Exhibit C – 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 Digital Realty 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.

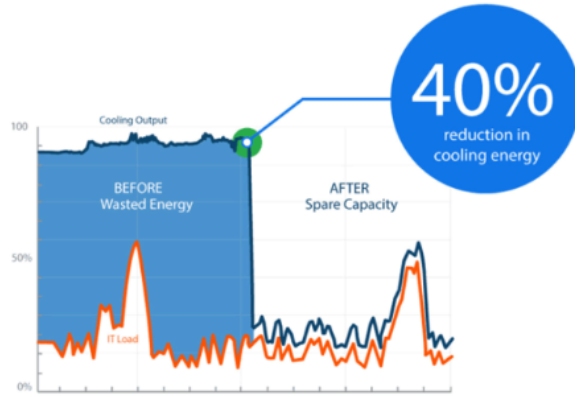
This claim chart is not intended to and does not construe the claims of the Asserted Patents and does not limit Valtrus' contentions. Valtrus specifically reserves the right to modify and supplement this claim chart. This preliminary claim chart is provided to illustrate exemplary information practically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

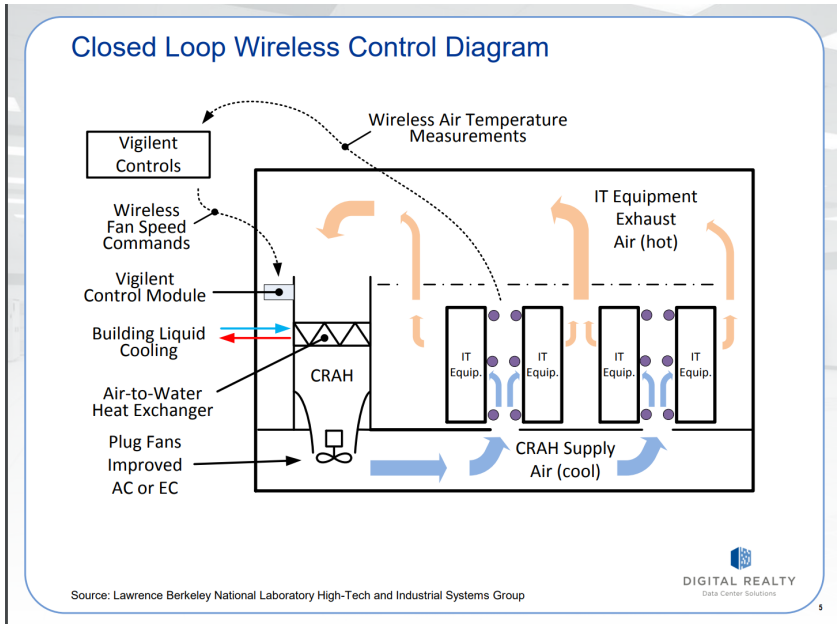
Vertiv Ex. 1004
Vertiv v. Valtrus

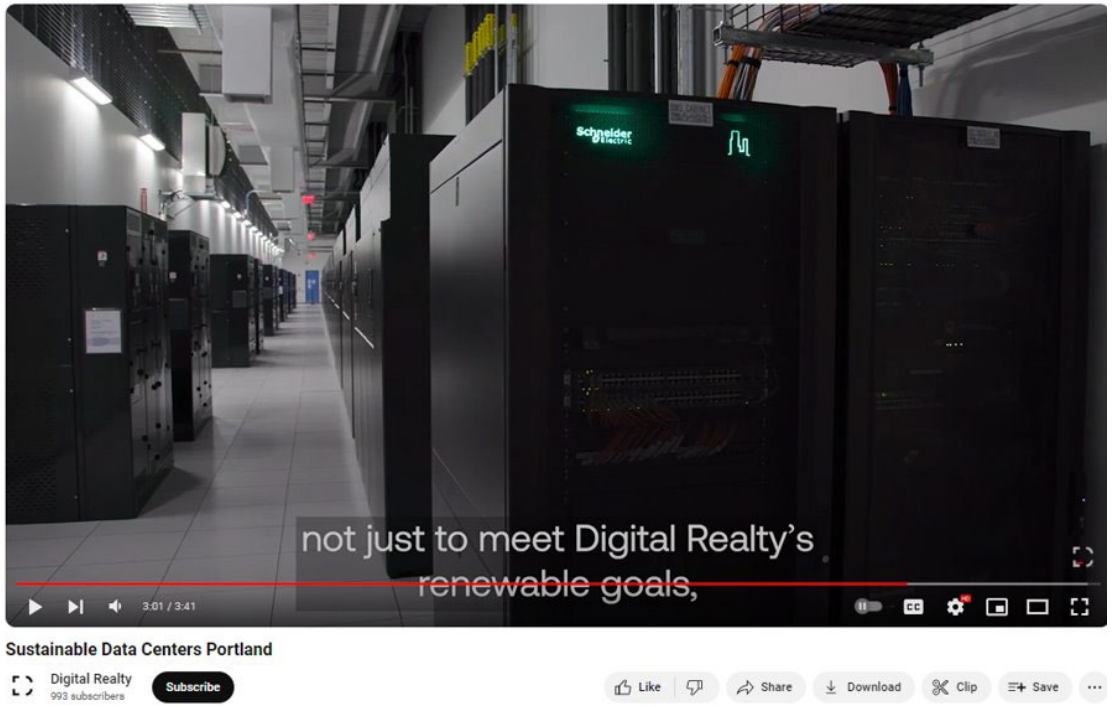
Claim Language	Exemplary Evidence of Infringement by Digital Realty
[1pre] A method of cooling a plurality of racks in a data center, method comprising:	The Accused Products use a method of cooling a plurality of racks in a data center. For example, Digital Realty has used Liebert and Vertiv cooling units in its data centers. Liebert cooling units are controlled by Liebert's iCOM Intelligent Communication and Monitoring system. Vertiv CASE STUDY • DRIVING PLANET-SAVING INNOVATION DIGITAL REALTY **Partnering to prove the worth of pumped refrigerants** Vertiv developed their Liebert DSE system for data centers where chilled water thermal management was either too expensive or simply too big for the space available. Digital Realty was open to exploring a new cooling solution. For nine months, Vertiv and Digital Realty worked together to explore the energy savings and operational performance benefits of a pumped refrigerant system and compared it to that of a chilled water system. The companies shared their results with the CEC and apply for a formal exception to the air- and water- only rule in order to bring a promising new cooling solution to market. Digital Realty has saved more than 1 billion gallons of water since 2013, by using Liebert DSE pumped refrigerant systems in its data centers, compared to using chilled water systems. https://www.vertiv.com/4a10eb/globalassets/products/thermal-management/room-cooling/vertiv-and-digital-realty-case-study.pdf , pp. 1, 3. Liebert iCOM uses sensors installed in a plurality of racks. **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.

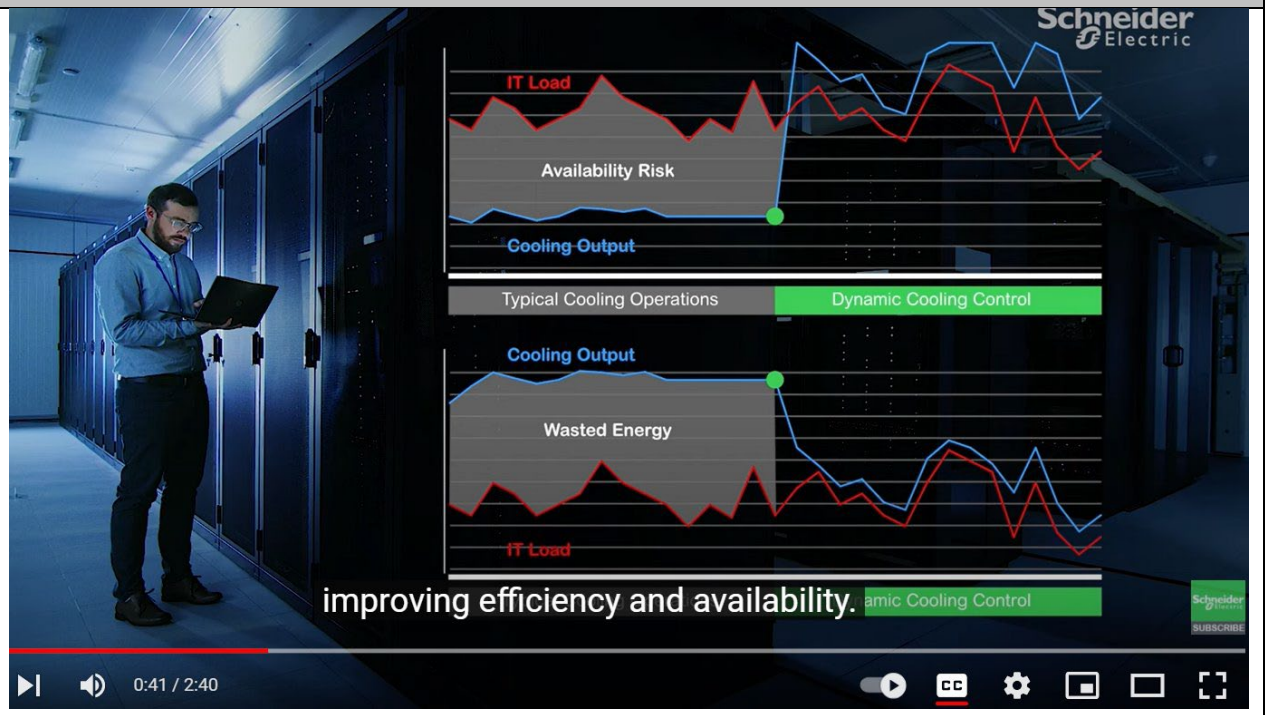
Claim Language	Exemplary Evidence of Infringement by Digital Realty
	https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 180. This read-only value indicates if the Liebert iCOM controller is setup in a Optimized Aisle configuration. To enable optimized aisle via the iCOM display, the Supply Air sensor must be set to control the cooling capacity and the remote sensor must be set to control the fan speed. This allows the cooling unit to maintain rack temperatures while still maintaining an even under floor air temperature when controlling unbalanced rooms. https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 210. Digital Realty has also used Vigilent's dynamic cooling management.

Claim Language	Exemplary Evidence of Infringement by Digital Realty
	Vigilent Optimizing Mission Critical Cooling WHO WE SERVE DIGITAL REALTY "We found that upgrading fans and adding fan speed controls in our data centers allowed us to cool them more effectively and efficiently. In addition, the facility's electrical energy usage was reduced, as was the average and peak electric power demand, resulting in a more energy efficient and sustainable data center environment." – Jim Smith, Chief Technology Officer, Digital Realty https://www.vigilent.com/digital-realty/

Claim Language	Exemplary Evidence of Infringement by Digital Realty
	DIGITAL REALTY DECREASES DATA CENTER COOLING ENERGY USAGE BY 66% Energy Management Software and Variable Speed Fans Dramatically Reduce Carbon Emissions, PUE San Francisco, CA – December 12, 2012 – Digital Realty Trust, Inc. (NYSE: DLR), Vigilent® Corporation, and Lawrence Berkeley National Laboratory today announced the results of a joint study focused on improving the energy efficiency of a data center designed, owned and operated by Digital Realty. https://www.vigilent.com/digital-realty-decreases-data-center-cooling-energy-usage-by-66/ VIGILENT CONTINUOUSLY MATCHES COOLING OUTPUT TO HEAT LOAD Optimized airflow eliminates hot spots. Vigilent continuously optimizes the airflow in your facility, delivering improved reliability and availability. The system automatically finds and eliminates hot spots, while its comprehensive reports and tools facilitate easier operations management. Our system delivers the right amount of cooling exactly where it's needed. This typically results in up to a 40% reduction in carbon emissions and your cooling energy bill. We achieve that with sophisticated AI-based technology that learns your environment and adapts to change. 

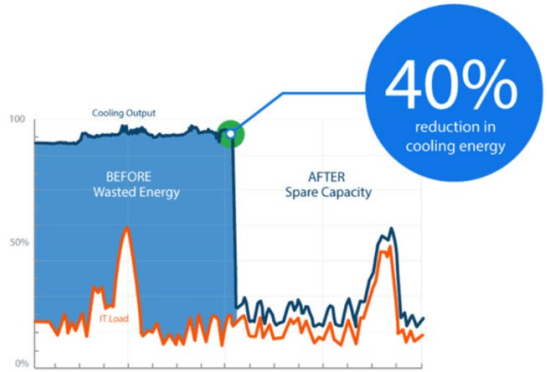
Claim Language	Exemplary Evidence of Infringement by Digital Realty
	https://www.vigilent.com/who-we-serve/by-facility/data-centers/  https://www.vigilent.com/wp-content/uploads/2014/06/DigitalRealty.pdf Vigilent's cooling system uses sensors installed in a plurality of racks. Using wireless temperature sensors, the system collects granular information about the thermal environment of your facility. Temperature sensors are placed every three to four racks measuring temperature at the top and bottom of the rack. Thermal data is communicated via a wireless mesh network back to the control software. The AI control software uses the real-time thermal data to learn and build an airflow model of the environment. The model is used to determine the optimal cooling output to ensure that the thermal environment is maintained with a minimal amount of energy. The software then makes active control decisions for each cooling unit. The **Data Center Control** section provides more detail on the different control capabilities of the system. The real-time temperature monitoring provides thermal feedback

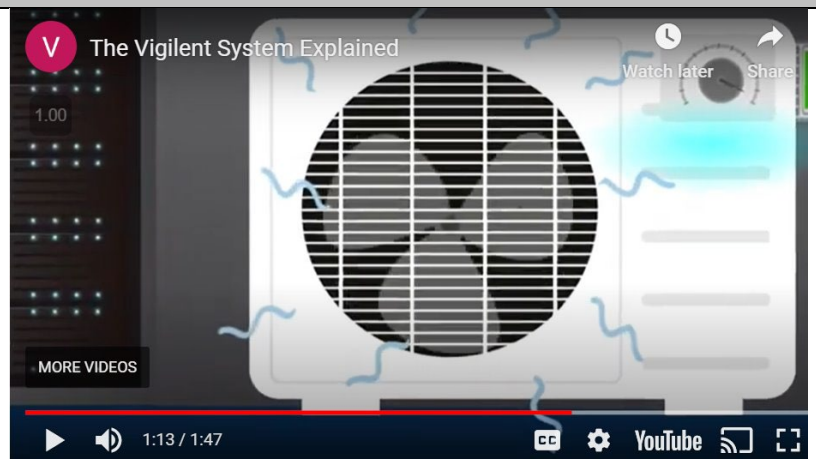
Claim Language	Exemplary Evidence of Infringement by Digital Realty
	https://fccid.io/ANATEL/01612-15-08292/MANUAL/16006226-67DD-49FB-8873-2E15C3330211/PDF, p. 106. Digital Realty has also used Schneider Electric's cooling system.  https://youtu.be/PI6ygk-_Jmk, at 3:01.

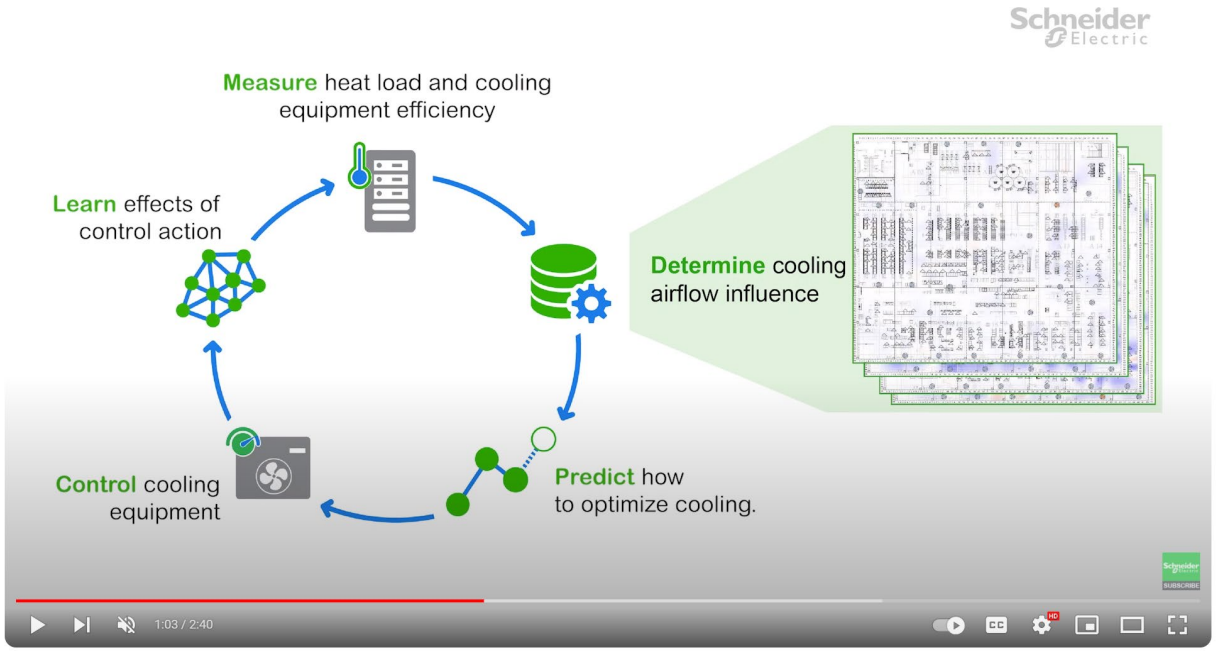
Claim Language	Exemplary Evidence of Infringement by Digital Realty
	 https://www.youtube.com/watch?v=yFMS-88wXn8, at 0:32. Schneider Electric's cooling system uses intelligent thermal management in a plurality of racks. Intelligent thermal management: Rack-level temperature data is wirelessly transmitted 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, p. 2.

