STULZ Solutions and Services

STULZ mission is to be the premier provider of energy efficient temperature and humidity control solutions for mission critical applications.
STULZ is a global provider of innovative data center cooling solutions and services.

**Cooling Technology Leader**

STULZ is the technology leader, providing cooling solutions and services for mission critical applications. This is accomplished through the design and manufacture of highly energy efficient temperature and humidity control equipment for commercial and industrial applications.

Energy efficiency is at the core of every STULZ product - including our HQ/Factory's 950 kW solar array.

**Pre-Engineered**

STULZ products are available in a variety of configurations and options based on our factory designed and tested components and modules. We can also provide a custom touch to adapt our products to meet your specific needs.

**Breadth and Depth**

With more than 20 years of expertise in controls, economizers, and mission critical solutions, STULZ offers the largest portfolio to fill any and all precision cooling needs.

**Designed and Manufactured in the U.S.A.**

While some products are merely assembled in America, STULZ is proud to research, design, manufacture, test and support our advanced cooling technologies in our Frederick, MD facility.

STULZ products meet the requirements of:

- Buy America Act

**STULZ can be found in most of the world’s leading data centers. We work closely with leading companies of all sizes to provide you with a complete data center cooling solution.**

<table>
<thead>
<tr>
<th>Consulting Engineers</th>
<th>Contractors</th>
<th>Owners / Users</th>
<th>Solutions Partners</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Most Extensive Cooling Line</td>
<td>• General &amp; Mechanical</td>
<td>• High Quality &amp; Reliability</td>
<td>• Specialized Partnerships with Rack, Containment, DCIM, and Cooling Tower Experts</td>
</tr>
<tr>
<td>• Unit Selection Support</td>
<td>• High Value</td>
<td>• Low Maintenance</td>
<td></td>
</tr>
<tr>
<td>• Energy Analysis</td>
<td>• Competitive Lead Times</td>
<td>• After Sales Service</td>
<td></td>
</tr>
<tr>
<td>• Electrical &amp; Mechanical Drawings</td>
<td>• Controls Support</td>
<td>• Fast ROI</td>
<td></td>
</tr>
<tr>
<td>• Custom Designs</td>
<td>• Start-up Service</td>
<td></td>
<td></td>
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</tbody>
</table>
### STULZ Mission Critical Cooling Solutions

<table>
<thead>
<tr>
<th>Outdoor Cooling</th>
<th>Indoor Cooling</th>
<th>Retrofit and Conditioning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modular Container</td>
<td>Perimeter</td>
<td>Humidification</td>
</tr>
<tr>
<td>Air Handler</td>
<td>Row</td>
<td>EC Fan Retrofit</td>
</tr>
<tr>
<td></td>
<td>Ceiling</td>
<td>Drop-in Replacement</td>
</tr>
</tbody>
</table>

#### Controls and Monitoring

#### STULZ Service and Parts

### Energy Efficiency
STULZ is committed to bringing reliable and energy efficient temperature and humidity control solutions to mission critical applications.

This is applied to our outdoor, indoor, retrofit, and conditioning solutions, providing the largest sensible cooling capacity per ft². STULZ products often qualify the owner for significant energy rebates.

For years, STULZ has brought you products that save money.

### ASHRAE
STULZ is an active participant on ASHRAE committees:
- ASHRAE 90.1 - 2010/2013 use of water and air economizers
- ASHRAE 127 test standard
- ASHRAE TC9.9 - 2011 data center temperature and RH

### Testing & Certifications
- STULZ Mission Energy Lab
  - A recognized Intertek (ETL) SATELLITE™ laboratory for ASHRAE 127 testing
  - Used for Research and Development and 3rd party witness testing
- CWE Product Line is OSHPD Approved
- CEC (California Energy Commission)
- STULZ designs and tests to meet CEC requirements

You can rely on STULZ products to meet key industry standards, assuring they perform as advertised.
STULZ Controls and Monitoring
Pre-Engineered Controls

Outdoor Cooling

- Modular Container
  - STULZ CyberCon

Air Handler
- STULZ CyberHandler

Perimeter
- STULZ CyberAiR® CRAC/CRAH

Row
- STULZ CyberRow®

Indoor Cooling

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**E² Microprocessor Controller**

STULZ E² is the standard microprocessor controller across all STULZ product platforms, providing precision monitoring and control of your mission critical environment.

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**STULZ E² Controller Ties it all Together**

<table>
<thead>
<tr>
<th>Designed specifically for precision control of mission critical environments</th>
<th>Multiple I/O capabilities for all major components to optimize control for energy savings</th>
<th>Supports Universal BMS interface for remote monitoring (address readable) and remote control (address writable)</th>
<th>Capable of networking controllers in a workgroup (pLAN) to work as one (no BMS required)</th>
<th>Pre-engineered controls for economizers and adiabatic cooling</th>
</tr>
</thead>
</table>

- **Control Panel**
  - Backlit LCD alphanumeric display for visual indication
  - Operated via 6-key menus, in five different modes
  - Unit functions for cooling, heating, humidifying and dehumidifying
  - Three levels of restricted entry into the configuration

- **Microprocessor**
  - Sensor inputs control inputs/outputs
  - Additional I/O Sensors & Alarms
  - Psychrometric control provided as a user configurable temperature and humidity (relative humidity) or dew point control
  - Optional UPS backup module

- **Software**
  - Independent EC Fan and cooling control (CW valve or DX)
  - Cooling control sequence: return air temperature, humidity, supply air temperature, dew point
  - Fan control sequence: BMS, local/static pressure, and temperature based (supply or return air)

- **Networking**
  - Capable of networking up to eight E² controllers with an independent LAN.
  - The E² controller will communicate to BMS/BAS systems via the following protocols:
    - BACnet IP
    - BACnet over Ethernet
    - HTTP
    - SNMP V1, V2c
    - Modbus IP
    - Modbus RTU
    - BACnet MS/TP

---

Control Panel with Touchscreen

Microprocessor
STULZ Controls and Monitoring

**Indoor Cooling**

**Ceiling**
- STULZ CeilAiR®

**Humidification**
- STULZ Ultrasonic

**EC Fan Retrofit**
- STULZ CyberMOD

**Drop-in Replacement**
- STULZ Replacement

---

**Advanced Controls**

- Independent Control: Efficiency of EC Fans and CW valve (or compressor) can be maximized
- Dew Point Control: Temperature and RH examined and humidification/dehumidification modes optimized
- Static Pressure Control: Provides even airflow on demand at any room position and precise control for containment
- Unit Networking: Capable of BMS interface or private local area network (pLAN)
- Redundancy: Controller defaults to set points if a sensor fails or if BMS control signal fails, EC Fans ramp up if one fails

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**Real Time Monitoring**

The STULZ E2 controller provides a direct LAN connection for real time status of the EC Fan array. These data points are made available to a BMS system for advanced system monitoring.

