert iCOM system is able to identify if the temperature is at the setpoint value, and change the response to the varied flow field based on length of time temperature has deviated, and amount of deviation from setpoint.

Claim Language	Exemplary Evidence of Infringement by TierPoint

Temperature Integration Time

Adjusts amount of cooling/heating based on the length of time the temperature has deviated from the setpoint. The time selected is the amount of time it will take cooling capacity to reach 100%. For example, if three minutes is selected, cooling capacity will increase to 100% in three minutes.

NOTE: Three to five minutes of integration time is adequate for most applications. See Considerations when Using PI Temperature Control on page 28 .

NOTE: Only used when Temperature Control Type is PI.

Temperature Proportional Band

Adjusts the activation point of cooling/heating components based on deviation from setpoint by placing half of the selected value on each side of the temperature control setpoint. A smaller number causes faster reaction to temperature changes.

NOTE: Setting this too low causes short cycling of compressors.

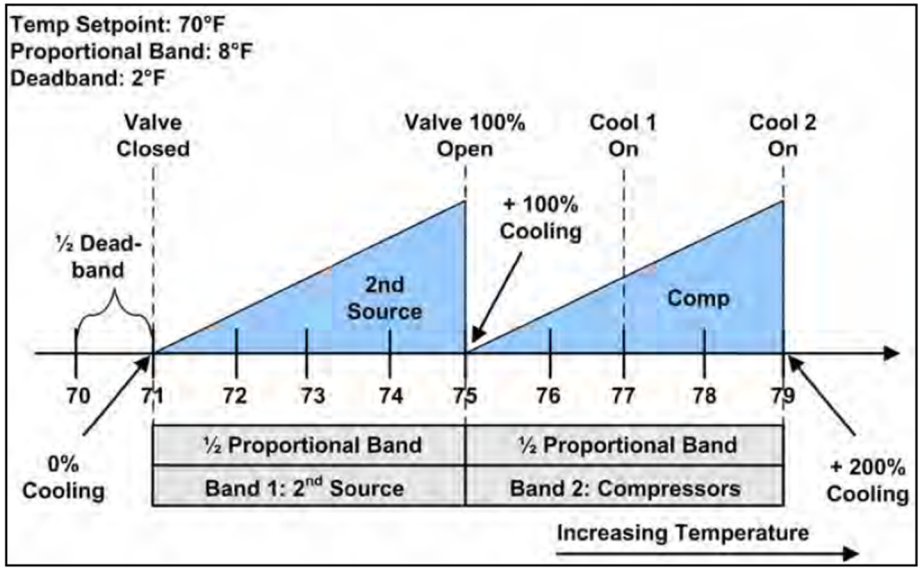
https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 25.

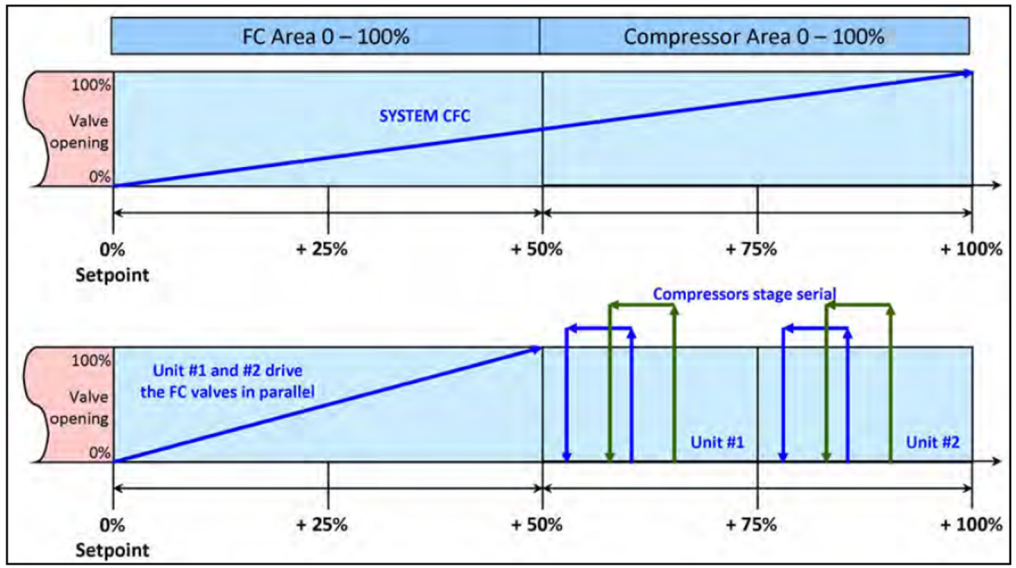
As another example, Schneider's Cooling Optimize system is used to determine whether the sensed temperature is within a predetermined temperature range, for example, by using the temperature compliance report identifying if rack temperatures have compiled with required setpoints.

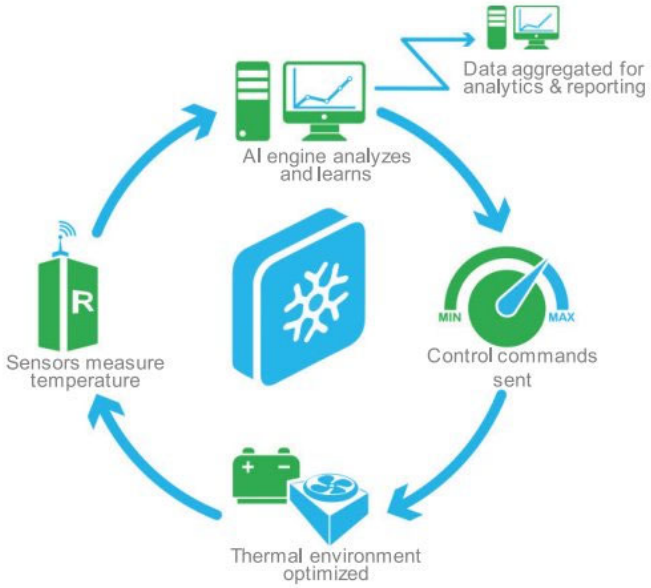
Reports	
Benchmark report	Verifies energy and cost savings, as well as greenhouse gas reductions, achieved through the use of dynamic cooling management.
Temperature compliance report	Identifies if rack temperatures have complied with required set points, and the time period that racks have been in violation of the set point limits, enabling easy detection of potential physical infrastructure irregularities.

https://download.schneider-electric.com/files?p_enDocType=Brochure&p_File_Name=998-

Claim Language	Exemplary Evidence of Infringement by TierPoint
	21764381_EcoStruxure_IT_Advisor_Cooling_Optimize.pdf&p_Doc_Ref=SPD_RMCR-9K5JG4_EN.
[9c] manipulating said controllable partition to vary said supply of said cooling fluid to said zone in response to at least one of said sensed and received temperatures being outside of said predetermined temperature range.	The Accused Products manipulate said controllable partition to vary said supply of said cooling fluid to said zone in response to at least one of said sensed and received temperatures being outside of said predetermined temperature range, regardless of which cooling technology is used (Liebert, Schneider, or others). For example, Liebert's iCOM system is used to manipulate the motorized ball valve (controllable partition) from 0% to 100% flow of chilled water/glycol. **7.1.4 Temperature Control with a Fluid Economizer** When an economizer is installed, the cooling requirement (determined by the temperature proportional band) is addressed first by the economizer's secondary cooling, if the economizer cooling capacity is insufficient, the compressor(s) begin cooling to bring the room air temperature down to the temperature setpoint. The fluid economizer employs a motorized ball valve that controls the flow of chilled water/glycol to provide a cooling capacity from 0% to 100%. https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 110.

Claim Language	Exemplary Evidence of Infringement by TierPoint
	Figure 3.17 Second Cooling Source and Two-Step Compressorized Cooling  https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 69, Fig. 3.17.