Claim Language	Exemplary Evidence of Infringement by Digital Realty
	Each rack in a well-formed hot aisle/cold aisle layout shows a color-coded capture index (CI) percentage. The CI value identifies inlet air which is supplied by what fraction of the equipment's exhaust airflow is captured by the InRow® cooling units included in that row pair or by the CRAC or CRACs in the room through the perforated tiles. Select the **Cooling** tab in the floor layout. 1. Add CRACs, InRow® cooling units and perforated tiles as needed by dragging them from the **Genomes** pane into the layout. 2. Review or modify the cooling settings of the added equipment or the room as needed by right-clicking the item, and selecting **Properties**, and using the settings in the **Cooling** page. 3. Simulate failure of one or more cooling units by selecting one or more cooling units in the floor layout, right-clicking, and deselecting **Activate**. 4. Simulate cooling performance changes of one or more racks by selecting one or more racks in the floor layout, right-clicking and selecting **Cooling>Normal: 160 CFM/kW**, **Blade: 105 CFM/kW** or another value*, if available. https://dcimsupportattachments.ecostruxureit.com/140711358/StruxureWare%20Data%20Center%20Operation%20User's%20Guide.pdf ("StruxureWare Manual") at p. 44.
[1a] activating a cooling device and opening a controllable partition configured to vary a supply of cooling fluid within a zone of data center, zone including at least one associated rack of plurality of racks;	The Accused Products activate a cooling device and opening a controllable partition configured to vary a supply of cooling fluid within a zone of data center, zone including at least one associated rack of plurality of racks, regardless of which cooling technology is used (Liebert, Vigilent, Schneider, or others). For example, Liebert's iCOM Intelligent Communication and Monitoring controls the cooling units by turning it ON and utilizing fluid economizer system, which activates the flow of chilled water/glycol, and varies cooling capacity by adjusting a motorized ball valve (controllable partition). When enabled, the cooling unit returns to the status at which it was operating when input power returns after a power failure. (ON if it was powered on and OFF if it was powered off before the failure.) See Automatic Restart after Power Failure on page 54 . https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 51, 59.

Claim Language	Exemplary Evidence of Infringement by Digital Realty
	iCOM controls the cooling units based on a calculated need for cooling (and heating, if included on your system). The requirement is expressed as a percentage and is calculated using the selected temperature control type. **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. https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 34. **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 *See also* https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf at p. 33-34 (valve control), p. 70, Fig. 3.18 (valve opening).

Claim Language	Exemplary Evidence of Infringement by Digital Realty
	As another example, Vigilent's optimized airflow system which utilizes artificial intelligence to remotely control air conditioners to provide the right amount of cooling exactly where and when it is needed. VIGILENT CONTINUOUSLY MATCHES COOLING OUTPUT TO HEAT LOAD Optimized airflow eliminates hot spots. Vigilent continuously optimizes the airflow in your facility, delivering improved reliability and availability. The system automatically finds and eliminates hot spots, while its comprehensive reports and tools facilitate easier operations management. Our system delivers the right amount of cooling exactly where it's needed. This typically results in up to a 40% reduction in carbon emissions and your cooling energy bill. We achieve that with sophisticated AI-based technology that learns your environment and adapts to change.  https://www.vigilent.com/who-we-serve/by-facility/data-centers/

Claim Language	Exemplary Evidence of Infringement by Digital Realty
	 https://www.vigilent.com/the-vigilent-system-explained/, at 1:13. *See also*: https://fccid.io/ANATEL/01612-15-08292/MANUAL/16006226-67DD-49FB-8873-2E15C3330211/PDF at pp. 46, 51 (fan speed control) and pp. 134, 135 (fan VFD speed). As another example, 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.

Claim Language	Exemplary Evidence of Infringement by Digital Realty
	 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 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.

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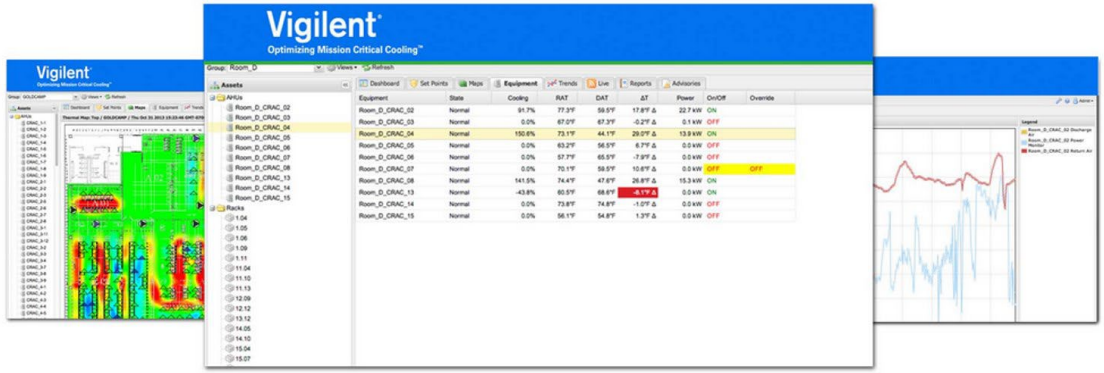
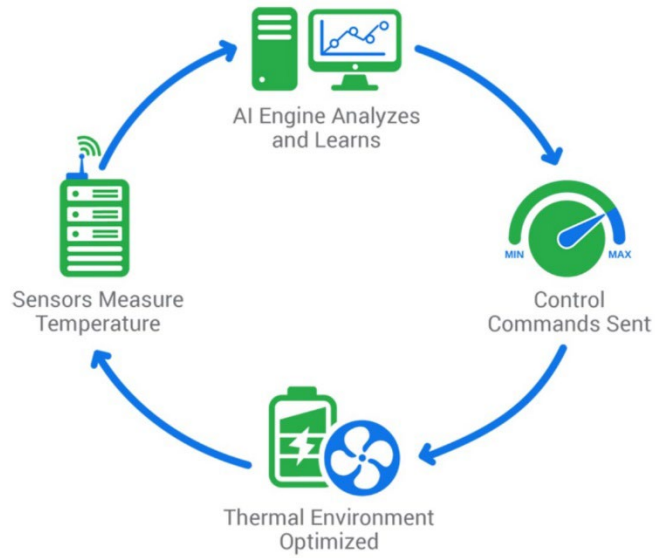
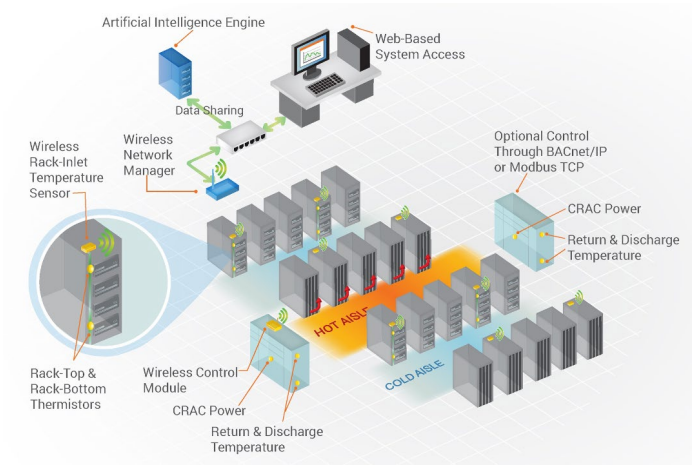
	8. **How Row-based Data** Center Cooling Works Schneider Electric – Data Center Science Center Rev 0 8 The figures above help to visualize the effect of row coolers on hot air capture index values and cooling stand-alone IT device. As row coolers are variable capacity devices that are capable of over-supplying 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

Claim Language	Exemplary Evidence of Infringement by Digital Realty
	the proper temperature, and saving energy by only consuming the amount required to cool the IT heat load. **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.

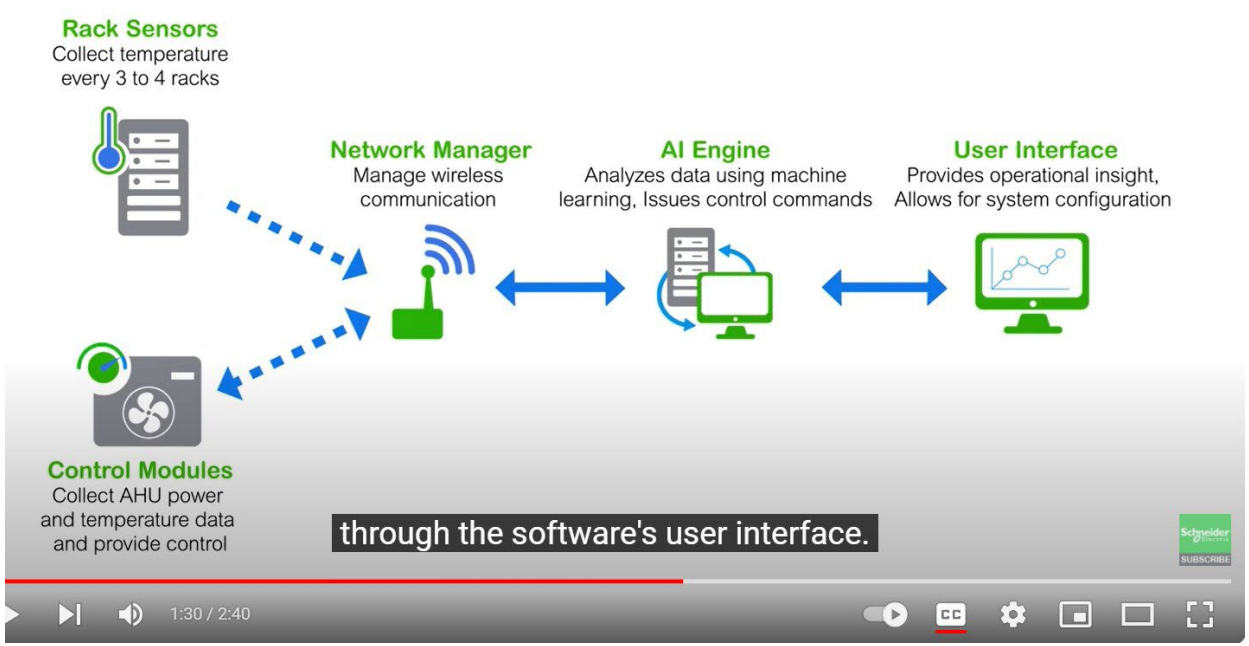
Claim Language	Exemplary Evidence of Infringement by Digital Realty
	Intelligent energy management of these systems is enabled by Schneider Electric EcoStruxure™ integrated hardware and software system architecture. StruxureWare software applications and suites are a key element of the EcoStruxure architecture. 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.

Claim Language	Exemplary Evidence of Infringement by Digital Realty
[1b] sensing the temperature of at least one associated rack;	The Accused Products sense the temperature of at least one associated rack, regardless of which cooling technology is used (Liebert, Vigilent, Schneider, or others). For example, Digital Realty has used Liebert cooling units and the Liebert cooling unit control system senses temperatures. 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 , pp.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 , pp. 164. As another example, Vigilent's Optimizing Mission Critical Cooling is used to sense temperatures. For example, users can quickly view real time temperature data of one specific rack sensor.

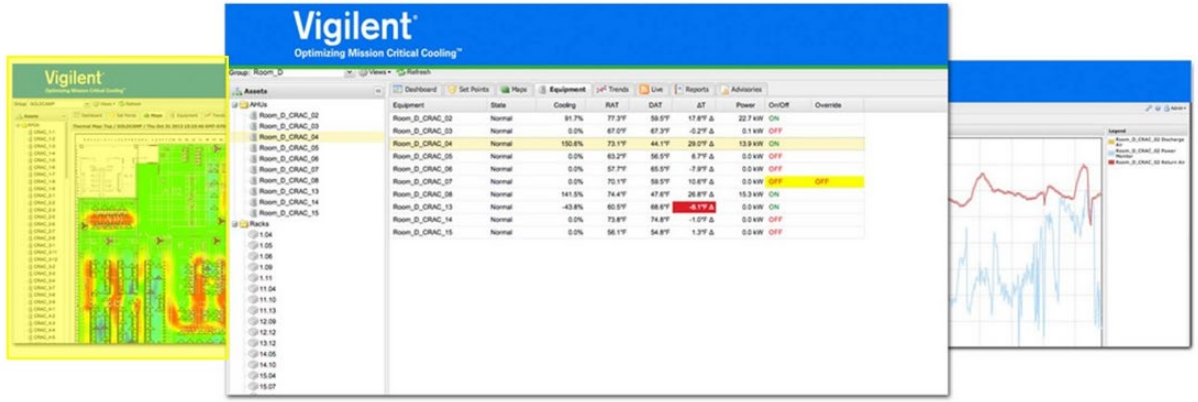
Claim Language	Exemplary Evidence of Infringement by Digital Realty
	 **EVERYDAY TOOLS** With our intuitive, at-a-glance system interface, checking the current status of your facility is always at your fingertips. **CHECK TEMPERATURES** With a few clicks, you can quickly dive down from a broad facility view into the real-time temperature data of one specific rack sensor. **EASY TRENDING** Customize data to quickly surface the information you need.

Claim Language	Exemplary Evidence of Infringement by Digital Realty
	 https://www.vigilent.com/products-and-services/dynamic-control/. 

Claim Language	Exemplary Evidence of Infringement by Digital Realty
	https://www.vigilent.com/products-and-services/dynamic-control/ Wireless sensors are typically deployed every third rack to measure the inlet air temperature every minute. The sensors have two thermistors, one to capture temperature at rack bottom, the other at rack top. https://www.vigilent.com/technology/system-architecture/ *See also*: https://fccid.io/ANATEL/01612-15-08292/MANUAL/16006226-67DD-49FB-8873-2E15C3330211/PDF at Section 4 (e.g., p. 102 "Using wireless temperature sensors, the system collects granular information about the thermal environment of your facility. Temperature sensors are placed every three to four racks measuring temperature at the top and bottom of the rack. Thermal data is communicated via a wireless mesh network back to the control software."). 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. **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.

Claim Language	Exemplary Evidence of Infringement by Digital Realty
	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.  https://www.youtube.com/watch?v=yFMS-88wXn8, at 1:30.

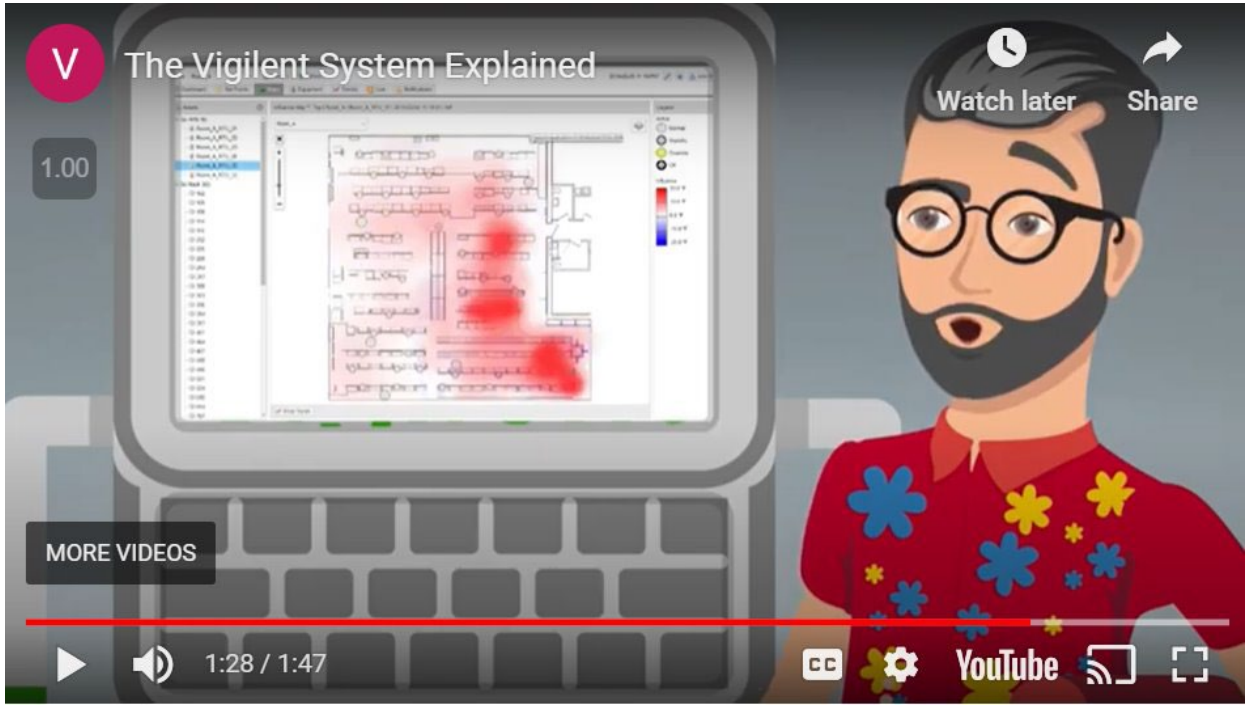
Claim Language	Exemplary Evidence of Infringement by Digital Realty
[1c] determining whether sensed temperature is within a predetermined temperature range; and	The Accused Products determine whether sensed temperature is within a predetermined temperature range, regardless of which cooling technology is used (Liebert, Vigilent, 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. **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, Vigilent's Optimizing Mission Critical Cooling is used to check the temperatures within its data centers to determine whether the sensed temperature is within a predefined temperature range.