**Real time data includes:**
- Speed
- Power
- Temperature
- Voltage
- Alarm Status

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**Easy to program multiple alarms including virtual flow alarm and “condensate possible” alarm**

**LAN communication options available**

**Ultra Capacitor system can intelligently close valves or dampers after a sudden power loss**

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**Multiple Sensor Averaging Control**
- (up to 4 temperature or humidity sensors)
  - Refrigerant pressure and temperature monitoring for DX
  - Water temperature sensor for CW
  - Return or supply temperature/humidity sensor
  - Static pressure sensor
The STULZ \( E^2 \) Controller monitors and controls all aspects of system operation to economically provide the required cooling, based on real-time indoor and outdoor conditions.

### Decision Criteria for Choosing Economizer Type

- Weather Conditions (bin weather data)
  - Dry Bulb, Wet Bulb
  - Enthalpy, Dew Point
- Quality of Air
- Willingness to bring outside air into the data center
- Ability to duct outside air through the building
- Availability and cost of water
- Capital Budget (CapEx) and Operating Budget (OpEx)
- Maintenance Capability

### Pre-Engineered Controls

<table>
<thead>
<tr>
<th>STULZ ( E^2 ) Sensor Inputs</th>
<th>STULZ ( E^2 ) Control Outputs</th>
<th>STULZ CRAC, CRAH or AHU</th>
<th>STULZ CRAC</th>
<th>STULZ CRAH</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Outside Air Temperature and humidity</strong></td>
<td><strong>Outside Air Intake</strong></td>
<td>Varies the speed of the Dry Cooler or Cooling Tower fans and Pump Package to optimize free cooling</td>
<td>Varies the speed of the Dry Cooler or Cooling Tower fans and Pump Package to optimize free cooling</td>
<td>Modulates the STULZ Free Cooling Valve and EC Fans to extend free cooling operation</td>
</tr>
<tr>
<td><strong>Supply / Return air temperature</strong></td>
<td><strong>Direct or indirect adiabatic cooling (if equipped)</strong></td>
<td>Uses the Dry Cooler or Cooling Tower for primary cooling - based on fluid temperature</td>
<td>Uses the Dry Cooler or Cooling Tower for primary cooling - based on fluid temperature</td>
<td>Enable / Disables Chiller, Pumps, and Cooling Tower</td>
</tr>
<tr>
<td><strong>BMS control</strong></td>
<td><strong>STULZ DX or CW operation (if needed)</strong></td>
<td>Activates the compressor when DX trim or full DX cooling is required</td>
<td>Activates the compressor when DX trim or full DX cooling is required</td>
<td>Uses the Cooling Tower for primary cooling - based on fluid temperature</td>
</tr>
<tr>
<td><strong>STULZ CRAC, CRAH or AHU</strong></td>
<td><strong>STULZ CRAC</strong></td>
<td><strong>STULZ CRAH</strong></td>
<td><strong>STULZ CRAH</strong></td>
<td><strong>STULZ CRAH</strong></td>
</tr>
<tr>
<td><strong>Outside Air Intake</strong></td>
<td><strong>Direct or indirect adiabatic cooling (if equipped)</strong></td>
<td><strong>CRAC traditional operation; dry cooler supplies glycol to unit condenser</strong></td>
<td><strong>CRAC traditional operation; dry cooler supplies glycol to unit condenser</strong></td>
<td><strong>CRAC traditional operation; cooling tower supplies primary cooling; chiller provides trim</strong></td>
</tr>
<tr>
<td><strong>Direct or indirect adiabatic deactivated</strong></td>
<td><strong>CRAC/CRAH with traditional operation</strong></td>
<td><strong>CRAH traditional operation; cooling tower supplies primary cooling; chiller provides trim</strong></td>
<td><strong>CRAH traditional operation; cooling tower supplies primary cooling; chiller provides trim</strong></td>
<td><strong>CRAH uses Cooling Tower for primary cooling</strong></td>
</tr>
</tbody>
</table>

### Modes of Operation

#### Warmer / High Humidity
- Outside air dampers close
- Direct or indirect adiabatic deactivated
- CRAC/CRAH with traditional operation
- CRAC traditional operation; dry cooler supplies glycol to unit condenser
- CRAH traditional operation; cooling tower supplies primary cooling; chiller provides trim

#### Within Proper Range
- Outside air dampers open
- Direct or indirect adiabatic activated
- CRAC has combination of glycol Free Cooling (FC) Coil & one DX Compressor (trim)
- CRAH uses Cooling Tower for primary cooling

#### Colder than Desired
- Dampers mix outside air & return air to achieve desired temperature
- Warm return air mixes with outside air before the filter to prevent freezing
- CRAC has glycol transferred to free cooling coil; compressor off
  - fans on dry coolers and pumps operate at lowest possible speeds to supply required cooling, using the least amount of energy
  - as ambient increases, fans on dry coolers and pumps increase speed to extend available free cooling
- CRAH uses cooling tower for primary cooling

www.STULZ.com
STULZ Air-Side Economizer
Pre-Engineered Solutions

STULZ Vertical and Horizontal Mixing Boxes
STULZ vertical and horizontal mixing boxes for air-side economizer options using STULZ floor-standing CRAC’s or CRAH’s.
- CRACs or CRAHs with an integrated mixing box and damper controls provide direct free cooling
- Units attached to the top of a CRAC or CRAH in a vertical or horizontal position
- Pre-filter and freeze protection damper options
- Mixes outside and return air depending on outside air conditions
- Full economizer controls provided by the CRAC or CRAH