Claim Language	Exemplary Evidence of Infringement by TierPoint
	Figure 3.18 Freecooling and Compressorized Operation  https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 70, Fig. 3.18. *See also* https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf at p. 33-34 (manipulating valves), 70, Fig. 3.18 (valve opening). As another example, Schneider's Cooling Optimize adjusts cooling output by manipulating controllable partitions to vary supply of cooling fluid to zone in response to sensed temperature being outside predetermined temperature range.

Claim Language	Exemplary Evidence of Infringement by TierPoint
	As IT load changes, the built-in machine learning automatically adjusts cooling output to match the dynamic data center environment.  https://download.schneider-electric.com/files?p_enDocType=Brochure&p_File_Name=998-21764381_EcoStruxure_IT_Advisor_Cooling_Optimize.pdf&p_Doc_Ref=SPD_RMCR-9K5JG4_EN. The cooling capacity is achieved by increasing airflow via increasing fan speed and/or lower supply air temperature via increasing chilled water flow of row cooler.

Claim Language	Exemplary Evidence of Infringement by TierPoint
	8. **How Row-based Data** Center Cooling Works Schneider Electric – Data Center Science Center Rev 0 8 The figures above help to visualize the effect of row coolers on hot air capture index values and cooling stand-alone IT device. As row coolers are variable capacity devices that are capable of over-supplying cold air to the cold aisle. When the system is in balance, the supply temperature from the cooler is equal to the IT inlet temperature. When ancillary equipment (i.e. stand-alone devices) is initially added outside of the pod, the temperature of the overall room environment increases due to air mixing. Nearby row-based cooling units sense this increase and respond by increasing cooling capacity thereby neutralizing the hot air. This increased cooling capacity is achieved by increased air flow (row coolers increase fan speed) and or lower supply air temperature (row cooler increase chilled water valve flow). These adjustments occur initially but remain unchanged once the data center reaches steady state. The steps describing how the row-based coolers "pick up the ancillary load" are the same even when containment is used. In either case we expect the ancillary equipment to operate at higher temperatures than the row-based racks, because it is not directly coupled to row coolers in their own pod. The further away stand-alone IT gear is from row coolers, the higher their inlet air temperature will be. Should you be concerned about the elevated https://www.slideshare.net/SchneiderElectric/how-rowbased-data-center-cooling-works Active response controls ensure that servers consistently operate at the desired rack inlet setpoint. As temperatures shift, built-in probes detect changes and send a signal to the controller. The cooling output is continually adjusted to accommodate varying loads, determined by the difference between the setpoint and the actual temperature as well as the airflow for each cooling unit. The fluid valve (controllable partition) modulates fluid flow into the cooling coil, keeping equipment at the proper temperature, and saving energy by only consuming the amount required to cool the IT heat load.

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	Active Response Controls Active response controls ensure that servers consistently operate at the desired rack inlet setpoint. As temperatures shift, built-in probes detect changes and send a signal to the controller. The cooling output is continually adjusted to accommodate varying loads, determined by the difference between the setpoint and the actual temperature as well as the airflow for each cooling unit. The fluid valve modulates fluid flow into the cooling coil, keeping equipment at the proper temperature, and saving energy by only consuming the amount required to cool the IT heat load. **Chiller/CRAC Communications** Uniflair chillers and CRAC units efficiently work together to optimize the system performance according to the different load and operating conditions. When a single modulating chiller is connected to a single internal unit, the CRAC regulates the cooling load according to the discharge air temperature by means of the three-way valve and the chilled water temperature, which is regulated on the chiller and connected via LAN. When connected to more than one chiller, or when one or more large chillers are installed and connected to all internal CRAC units within the same room, internal and external units can communicate in LAN. The CRAC units regulate the load according to the average suction air temperature by means of the three-way valve and the chilled water temperature.

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<tr><td></td><td>https://www.mobiledatacentre.com/wp-content/uploads/2021/05/Schneider-Electric-Cooling-Solutions-Brochure-29-01-19.pdf, p. 21.

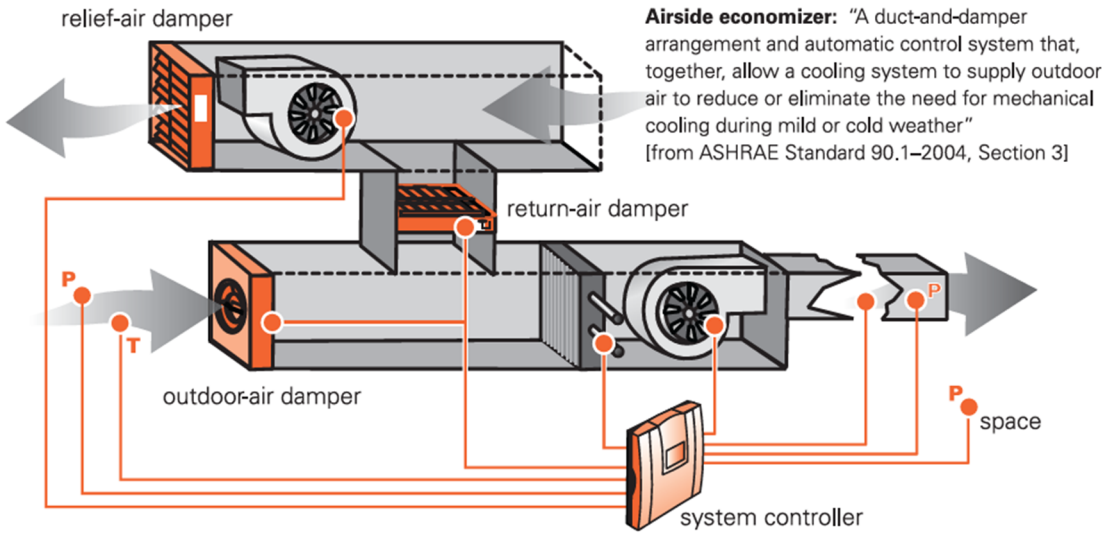
The CRAC airflow can be changed by right clicking a CRAC and selecting properties.

• Cooler airflow in cubic feet per minute (CFM) is assumed to be:

<table><tr><th>Cooler type</th><th>Minimum CFM</th><th>Maximum CFM</th></tr><tr><td>InRow RC (300 mm)</td><td>1450</td><td>2900</td></tr><tr><td>InRow RC (600 mm)</td><td>2760</td><td>6900</td></tr><tr><td>InRow RP (600 mm Chilled Water)</td><td>2760</td><td>6900</td></tr><tr><td>InRow RP (600 mm Air Cooled)</td><td>1920</td><td>4800</td></tr><tr><td>InRow RD (600 mm Air Cooled)</td><td>2000</td><td>5000</td></tr><tr><td>InRow RD (300 mm Air Cooled)</td><td>916</td><td>2300</td></tr><tr><td>InRow RD (300 mm Fluid Cooled)</td><td>916</td><td>2300</td></tr></table>
• Rack airflow is by default assumed to be 160 CFM/kW based on the total rack power. This value can be changed by right-clicking a rack and selecting Properties, to change to, for example, 105 CFM/kW for blade server racks.
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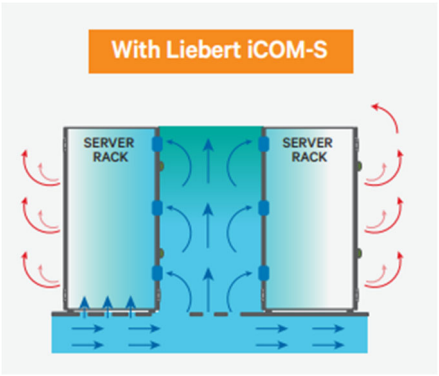
https://dcimsupportattachments.ecostruxureit.com/140711358/StruxureWare%20Data%20Center%20Operation%20User's%20Guide.pdf (“StruxureWare Manual”) at p. 50.