Claim Language	Exemplary Evidence of Infringement by Digital Realty
	 **EVERYDAY TOOLS** With our intuitive, at-a-glance system interface, checking the current status of your facility is always at your fingertips. **CHECK TEMPERATURES** With a few clicks, you can quickly dive down from a broad facility view into the real-time temperature data of one specific rack sensor. **EASY TRENDING** Customize data to quickly surface the information you need. https://www.vigilent.com/who-we-serve/by-facility/data-centers/. For example, the setpoint tab for data centers allows users to configure desired rack inlet temperature. The green color indication such as "Good" describes the current temperature is between low and high setpoints.

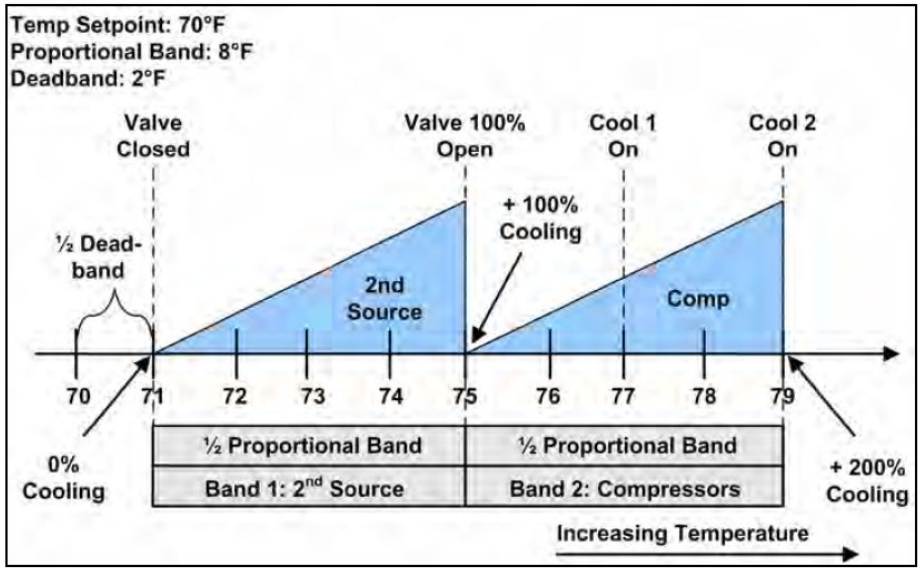
Claim Language	Exemplary Evidence of Infringement by Digital Realty
	The Set Points Tab for Data Centers, Telcos, and Colocation Facilities The Set Points Tab is where you can configure the desired rack inlet temperatures for your facility. Dashboard | Set Points | Maps | Equipment | Trends | Live | Reports | Advisories Assets AHUs CRU-02 CRU-03 CRU-04 CRU-05 CRU-06 CRU-07 CRU-08 CRU-09 CRU-11 CRU-12 CRU-13 CRU-16 Racks AA-39

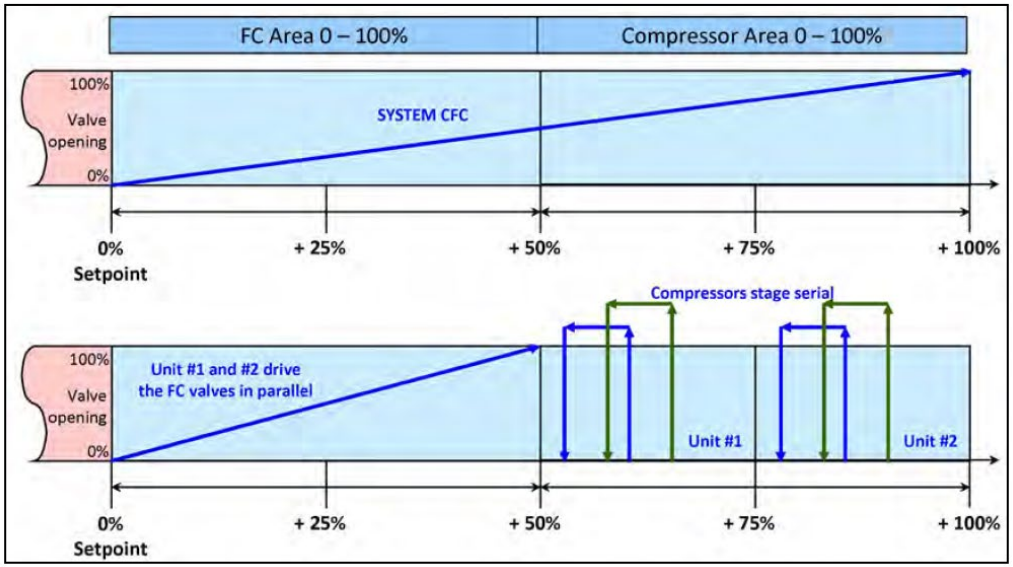
Equipment	Top ↓	Bottom	ΔT	High Lim...	Low Lim...	ΔHT	ΔHB
D-7	84.8°F	80.4°F	4.4°F Δ	80.6°F	64.4°F	-4.2°F Δ	0.2°F Δ
BN-62	80.6°F	75.6°F	4.9°F Δ	80.6°F	64.4°F	0.0°F Δ	5.0°F Δ
BN-57	77.0°F	72.9°F	4.1°F Δ	80.6°F	64.4°F	3.6°F Δ	7.7°F Δ
BG-63	76.5°F	72.1°F	4.4°F Δ	80.6°F	64.4°F	4.1°F Δ	8.5°F Δ
BJ-60	76.2°F	71.5°F	4.7°F Δ	80.6°F	64.4°F	4.4°F Δ	9.1°F Δ
BN-54	75.5°F	71.2°F	4.2°F Δ	80.6°F	64.4°F	5.1°F Δ	9.4°F Δ
J-57	74.6°F	70.7°F	3.9°F Δ	80.6°F	64.4°F	6.0°F Δ	9.9°F Δ
I-54	74.5°F	70.4°F	4.0°F Δ	80.6°F	64.4°F	6.1°F Δ	10.2°F Δ
BG-59	73.8°F	69.5°F	4.2°F Δ	80.6°F	64.4°F	6.8°F Δ	11.1°F Δ
F-45	73.7°F	69.7°F	4.0°F Δ	80.6°F	64.4°F	6.9°F Δ	10.9°F Δ
BJ-57	73.7°F	69.4°F	4.3°F Δ	80.6°F	64.4°F	6.9°F Δ	11.2°F Δ
H-51	73.6°F	69.3°F	4.3°F Δ	80.6°F	64.4°F	7.0°F Δ	11.3°F Δ
L-54	72.1°F	68.0°F	4.2°F Δ	80.6°F	64.4°F	8.5°F Δ	12.6°F Δ
BJ-54	71.7°F	67.3°F	4.4°F Δ	80.6°F	64.4°F	8.9°F Δ	13.3°F Δ
BG-55	71.4°F	66.6°F	4.8°F Δ	80.6°F	64.4°F	9.2°F Δ	14.0°F Δ

Claim Language	Exemplary Evidence of Infringement by Digital Realty
	Legend Set Points Good Cold Hot Watch N/A Limit Disabled General Updated Cell • **Good** (current temperature is between the low and high set points) - Green • **Cold** (current temperature is below the low limit) - Blue • **Hot** (current temperature is above the guard band range above the high set point. A red value in this column indicates a serious hot spot that should be addressed) - Red • **Watch** (current temperature is above the set point, but not yet high enough to trigger a control event) - Yellow • **N/A** (sensors not applicable for the set points) - Brown Dashboard | Set Points | Maps | Equipment | Trends | Live | Reports | Advisories Equipment | Zone | High Limit | Low Limit | ΔH | ΔL | Auto High | Auto? | Auto Low | Auto? 3_12_Open_Area | 75.5°F | 76.0°F | 70.0°F | 1.3°F Δ | 2.7°F Δ | 76.7°F | ✓ | 72.7°F | ✓ Phone_Room | 75.3°F | 76.0°F | 70.0°F | 2.4°F Δ | 1.6°F Δ | 77.6°F | ✓ | 73.6°F | ✓ 3_11_Open_Area | 74.4°F | 80.6°F | 64.4°F | 6.2°F Δ | 10.0°F Δ | 76.0°F | | 72.0°F | 3_9_Conference_313 | 73.6°F | 76.0°F | 70.0°F | 3.5°F Δ | 2.2°F Δ | 77.1°F | ✓ | 71.4°F | ✓ M-8_Office | 73.6°F | 100.0°F | 50.0°F | 26.4°F Δ | 23.6°F Δ | 75.5°F | | 71.5°F | Eng 2 | 73.0°F | 76.0°F | 70.0°F | 3.9°F Δ | 0.1°F Δ | 76.9°F | ✓ | 72.9°F | ✓ 3_15_Open_Area | 73.0°F | 76.0°F | 70.0°F | 3.3°F Δ | 0.7°F Δ | 76.2°F | ✓ | 72.2°F | ✓ 3_8_Conference_312 | 73.0°F | 76.0°F | 70.0°F | 4.4°F Δ | 5.1°F Δ | 77.4°F | ✓ | 67.8°F | ✓ B_11_FA_Room | 73.0°F | 76.0°F | 70.0°F | 3.6°F Δ | 0.4°F Δ | 76.5°F | ✓ | 72.5°F | ✓ [illegible] | 72.8°F | 76.0°F | 70.0°F | 3.0°F Δ | 1.0°F Δ | 75.9°F | ✓ | 71.9°F | ✓ Legend Set Points Good Cold Hot Watch N/A Limit Disabled General Updated Cell https://fccid.io/ANATEL/01612-15-08292/MANUAL/16006226-67DD-49FB-8873-2E15C3330211/PDF, pp. 15, 16, 17, p. 105 ("High Temperature (also known as Guard Mode) –

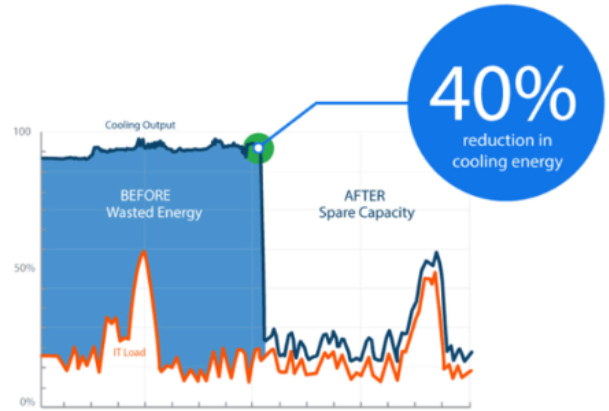
Claim Language	Exemplary Evidence of Infringement by Digital Realty
	If there is a rise in rack inlet temperatures, the Vigilent system responds by turning on more cooling equipment quickly. Full cooling will be provided until temperatures fall back within their configured ranges.”)  https://www.vigilent.com/the-vigilent-system-explained/, at 1:28. 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.

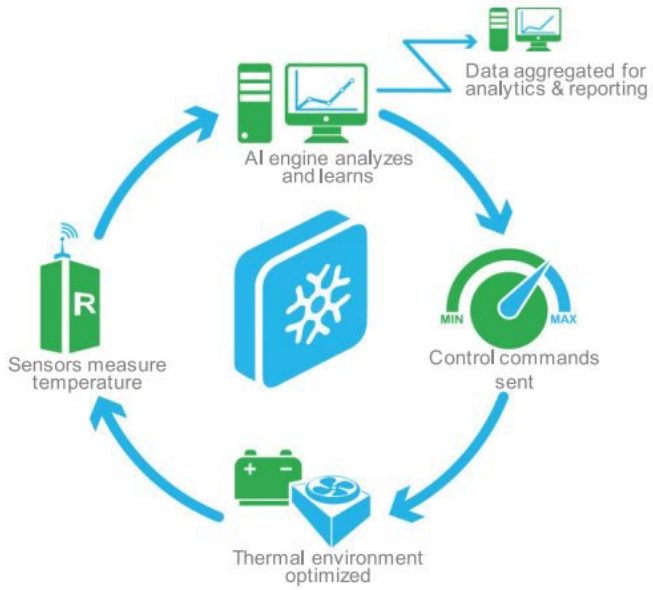
Claim Language	Exemplary Evidence of Infringement by Digital Realty
	Reports Benchmark report: Verifies energy and cost savings, as well as greenhouse gas reductions, achieved through the use of dynamic cooling management. Temperature compliance report: Identifies if rack temperatures have complied with 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.
[1d] manipulating controllable partition to vary supply of cooling fluid to zone in response to sensed temperature being outside predetermined temperature range.	The Accused Products manipulate controllable partitions to vary supply of cooling fluid to zone in response to sensed temperature being outside predetermined temperature range, regardless of which cooling technology is used (Liebert, Vigilent, 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 Digital Realty
	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 Digital Realty
	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, Vigilent's cooling system can automatically eliminate hot spots in its data centers 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 Digital Realty
	AT A GLANCE Cooling becomes a managed resource that reacts to real-time data, which reduces the chances of downtime. **Automated hot spot reduction** The system can automatically removes 95% (or more) of hot spots and diagnoses how to treat the remaining problems through facility adjustments. **Instant results** From the moment the system goes live, the energy savings and carbon emissions reductions are immediate. **Cost savings** The system finds the perfect balance between delivering the right amount of cooling and the lowest possible energy expenditure. **Constantly adapting** The AI engine constantly changes cooling when it detects new equipment and varying IT loads. **Analytics** Our system turns mountains of current and historic data into focused, actionable information. **Risk mitigation** System failsafes help avoid costly outages.

Claim Language	Exemplary Evidence of Infringement by Digital Realty
	VIGILENT CONTINUOUSLY MATCHES COOLING OUTPUT TO HEAT LOAD Optimized airflow eliminates hot spots. Vigilent continuously optimizes the airflow in your facility, delivering improved reliability and availability. The system automatically finds and eliminates hot spots, while its comprehensive reports and tools facilitate easier operations management. Our system delivers the right amount of cooling exactly where it's needed. This typically results in up to a 40% reduction in carbon emissions and your cooling energy bill. We achieve that with sophisticated AI-based technology that learns your environment and adapts to change.  https://www.vigilent.com/who-we-serve/by-facility/data-centers/. 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 Digital Realty
	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 Digital Realty
	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 Digital Realty
	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. 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.

<table>
<tr><th>Claim Language</th><th>Exemplary Evidence of Infringement by Digital Realty</th></tr>
<tr><td></td><td>

- 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.

</td></tr>
<tr><td>[2pre] The method according to claim 1, further comprising:</td><td>The Accused Products infringe claim 1. See supra.</td></tr>
<tr><td>[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</td><td>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, Vigilent, Schneider, or others).

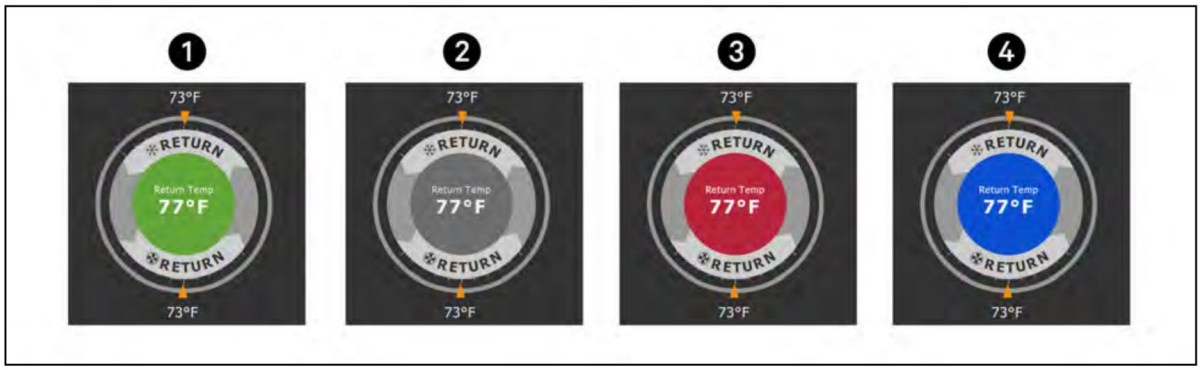
For example, Digital Realty uses the Liebert iCOM system which can identify if the rack temperature is below or equal to the predetermined minimum set point value temperature. The Liebert iCOM system defines the minimum temperature.</td></tr>
</table>

Claim Language	Exemplary Evidence of Infringement by Digital Realty

S105	Temperature User Low Limit	41 - 104 ℉ 5.0 - 40.0 ℃	41 ℉ 5.0 ℃	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.
	Temperature User High Limit	41 - 104 ℉ 5.0 - 40.0 ℃	104 ℉ 40.0 ℃	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.