STULZ CyberHandler with Direct Air Economizer, Direct Adiabatic Cooling, and DX for trim
Direct Air-Side Economizer
- Outside air (less than supply air temp) is directly introduced into the data center
Direct Adiabatic Cooling
- The outside air is cooled with an adiabatic system and directly introduced into the data center
Direct DX Cooling
- The outside and/or return air is cooled with a DX evaporator coil and directly introduced into the data center

STULZ CyberCon with Direct Air Economizer, Direct Adiabatic Cooling, and DX for trim
Direct Air-Side Economizer
- Outside air (less than supply air temp) is directly introduced into the data center
Direct Adiabatic Cooling
- The outside air is cooled with an adiabatic system and directly introduced into the data center
Direct DX Cooling
- The outside and/or return air is cooled with a DX evaporator coil and directly introduced into the data center

STULZ CyberHandler w/ Indirect Air Economizer, Indirect Adiabatic Cooling, and DX for trim
Indirect Air-Side Economizer
- Outside Air (less than supply air temp) passes through an air-to-air heat exchanger to indirectly cool the data center return air
Indirect Adiabatic Cooling
- The return air is indirectly cooled via an air-to-air heat exchanger that has an adiabatic spray applied to it
A STULZ DX cooling unit with water-side economizer consists of a direct expansion coil and a water/glycol economizer coil.

When required cooling capacity can be satisfied with just the cooled fluid from the outdoor dry cooler, the unit turns off the DX compressors and only cools using the economizer coil.

When ambient temperature rises, the flow of fluid is diverted into the DX cooling circuit to provide an assist mode of operation.

When the fluid temperature is warm, the unit operates as a fluid cooled DX unit, rejecting the heat into the fluid cooled condenser to be rejected by an external heat rejection device.

This STULZ DX unit is used in the following two scenarios.

Variable Economizer Cooling

Variable Economizer Cooling is comprised of a variable fan speed dry cooler (with fan speed controlled based on fluid temperature), variable speed pump (controlled based on fluid temperature), and water/glycol cooled free cooling CRACs (consisting of both a DX and a water/glycol economizer coil).

Evaporative Tower Economizer Cooling

Evaporative Tower Economizer Cooling is comprised of a closed loop evaporative cooling tower (controlled based on fluid temperature), a constant speed pump, and water/glycol cooled free cooling CRACs (consisting of both a DX and a water/glycol economizer coil).
Dual-Source Chilled Water Economizer Cooling

Dual-Source Chilled Water Economizer Cooling is comprised of an evaporative cooling tower (controlled based on fluid temperature), cooling tower pump, chiller (controlled based on fluid temperature), chiller pump, and a CRAH unit (with dual circuited interlaced chilled water cooling coil).

STULZ Dynamic Economizer Cooling

STULZ Dynamic Economizer Cooling is the latest state-of-the-art water-side economizer solution, and is comprised of an evaporative cooling tower, cooling tower pump, air or water cooled chiller, chiller pumps, control mixing valves, and chilled water cooled CRAHs (with a single coil).

When ambient temperature is near or below required cooling fluid temperature, the chiller assisted cooling system operates in the cooling tower mode, providing cooling without energizing the chiller.

If ambient temperature increases above the required cooling fluid temperature, then the flow from the tower is diverted to the chiller to provide the trim needed to maintain the cooling fluid temperature. This system is designed to minimize the hours of chiller operation and optimize opportunity for economization.

The STULZ Dynamic Economizer Cooling System achieves incredible efficiency by executing a carefully coordinated sequence of operations, where the functions of CRAH’s, closed loop cooling towers, variable speed pump packages, modulating three-way valves, and supporting chillers are orchestrated together. Raising the return air conditions to the CRAH (by using containment) and providing an evaporator coil in the CRAH (that enables a large delta-T) allows the use of 70°F supply water and 75°F supply air to the IT equipment (well within ASHRAE TC9.9 guidelines).

Savings Using Dual-Source CW Economizer Cooling

- Graph based on nominal 30 ton system
- Return Air 80°F/30% RH

Savings Using STULZ Dynamic Economizer Cooling

- Graph based on nominal 30 ton system
- 50°F Entering Water

STULZ Dynamic Economizer Cooling has been designed and first installed in a large multi-tenant data center in Ashburn, VA.
STULZ CyberHandler provides superior value as a pre-engineered outdoor air handling system for precision temperature and humidity control in a data center.

- Designed with proven STULZ technology
- Frees up white space in the data center

### Common Features

<table>
<thead>
<tr>
<th>Modular Construction</th>
<th>Pre-engineered modules designed to be configured to your needs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Designed for Data Centers</td>
<td>Designed to handle higher return air temperatures than comfort cooling AHUs</td>
</tr>
<tr>
<td></td>
<td>Engineered and tested for 7x24 operation</td>
</tr>
<tr>
<td></td>
<td>Outdoor placement frees white space and keeps maintenance away from sensitive IT equipment</td>
</tr>
<tr>
<td></td>
<td>STULZ E2 controller, available with BMS interface</td>
</tr>
<tr>
<td>Galvanized Steel Base</td>
<td>Allows Roof, Pad or Curb Mounting</td>
</tr>
<tr>
<td></td>
<td>Sturdy Construction</td>
</tr>
<tr>
<td></td>
<td>Excellent Corrosion Protection</td>
</tr>
<tr>
<td>Hinged Access Doors</td>
<td>Service access to all sections</td>
</tr>
<tr>
<td>Double Wall Panels</td>
<td>Excellent insulation and corrosion resistance</td>
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<tr>
<td></td>
<td>Thermal break</td>
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<tr>
<td></td>
<td>Lightweight</td>
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<tr>
<td></td>
<td>Minimal deflection</td>
</tr>
<tr>
<td>EC Fan Array</td>
<td>Highly reliable</td>
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<tr>
<td></td>
<td>Low maintenance</td>
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<tr>
<td></td>
<td>Built in redundancy</td>
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<tr>
<td></td>
<td>Low energy consumption</td>
</tr>
<tr>
<td></td>
<td>Variable speed</td>
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<tr>
<td></td>
<td>Direct drive</td>
</tr>
</tbody>
</table>