See also:</td></tr>
</table>

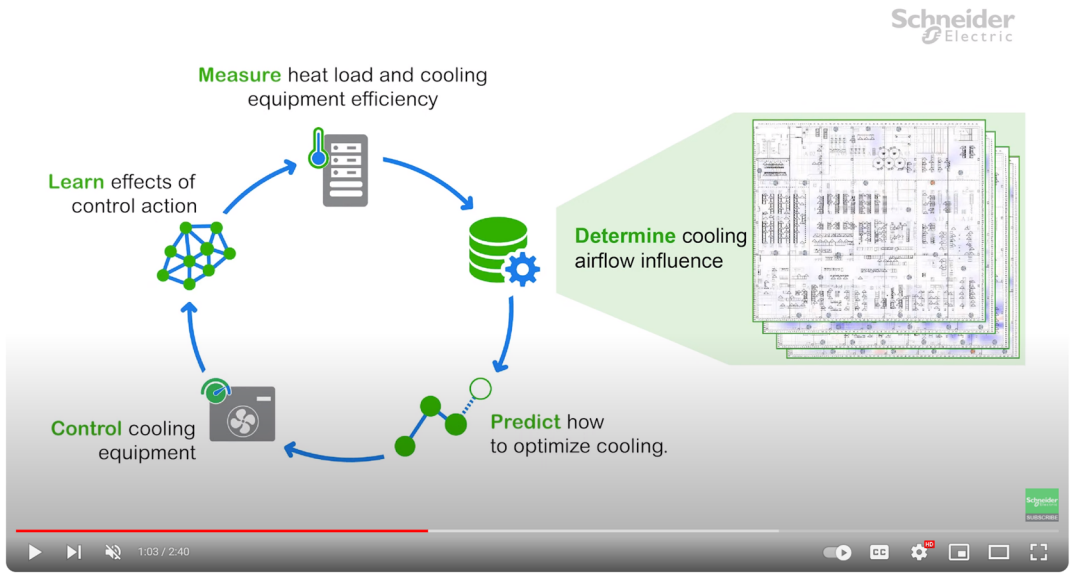
Claim Language	Exemplary Evidence of Infringement by TierPoint
	 See, *e.g.*, Keeping cool with outdoor air, Airside Economizers, Trane Engineers Newsletter, Vol. 35-2, https://www.trane.com/content/dam/Trane/Commercial/global/products-systems/education-training/engineers-newsletters/airside-design/admapn020en-0406.pdf.
[10] The method according to claim 4, further comprising: performing a numerical modeling of a temperature distribution and flow characteristics of the data center; and	The Accused Products infringe claim 4. *See supra*. The Accused Products perform a numerical modeling of a temperature distribution and flow characteristics of the data center and manipulating said cooling device in response to said numerical modeling, regardless of which cooling technology is used (Liebert, Schneider, or others).

Claim Language	Exemplary Evidence of Infringement by TierPoint
manipulating said cooling device in response to said numerical modeling.	For example, Liebert iCOM optimizes thermal system performance to optimize capacity across the datacenter. It provides adaptive control for hot spot reduction. The data center environment is monitored through sensor and operation of multiple cooling units is controlled accordingly. **At the cooling unit level,** the Liebert iCOM unit control provides the highest protection available and optimal performance. • Monitors 380 unit and component points to eliminate single points of failure • Self-healing features avoid passing unsafe operating thresholds • Highly intuitive, full-color, touch screen simplifies operations to save time and reduce human error • Multiple, automated unit protection routines, including lead/lag, cascade, rapid restart, refrigerant protection and valve calibration  **At the supervisory level,** the Liebert iCOM-S system control offers a revolutionary way to harmonize and optimize thermal system performance to optimize capacity across the data center, gain quick access to actionable data, and automate system diagnostics and trending. • Advanced monitoring and at-a-glance reporting on performance metrics and trends for efficiency, capacity and adverse events • Up to 50% system efficiency gains • 30% lower deployment costs • Teamwork modes that prevent conflict between units and allow them to adapt to changes in facility and IT demand to improve efficiency and availability and reduce system wear and tear – saving more than $10,000 per unit per year in energy costs • Simple and easy to deploy — auto-configuration to detect and configure up to 4,800 sensors, eliminating the need for custom integration to building management systems and cutting sensor deployment times in half Liebert iCOM unit control and Liebert iCOM-S system control are available for new Vertiv™ data center cooling units or as retrofits. 

Claim Language	Exemplary Evidence of Infringement by TierPoint
	Advanced monitoring and collaborative protection Efficiency, capacity and system performance monitoring, trending and planning Visual floor plan thermal sensor map High security mesh wireless sensor network Adaptive control for hot spot reduction and self-healing **System Control: Greater Protection and Insight** Liebert® iCOM™-S system controls allow data centers to more easily reach and maintain the optimal balance point of matched cooling capacity and IT load. They accomplish this by monitoring the data center environment through wired or wireless sensors and controlling the operation of multiple cooling units through machine-to-machine communications. Failsafe routines automatically activate to protect against adverse events. https://www.vertiv.com/49d637/globalassets/shared/liebert-icom-thermal-system-controls-brochure.pdf, pp. 3, 4, 7. Liebert iCOM also controls harmonizes and optimizes thermal system performance across the data center, and provide quick access to actionable data, including system diagnostics and trending. Automated routines and machine-to-machine communications allow the system as a whole to adapt to changes in facility-level demand as efficiently as possible. The airflow and temperature are matched to changing IT load requirements. **System Control: Greater Efficiency, Faster Deployment** Liebert® iCOM™-S system controls harmonize and optimize thermal system performance across the data center, and provide quick access to actionable data, including system diagnostics and trending. Automated routines and machine-to-machine communications allow the system as a whole to adapt to changes in facility-level demand as efficiently as possible. Simplified configuration routines and functions speed deployment.

Claim Language	Exemplary Evidence of Infringement by TierPoint
	Liebert iCOM-S controls decouple cooling components — compressors, chilled water valves and economizers — from fan operation, allowing them to operate independently. This matches airflow and temperature to changing IT load requirements and maximizes the efficiency of each component. Air is returned to the cooling units at a higher temperature resulting in higher efficiency.  **Capacity with IT Load** Liebert iCOM-S controls automatically adjust cooling units to match cooling unit capacities to the IT load, even at extreme low load conditions. Without Liebert iCOM-S controls, cooling units may overcool the data center, resulting in wasted energy. https://www.vertiv.com/49d637/globalassets/shared/liebert-icom-thermal-system-controls-brochure.pdf, p. 9. Liebert iCOM combats cooling problems related to air recirculation and air distribution based on information received from the remote sensor installed in the monitored racks.

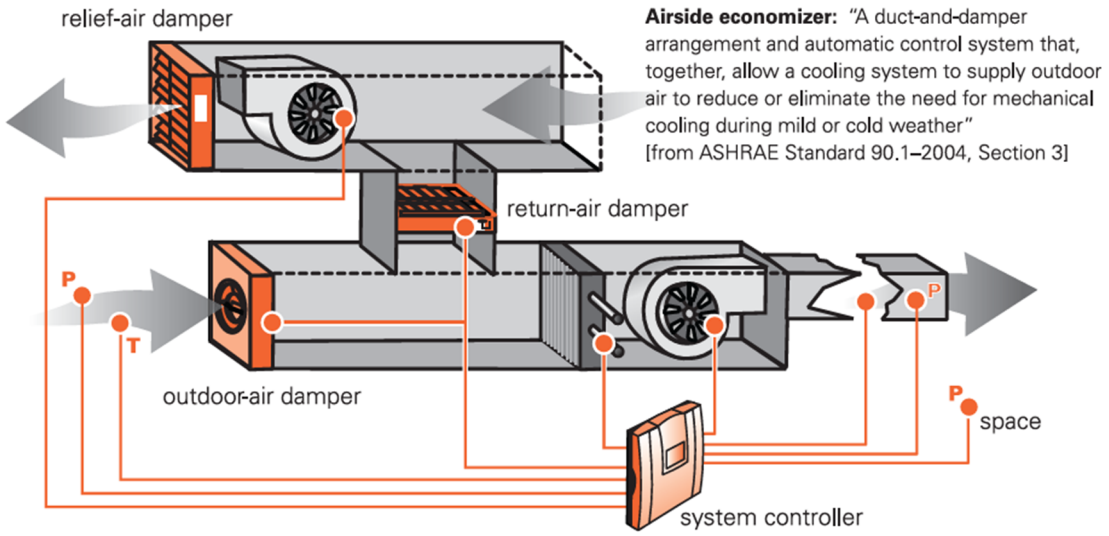
Claim Language	Exemplary Evidence of Infringement by TierPoint
	Understanding the limitations for static pressure to automatically adjust the fan speed based on the IT equipment demand should prompt an initial CFD (Computational Fluid Dynamics) evaluation of the site to determine high and low pressure areas under the floor. In addition CFD's should be performed when the floor tile arrangement changes or the IT equipment demand changes. The under floor environment will also change based on the floor tile arrangement changes and may not relate to above floor air flow expectations. The SixSigma® and Tile Flow® simulations in the next sections will illustrate under floor airflow in relation to tile flow and how the two variables change based on a unit being turned Off or in standby. https://manualzz.com/doc/28145243/liebert%C2%AE-icom, p.112. **13.2 Installing Wired Remote Sensors** Up to 10 remote sensor modules, installed in the monitored racks and connected to the cooling unit, provide control and reference input to iCOM and building-management systems. Using remote, rack sensors combats cooling problems related to recirculation air, uneven rack loading, and air distribution. iCOM Manual at p. 180. As another example, Schneider's Cooling Optimize is a closed-loop system that reacts to real-time data, automatically identifies and eliminates hot spots and helps diagnose potential facility risks.