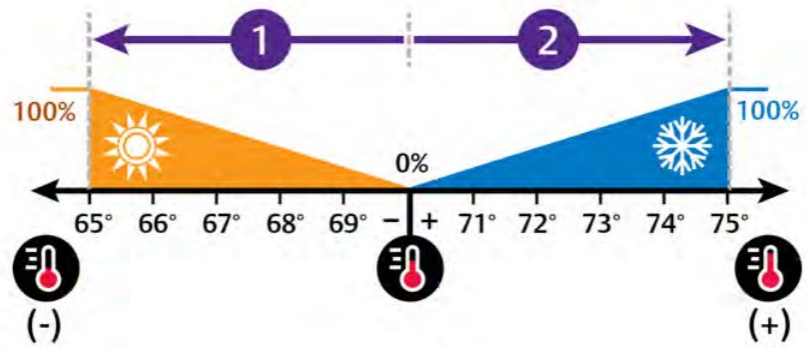
Figure 1.3 Dial Background Colors



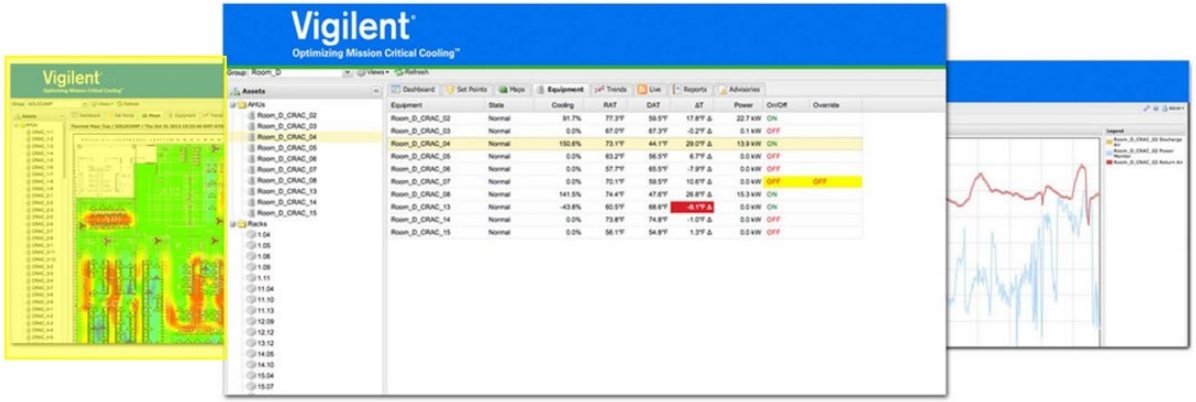
Item	Description
1	Sensor reading is within threshold limits..
2	Unit is powered off.
3	Sensor reading is above threshold limit or the unit is in an alarm condition.
4	Sensor reading is below threshold limit.

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

Claim Language	Exemplary Evidence of Infringement by Digital Realty
	The Liebert iCOM system uses temperature control sensors to cool the racks. **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 Digital Realty
	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** 

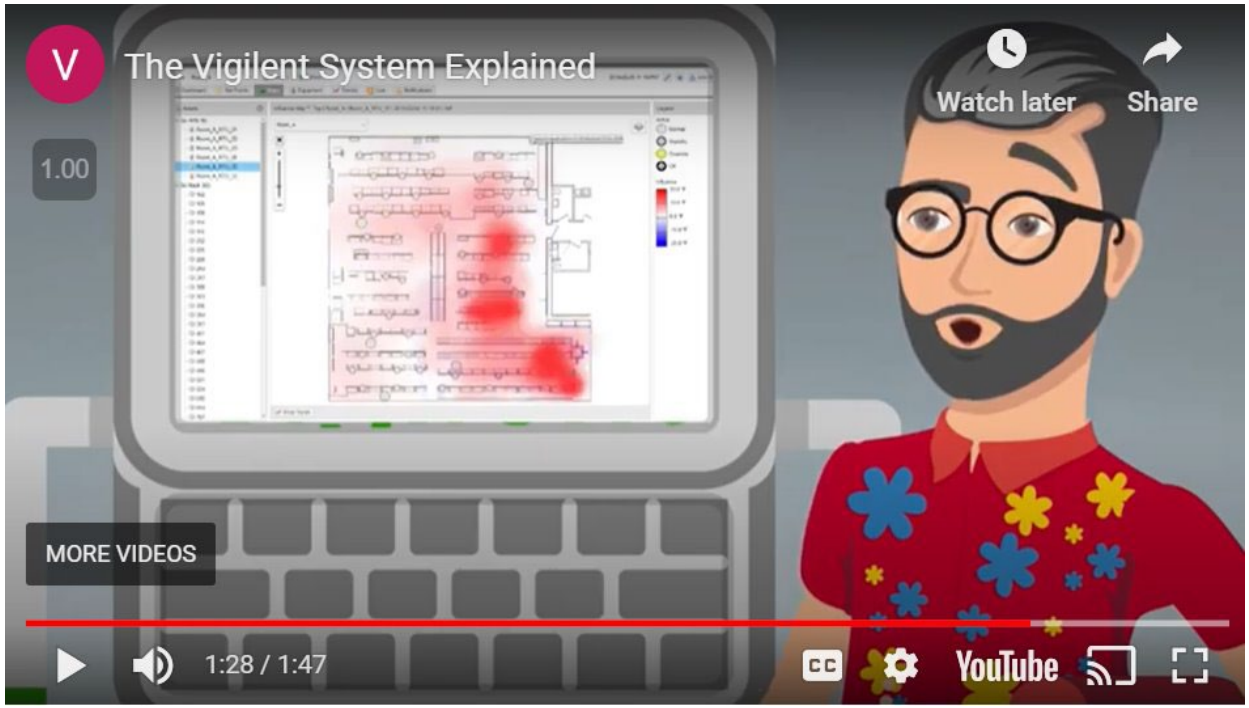
Claim Language	Exemplary Evidence of Infringement by Digital Realty
	https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 27. The amount of cooling/heating is adjusted based on length of time temperature has deviated, and amount of deviation from setpoint. **Temperature 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, Vigilent's Optimizing Mission Critical Cooling is used to check the temperatures. For example, users can quickly view real time temperature data of one specific rack sensor.

Claim Language	Exemplary Evidence of Infringement by Digital Realty
	 **EVERYDAY TOOLS** With our intuitive, at-a-glance system interface, checking the current status of your facility is always at your fingertips. **CHECK TEMPERATURES** With a few clicks, you can quickly dive down from a broad facility view into the real-time temperature data of one specific rack sensor. **EASY TRENDING** Customize data to quickly surface the information you need. https://www.vigilent.com/who-we-serve/by-facility/data-centers/. For example, the setpoint tab for data centers allows to configure desired rack inlet temperature. The blue color indication such as "Cold" describes the current temperature is below the low limit.

Claim Language	Exemplary Evidence of Infringement by Digital Realty
	The Set Points Tab for Data Centers, Telcos, and Colocation Facilities The Set Points Tab is where you can configure the desired rack inlet temperatures for your facility. Dashboard | Set Points | Maps | Equipment | Trends | Live | Reports | Advisories Assets AHUs CRU-02 CRU-03 CRU-04 CRU-05 CRU-06 CRU-07 CRU-08 CRU-09 CRU-11 CRU-12 CRU-13 CRU-16 Racks AA-39

Equipment	Top	Bottom	ΔT	High Lim...	Low Lim...	ΔHT	ΔHB
D-7	84.8°F	80.4°F	4.4°F Δ	80.6°F	64.4°F	-4.2°F Δ	0.2°F Δ
BN-62	80.6°F	75.6°F	4.9°F Δ	80.6°F	64.4°F	0.0°F Δ	5.0°F Δ
BN-57	77.0°F	72.9°F	4.1°F Δ	80.6°F	64.4°F	3.6°F Δ	7.7°F Δ
BG-63	76.5°F	72.1°F	4.4°F Δ	80.6°F	64.4°F	4.1°F Δ	8.5°F Δ
BJ-60	76.2°F	71.5°F	4.7°F Δ	80.6°F	64.4°F	4.4°F Δ	9.1°F Δ
BN-54	75.5°F	71.2°F	4.2°F Δ	80.6°F	64.4°F	5.1°F Δ	9.4°F Δ
J-57	74.6°F	70.7°F	3.9°F Δ	80.6°F	64.4°F	6.0°F Δ	9.9°F Δ
I-54	74.5°F	70.4°F	4.0°F Δ	80.6°F	64.4°F	6.1°F Δ	10.2°F Δ
BG-59	73.8°F	69.5°F	4.2°F Δ	80.6°F	64.4°F	6.8°F Δ	11.1°F Δ
F-45	73.7°F	69.7°F	4.0°F Δ	80.6°F	64.4°F	6.9°F Δ	10.9°F Δ
BJ-57	73.7°F	69.4°F	4.3°F Δ	80.6°F	64.4°F	6.9°F Δ	11.2°F Δ
H-51	73.6°F	69.3°F	4.3°F Δ	80.6°F	64.4°F	7.0°F Δ	11.3°F Δ
L-54	72.1°F	68.0°F	4.2°F Δ	80.6°F	64.4°F	8.5°F Δ	12.6°F Δ
BJ-54	71.7°F	67.3°F	4.4°F Δ	80.6°F	64.4°F	8.9°F Δ	13.3°F Δ
BG-55	71.4°F	66.6°F	4.8°F Δ	80.6°F	64.4°F	9.2°F Δ	14.0°F Δ

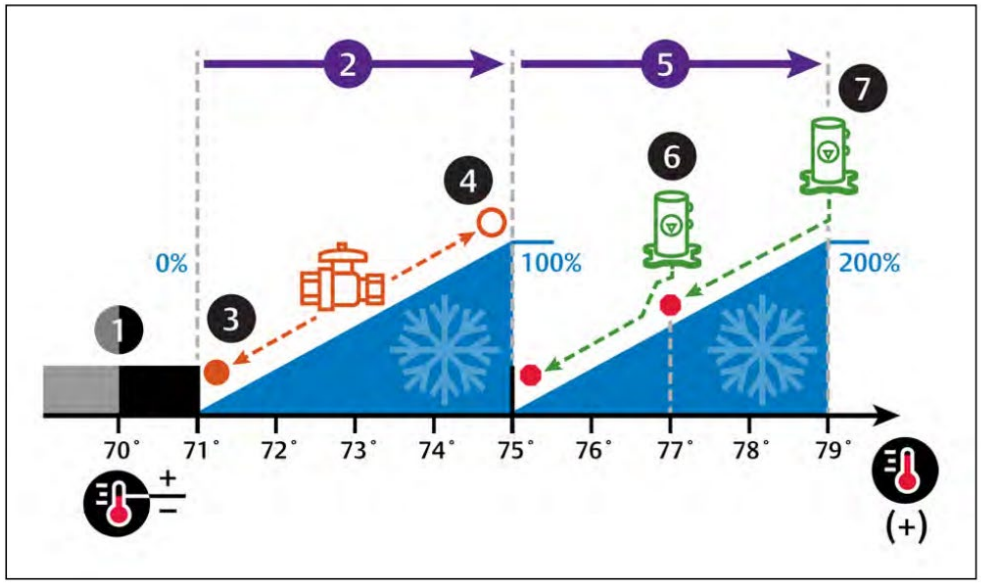
Claim Language	Exemplary Evidence of Infringement by Digital Realty
	Legend Set Points Good Cold Hot Watch N/A Limit Disabled General Updated Cell • **Good** (current temperature is between the low and high set points) - Green • **Cold** (current temperature is below the low limit) - Blue • **Hot** (current temperature is above the guard band range above the high set point. A red value in this column indicates a serious hot spot that should be addressed) - Red • **Watch** (current temperature is above the set point, but not yet high enough to trigger a control event) - Yellow • **N/A** (sensors not applicable for the set points) - Brown Dashboard | Set Points | Maps | Equipment | Trends | Live | Reports | Advisories Equipment | Zone | High Limit | Low Limit | ΔH | ΔL | Auto High | Auto? | Auto Low | Auto? 3_12_Open_Area | 75.5°F | 76.0°F | 70.0°F | 1.3°F Δ | 2.7°F Δ | 76.7°F | ✓ | 72.7°F | ✓ Phone_Room | 75.3°F | 76.0°F | 70.0°F | 2.4°F Δ | 1.6°F Δ | 77.6°F | ✓ | 73.6°F | ✓ 3_11_Open_Area | 74.4°F | 80.6°F | 64.4°F | 6.2°F Δ | 10.0°F Δ | 76.0°F | | 72.0°F | 3_9_Conference_313 | 73.6°F | 76.0°F | 70.0°F | 3.5°F Δ | 2.2°F Δ | 77.1°F | ✓ | 71.4°F | ✓ M-8_Office | 73.6°F | 100.0°F | 50.0°F | 26.4°F Δ | 23.6°F Δ | 75.5°F | | 71.5°F | Eng 2 | 73.0°F | 76.0°F | 70.0°F | 3.9°F Δ | 0.1°F Δ | 76.9°F | ✓ | 72.9°F | ✓ 3_15_Open_Area | 73.0°F | 76.0°F | 70.0°F | 3.3°F Δ | 0.7°F Δ | 76.2°F | ✓ | 72.2°F | ✓ 3_8_Conference_312 | 73.0°F | 76.0°F | 70.0°F | 4.4°F Δ | 5.1°F Δ | 77.4°F | ✓ | 67.8°F | ✓ B_11_FA_Room | 73.0°F | 76.0°F | 70.0°F | 3.6°F Δ | 0.4°F Δ | 76.5°F | ✓ | 72.5°F | ✓ [illegible] | 72.8°F | 76.0°F | 70.0°F | 3.0°F Δ | 1.0°F Δ | 75.9°F | ✓ | 71.9°F | ✓ Legend Set Points Good Cold Hot Watch N/A Limit Disabled General Updated Cell https://fccid.io/ANATEL/01612-15-08292/MANUAL/16006226-67DD-49FB-8873-2E15C3330211/PDF, pp.12, 14, 15, 16, 17, 56, 142 (cold spots).

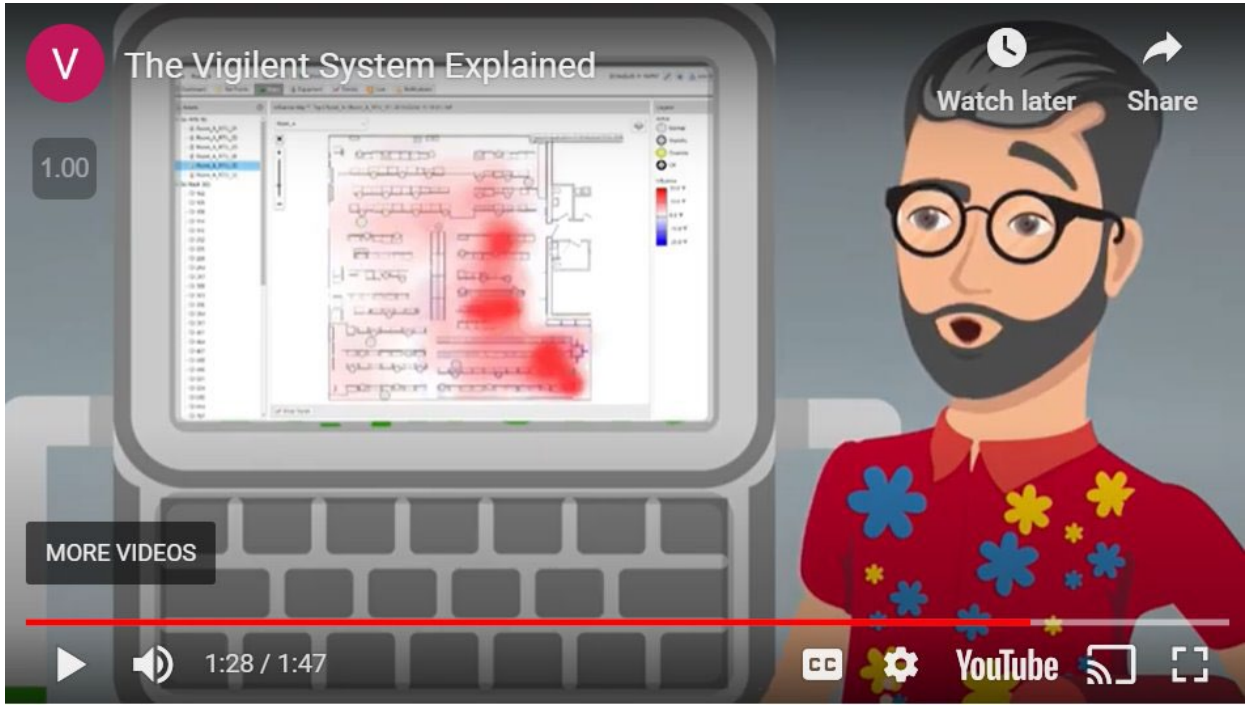
Claim Language	Exemplary Evidence of Infringement by Digital Realty
	 https://www.vigilent.com/the-vigilent-system-explained/, at 0:30-32; 0:50-56; 1:10-1:15, 1:28. As another example, Schneider's Cooling Optimize system is used to determine whether the sensed temperature is within a predetermined temperature range, for example, by using the temperature compliance report identifying if rack temperatures have compiled with required setpoints.