### STULZ CyberHandler (ASM)

<table>
<thead>
<tr>
<th>STULZ CyberHandler (ASM)</th>
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</thead>
<tbody>
<tr>
<td>Direct Air Economizer</td>
<td>Indirect Air Economizer</td>
<td></td>
</tr>
<tr>
<td>with DX or CW</td>
<td>with DX or CW</td>
<td></td>
</tr>
<tr>
<td>kW</td>
<td>kW</td>
<td>kW</td>
</tr>
<tr>
<td>124 - 538</td>
<td>124 - 480</td>
<td>124 - 480</td>
</tr>
<tr>
<td>MBH</td>
<td>MBH</td>
<td>MBH</td>
</tr>
<tr>
<td>421 - 1,836</td>
<td>421 - 1,638</td>
<td>421 - 1,638</td>
</tr>
<tr>
<td>Tons</td>
<td>Tons</td>
<td>Tons</td>
</tr>
<tr>
<td>35 - 153</td>
<td>35 - 137</td>
<td>35 - 137</td>
</tr>
<tr>
<td>CFM</td>
<td>CFM</td>
<td>CFM</td>
</tr>
<tr>
<td>12,000 - 55,000</td>
<td>12,000 - 50,000</td>
<td>12,000 - 50,000</td>
</tr>
</tbody>
</table>

*Based on standard designs. Contact factory for project specific design.*
### STULZ CyberHandler Configuration - Example 1

<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct Air Economizer</td>
<td>Outside air (less than supply air temp) is directly introduced into the data center</td>
</tr>
<tr>
<td>Direct Adiabatic Cooling</td>
<td>The outside air is cooled with an adiabatic system and directly introduced into the data center</td>
</tr>
<tr>
<td>DX Cooling</td>
<td>Used only when required for trim or full capacity</td>
</tr>
</tbody>
</table>

![Diagram of STULZ CyberHandler Configuration - Example 1](image1)

### STULZ CyberHandler Configuration - Example 2

<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indirect Air Economizer</td>
<td>Outside Air (less than supply air temp) passes through an air-to-air heat exchanger to indirectly cool the data center return air</td>
</tr>
<tr>
<td>Indirect Adiabatic Cooling</td>
<td>The return air is indirectly cooled with an adiabatic spray applied to the outside air and air-to-air heat exchanger</td>
</tr>
<tr>
<td>DX Cooling</td>
<td>Used only when required for trim (can be sized for full capacity)</td>
</tr>
</tbody>
</table>

![Diagram of STULZ CyberHandler Configuration - Example 2](image2)
STULZ CyberCon provides superior value for precision temperature and humidity control in a modular/containerized data center (POD).

Common Features

Designed for modular / containerized data centers
- Minimum mechanical installation required - only utilities (condensate drain and other options)
- No protruding components like fans, doors, or louvers
- DX or CW cooling with direct or indirect adiabatic cooling option
- STULZ E² controller, available with BMS interface

Standard 20’ high-cube container dimension
- Allows IT POD, Pad, or Curb Mounting
- Rapid deployment
- Easy shipping and handling
- Short construction time

Hinged access doors
- Service access to all internal components

EC Fan system
- Highly reliable
- Low maintenance
- Built in redundancy
- Low energy consumption
- Variable speed
- Direct drive

Designed for growth as needed
- Outside air intake & service access from one long side
- Allows end-to-end, back-to-back installation, and modular build out

STULZ CyberCon (CON)

<table>
<thead>
<tr>
<th></th>
<th>Direct Air Economizer with Adiabatic and/or DX</th>
<th>Indirect Air Economizer with DX</th>
<th>Indirect Water Economizer with Chiller</th>
</tr>
</thead>
<tbody>
<tr>
<td>kW</td>
<td>243</td>
<td>223</td>
<td>243</td>
</tr>
<tr>
<td>MBH</td>
<td>830</td>
<td>760</td>
<td>830</td>
</tr>
<tr>
<td>Tons</td>
<td>69</td>
<td>63</td>
<td>69</td>
</tr>
<tr>
<td>CFM</td>
<td>23,000</td>
<td>23,000</td>
<td>23,000</td>
</tr>
</tbody>
</table>

* Based on standard designs. Contact factory for project specific design.
STULZ CyberCon Configuration - Example One

**Direct Air Economizer**
Outside air (less than supply air temp) is directly introduced into the data center

**Direct Adiabatic Cooling**
The outside air is cooled with an adiabatic system and directly introduced into the data center

**DX Cooling (Integrated DX Condenser)**
Used only when required for trim or full capacity

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**STULZ CyberCon Configuration - Example Two (with STULZ Dynamic Economizer Cooling)**

**Indirect Water Economizer**
Outside air cools water in a closed loop

**Integrated Adiabatic Fluid Cooler**
Adiabatic cooling of closed water loop when more cooling is needed than water economizer can provide

**Integrated Chiller**
Chiller to trim closed water loop temperature if outside conditions are not suitable for water economizer or adiabatic fluid cooler only

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**STULZ CyberPack**

**DX Cooling**
- Up to two independent cooling circuits with highly reliable scroll compressors
- Environmentally Friendly R410A refrigerant. -30 Degrees F ambient operation with optional flooded head pressure control

**Packaged AHU**
- Functional operations: cooling, dehumidification and filtration
- EC Fans for energy cost savings and long life - Fan speed is continuously adjustable
- 4” thick, MERV 7-13 cartridge air filters
- Controller user interface display panel for ease of use

<table>
<thead>
<tr>
<th>STULZ CyberPack</th>
<th>DX</th>
</tr>
</thead>
<tbody>
<tr>
<td>kW</td>
<td>42 - 88</td>
</tr>
<tr>
<td>MBH</td>
<td>144,000 - 300,000</td>
</tr>
<tr>
<td>Tons</td>
<td>12 - 25</td>
</tr>
<tr>
<td>CFM</td>
<td>5,000 - 10,000</td>
</tr>
</tbody>
</table>
STULZ Perimeter Cooling consists of direct expansion (DX) systems and chilled water (CW) systems. Both are available as down-flow and up-flow configurations.