Claim Language	Exemplary Evidence of Infringement by TierPoint
	 EcoStruxure™ IT Advisor: Cooling Optimize - dynamic, intelligent cooling | Schneider Electric https://www.youtube.com/watch?v=yFMS-88wXn8, at 1:03; https://download.schneider-electric.com/files?p_enDocType=Brochure&p_File_Name=998-21764381_EcoStruxure_IT_Advisor_Cooling_Optimize.pdf&p_Doc_Ref=SPD_RMCR-9K5JG4_EN. The overlay of the data center floor layout shows plenum airflow velocities and color-coded overview of the pressure distribution for the data center. **Floor Plenum** — This overlay of the data center floor layout shows plenum airflow velocities and perforated tile airflow rates. The tile airflow rate is indicated by tile color and is also shown in the pop-up box when the cursor is placed over a tile. **Floor Plenum Pressure** — This overlay of the data center floor layout shows a color-coded overview of the pressure distribution for the type of data center layout that includes a raised floor environment, perforated tiles, and downflow CRACs.

Claim Language	Exemplary Evidence of Infringement by TierPoint
	https://dcimsupportattachments.ecostruxureit.com/140711358/StruxureWare%20Data%20Center%20Operation%20User's%20Guide.pdf ("StruxureWare Manual") at p. 24.
[11] The method according to claim 5, further comprising: increasing the output of said cooling device in response to said measured pressure falling below or equaling said predetermined minimum set point pressure.	The Accused Products infringe claim 5. *See supra*. The Accused Products increase the output of said cooling device in response to said measured pressure falling below or equaling said predetermined minimum set point pressure, regardless of which cooling technology is used (Liebert, Schneider, or others). For example, in Liebert's cooling system the low-pressure condition is ignored for a setpoint to avoid false trips due to bubbles in the refrigerant or other misreading of the low-pressure device at compressor startup. The number of times the valve opens and closes is adjusted based on added pressure offset. **Setting Low Pressure Time Delay** At compressor start up, a low pressure condition is ignored for a set period to avoid false trips due to bubbles in the refrigerant or other misreading of the low pressure device. **NOTE: The factory-default setting is a three minute delay for air cooled units and a zero to one minute delay for water cooled units.** 1. Touch SERVICE then ☰ > *Options Setup* > *Compressor Settings*. 2. Use the *Winter Start Delay* slider to select the number of minutes for the delay, and touch *Save*. **Adjusting Ball Valve Pressure Offset** **NOTE: Only a properly trained and qualified technician should modify the motorized ball valve setting.** The number of times the valve opens and closes is adjusted based on added pressure offset. 1. Touch SERVICE then ☰ > *Options Setup* > *Compressor Settings*. 2. Use the *Ball Valve Setpoint Offset* slider to select amount of pressure added to open the valve wider, and touch *Save*.

Claim Language	Exemplary Evidence of Infringement by TierPoint
	https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 65. The motorized ball valve controls the flow of chilled water/glycol to provide a cooling capacity from 0 to 100%. **7.1.4 Temperature Control with a Fluid Economizer** When an economizer is installed, the cooling requirement (determined by the temperature proportional band) is addressed first by the economizer's secondary cooling, if the economizer cooling capacity is insufficient, the compressor(s) begin cooling to bring the room air temperature down to the temperature setpoint. The fluid economizer employs a motorized ball valve that controls the flow of chilled water/glycol to provide a cooling capacity from 0% to 100%. https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 110. The compressor settings options include adjusting sensitivity to compressor discharge pressure or liquid pressure by increasing sensitivity. **3.3.5 Setting Compressor Options** 1. Touch SERVICE, then ☰ > *Options Setup* > *Compressor Settings*. The COMPRESSOR SETTINGS panel displays. 2. Make adjustments as needed and click *Save*. The option settings are updated. • Touch *Cancel* to discard the changes without saving. **NOTE: Depending on the type of thermal management unit, included components, and control settings of your system, all of the options listed may not be available on your Vertiv™ Liebert® iCOM™ display.** **Compressor Settings Options** **Ball Valve Setpoint Offset** Adjusts sensitivity to compressor discharge pressure or liquid pressure by increasing sensitivity. The higher the added pressure, the more the valve opens.

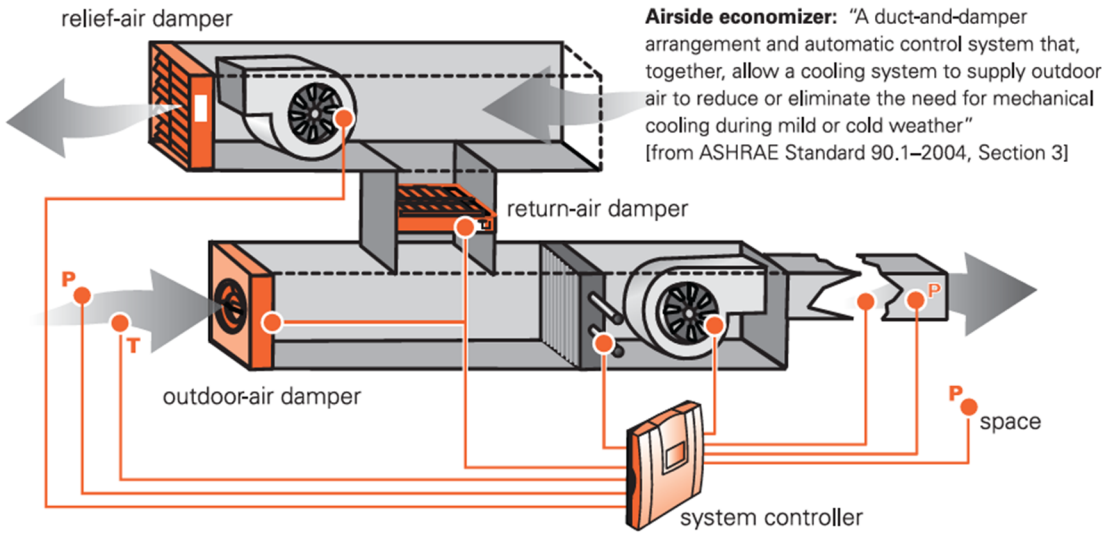
Claim Language	Exemplary Evidence of Infringement by TierPoint
	https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 56. **Capacity Change at 0%** Decreases the rate at which cooling capacity changes when close to or at the temperature setpoint to avoid undershooting the setpoint. **Capacity Change at 100%** Increases the rate at which the cooling capacity changes for a quicker reaction of cooling at high temperatures. https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 57. Liebert's DSE system optimization further improves efficiency by optimizing liquid refrigerant pressure setpoints in mid and high ambient temperature conditions thus reducing the operation of condenser fans while maintaining the appropriate heat rejection capacity. When your Thermal Management System is a Liebert® DSE system with a Liebert® EconoPhase pumped refrigerant economizer (PRE) and a Liebert® MC or MCV condenser, the EconoPhase screen, **Figure 2.1** on the facing page , shows the operating mode of the system. The DSE System Optimization feature is automatically employed and reduces power consumption significantly because a PRE package consumes about one-tenth the power of the compressors. EconoPhase operation saves energy by eliminating compressor operation when outdoor ambient temperatures are cool enough, or when the difference between the indoor and outdoor ambient temperature is satisfied. DSE System Optimization further improves efficiency by optimizing liquid refrigerant temperature and pressure setpoints in mid- and high-ambient temperature conditions, thus reducing the operation of condenser fans while maintaining the appropriate heat rejection capacity. https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 28. See also:

Claim Language	Exemplary Evidence of Infringement by TierPoint
	 See, *e.g.*, Keeping cool with outdoor air, Airside Economizers, Trane Engineers Newsletter, Vol. 35-2, https://www.trane.com/content/dam/Trane/Commercial/global/products-systems/education-training/engineers-newsletters/airside-design/admapn020en-0406.pdf.
[12] The method according to claim 5, further comprising: decreasing the output of said cooling device in response to said measured pressure exceeding said predetermined minimum set point pressure.	The Accused Products infringe claim 5. *See supra*. The Accused Products decrease the output of said cooling device in response to said measured pressure exceeding said predetermined minimum set point pressure, regardless of which cooling technology is used (Liebert, Schneider, or others). For example, in Liebert's cooling system the low-pressure condition is ignored for a setpoint to avoid false trips due to bubbles in the refrigerant or other misreading of the

Claim Language	Exemplary Evidence of Infringement by TierPoint
	low-pressure device at compressor startup. The number of times the valve opens and close is adjusted based on added pressure offset. **Setting Low Pressure Time Delay** At compressor start up, a low pressure condition is ignored for a set period to avoid false trips due to bubbles in the refrigerant or other misreading of the low pressure device. **NOTE: The factory-default setting is a three minute delay for air cooled units and a zero to one minute delay for water cooled units.** 1. Touch  then  > *Options Setup* > *Compressor Settings*. 2. Use the *Winter Start Delay* slider to select the number of minutes for the delay, and touch *Save*. **Adjusting Ball Valve Pressure Offset** **NOTE: Only a properly trained and qualified technician should modify the motorized ball valve setting.** The number of times the valve opens and closes is adjusted based on added pressure offset. 1. Touch  then  > *Options Setup* > *Compressor Settings*. 2. Use the *Ball Valve Setpoint Offset* slider to select amount of pressure added to open the valve wider, and touch *Save*. https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 65 The motorized ball valve controls the flow of chilled water/glycol to provide a cooling capacity from 0 to 100%.

Claim Language	Exemplary Evidence of Infringement by TierPoint
	7.1.4 Temperature Control with a Fluid Economizer When an economizer is installed, the cooling requirement (determined by the temperature proportional band) is addressed first by the economizer's secondary cooling, if the economizer cooling capacity is insufficient, the compressor(s) begin cooling to bring the room air temperature down to the temperature setpoint. The fluid economizer employs a motorized ball valve that controls the flow of chilled water/glycol to provide a cooling capacity from 0% to 100%. https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 110. The compressor settings options include adjusting sensitivity to compressor discharge pressure or liquid pressure by increasing sensitivity. **3.3.5 Setting Compressor Options** 1. Touch SERVICE, then ☰ > *Options Setup* > *Compressor Settings*. The COMPRESSOR SETTINGS panel displays. 2. Make adjustments as needed and click *Save*. The option settings are updated. • Touch *Cancel* to discard the changes without saving. NOTE: Depending on the type of thermal management unit, included components, and control settings of your system, all of the options listed may not be available on your Vertiv™ Liebert® iCOM™ display. **Compressor Settings Options** **Ball Valve Setpoint Offset** Adjusts sensitivity to compressor discharge pressure or liquid pressure by increasing sensitivity. The higher the added pressure, the more the valve opens. https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 56.

Claim Language	Exemplary Evidence of Infringement by TierPoint
	Capacity Change at 100% Increases the rate at which the cooling capacity changes for a quicker reaction of cooling at high temperatures. **Capacity Change at 0%** Decreases the rate at which cooling capacity changes when close to or at the temperature setpoint to avoid undershooting the setpoint. https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 57. Liebert's DSE system optimization further improves efficiency by optimizing liquid refrigerant pressure setpoints in mid and high ambient temperature conditions thus reducing the operation of condenser fans while maintaining the appropriate heat rejection capacity. When your Thermal Management System is a Liebert® DSE system with a Liebert® EconoPhase pumped refrigerant economizer (PRE) and a Liebert® MC or MCV condenser, the EconoPhase screen, **Figure 2.1** on the facing page , shows the operating mode of the system. The DSE System Optimization feature is automatically employed and reduces power consumption significantly because a PRE package consumes about one-tenth the power of the compressors. EconoPhase operation saves energy by eliminating compressor operation when outdoor ambient temperatures are cool enough, or when the difference between the indoor and outdoor ambient temperature is satisfied. DSE System Optimization further improves efficiency by optimizing liquid refrigerant temperature and pressure setpoints in mid- and high-ambient temperature conditions, thus reducing the operation of condenser fans while maintaining the appropriate heat rejection capacity. https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 28. See also:

Claim Language	Exemplary Evidence of Infringement by TierPoint
	 See, *e.g.*, Keeping cool with outdoor air, Airside Economizers, Trane Engineers Newsletter, Vol. 35-2, https://www.trane.com/content/dam/Trane/Commercial/global/products-systems/education-training/engineers-newsletters/airside-design/admapn020en-0406.pdf.
[13] The method according to claim 6, further comprising: increasing an output of said cooling fluid from said cooling device in response to said decrease in cooling fluid supply to said zone falling below said increase in cooling fluid supply to said zone.	The Accused Products infringe claim 6. *See supra*. The Accused Products increase an output of said cooling fluid from said cooling device in response to said decrease in cooling fluid supply to said zone falling below said increase in cooling fluid supply to said zone, regardless of which cooling technology is used (Liebert, Schneider, or others).

Claim Language	Exemplary Evidence of Infringement by TierPoint
	For example, Liebert's iCOM system adjusts the activation points of the cooling fluid based on the sensor value deviation from the setpoint. Thus, Liebert increases an output of said cooling fluid from said cooling device in response to said decrease in cooling fluid supply to said zone falling below said increase in cooling fluid supply to said zone.

S106	Temperature Proportional Band	4 - 200 ℉ 2.2 - 111.0 K	12 ℉ 6.7 K	Adjusts the activation points of compressors/chilled water valves or rate of changed based on the actual sensor values deviation from setpoint. The smaller this number, the faster the compressors/chilled water values will increase capacity. Too small of a number may cause the unit to short cycle compressors or excessively reposition the valve.
	Temperature Integral Time	0.0 - 15.0 min	5.0 min	Adjusts the capacity of the units based on time away from setpoint so that accurate temperature control can be maintained. The proportional and integral time settings work together to maintain setpoint. Large p-band and small integral time is typical when controlling to supply air.

https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 203.