<table>
<tr><th>Claim Language</th><th>Exemplary Evidence of Infringement by Digital Realty</th></tr>
<tr><td></td><td>
<table>
<tr><th>Reports</th><th></th></tr>
<tr><td>Benchmark report</td><td>Verifies energy and cost savings, as well as greenhouse gas reductions, achieved through the use of dynamic cooling management.</td></tr>
<tr><td>Temperature compliance report</td><td>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.</td></tr>
</table>
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.
</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, Vigilent, 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>
</td></tr>
</table>

Claim Language	Exemplary Evidence of Infringement by Digital Realty
	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 Digital Realty
	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 Digital Realty
	As another example, in Vigilent's Optimizing Mission Critical Cooling, the cooling fluid is decreased in response to a temperature falling below the predetermined temperature.  https://www.vigilent.com/the-vigilent-system-explained/, at 0:30-32; 0:50-56; 1:10-1:15, 1:28. https://fccid.io/ANATEL/01612-15-08292/MANUAL/16006226-67DD-49FB-8873-2E15C3330211/PDF, pp. 12, 14, 15, 16, 17, 56, 142 (cold spots).

Claim Language	Exemplary Evidence of Infringement by Digital Realty
	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 Digital Realty
	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. 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.

<table>
<tr><th>Claim Language</th><th>Exemplary Evidence of Infringement by Digital Realty</th></tr>
<tr><td></td><td>

- 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.

</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, Vigilent, 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 Digital Realty
	Table 4.4 Events Specific to Liebert EconoPhase™ Event: PB1 IN PRES SENS FAIL — Description: Inlet refrigerant pressure sensor failure. Pump shut down. • Event is reset when condition clears. Event: PB1 IN TEMP SENS FAIL — Description: Inlet refrigerant temperature sensor failure. Pump shut down. • Event is reset when condition clears. Event: PB1 OUT PRES SEN FAIL — Description: 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. As another example, Vigilent systems measure pressure and can use that as feedback for controlling cooling fluid supply.

Claim Language	Exemplary Evidence of Infringement by Digital Realty
	https://fccid.io/ANATEL/01612-15-08292/MANUAL/16006226-67DD-49FB-8873-2E15C3330211/PDF, p. 107 (local pressure feedback and static pressure setpoint), p. 113 (sensors monitor pressure data).
[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, Vigilent, Schneider, or others). For example, Liebert's iCOM system senses the cooling fluid pressure. **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 Digital Realty
	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. 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. As another example, Vigilent systems measure pressure and can determine whether it is within a predetermined range.

Claim Language	Exemplary Evidence of Infringement by Digital Realty
	https://fccid.io/ANATEL/01612-15-08292/MANUAL/16006226-67DD-49FB-8873-2E15C3330211/PDF, p. 66 (Pressure control Min and Max), p. 107 (local pressure feedback and static pressure setpoint), p. 113 (sensors monitor pressure data).
[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, Vigilent, 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. **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 Digital Realty
	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.

Claim Language	Exemplary Evidence of Infringement by Digital Realty
	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. **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. 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.

<table>
<tr><th>Claim Language</th><th>Exemplary Evidence of Infringement by Digital Realty</th></tr>
<tr><td></td><td>As another example, Vigilent systems can vary an output of said cooling device in response to said sensed pressure falling outside of said predetermined pressure range

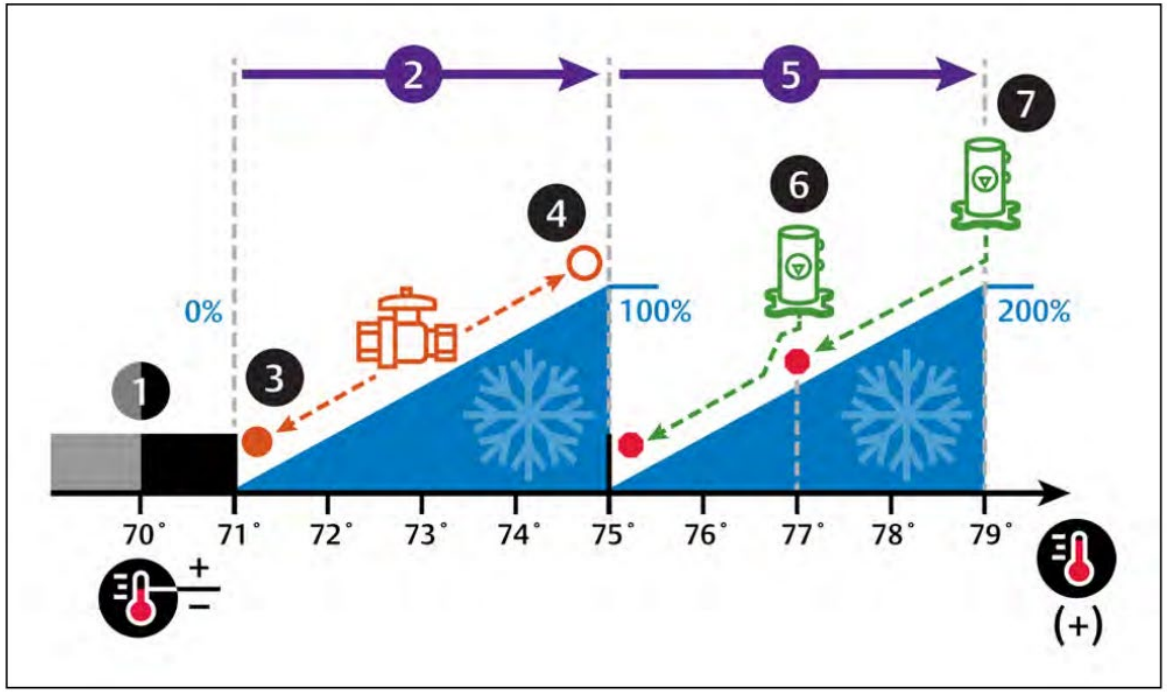
https://fccid.io/ANATEL/01612-15-08292/MANUAL/16006226-67DD-49FB-8873-2E15C3330211/PDF, p. 66 (Pressure control Min and Max), p. 107 (local pressure feedback and static pressure setpoint), p. 113 (sensors monitor pressure data).</td></tr>
<tr><td>[4] The method according to claim 2, further comprising: 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, Vigilent, 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>
</table>

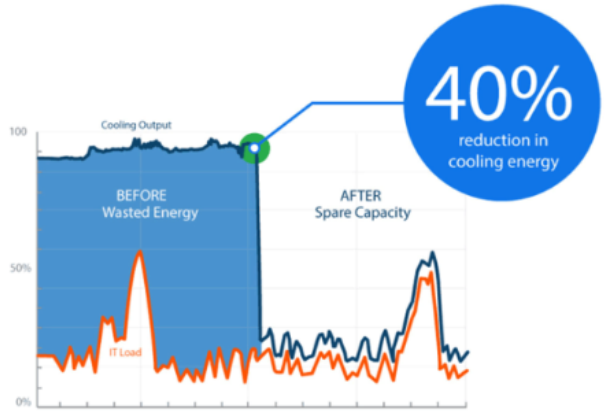
Claim Language	Exemplary Evidence of Infringement by Digital Realty
	https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 203. **7.1.4 Temperature Control with a Fluid Economizer** When an economizer is installed, the cooling requirement (determined by the temperature 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.

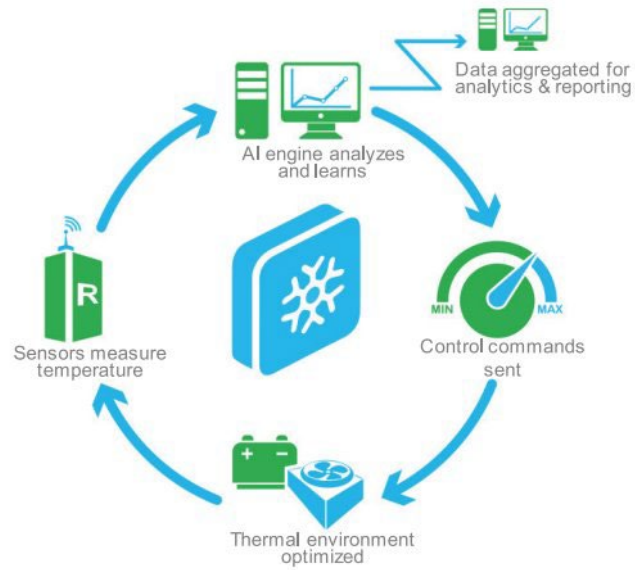
Figure 7.1 Temperature Control—Fluid Economizer and Example Two Step Compressor Capacity



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 Digital Realty
	https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 112. As another example, Vigilent's cooling system is used to automatically eliminate hot spots in its data centers. Thus, Vigilent 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. AT A GLANCE Cooling becomes a managed resource that reacts to real-time data, which reduces the chances of downtime. **Automated hot spot reduction** The system can automatically removes 95% (or more) of hot spots and diagnoses how to treat the remaining problems through facility adjustments. **Instant results** From the moment the system goes live, the energy savings and carbon emissions reductions are immediate. **Cost savings** The system finds the perfect balance between delivering the right amount of cooling and the lowest possible energy expenditure. **Constantly adapting** The AI engine constantly changes cooling when it detects new equipment and varying IT loads. **Analytics** Our system turns mountains of current and historic data into focused, actionable information. **Risk mitigation** System failsafes help avoid costly outages.

Claim Language	Exemplary Evidence of Infringement by Digital Realty
	VIGILENT CONTINUOUSLY MATCHES COOLING OUTPUT TO HEAT LOAD Optimized airflow eliminates hot spots. Vigilent continuously optimizes the airflow in your facility, delivering improved reliability and availability. The system automatically finds and eliminates hot spots, while its comprehensive reports and tools facilitate easier operations management. Our system delivers the right amount of cooling exactly where it's needed. This typically results in up to a 40% reduction in carbon emissions and your cooling energy bill. We achieve that with sophisticated AI-based technology that learns your environment and adapts to change.  https://www.vigilent.com/who-we-serve/by-facility/data-centers/. 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.

Claim Language	Exemplary Evidence of Infringement by Digital Realty
	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 Digital Realty
	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 Digital Realty
	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. 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.

<table>
<tr><th>Claim Language</th><th>Exemplary Evidence of Infringement by Digital Realty</th></tr>
<tr><td></td><td>

- 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.

</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, Vigilent, 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 Digital Realty
	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.

Claim Language	Exemplary Evidence of Infringement by Digital Realty
	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. **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. 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. 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 Digital Realty
	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 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 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*. https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 65.

<table>
<tr><th>Claim Language</th><th>Exemplary Evidence of Infringement by Digital Realty</th></tr>
<tr><td></td><td>As another example, Vigilent systems can vary said cooling device output including determining whether said measured pressure falls below or equals a predetermined minimum set point pressure.

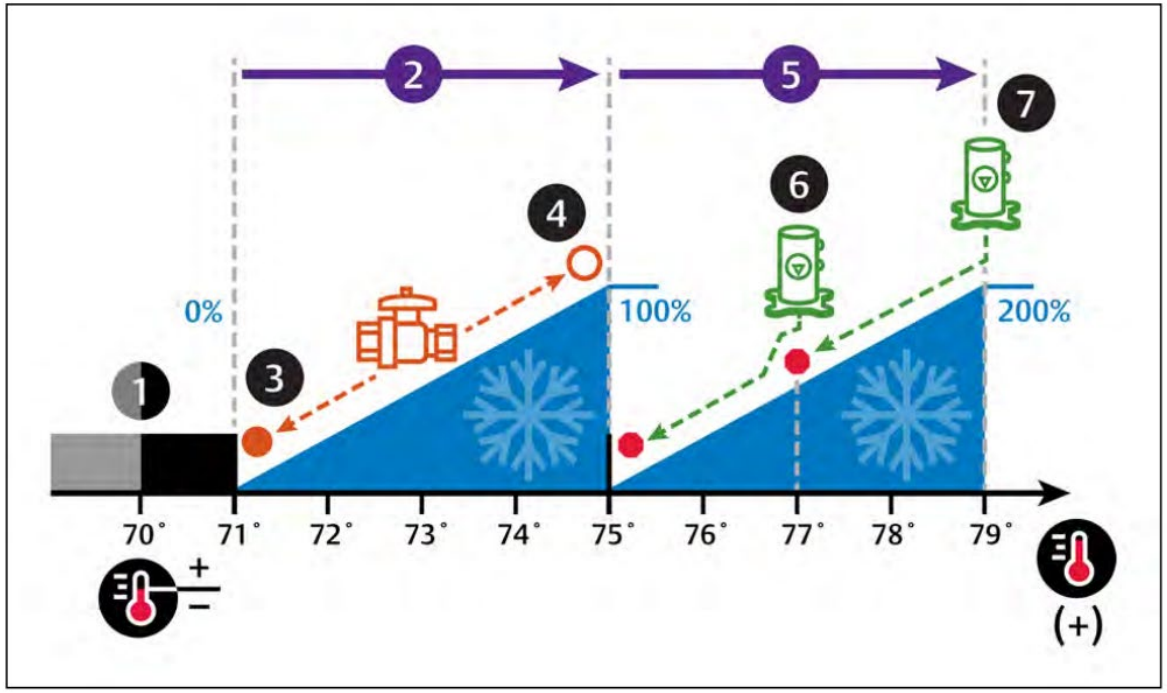
https://fccid.io/ANATEL/01612-15-08292/MANUAL/16006226-67DD-49FB-8873-2E15C3330211/PDF, p. 66 (Pressure control Min and Max), p. 107 (local pressure feedback and static pressure setpoint), p. 113 (sensors monitor pressure data).</td></tr>
<tr><td>[6] The method according to claim 4, further comprising: 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.</td><td>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, Vigilent, 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.
<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>
</table>

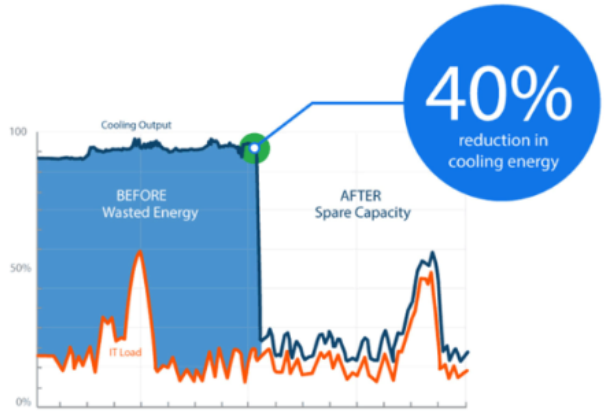
Claim Language	Exemplary Evidence of Infringement by Digital Realty
	https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 203. **7.1.4 Temperature Control with a Fluid Economizer** When an economizer is installed, the cooling requirement (determined by the temperature 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.

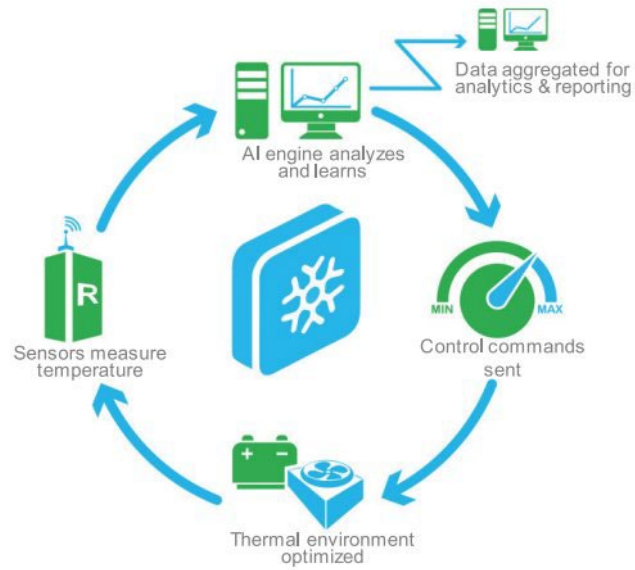
Figure 7.1 Temperature Control—Fluid Economizer and Example Two Step Compressor Capacity



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 Digital Realty
	https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 112. As another example, Vigilent's cooling system is used to automatically eliminate hot spots in its data centers. Thus, Vigilent 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. AT A GLANCE Cooling becomes a managed resource that reacts to real-time data, which reduces the chances of downtime. **Automated hot spot reduction** The system can automatically removes 95% (or more) of hot spots and diagnoses how to treat the remaining problems through facility adjustments. **Instant results** From the moment the system goes live, the energy savings and carbon emissions reductions are immediate. **Cost savings** The system finds the perfect balance between delivering the right amount of cooling and the lowest possible energy expenditure. **Constantly adapting** The AI engine constantly changes cooling when it detects new equipment and varying IT loads. **Analytics** Our system turns mountains of current and historic data into focused, actionable information. **Risk mitigation** System failsafes help avoid costly outages.