**STULZ offers the broadest range of cooling capacities for CW & DX precision cooling, including the highest capacity CRAH’s on the market.**

### Common Features

- V-Frame Evaporator (CRAC) and Chilled Water Coils (CRAH)
- Multiple upflow & downflow air patterns available, providing flexibility to meet requirements
- Front discharge units available (ideal for slab floors)
- Multiple floor stand configurations available (optional design to meet seismic requirements)
- Energy savings by providing optimal air flow
- Water-side economizer with dual coil applications (DX/CW or CW/CW)
- Optional - integral steam canister humidifier with various capacities and proportional control option
- Optional - provide seamless control of external ultrasonic or other adiabatic humidification systems
- Optional - air-side economizer with vertical or horizontal mixing box
- Optional - Hot water and low pressure steam reheat using an external heating medium
- Optional - Electric reheat - multi-stage low watt density, electric resistance heaters

### CRAC

- DX systems provided with highly efficient and reliable low noise scroll compressors
- Single or multi-stage compressor arrangement including tandem configurations
- Micro Plate Heat Exchangers offer major improvements in heat transfer
- Optimized AW5/Free-cooling coils to closely match DX cooling capacities, increasing energy savings opportunities
- Refrigeration-based dehumidification system effectively removes excess moisture
- Hot gas reheat - provides reheat using recycled compressor heat
- Snap acting / full floating hot gas bypass system provides cooling capacity modulation and evaporator coil freeze protection
- Multiple stages of DX cooling to match load requirement
- Electronic Expansion Valves can be optimized to work over a wide range of conditions

### CRAH

- Largest capacity perimeter CW units in the industry
- Greater airflow than other solutions
- Multiple EC Fan options (additional fans in same size cabinet)
- All EC Fans mounted in the cabinet meet full performance without having to be dropped into the raised floor
- Fewer units at higher capacity can significantly reduce capital cost and operating cost
- 2 x CW Valves standard on CFD-510 and larger units (option for 1 CW valve)
- Dehumidification efficiently achieved through reduced air volume at maximum cooling
- Standard and Seismic Floor Stands available for all CW units
- Filter Plenums designed with increased surface area for filtration, lower pressure drop, and improved energy savings
- Standard MERV 8 filters (optional up to MERV 14 filters)
- 100% Front Access on all sizes

### STULZ CyberAir

<table>
<thead>
<tr>
<th>High Capacity</th>
<th>STULZ CyberAir</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CRAC</td>
</tr>
<tr>
<td></td>
<td>CF (D/U) - D</td>
</tr>
<tr>
<td>Dual Circuit DX Systems</td>
<td>Single &amp; Dual Circuit CW Systems</td>
</tr>
<tr>
<td>kW</td>
<td>21 - 105</td>
</tr>
<tr>
<td>MBH</td>
<td>72 - 360</td>
</tr>
<tr>
<td>Tons</td>
<td>6 - 30</td>
</tr>
<tr>
<td>CFM</td>
<td>900 - 15,000</td>
</tr>
</tbody>
</table>

[STULZ.com](http://www.STULZ.com)
STULZ continues to advance the perimeter cooling systems that changed energy efficiency best practices.

STULZ provides a broad range of heat rejection options for STULZ DX Cooling.

STULZ provides a broad range of heat rejection options for STULZ DX Cooling.

Other CW & DX Perimeter Cooling products from STULZ

### Superior Components

**EC Fan** *(Backward curved plenum fan with Electronically Commutated motor)*

- Fans designed to operate at reduced speed to maximize efficiency
- Fully scalable air volume
- Superior efficiency as compared to forward curved fans
  - Over 20% immediate energy savings by design
  - Over 60% energy savings when running at partial load
- Optimized under-floor pressure and balanced air flow
- Low vibration; no belt dust
- Maintenance free

### V-Frame Evaporator (CRAC) and Chilled Water Coils (CRAH)

- Minimizes the possibility of water carryover
- Reduced air-side pressure drop vs A-Frame coil
- Provides optimal draw-through air pattern for uniform air distribution
- Constructed for maximum heat transfer with minimal water-side pressure drop (CRAH only)
- DX refrigerant flow is controlled by electronic expansion valves

### Heat Rejection

#### Air Cooled

**Common Features for MicroChannel (SCS - MC) and Standard Condensers (SCS)**

- Direct-driven high performance axial fans
- AC and EC Fan motor
- Integrated control box with main disconnect and motor protection
- Various fan speed control options based on refrigerant pressure
- R-407c & R-410a rated
- Low ambient temperature control options

**Features Specific to MicroChannel Condenser (SCS - MC)**

- MicroChannel coil designs for better heat rejection with smaller footprint and improved SCOP
- Lower weight than traditional design
- Uses less refrigerant
- Integrated receiver skid

#### Liquid Cooled

**Glycol System Remote Drycooler**

- Direct-driven high performance axial fans
- AC and EC Fan motor
- Integrated control box with main disconnect and motor protection
- Free cooling dry coolers are available for the entire product line

**Glycol System Pump Packages**

- Single and dual pump package with redundant pumps
- Individually powered or powered from Drycooler

### CW & DX Options

<table>
<thead>
<tr>
<th>STULZ Mini-Space (CCU/D)</th>
<th>STULZ FLAIR (FCS)</th>
<th>STULZ CyberONE EC (COS)</th>
<th>STULZ ModulAIR (MCS)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CW &amp; DX</strong></td>
<td><strong>DX (Air, Water, Glycol Cooled)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>kW</td>
<td>3 - 25</td>
<td>5 - 18</td>
<td>7 - 35</td>
</tr>
<tr>
<td>MBH</td>
<td>12 - 84</td>
<td>18 - 60</td>
<td>24 - 120</td>
</tr>
<tr>
<td>Tons</td>
<td>1 - 7</td>
<td>1.5 - 5</td>
<td>2 - 10</td>
</tr>
<tr>
<td>CFM</td>
<td>1,180 - 4,130</td>
<td>750 - 2,300</td>
<td>1,000 - 4,800</td>
</tr>
</tbody>
</table>

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www.STULZ.com 15
STULZ CyberRow®

Indoor Cooling

STULZ CyberRow cooling systems are ideal for high density cooling in open or contained systems and provide for targeted hot spot reduction.