7.1.4 Temperature Control with a Fluid Economizer

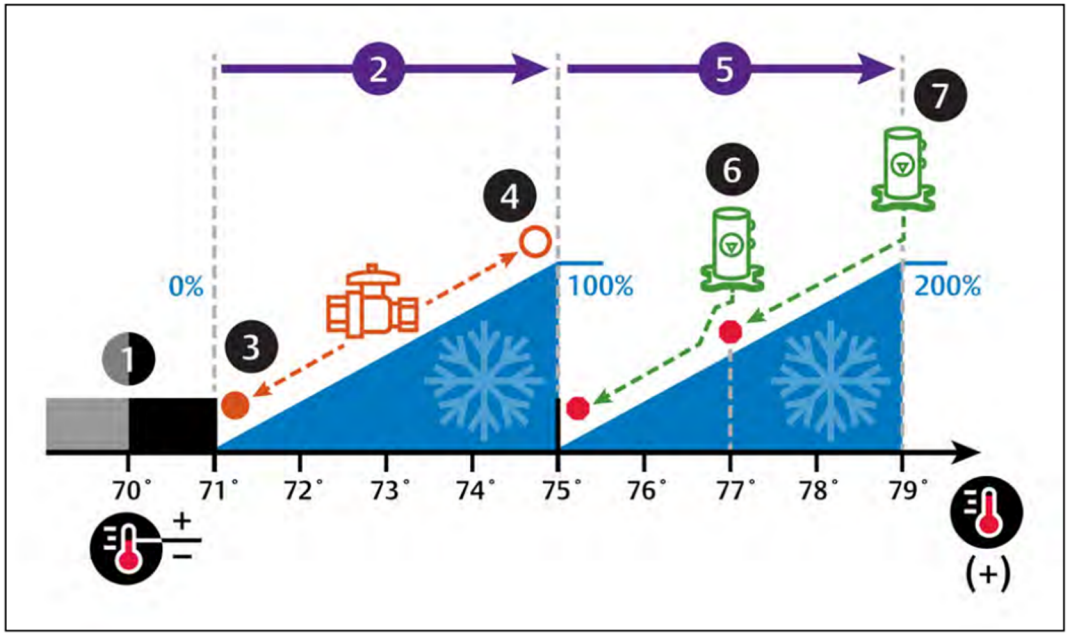
When an economizer is installed, the cooling requirement (determined by the temperature proportional band) is addressed first by the economizer's secondary cooling, if the economizer cooling capacity is insufficient, the compressor(s) begin cooling to bring the room air temperature down to the temperature setpoint.

The fluid economizer employs a motorized ball valve that controls the flow of chilled water/glycol to provide a cooling capacity from 0% to 100%.

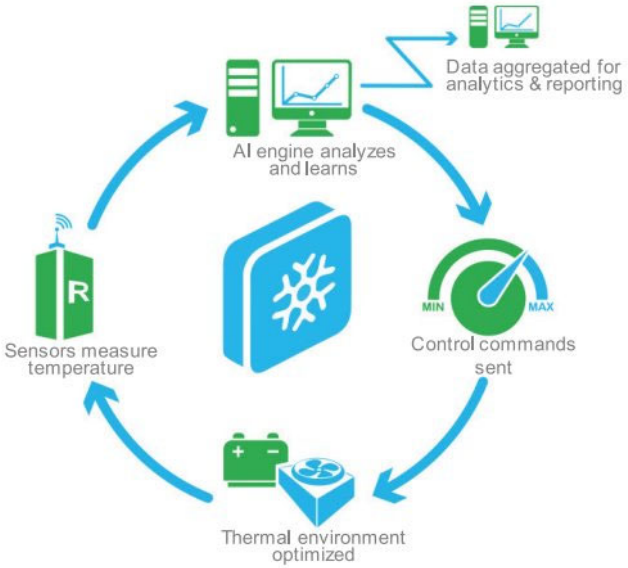
https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 110.

Claim Language	Exemplary Evidence of Infringement by TierPoint
	https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 112.

Figure 7.1 Temperature Control—Fluid Economizer and Example Two Step Compressor Capacity



No.	Description	No.	Description
1	Deadband.	5	½ of proportional band assigned to compressor(s) operation.
2	½ of proportional band assigned to valve operation.	6	Scroll compressor step 1. (Compressor 1 in dual compressor configuration, Unloaded in single compressor configuration.)
3	Fluid control valve closed.	7	Scroll compressor step 2. (Compressor 2 in dual compressor configuration, Loaded in single compressor configuration.)
7	Fluid control valve fully open.		

Claim Language	Exemplary Evidence of Infringement by TierPoint
	As another example, Schneider's Cooling Optimize is used to adjust cooling output. Schneider's system increases an output of said cooling fluid from said cooling device in response to said decrease in cooling fluid supply to said zone falling below said increase in cooling fluid supply to said zone. As IT load changes, the built-in machine learning automatically adjusts cooling output to match the dynamic data center environment.  https://download.schneider-electric.com/files?p_enDocType=Brochure&p_File_Name=998-21764381_EcoStruxure_IT_Advisor_Cooling_Optimize.pdf&p_Doc_Ref=SPD_RMCR-9K5JG4_EN. The cooling capacity is achieved by increasing airflow via increasing fan speed and/or lower supply air temperature via increasing chilled water flow of row cooler.

Claim Language	Exemplary Evidence of Infringement by TierPoint
	8. **How Row-based Data** Center Cooling Works Schneider Electric – Data Center Science Center Rev 0 8 The figures above help to visualize the effect of row coolers on hot air capture index values and cooling stand-alone IT device. As row coolers are variable capacity devices that are capable of over-supplying cold air to the cold aisle. When the system is in balance, the supply temperature from the cooler is equal to the IT inlet temperature. When ancillary equipment (i.e. stand-alone devices) is initially added outside of the pod, the temperature of the overall room environment increases due to air mixing. Nearby row-based cooling units sense this increase and respond by increasing cooling capacity thereby neutralizing the hot air. This increased cooling capacity is achieved by increased air flow (row coolers increase fan speed) and or lower supply air temperature (row cooler increase chilled water valve flow). These adjustments occur initially but remain unchanged once the data center reaches steady state. The steps describing how the row-based coolers "pick up the ancillary load" are the same even when containment is used. In either case we expect the ancillary equipment to operate at higher temperatures than the row-based racks, because it is not directly coupled to row coolers in their own pod. The further away stand-alone IT gear is from row coolers, the higher their inlet air temperature will be. Should you be concerned about the elevated https://www.slideshare.net/SchneiderElectric/how-rowbased-data-center-cooling-works Active response controls ensure that servers consistently operate at the desired rack inlet setpoint. As temperatures shift, built-in probes detect changes and send a signal to the controller. The cooling output is continually adjusted to accommodate varying loads, determined by the difference between the setpoint and the actual temperature as well as the airflow for each cooling unit. The fluid valve (controllable partition) modulates fluid flow into the cooling coil, keeping equipment at the proper temperature, and saving energy by only consuming the amount required to cool the IT heat load.

Claim Language	Exemplary Evidence of Infringement by TierPoint
	Active Response Controls Active response controls ensure that servers consistently operate at the desired rack inlet setpoint. As temperatures shift, built-in probes detect changes and send a signal to the controller. The cooling output is continually adjusted to accommodate varying loads, determined by the difference between the setpoint and the actual temperature as well as the airflow for each cooling unit. The fluid valve modulates fluid flow into the cooling coil, keeping equipment at the proper temperature, and saving energy by only consuming the amount required to cool the IT heat load. **Chiller/CRAC Communications** Uniflair chillers and CRAC units efficiently work together to optimize the system performance according to the different load and operating conditions. When a single modulating chiller is connected to a single internal unit, the CRAC regulates the cooling load according to the discharge air temperature by means of the three-way valve and the chilled water temperature, which is regulated on the chiller and connected via LAN. When connected to more than one chiller, or when one or more large chillers are installed and connected to all internal CRAC units within the same room, internal and external units can communicate in LAN. The CRAC units regulate the load according to the average suction air temperature by means of the three-way valve and the chilled water temperature.

<table>
<tr><th>Claim Language</th><th>Exemplary Evidence of Infringement by TierPoint</th></tr>
<tr><td></td><td>https://www.mobiledatacentre.com/wp-content/uploads/2021/05/Schneider-Electric-Cooling-Solutions-Brochure-29-01-19.pdf, p. 21.