Claim Language	Exemplary Evidence of Infringement by Digital Realty
	VIGILENT CONTINUOUSLY MATCHES COOLING OUTPUT TO HEAT LOAD Optimized airflow eliminates hot spots. Vigilent continuously optimizes the airflow in your facility, delivering improved reliability and availability. The system automatically finds and eliminates hot spots, while its comprehensive reports and tools facilitate easier operations management. Our system delivers the right amount of cooling exactly where it's needed. This typically results in up to a 40% reduction in carbon emissions and your cooling energy bill. We achieve that with sophisticated AI-based technology that learns your environment and adapts to change.  https://www.vigilent.com/who-we-serve/by-facility/data-centers/. 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 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 Digital Realty
	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 Digital Realty
	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 Digital Realty
	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. 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.

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- 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
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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.

</td></tr>
<tr><td>[9pre] The method according to claim 4, further comprising:</td><td>The Accused Products infringe claim 4. See supra.</td></tr>
<tr><td>[9a] receiving temperatures from a movable device configured to detect at least one environmental condition at various locations of said data center;</td><td>

The Accused Products receive temperatures from a movable device configured to detect at least one environmental condition at various locations of said data center.

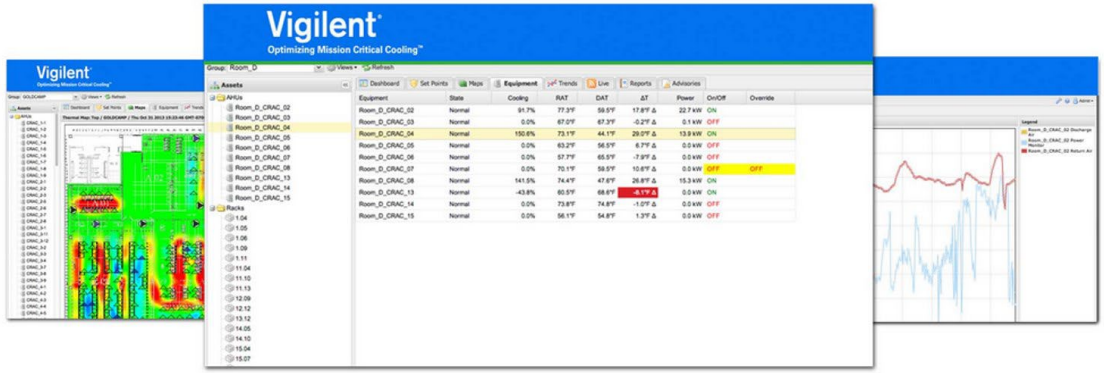
For example, remote sensors are installed in the monitored racks which provides temperature data to the Liebert iCOM system.

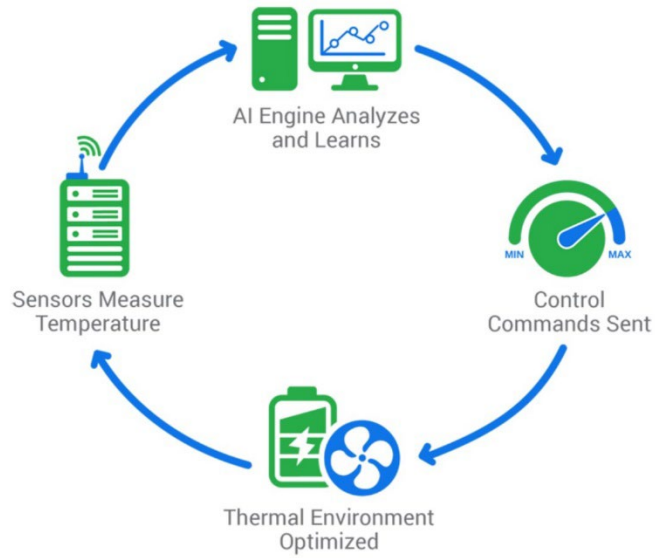
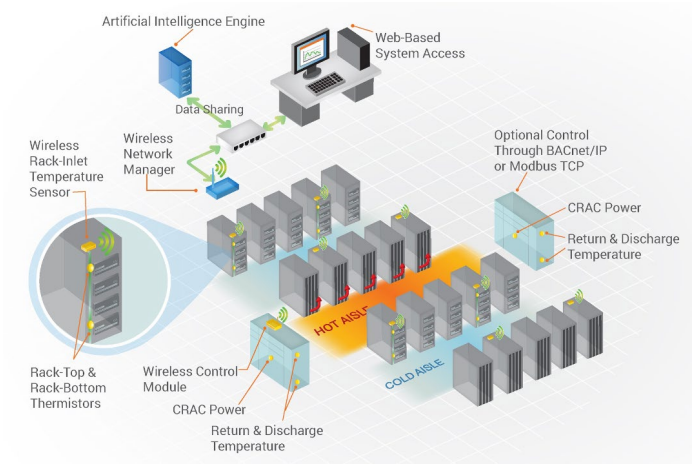
13.2 Installing Wired Remote Sensors

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.

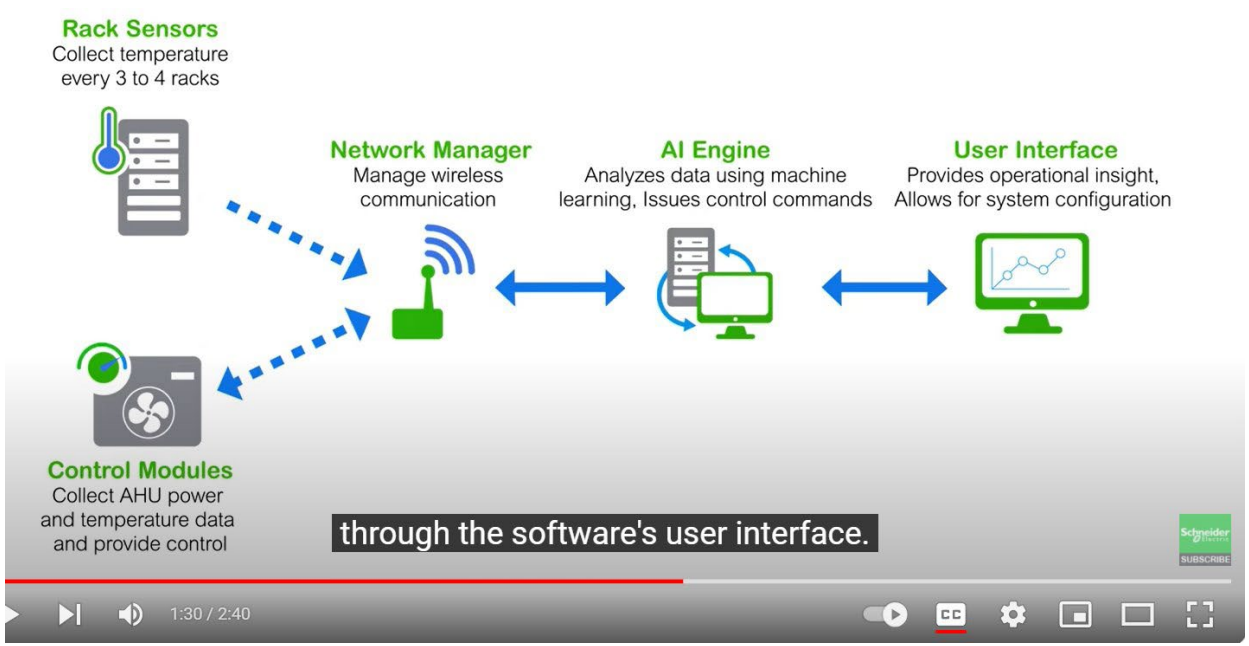
</td></tr>
</table>

Claim Language	Exemplary Evidence of Infringement by Digital Realty
	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, Vigilent's Optimizing Mission Critical Cooling is used to sense temperatures. For example, users can quickly view real time temperature data of one specific rack sensor.

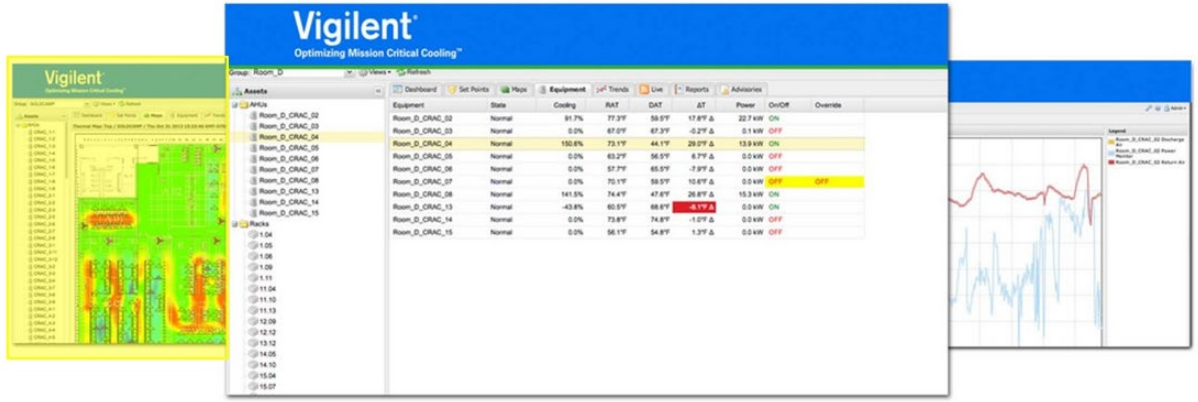
Claim Language	Exemplary Evidence of Infringement by Digital Realty
	 **EVERYDAY TOOLS** With our intuitive, at-a-glance system interface, checking the current status of your facility is always at your fingertips. **CHECK TEMPERATURES** With a few clicks, you can quickly dive down from a broad facility view into the real-time temperature data of one specific rack sensor. **EASY TRENDING** Customize data to quickly surface the information you need.

Claim Language	Exemplary Evidence of Infringement by Digital Realty
	 https://www.vigilent.com/products-and-services/dynamic-control/. 

Claim Language	Exemplary Evidence of Infringement by Digital Realty
	https://www.vigilent.com/products-and-services/dynamic-control/ Wireless sensors are typically deployed every third rack to measure the inlet air temperature every minute. The sensors have two thermistors, one to capture temperature at rack bottom, the other at rack top. https://www.vigilent.com/technology/system-architecture/ *See also*: https://fccid.io/ANATEL/01612-15-08292/MANUAL/16006226-67DD-49FB-8873-2E15C3330211/PDF at Section 4 (e.g., p. 102 "Using wireless temperature sensors, the system collects granular information about the thermal environment of your facility. Temperature sensors are placed every three to four racks measuring temperature at the top and bottom of the rack. Thermal data is communicated via a wireless mesh network back to the control software."). 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. **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.

Claim Language	Exemplary Evidence of Infringement by Digital Realty
	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, p. 1, 2.  https://www.youtube.com/watch?v=yFMS-88wXn8, at 1:30.

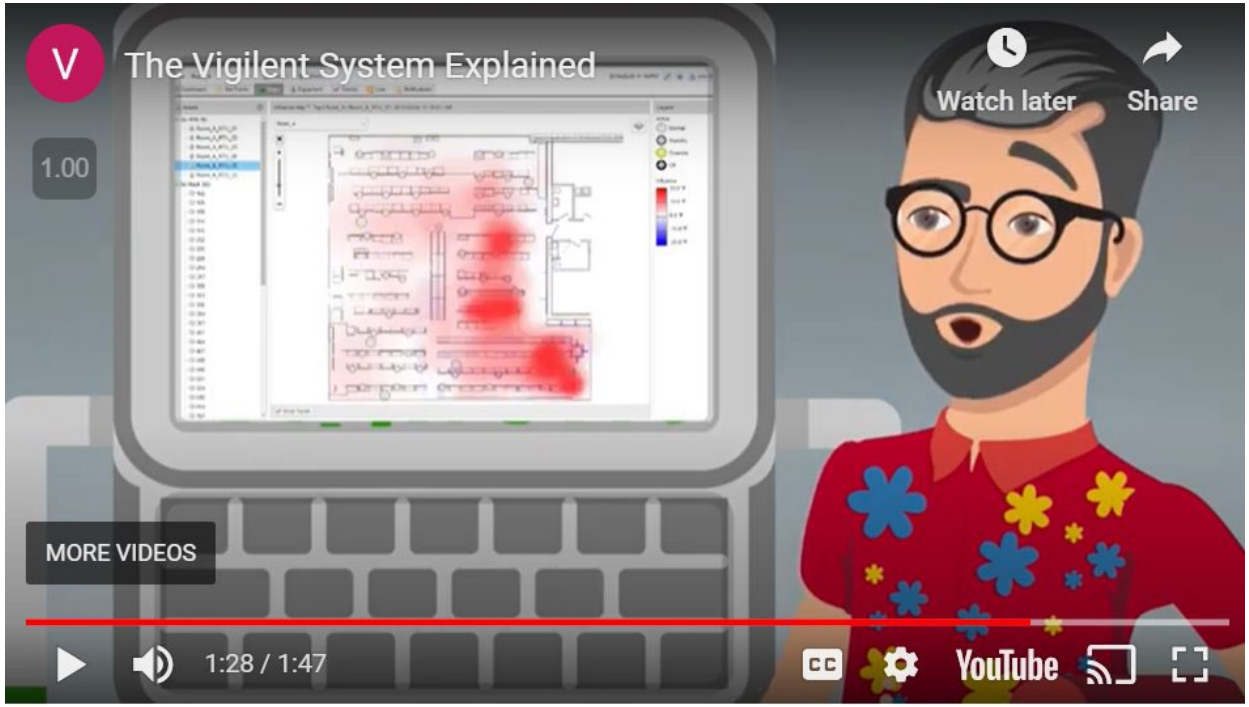
Claim Language	Exemplary Evidence of Infringement by Digital Realty
[9b] determining whether at least one of said sensed temperatures and received temperatures are within a predetermined temperature range; and	The Accused Products determine whether at least one of said sensed temperatures and received temperatures are within a predetermined temperature range, regardless of which cooling technology is used (Liebert, Vigilent, 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. **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, Vigilent's Optimizing Mission Critical Cooling is used to check the temperatures within its data centers to determine whether the sensed temperature is within a predefined temperature range.

Claim Language	Exemplary Evidence of Infringement by Digital Realty
	 **EVERYDAY TOOLS** With our intuitive, at-a-glance system interface, checking the current status of your facility is always at your fingertips. **CHECK TEMPERATURES** With a few clicks, you can quickly dive down from a broad facility view into the real-time temperature data of one specific rack sensor. **EASY TRENDING** Customize data to quickly surface the information you need. https://www.vigilent.com/who-we-serve/by-facility/data-centers/. For example, the setpoint tab for data centers allows users to configure desired rack inlet temperature. The green color indication such as "Good" describes the current temperature is between low and high setpoints.