Row based cooling system that puts the cooling where the heat is

Features

Benefits

Performance
- Widest range of units with the largest cooling capacity in the industry
- EC fans provide adjustable air volume based on real time cooling requirements at the lowest energy consumption

Flexible
- Adapts to all major manufacturers racks and rack containment systems
- Installation on raised / non-raised floors
- Suitable for new and existing data centers; easy to add units as you grow
- Used in containment, open architecture and hot spot reduction applications
- Top or bottom pipe and power connections
- 100% serviceable through front and rear access
- DX with Free Cooling (FC) Coil available in 24” cabinet

Cold Air Discharge
- Cold air discharge options; front or side discharge available
- Front discharge recommended for containment configurations
- Side discharge recommended for open architecture configurations

Controls
- Various fan control options allowing optimized air distribution
- Dual power with true auto switch-over function (all CW and 24” DX)

Chilled Water (CW)
- 2-way or 3-way CW control valves
- Low water-side pressure drop

Direct Expansion (DX)
- DX systems provided with high efficiency, highly reliable, low noise scroll compressors
- Capacity control utilizing electronic hot gas bypass with electronic expansion valves
- R-410a refrigerant
- Heat rejection with air, water, or glycol cooled condensers for the entire product range
- DX systems are available with free cooling option (CRS-091 only)
- Optional VFD Compressor and Micro-Channel evaporator

Economizer
- Water-side economizer with dual coils (DX/CW or CW/CW)

Row based cooling system that puts the cooling where the heat is

STULZ CyberRow

<table>
<thead>
<tr>
<th></th>
<th>CRS-090 (12”)</th>
<th>CRS-180 (24”)</th>
<th>CRS-042 (12”)</th>
<th>CRS-084 (12”)</th>
<th>CRS-090 (12”)*</th>
<th>CRS-091 (24”)**</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CW</td>
<td>DX</td>
<td>CW</td>
<td>DX</td>
<td>CW</td>
<td>DX</td>
</tr>
<tr>
<td>kW</td>
<td>13 - 37</td>
<td>31 - 75</td>
<td>16</td>
<td>31</td>
<td>33</td>
<td>33</td>
</tr>
<tr>
<td>MBH</td>
<td>44 - 126</td>
<td>106 - 256</td>
<td>55</td>
<td>106</td>
<td>112</td>
<td>112</td>
</tr>
<tr>
<td>Tons</td>
<td>4 - 11</td>
<td>9 - 21</td>
<td>5</td>
<td>9</td>
<td>9.3</td>
<td>9.3</td>
</tr>
<tr>
<td>CFM</td>
<td>2,900</td>
<td>5,800</td>
<td>1,500</td>
<td>2,900</td>
<td>2,900</td>
<td>2,900</td>
</tr>
</tbody>
</table>

* VFD Compressor & Micro-Channel Evaporator
** with FC Coil
As the ultimate space saver, STULZ CeilAiR ceiling mounted air conditioners provide precision temperature and humidity control.

The most complete line of ceiling mounted cooling products in the industry

<table>
<thead>
<tr>
<th>Features</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Performance</strong></td>
<td>• DX systems with independently circuited, high efficiency, high reliability, and low noise scroll compressors</td>
</tr>
<tr>
<td></td>
<td>• Wide range of options with DX or CW for precision cooling</td>
</tr>
<tr>
<td></td>
<td>• High static blowers are available for ducted systems</td>
</tr>
<tr>
<td></td>
<td>• Condensate pumps can be factory or field installed (in some models)</td>
</tr>
<tr>
<td><strong>Flexible</strong></td>
<td>• High efficiency EC Fans available as option in certain units</td>
</tr>
<tr>
<td></td>
<td>• Fully accessible in-place through easily removable side access panels</td>
</tr>
<tr>
<td></td>
<td>• Smaller capacity units easily mounted in a standard 2’ x 4’ grid of a dropped ceiling plenum</td>
</tr>
<tr>
<td></td>
<td>• Spot cooler and ducted configuration</td>
</tr>
<tr>
<td></td>
<td>• Available with same-face / one-sided / L-shaped air pattern</td>
</tr>
<tr>
<td></td>
<td>• Available with low profile for limited installation height</td>
</tr>
<tr>
<td></td>
<td>• Small capacity with precision cooling characteristics</td>
</tr>
<tr>
<td><strong>Dependable</strong></td>
<td>• Aluminum cabinet construction for no corrosion / low weight</td>
</tr>
<tr>
<td></td>
<td>• Thermal insulation provided</td>
</tr>
<tr>
<td><strong>Economizer</strong></td>
<td>• Water-side economizer with free cooling or alternate water source</td>
</tr>
<tr>
<td><strong>Controls</strong></td>
<td>• Variety of controls from electromechanical to state of the art E2 microprocessor, allowing seamless integration with all BMS platforms</td>
</tr>
<tr>
<td><strong>Humidification</strong></td>
<td>• Integral steam canister humidifier with various capacities and proportional control option</td>
</tr>
<tr>
<td><strong>Reheat</strong></td>
<td>• Hot gas reheat - Provides reheat using recycled compressor heat</td>
</tr>
<tr>
<td></td>
<td>• Hot water and low pressure steam - Using an external heating medium</td>
</tr>
<tr>
<td></td>
<td>• Electric reheat - Single-stage low watt density, electric resistance heaters</td>
</tr>
<tr>
<td><strong>Chilled Water (CW)</strong></td>
<td>• Proportional controls</td>
</tr>
<tr>
<td></td>
<td>• 2-way or 3-way water / glycol control valves</td>
</tr>
<tr>
<td></td>
<td>• High pressure chilled water valves</td>
</tr>
<tr>
<td><strong>Direct Expansion (DX)</strong></td>
<td>• Heat rejection: air cooled self-contained, air cooled split, or water / glycol cooled</td>
</tr>
<tr>
<td></td>
<td>• Refrigerant R-407c or 410a</td>
</tr>
<tr>
<td></td>
<td>• Single and dual stage refrigerant circuits with enterlaced coils</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>STULZ CeilAiR (OHS)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>KW</strong></td>
<td>3.5 - 35</td>
</tr>
<tr>
<td><strong>MBH</strong></td>
<td>12 - 120</td>
</tr>
<tr>
<td><strong>Tons</strong></td>
<td>1 - 10</td>
</tr>
<tr>
<td><strong>CFM</strong></td>
<td>500 - 4,400</td>
</tr>
</tbody>
</table>
State-of-the-art humidification for mission critical applications and any environment where clean, efficient, and precise humidity control is required