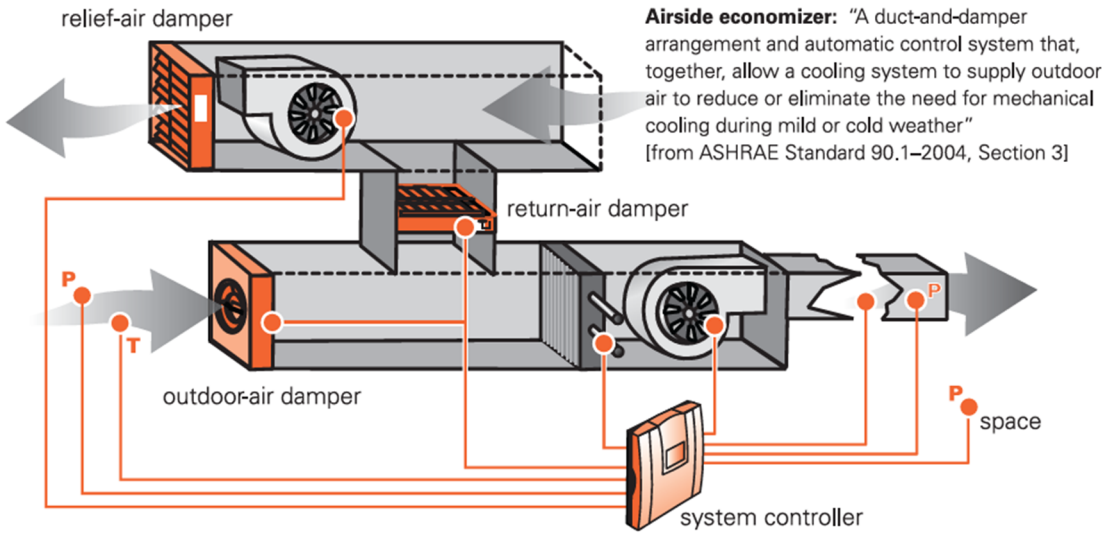
The CRAC airflow can be changed by right clicking a CRAC and selecting properties.

• Cooler airflow in cubic feet per minute (CFM) is assumed to be:

<table><tr><th>Cooler type</th><th>Minimum CFM</th><th>Maximum CFM</th></tr><tr><td>InRow RC (300 mm)</td><td>1450</td><td>2900</td></tr><tr><td>InRow RC (600 mm)</td><td>2760</td><td>6900</td></tr><tr><td>InRow RP (600 mm Chilled Water)</td><td>2760</td><td>6900</td></tr><tr><td>InRow RP (600 mm Air Cooled)</td><td>1920</td><td>4800</td></tr><tr><td>InRow RD (600 mm Air Cooled)</td><td>2000</td><td>5000</td></tr><tr><td>InRow RD (300 mm Air Cooled)</td><td>916</td><td>2300</td></tr><tr><td>InRow RD (300 mm Fluid Cooled)</td><td>916</td><td>2300</td></tr></table>
• Rack airflow is by default assumed to be 160 CFM/kW based on the total rack power. This value can be changed by right-clicking a rack and selecting Properties, to change to, for example, 105 CFM/kW for blade server racks.
• CRAC airflow is, by default, assumed to be 6000 CFM. This can be changed by right-clicking a CRAC and selecting Properties.

https://dcimsupportattachments.ecostruxureit.com/140711358/StruxureWare%20Data%20Center%20Operation%20User's%20Guide.pdf (“StruxureWare Manual”) at p. 50.

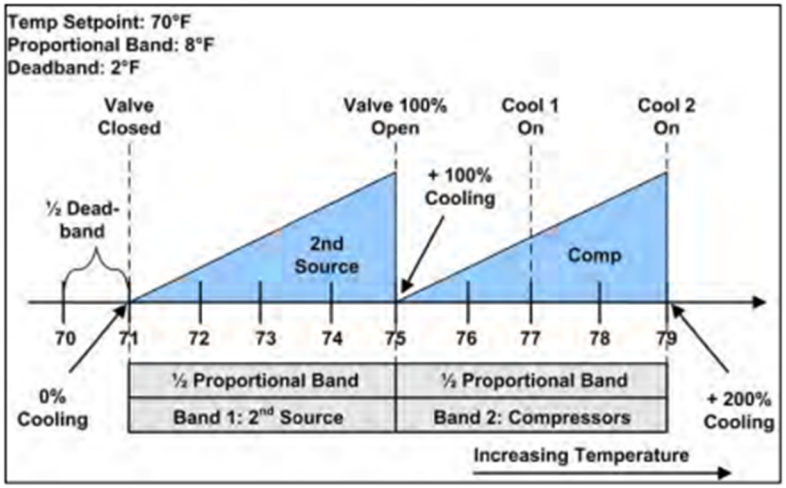
See also:</td></tr>
</table>

Claim Language	Exemplary Evidence of Infringement by TierPoint
	 See, *e.g.*, Keeping cool with outdoor air, Airside Economizers, Trane Engineers Newsletter, Vol. 35-2, https://www.trane.com/content/dam/Trane/Commercial/global/products-systems/education-training/engineers-newsletters/airside-design/admapn020en-0406.pdf.
[15] The method according to claim 10, further comprising: implementing said numerical modeling to correlate at least two of temperature, velocity and pressure of said cooling fluid and power draw of at least one of said zone and said racks within said data	The Accused Products infringe claim 10. *See supra*. The Accused Products implement said numerical modeling to correlate at least two of temperature, velocity and pressure of said cooling fluid and power draw of at least one of said zone and said racks within said data center to thereby infer a thermal condition throughout said data center, wherein said manipulating step further comprises manipulating said cooling device in response to said inferred thermal condition.

Claim Language	Exemplary Evidence of Infringement by TierPoint
center to thereby infer a thermal condition throughout said data center, wherein said manipulating step further comprises manipulating said cooling device in response to said inferred thermal condition.	For example, TierPoint provides the following information relating to its power draw. TierPoint uses the Liebert cooling system in which the cooling fluid temperature is controlled in the user sensor data menu. When the cooling fluid temperature is not cold enough, then the compressor is employed to control the temperature of cooling fluid. When the fluid temperature is above the minimum chilled water temperature, then the control will operate the chilled water (free cooling) and compressors simultaneously if needed. **Delta T (Temperature Difference) between Room and Fluid** The comparator circuit determines if the glycol / chilled water temperature of the second cooling source is low enough to provide at least partial cooling capacity. Free-Cooling Fluid Temperature is controlled in the User - Sensor Data menu, Figure 7.10 on page 128. The comparator circuit has four settings (DT Between Room / FC Type, [Service Menu, Setpoints]):

Claim Language	Exemplary Evidence of Infringement by TierPoint

Figure 3.17 Second Cooling Source and Two-Step Compressorized Cooling



Minimum Chilled Water Temperature—This feature allows the user to select a minimum chilled water temperature to prevent simultaneous operation of the chilled water (free cooling) and compressor(s) on units factory-programmed to operate both sources simultaneously. This feature is enabled in Service>Setpoints, parameter Minimum CW Temp.

If the fluid temperature sensed is below the Minimum CW Temp Value, (Service Menu, Setpoints), and the Delta T (Temperature Difference) Between Room and Glycol (see Differential Temperatures/Controls (Comparator Circuit) on the previous page) is satisfied, the control will operate ONLY the chilled water for cooling. The compressor(s) is locked out. If cooling does not operate, (i.e., loss of chilled water flow), the control will override this setting and activate a compressor(s). When this happens, free-cooling will be locked out for one hour.

If the fluid temperature is above the minimum CW value, the control will operate the chilled water (free cooling) and compressor(s) simultaneously if needed. If the Minimum CW Temp is disabled, the control may operate both sources as load requires.

https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, pp. 76, 77.