Claim Language	Exemplary Evidence of Infringement by Digital Realty
	The Set Points Tab for Data Centers, Telcos, and Colocation Facilities The Set Points Tab is where you can configure the desired rack inlet temperatures for your facility. Dashboard | Set Points | Maps | Equipment | Trends | Live | Reports | Advisories Assets AHUs CRU-02 CRU-03 CRU-04 CRU-05 CRU-06 CRU-07 CRU-08 CRU-09 CRU-11 CRU-12 CRU-13 CRU-16 Racks AA-39

Equipment	Top ↓	Bottom	ΔT	High Lim...	Low Lim...	ΔHT	ΔHB
D-7	84.8°F	80.4°F	4.4°F Δ	80.6°F	64.4°F	-4.2°F Δ	0.2°F Δ
BN-62	80.6°F	75.6°F	4.9°F Δ	80.6°F	64.4°F	0.0°F Δ	5.0°F Δ
BN-57	77.0°F	72.9°F	4.1°F Δ	80.6°F	64.4°F	3.6°F Δ	7.7°F Δ
BG-63	76.5°F	72.1°F	4.4°F Δ	80.6°F	64.4°F	4.1°F Δ	8.5°F Δ
BJ-60	76.2°F	71.5°F	4.7°F Δ	80.6°F	64.4°F	4.4°F Δ	9.1°F Δ
BN-54	75.5°F	71.2°F	4.2°F Δ	80.6°F	64.4°F	5.1°F Δ	9.4°F Δ
J-57	74.6°F	70.7°F	3.9°F Δ	80.6°F	64.4°F	6.0°F Δ	9.9°F Δ
I-54	74.5°F	70.4°F	4.0°F Δ	80.6°F	64.4°F	6.1°F Δ	10.2°F Δ
BG-59	73.8°F	69.5°F	4.2°F Δ	80.6°F	64.4°F	6.8°F Δ	11.1°F Δ
F-45	73.7°F	69.7°F	4.0°F Δ	80.6°F	64.4°F	6.9°F Δ	10.9°F Δ
BJ-57	73.7°F	69.4°F	4.3°F Δ	80.6°F	64.4°F	6.9°F Δ	11.2°F Δ
H-51	73.6°F	69.3°F	4.3°F Δ	80.6°F	64.4°F	7.0°F Δ	11.3°F Δ
L-54	72.1°F	68.0°F	4.2°F Δ	80.6°F	64.4°F	8.5°F Δ	12.6°F Δ
BJ-54	71.7°F	67.3°F	4.4°F Δ	80.6°F	64.4°F	8.9°F Δ	13.3°F Δ
BG-55	71.4°F	66.6°F	4.8°F Δ	80.6°F	64.4°F	9.2°F Δ	14.0°F Δ

Claim Language	Exemplary Evidence of Infringement by Digital Realty
	Legend Set Points Good Cold Hot Watch N/A Limit Disabled General Updated Cell • **Good** (current temperature is between the low and high set points) - Green • **Cold** (current temperature is below the low limit) - Blue • **Hot** (current temperature is above the guard band range above the high set point. A red value in this column indicates a serious hot spot that should be addressed) - Red • **Watch** (current temperature is above the set point, but not yet high enough to trigger a control event) - Yellow • **N/A** (sensors not applicable for the set points) - Brown Dashboard | Set Points | Maps | Equipment | Trends | Live | Reports | Advisories Equipment | Zone | High Limit | Low Limit | ΔH | ΔL | Auto High | Auto? | Auto Low | Auto? 3_12_Open_Area | 75.5°F | 76.0°F | 70.0°F | 1.3°F Δ | 2.7°F Δ | 76.7°F | ✓ | 72.7°F | ✓ Phone_Room | 75.3°F | 76.0°F | 70.0°F | 2.4°F Δ | 1.6°F Δ | 77.6°F | ✓ | 73.6°F | ✓ 3_11_Open_Area | 74.4°F | 80.6°F | 64.4°F | 6.2°F Δ | 10.0°F Δ | 76.0°F | | 72.0°F | 3_9_Conference_313 | 73.6°F | 76.0°F | 70.0°F | 3.5°F Δ | 2.2°F Δ | 77.1°F | ✓ | 71.4°F | ✓ M-8_Office | 73.6°F | 100.0°F | 50.0°F | 26.4°F Δ | 23.6°F Δ | 75.5°F | | 71.5°F | Eng 2 | 73.0°F | 76.0°F | 70.0°F | 3.9°F Δ | 0.1°F Δ | 76.9°F | ✓ | 72.9°F | ✓ 3_15_Open_Area | 73.0°F | 76.0°F | 70.0°F | 3.3°F Δ | 0.7°F Δ | 76.2°F | ✓ | 72.2°F | ✓ 3_8_Conference_312 | 73.0°F | 76.0°F | 70.0°F | 4.4°F Δ | 5.1°F Δ | 77.4°F | ✓ | 67.8°F | ✓ B_11_FA_Room | 73.0°F | 76.0°F | 70.0°F | 3.6°F Δ | 0.4°F Δ | 76.5°F | ✓ | 72.5°F | ✓ [illegible] | 72.8°F | 76.0°F | 70.0°F | 3.0°F Δ | 1.0°F Δ | 75.9°F | ✓ | 71.9°F | ✓ Legend Set Points Good Cold Hot Watch N/A Limit Disabled General Updated Cell https://fccid.io/ANATEL/01612-15-08292/MANUAL/16006226-67DD-49FB-8873-2E15C3330211/PDF, pp. 15, 16, 17, p. 105 ("High Temperature (also known as Guard Mode) –

Claim Language	Exemplary Evidence of Infringement by Digital Realty
	If there is a rise in rack inlet temperatures, the Vigilent system responds by turning on more cooling equipment quickly. Full cooling will be provided until temperatures fall back within their configured ranges.”)  https://www.vigilent.com/the-vigilent-system-explained/, at 1:28. 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.

<table>
<tr><th>Claim Language</th><th>Exemplary Evidence of Infringement by Digital Realty</th></tr>
<tr><td></td><td>
<table>
<tr><th>Reports</th><th></th></tr>
<tr><td>Benchmark report</td><td>Verifies energy and cost savings, as well as greenhouse gas reductions, achieved through the use of dynamic cooling management.</td></tr>
<tr><td>Temperature compliance report</td><td>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.</td></tr>
</table>
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.
</td></tr>
<tr><td>[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.</td><td>
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, Vigilent, Schneider, or others).

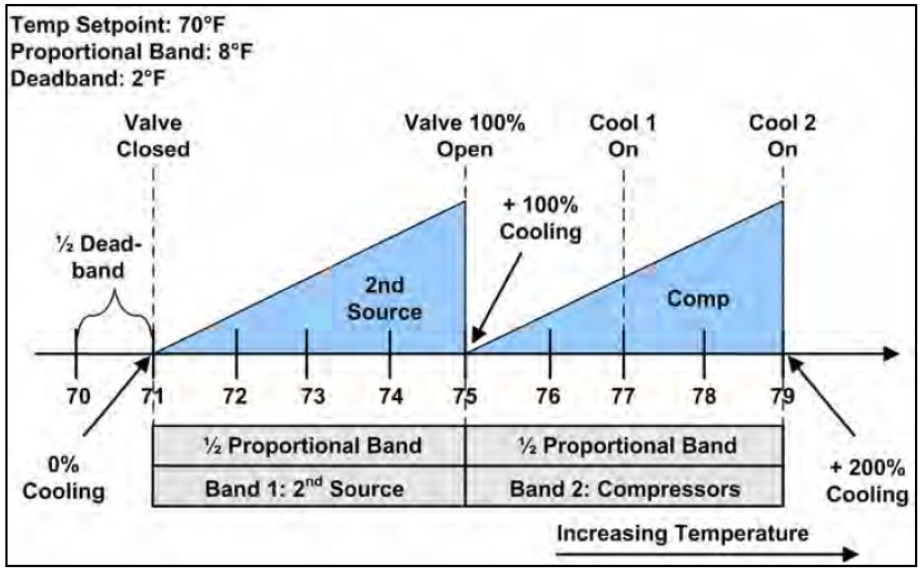
For example, Liebert's iCOM system is used to manipulate the motorized ball valve (controllable partition) from 0% to 100% flow of chilled water/glycol.

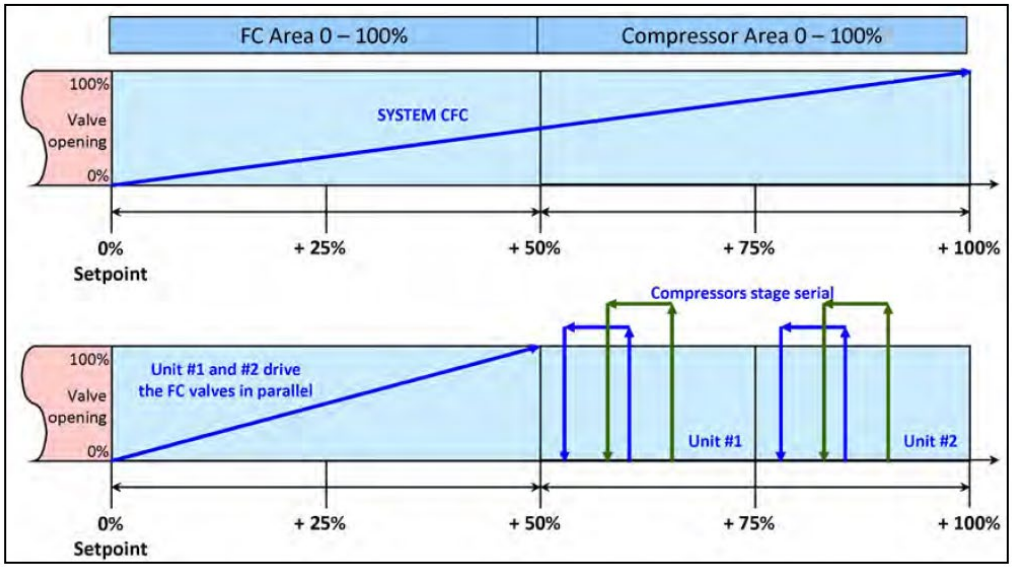
7.1.4 Temperature Control with a Fluid Economizer

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.

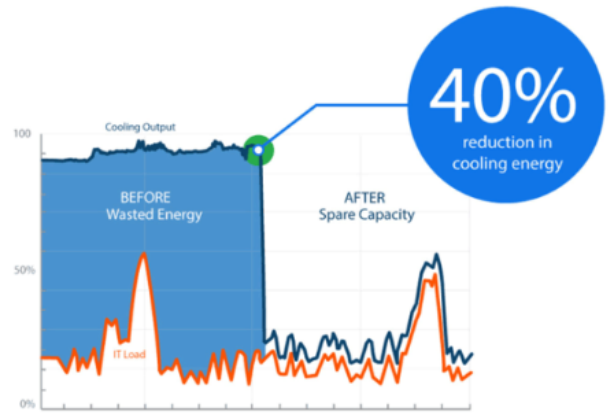
The fluid economizer employs a motorized ball valve that controls the flow of chilled water/glycol to provide a cooling capacity from 0% to 100%.

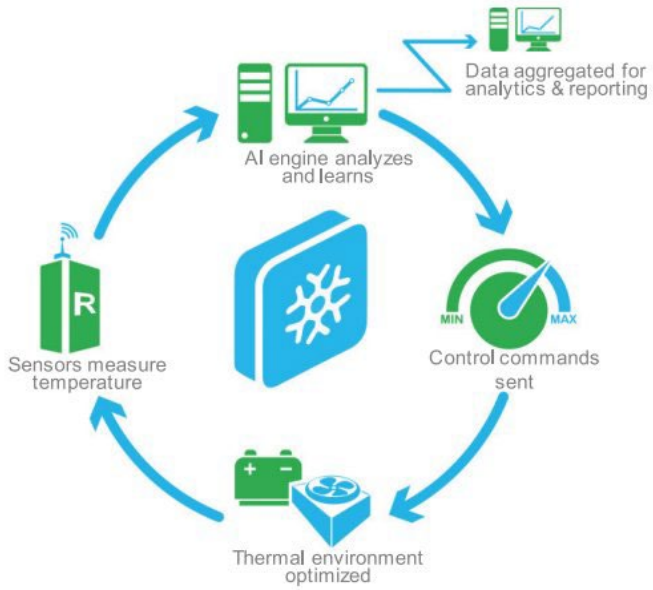
https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 110.
</td></tr>
</table>

Claim Language	Exemplary Evidence of Infringement by Digital Realty
	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 Digital Realty
	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, Vigilent's cooling system can automatically eliminate hot spots in its data centers 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 Digital Realty
	AT A GLANCE Cooling becomes a managed resource that reacts to real-time data, which reduces the chances of downtime. **Automated hot spot reduction** The system can automatically removes 95% (or more) of hot spots and diagnoses how to treat the remaining problems through facility adjustments. **Instant results** From the moment the system goes live, the energy savings and carbon emissions reductions are immediate. **Cost savings** The system finds the perfect balance between delivering the right amount of cooling and the lowest possible energy expenditure. **Constantly adapting** The AI engine constantly changes cooling when it detects new equipment and varying IT loads. **Analytics** Our system turns mountains of current and historic data into focused, actionable information. **Risk mitigation** System failsafes help avoid costly outages.

Claim Language	Exemplary Evidence of Infringement by Digital Realty
	VIGILENT CONTINUOUSLY MATCHES COOLING OUTPUT TO HEAT LOAD Optimized airflow eliminates hot spots. Vigilent continuously optimizes the airflow in your facility, delivering improved reliability and availability. The system automatically finds and eliminates hot spots, while its comprehensive reports and tools facilitate easier operations management. Our system delivers the right amount of cooling exactly where it's needed. This typically results in up to a 40% reduction in carbon emissions and your cooling energy bill. We achieve that with sophisticated AI-based technology that learns your environment and adapts to change.  https://www.vigilent.com/who-we-serve/by-facility/data-centers/. 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 Digital Realty
	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 Digital Realty
	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 Digital Realty
	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. 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.

<table>
<tr><th>Claim Language</th><th>Exemplary Evidence of Infringement by Digital Realty</th></tr>
<tr><td></td><td>

- 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.

</td></tr>
<tr><td>[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

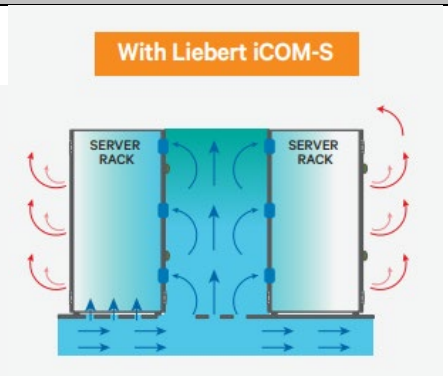
manipulating said cooling device in response to said numerical modeling.</td><td>The Accused Products infringe claim 4. See supra.

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, Vigilent, Schneider, or others).

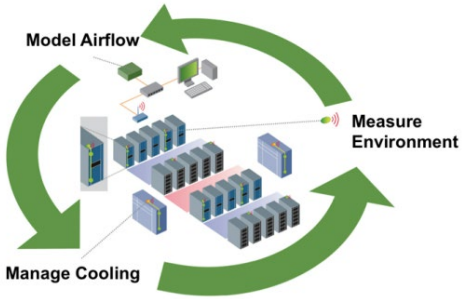
For example, Liebert iCOM optimizes thermal system performance to optimize capacity across the datacenter. It provides adaptive control for hot spot reduction. The data center environment is monitored through sensor and operation of multiple cooling units is controlled accordingly.</td></tr>
</table>

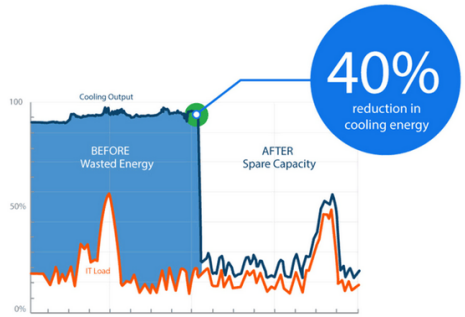
Claim Language	Exemplary Evidence of Infringement by Digital Realty
	At the cooling unit level, the Liebert iCOM unit control provides the highest protection available and optimal performance. • Monitors 380 unit and component points to eliminate single points of failure • Self-healing features avoid 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 Digital Realty
	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 Digital Realty
	 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. 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.