93% energy savings over steam humidifiers

### Features

#### Design
- Multiple piezoelectric transducers immersed in a water bed impart high frequency oscillation
- Alternating pressure and vacuum causes cavitation and production of very fine water mist
- Average 1 micron diameter water droplets evaporate quickly in a room or moving air stream
- All wetted surfaces are constructed of non-corrosive materials including plastic and stainless steel
- Distributed power to the piezoelectric transducers is 48 Volts, AC or DC depending on application
- Internal humidifier safeties include low and high water level switches and high temperature cutout

#### Performance
- Adiabatic humidification process requires less than 10% of the energy required to boil water into steam
- Additional benefit of evaporative cooling - improves efficiency of high sensible heat applications such as data centers
- All specifications and selections include mixed bed deionization water treatment systems by Culligan
- 100% of the demineralized water in the humidifier may be utilized and does not require a flush cycle
- Extremely low operational expense equates to very short term Return on Investment (ROI)

#### Controls
- STULZ Ultra-Series Proportional controls are engineered for single or multiple humidifier systems
- Utilizes STULZ E² Microprocessor Controller for integrated operation of up to 16 humidifiers per zone
- Ultra-Series control boxes enclose up to 8 power supplies each, providing power and control distribution
- Proportional analog output from microprocessor converted to Pulse Width Modulation at humidifiers
- Monitors and communicates various system functions and alarms including water quality via integrated control and/or optional BMS

#### Applications
- Data Centers / Telecom
- Libraries / Museums
- High Tech Manufacturing
- Printing / Duplication
- Food & Beverage
- Agriculture / Tobacco
- Health Care Facilities
- Laboratories
- Commercial Offices

### Benefits

### Wall or Shelf Mounted Unit

<table>
<thead>
<tr>
<th></th>
<th>DRH - Direct Room Humidifier</th>
<th>DAH - Ducted Air Humidifier</th>
</tr>
</thead>
<tbody>
<tr>
<td>lbs / hr</td>
<td>4.4 - 17.6</td>
<td>5.3 - 39.6</td>
</tr>
<tr>
<td>kg / hr</td>
<td>2.0 - 8.0</td>
<td>2.4 - 18.0</td>
</tr>
</tbody>
</table>
STULZ Water Treatment

by Culligan.

Mixed Bed Deionization (DI) provides high purity water quality specified for STULZ Ultrasonic Humidification Systems
• Portable Exchange Deionizers (PEDI) and total water systems serviced by 700+ Culligan dealerships throughout North America
• STULZ RO/DI by Culligan assures third party certification of industry standards and complete end-to-end solutions from a single source

DRH - Direct Room Humidifier
• Mounts below the ceiling in a conditioned space
• On wall or column with factory furnished mounts
• Suspended from above in open space
• Integral blower and washable filter
• Absorption distance determined by RH of room

DAH - Ducted Air Humidifier
• Mounts in moving air stream of AHU or ductwork
• Multiple humidifiers assembled on factory rack system
• Air velocity design similar to heating/cooling coils
• Factory accessories for optimized airflow and mist control
• Absorption distance determined by RH of airstream

STULZ Demi-Cabinet
• STULZ Demi-Cabinet enclosures for unitary RO and/or DI applied to small capacity and light commercial humidifier applications

Skid Mount RO/DI
• Culligan High Purity Reverse Osmosis (RO) plant preconditioner for large capacity humidifier applications
• CHP-250 to 8000 GPD RO/DI packages include prefiltration, storage, repressurization, UV sterilization, monitoring and start-up
STULZ CyberMOD

Retrofit & Conditioning

Fan Retrofit

Easy-to-install, variable speed EC Fan Retrofit Kit replaces belt drive DWDI blowers for clean, efficient upgrade to legacy mission critical CRAH and CRAC units.

20-60%* fan energy savings

Eliminate the inefficient centrifugal blowers

Features

<table>
<thead>
<tr>
<th>Applications</th>
<th>Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Extend the life, improve efficiency &amp; reliability of existing systems</td>
</tr>
<tr>
<td></td>
<td>2- and 3-fan configurations available</td>
</tr>
<tr>
<td></td>
<td>No changes required to the primary electric or piping</td>
</tr>
<tr>
<td>Design</td>
<td>Welded aluminum construction</td>
</tr>
<tr>
<td></td>
<td>Provides superior air distribution</td>
</tr>
<tr>
<td></td>
<td>Built-in fan redundancy</td>
</tr>
<tr>
<td></td>
<td>Easy installation</td>
</tr>
<tr>
<td>Operation</td>
<td>Quiet Operation (low vibration, no inverter whine)</td>
</tr>
<tr>
<td></td>
<td>Low maintenance (no belts to adjust, no belt dust, no greasing)</td>
</tr>
<tr>
<td>Performance</td>
<td>Energy-saving advantages: 20% by replacing the fans only, at full flow</td>
</tr>
<tr>
<td></td>
<td>Up to 60% when allowing additional control options, partial load operation</td>
</tr>
<tr>
<td></td>
<td>EC Fans operate at lower speeds, lower energy, even airflow</td>
</tr>
<tr>
<td></td>
<td>Fast ROI - typically within 2-4 years and qualifies for utility rebates</td>
</tr>
<tr>
<td></td>
<td>EC Fans consume less energy, therefore higher net cooling capacity</td>
</tr>
<tr>
<td></td>
<td>EC Fans provide optimized under-floor pressure and balanced airflow</td>
</tr>
<tr>
<td>Controls</td>
<td>STULZ E² controller ties directly to or replaces existing controller</td>
</tr>
<tr>
<td></td>
<td>Fan speed control is independent of CW valve control operation</td>
</tr>
<tr>
<td></td>
<td>Update existing control options (under-floor pressure control; return or supply air temperature control; independent fan and valve control)</td>
</tr>
<tr>
<td></td>
<td>Communicates with BMS - optional</td>
</tr>
</tbody>
</table>