Claim Language	Exemplary Evidence of Infringement by TierPoint
	Secondary Cooling Temperature Control with Two Step Compressor When the fluid temperature meets the set up requirements, secondary cooling provides temperature control as follows. If the fluid is not cold enough, primary compressorized cooling operates as normal. **NOTE: The compressor control method is not affected by economizer operation and operates across the assigned proportional band based on the compressor configuration of your system (one step, two step, four step, or digital scroll). See Compressor Control by Cooling Requirement on page 28 , for a description compressor control methods.** • 70° temperature setpoint • 8° temperature proportional band • 2° temperature deadband https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 119. The Liebert cooling unit controls activates the flow of chilled water/glycol, and varies cooling capacity by adjusting a motorized ball valve. **7.1.4 Temperature Control with a Fluid Economizer** When an economizer is installed, the cooling requirement (determined by the temperature proportional band) is addressed first by the economizer's secondary cooling, if the economizer cooling capacity is insufficient, the compressor(s) begin cooling to bring the room air temperature down to the temperature setpoint. The fluid economizer employs a motorized ball valve that controls the flow of chilled water/glycol to provide a cooling capacity from 0% to 100%. https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 110. The number of times the valve opens and closes is adjusted based on added pressure offset.

Claim Language	Exemplary Evidence of Infringement by TierPoint
	Adjusting Ball Valve Pressure Offset **NOTE: Only a properly trained and qualified technician should modify the motorized ball valve setting.** The number of times the valve opens and closes is adjusted based on added pressure offset. 1. Touch SERVICE then ☰ > *Options Setup* > *Compressor Settings*. 2. Use the *Ball Valve Setpoint Offset* slider to select amount of pressure added to open the valve wider, and touch *Save*. https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 65. The Liebert iCOM receives data from sensor installed in the monitored racks to combats cooling problems related to air recirculation and air distribution. Up to 10 remote sensor modules, installed in the monitored racks and connected to the cooling unit, provide control and reference input to iCOM and building-management systems. Using remote, rack sensors combats cooling problems related to recirculation air, uneven rack loading, and air distribution. https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 188. The amount of cooling/heating is adjusted based upon the based on the length of time temperature has deviated and the amount of deviation from the setpoint.

Claim Language	Exemplary Evidence of Infringement by TierPoint
	Temperature Integration Time Adjusts amount of cooling/heating based on the length of time the temperature has deviated from the setpoint. The time selected is the amount of time it will take cooling capacity to reach 100%. For example, if three minutes is selected, cooling capacity will increase to 100% in three minutes. **NOTE: Three to five minutes of integration time is adequate for most applications. See Considerations when Using PI Temperature Control on page 28 .** **NOTE: Only used when Temperature Control Type is PI.** **Temperature Proportional Band** Adjusts the activation point of cooling/heating components based on deviation from setpoint by placing half of the selected value on each side of the temperature control setpoint. A smaller number causes faster reaction to temperature changes. **NOTE: Setting this too low causes short cycling of compressors.** iCOM Manual at p. 25. As another example, in Schneider's cooling system, the cooling capacity is achieved by increasing airflow via increasing fan speed and/or lower supply air temperature via increasing chilled water flow of row cooler. 8. **How Row-based Data** Center Cooling Works Schneider Electric – Data Center Science Center Rev 0 8 The figures above help to visualize the effect of row coolers on hot air capture index values and cooling stand-alone IT device. As row coolers are variable capacity devices that are capable of over-supplying cold air to the cold aisle. When the system is in balance, the supply temperature from the cooler is equal to the IT inlet temperature. When ancillary equipment (i.e. stand-alone devices) is initially added outside of the pod, the temperature of the overall room environment increases due to air mixing. Nearby row-based cooling units sense this increase and respond by increasing cooling capacity thereby neutralizing the hot air. This increased cooling capacity is achieved by increased air flow (row coolers increase fan speed) and or lower supply air temperature (row cooler increase chilled water valve flow). These adjustments occur initially but remain unchanged once the data center reaches steady state. The steps describing how the row-based coolers "pick up the ancillary load" are the same even when containment is used. In either case we expect the ancillary equipment to operate at higher temperatures than the row-based racks, because it is not directly coupled to row coolers in their own pod. The further away stand-alone IT gear is from row coolers, the higher their inlet air temperature will be. Should you be concerned about the elevated https://www.slideshare.net/SchneiderElectric/how-rowbased-data-center-cooling-works Schneider's cooling system determines power utilization of the servers in a rack.

Claim Language	Exemplary Evidence of Infringement by TierPoint
	This overlay shows power utilization of the servers in a rack. Racks are colored to describe the utilization as: green: max amount of servers are utilized; yellow: max amount of servers could be consolidated; red: max amount of servers could be retired. The tooltip includes a graphical overview of the server utilization in a selected rack. (StruxureWare Data Center: IT Optimize feature) https://dcimsupportattachments.ecostruxureit.com/140711358/StruxureWare%20Data%20Center%20Operation%20User's%20Guide.pdf ("StruxureWare Manual") at p. 24. Provides information about that component, e.g. how much power the equipment draws, how many power cords the equipment has, how much space the equipment takes up in a rack. https://dcimsupportattachments.ecostruxureit.com/140711358/StruxureWare%20Data%20Center%20Operation%20User's%20Guide.pdf ("StruxureWare Manual") at p. 52. Active response controls ensure that servers consistently operate at the desired rack inlet setpoint. As temperatures shift, built-in probes detect changes and send a signal to the controller. The cooling output is continually adjusted to accommodate varying loads, determined by the difference between the setpoint and the actual temperature as well as the airflow for each cooling unit. The fluid valve modulates fluid flow into the cooling coil, keeping equipment at the proper temperature, and saving energy by only consuming the amount required to cool the IT heat load.

Claim Language	Exemplary Evidence of Infringement by TierPoint
	Active Response Controls Active response controls ensure that servers consistently operate at the desired rack inlet setpoint. As temperatures shift, built-in probes detect changes and send a signal to the controller. The cooling output is continually adjusted to accommodate varying loads, determined by the difference between the setpoint and the actual temperature as well as the airflow for each cooling unit. The fluid valve modulates fluid flow into the cooling coil, keeping equipment at the proper temperature, and saving energy by only consuming the amount required to cool the IT heat load. **Chiller/CRAC Communications** Uniflair chillers and CRAC units efficiently work together to optimize the system performance according to the different load and operating conditions. When a single modulating chiller is connected to a single internal unit, the CRAC regulates the cooling load according to the discharge air temperature by means of the three-way valve and the chilled water temperature, which is regulated on the chiller and connected via LAN. When connected to more than one chiller, or when one or more large chillers are installed and connected to all internal CRAC units within the same room, internal and external units can communicate in LAN. The CRAC units regulate the load according to the average suction air temperature by means of the three-way valve and the chilled water temperature.

Claim Language	Exemplary Evidence of Infringement by TierPoint
	Intelligent energy management of these systems is enabled by Schneider Electric EcoStruxure™ integrated hardware and software system architecture. StruxureWare software applications and suites are a key element of the EcoStruxure architecture. The software helps maximize system reliability and optimize operational efficiency. https://www.mobiledatacentre.com/wp-content/uploads/2021/05/Schneider-Electric-Cooling-Solutions-Brochure-29-01-19.pdf , pp. 21, 22. The CRAC airflow can be changed by right clicking a CRAC and selecting properties. • Cooler airflow in cubic feet per minute (CFM) is assumed to be: **Cooler type** / **Minimum CFM** / **Maximum CFM** InRow RC (300 mm) / 1450 / 2900 InRow RC (600 mm) / 2760 / 6900 InRow RP (600 mm Chilled Water) / 2760 / 6900 InRow RP (600 mm Air Cooled) / 1920 / 4800 InRow RD (600 mm Air Cooled) / 2000 / 5000 InRow RD (300 mm Air Cooled) / 916 / 2300 InRow RD (300 mm Fluid Cooled) / 916 / 2300 • Rack airflow is by default assumed to be 160 CFM/kW based on the total rack power. This value can be changed by right-clicking a rack and selecting **Properties**, to change to, for example, 105 CFM/kW for blade server racks. • CRAC airflow is, by default, assumed to be 6000 CFM. This can be changed by right-clicking a CRAC and selecting **Properties**. https://dcimsupportattachments.ecostruxureit.com/140711358/StruxureWare%20Data%20Center%20Operation%20User's%20Guide.pdf ("StruxureWare Manual") at p. 50.