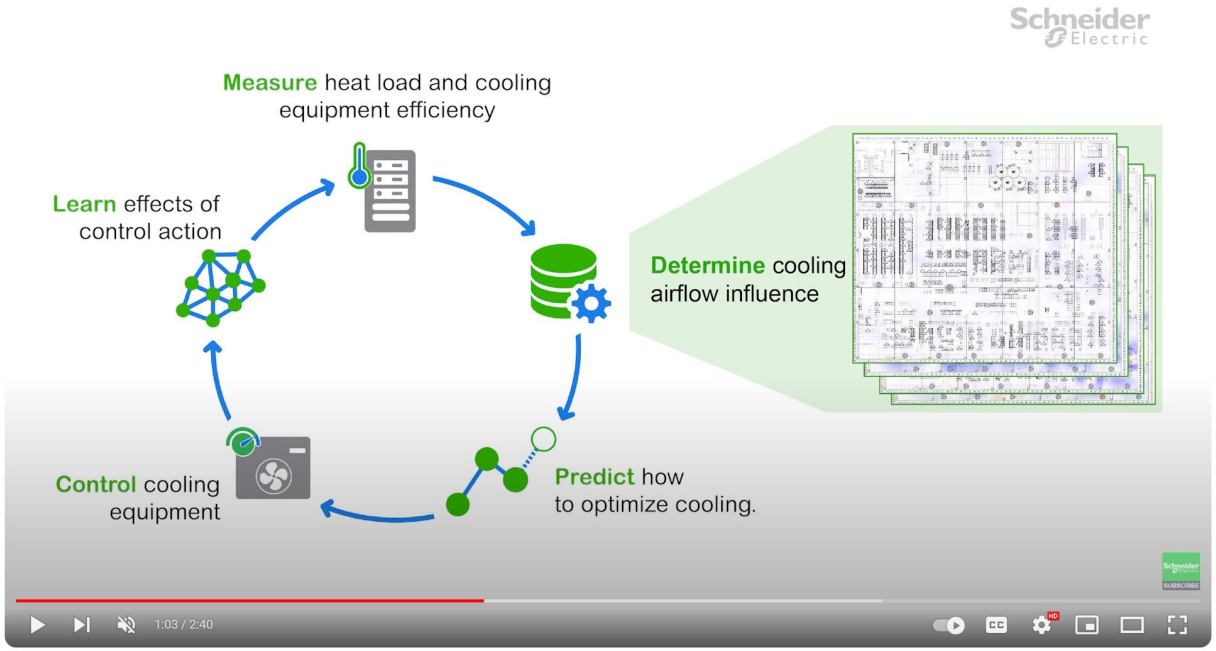
Claim Language	Exemplary Evidence of Infringement by Digital Realty
	13.2 Installing Wired Remote Sensors Up to 10 remote sensor modules, installed in the monitored racks and connected to the cooling unit, provide control and reference input to iCOM and building-management systems. Using remote, rack sensors combats cooling problems related to recirculation air, uneven rack loading, and air distribution. iCOM Manual at p. 180. As another example, Vigilent's cooling optimization tool facilitates viewing rack level details that give the ability to instantly identify hotspots, diagnose, test, and resolve issues. The tool optimizes airflow and eliminates hotspots. The AI control software uses the real-time thermal data to learn and build an airflow model of the environment. The model is used to determine the optimal cooling output. Vigilent® Optimizing Mission Critical Cooling® WHO WE SERVE DIGITAL REALTY "We found that upgrading fans and adding fan speed controls in our data centers allowed us to cool them more effectively and efficiently. In addition, the facility's electrical energy usage was reduced, as was the average and peak electric power demand, resulting in a more energy efficient and sustainable data center environment." – Jim Smith, Chief Technology Officer, Digital Realty https://www.vigilent.com/digital-realty/

Claim Language	Exemplary Evidence of Infringement by Digital Realty
	 Using wireless temperature sensors, the system collects granular information about the thermal environment of your facility. Temperature sensors are placed every three to four racks measuring temperature at the top and bottom of the rack. Thermal data is communicated via a wireless mesh network back to the control software. The AI control software uses the real-time thermal data to learn and build an airflow model of the environment. The model is used to determine the optimal cooling output to ensure that the thermal environment is maintained with a minimal amount of energy. The software then makes active control decisions for each cooling unit. The **Data Center Control** section provides more detail on the different control capabilities of the system. The real-time temperature monitoring provides thermal feedback https://fccid.io/ANATEL/01612-15-08292/MANUAL/16006226-67DD-49FB-8873-2E15C3330211/PDF, p. 106. TAKE YOUR DATA CENTER'S PULSE Vigilent transforms real-time data into actionable information, delivering insight that protects uptime. Quickly drill down from an overhead facility view to rack-level details that give you the ability to instantly identify hot spots, diagnose, test, and resolve issues. Change the environment, and you'll see the positive impact of your improvements on the screen. https://www.vigilent.com/products-and-services/monitoring/

Claim Language	Exemplary Evidence of Infringement by Digital Realty
	The system automatically finds and eliminates hotspots while its comprehensive reports and tools facilitate easier operations management. VIGILENT CONTINUOUSLY MATCHES COOLING OUTPUT TO HEAT LOAD Optimized airflow eliminates hot spots. Vigilent continuously optimizes the airflow in your facility, delivering improved reliability and availability. The system automatically finds and eliminates hot spots, while its comprehensive reports and tools facilitate easier operations management. Our system delivers the right amount of cooling exactly where it's needed. This typically results in up to a 40% reduction in carbon emissions and your cooling energy bill. We achieve that with sophisticated AI-based technology that learns your environment and adapts to change.  https://www.vigilent.com/who-we-serve/by-facility/data-centers/ The DCIM systems have the ability to use tools like computational fluid dynamics on the thermal side for making certain kinds of forecast.

Claim Language	Exemplary Evidence of Infringement by Digital Realty
	VIGILENT BRINGS ACTIVE COOLING CAPACITY PLANNING TO DCIM At-A-Glance Detail on Available and Stranded Capacity Simplifies Data Center IT Growth Planning Orlando, FL. (Oct. 1, 2013) – Vigilent®, a provider of dynamic cooling management™ systems, announced today that it is delivering a significant new enhancement to its system – active cooling capacity planning, which provides unparalleled insight into cooling conditions. Included as a module within the Vigilent DCIM Toolkit™, a new report provides facility managers with visual, granular, resource-level information, room by room or data center-wide, on available and stranded cooling capacity. This insight helps managers more quickly and accurately plan IT expansions. Introduced earlier this year, the DCIM Toolkit is a key component of the Vigilent Dynamic Cooling Management system. The DCIM Toolkit analyzes data continually collected on data center thermal and equipment performance, presenting facility managers with actionable information in digestible formats. The reports quickly surface key analytics to put control in the hands of site managers and allow them to quickly and effectively identify the location and severity of hot spots, CRAC performance, and before/after energy savings from infrastructure changes. https://www.vigilent.com/vigilent-brings-active-cooling-capacity-planning-to-dcim/

Claim Language	Exemplary Evidence of Infringement by Digital Realty
	DCIM company Vigilent also hopes to use machine learning to discover surprises within data centers, having embraced the technology more than eight years ago. The company uses machine learning to make predictions and then uses those predictive capabilities to "take actions automatically," Vigilent's founder and CTO, Dr Cliff Federspiel, told DCD. *"Some DCIM systems have the ability to use tools like computational fluid dynamics on the thermal side for making certain kinds of forecasts, but as far as I know, there isn't really a whole lot of data-oriented decision-making capabilities in DCIM systems, and in particular there aren't ones where the decision-making is automated."* https://www.vigilent.com/datacenterdynamics-the-machine-itself/ 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 Digital Realty
	 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.

Claim Language	Exemplary Evidence of Infringement by Digital Realty
	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. 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, Vigilent, 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.

Claim Language	Exemplary Evidence of Infringement by Digital Realty
	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*. 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 Digital Realty
	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.

Claim Language	Exemplary Evidence of Infringement by Digital Realty
	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. **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. 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.

Claim Language	Exemplary Evidence of Infringement by Digital Realty
	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. As another example, Vigilent systems can increase the output of said cooling device in response to said measured pressure falling below or equaling said predetermined minimum set point pressure *See* https://fccid.io/ANATEL/01612-15-08292/MANUAL/16006226-67DD-49FB-8873-2E15C3330211/PDF, p. 66 (Pressure control Min and Max), p. 107 (local pressure feedback and static pressure setpoint), p. 113 (sensors monitor pressure data).
[12] The method according to claim 5, further comprising: decreasing the output of said cooling device in response to said measured	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, Vigilent, Schneider, or others).

Claim Language	Exemplary Evidence of Infringement by Digital Realty
pressure exceeding said predetermined minimum set point pressure.	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. **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 Digital Realty
	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.

Claim Language	Exemplary Evidence of Infringement by Digital Realty
	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. **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. 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.

Claim Language	Exemplary Evidence of Infringement by Digital Realty
	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. As another example, Vigilent systems can decrease the output of said cooling device in response to said measured pressure exceeding said predetermined minimum set point pressure. *See* https://fccid.io/ANATEL/01612-15-08292/MANUAL/16006226-67DD-49FB-8873-2E15C3330211/PDF, p. 66 (Pressure control Min and Max), p. 107 (local pressure feedback and static pressure setpoint), p. 113 (sensors monitor pressure data).
[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	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, Vigilent, Schneider, or others).

<table>
<tr><th>Claim Language</th><th>Exemplary Evidence of Infringement by Digital Realty</th></tr>
<tr><td>said zone falling below said increase in cooling fluid supply to said zone.</td><td>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.

<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.

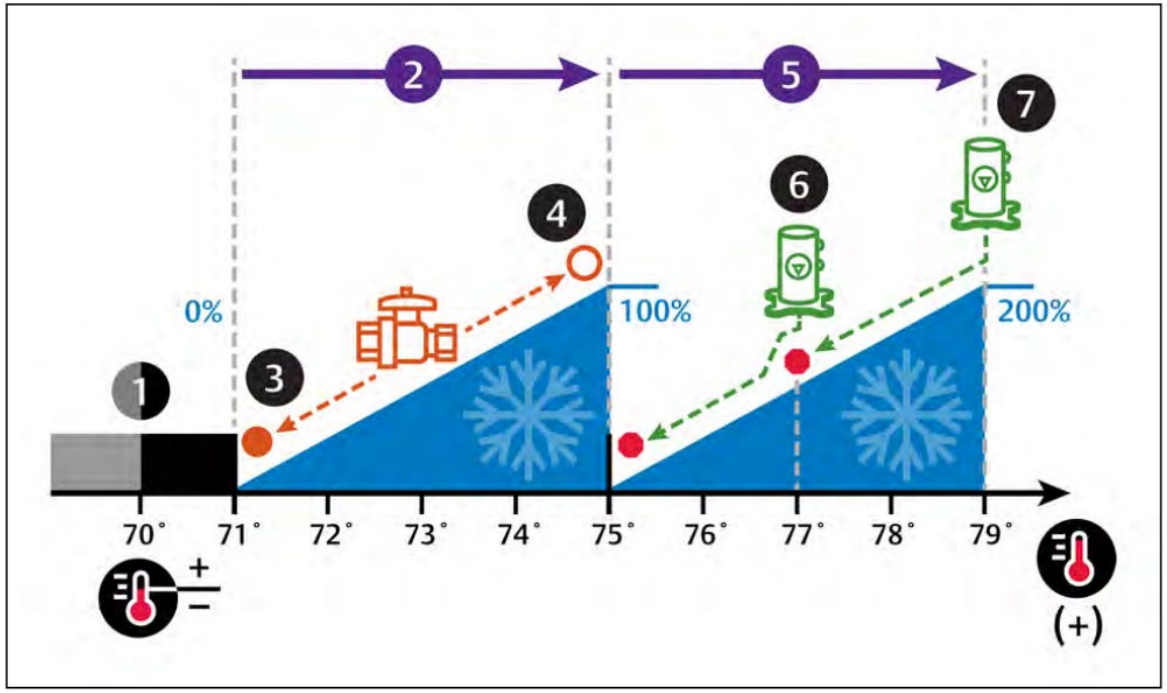
7.1.4 Temperature Control with a Fluid Economizer

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%.

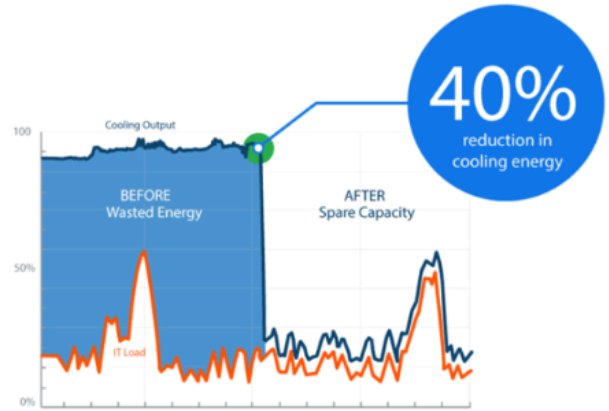
https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 110.</td></tr>
</table>

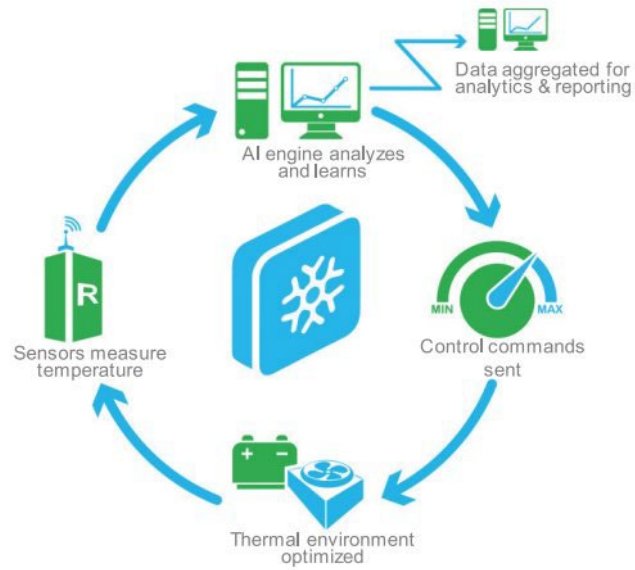
Figure 7.1 Temperature Control—Fluid Economizer and Example Two Step Compressor Capacity



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 Digital Realty
	https://www.vertiv.com/49b8b2/globalassets/shared/liebert-icom-user-manual_sl-31075.pdf, p. 112. As another example, Vigilent's cooling system is used to automatically eliminate hot spots in its data centers. Thus, Vigilent 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. AT A GLANCE Cooling becomes a managed resource that reacts to real-time data, which reduces the chances of downtime. **Automated hot spot reduction** The system can automatically removes 95% (or more) of hot spots and diagnoses how to treat the remaining problems through facility adjustments. **Instant results** From the moment the system goes live, the energy savings and carbon emissions reductions are immediate. **Cost savings** The system finds the perfect balance between delivering the right amount of cooling and the lowest possible energy expenditure. **Constantly adapting** The AI engine constantly changes cooling when it detects new equipment and varying IT loads. **Analytics** Our system turns mountains of current and historic data into focused, actionable information. **Risk mitigation** System failsafes help avoid costly outages.

Claim Language	Exemplary Evidence of Infringement by Digital Realty
	VIGILENT CONTINUOUSLY MATCHES COOLING OUTPUT TO HEAT LOAD Optimized airflow eliminates hot spots. Vigilent continuously optimizes the airflow in your facility, delivering improved reliability and availability. The system automatically finds and eliminates hot spots, while its comprehensive reports and tools facilitate easier operations management. Our system delivers the right amount of cooling exactly where it's needed. This typically results in up to a 40% reduction in carbon emissions and your cooling energy bill. We achieve that with sophisticated AI-based technology that learns your environment and adapts to change.  https://www.vigilent.com/who-we-serve/by-facility/data-centers/. 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.

Claim Language	Exemplary Evidence of Infringement by Digital Realty
	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 Digital Realty
	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 Digital Realty
	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. 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.

<table>
<tr><th>Claim Language</th><th>Exemplary Evidence of Infringement by Digital Realty</th></tr>
<tr><td></td><td>

- 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.

</td></tr>
<tr><td>[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 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.</td><td>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, regardless of which cooling technology is used (Liebert, Vigilent, Schneider, or others).

For example, Digital Realty provides the following information relating to its power draw.</td></tr>
</table>

Claim Language	Exemplary Evidence of Infringement by Digital Realty
	Technical Overview 1210 Integrity Drive **Building** • 2 Levels; 458,500 sq.ft. • Flood Zone: Outside 500 year flood plain • Seismic Rating: Zone 1 **Power** • Utility Power Capacity: 60,000 (kW) • UPS Power Capacity: 36,000 (kW) • UPS Redundancy: N+1 • Max Power Density: 158 (W/sq.ft.) • Generator Power Capacity: 48,000 (kW) https://go2.digitalrealty.com/rs/087-YZJ-646/images/DS_Digital_Realty_2308_DFW18_Property_Factsheet_EN.pdf?_ga=2.110958725.1070752906.1712034239-1539951261.1712034239, p. 3.

Claim Language	Exemplary Evidence of Infringement by Digital Realty
	 https://www.youtube.com/watch?v=uXia-8D0N-A, at 2:51. Digital Realty 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]):

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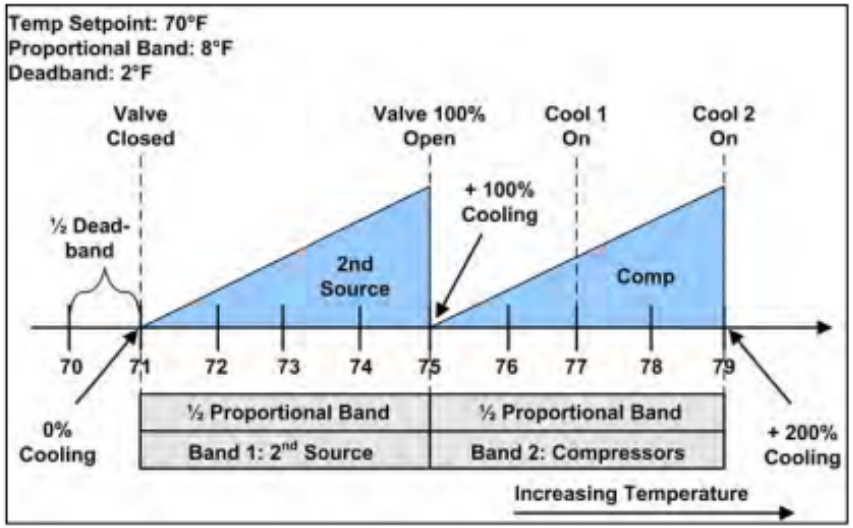
	Figure 3.17 Second Cooling Source and Two-Step Compressorized Cooling  **Minimum Chilled Water Temperature**—This feature allows the user to select a minimum chilled water temperature to prevent simultaneous operation of the chilled water (free cooling) and compressor(s) on units factory-programmed to 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, p. 76, 77.

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	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.

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	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.

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	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.

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	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.

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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. 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.

Claim Language	Exemplary Evidence of Infringement by Digital Realty
	• 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.