Applies to:
- Liebert
- Data Aire
- Compu-Aire
- Airflow
- ATS

STULZ Energy Analysis

Operating Cost Per Year (per unit basis)

Based on actual test data

*Savings estimate is derived from actual performance test results of (1) Liebert model FH740C with 10 hp forward curved centrifugal fan vs. (1) Liebert model FH740C modified with the STULZ EC Fan retrofit kit, against 0.3" of external static pressure. Results may vary.

www.STULZ.com
STULZ Replacement CRAH

Retrofit & Conditioning

Replacement

Direct drop-in chilled water, high capacity CRAH replaces inefficient legacy units providing instant energy savings and improved performance

40-60%* total energy savings

Applies to:
- Liebert FH 422C
- Liebert FH 529C
- Liebert FH 600C
- Liebert FH 740C

<table>
<thead>
<tr>
<th>Features</th>
<th>Benefits</th>
</tr>
</thead>
</table>
| Application | • All the benefits of STULZ Mission Critical Design  
• STULZ cabinet and unique design features allow a direct drop-in replacement  
• No modification to existing piping mains, primary electric, or floorstand |
| Performance | • STULZ V-Coil arrangement  
• Energy savings advantages:  
  - Up to 40% simply by replacing the CRAH  
  - Savings of 50% and beyond can be achieved using advanced controls  
  - Increased air volume at maximum fan speed  
  - EC Fans operate at lower speeds, lower energy, even airflow  
  - EC Fans consume less energy, therefore higher net cooling capacity  
  - EC Fans provide optimized under-floor pressure and balanced airflow  
• Fast ROI; qualifies for utility rebates |
| Controls | • The $^2$ controller will allow communication with all major BMS/BAS systems  
• Update existing control options (under-floor pressure control; return or supply air temperature control; independent fan and valve control) |

<table>
<thead>
<tr>
<th>STULZ Replacement CRAH</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>CW</td>
<td></td>
</tr>
<tr>
<td>kW</td>
<td>76 - 124</td>
</tr>
<tr>
<td>BTU/hr</td>
<td>261,000 - 423,000</td>
</tr>
<tr>
<td>Tons</td>
<td>21 - 35</td>
</tr>
<tr>
<td>CFM</td>
<td>12,500 - 18,600</td>
</tr>
</tbody>
</table>

$^2$ Controller Retrofit

Retrofit kits and authorized installation services are available for legacy STULZ chilled water units with C6000 controllers and select competitor units. $^2$ controllers can be quickly retrofitted and are an excellent way to unify disparate controller platforms and gain tighter control by adding dew point control/under-floor static pressure capabilities. The $^2$ controller improves BMS communications by eliminating outdated and unnecessary gateways while increasing read/write capability.

*Savings estimate is derived from actual performance test results of (1) STULZ CCD-1805 CWE-LR vs. (1) Liebert model FH740C, at 16,500 cfm, against 0.3” of external static pressure. Results may vary.
STULZ Product Support offers comprehensive Service Solutions to ensure our customers maximum efficiency and reliability.

Deployment Services

Factory Authorized Warranty Inspection/Start-up - STULZ guarantees customers an industry leading Two Year Parts Warranty and 90 Day Labor Warranty with a Warranty Inspection/Start-up. Factory Authorized technicians ensure that STULZ equipment has been installed per factory guidelines and identify any deficiencies prior to warranty validation. This essential service assures customers that their investment is installed and performing optimally from the very start.

Basic Product Familiarization - Factory Authorized technicians provide a brief equipment overview as part of the Warranty Inspection/Start-up visit.

BMS/Communication Services – Factory Authorized technicians ensure that STULZ products are configured and capable of communicating in accordance with customer requirements.

Commissioning Assistance – Factory Authorized technicians provide a factory interface to agents during commissioning, functional and integrated testing.

Owner Training – Comprehensive and flexible training programs for end users via onsite, factory or web-based sessions. These training sessions are tailored to the customer’s schedule, equipment and facility requirements.

Planned Service

Preventative Maintenance Contracts – Multiple options for Factory Authorized Preventative Maintenance contracts are available. In addition to maintaining optimal equipment performance, an Authorized STULZ PM contract guarantees response by qualified technicians when emergency repairs are necessary.

The STULZ Product Support Network (PSN)

The STULZ Product Support Network (PSN) is a comprehensive network of Factory Technicians and certified service partners throughout North America. All technicians and partners are pre-qualified and certified by STULZ. STULZ Product Support consists of four teams dedicated to post-sale support:

- Technical Support – Phone support for warranty parts/labor authorization and troubleshooting
- Field Service – Dispatch/coordination of authorized technicians for; start-up, Cx assist, PM, break fix, onsite retrofit & refurbishment projects.
- Parts – Factory authorized Part sales
- Training – Technician & Owner Training

These teams actively support end users, contractors and the STULZ Product Support Network (PSN).
Data Center Best Practices

- When designing a data center, consider initial and future loads; in particular and low-load conditions.
- Lower data center power consumption and increase cooling efficiency by grouping together equipment with similar heat load densities and temperature requirements. This allows cooling systems to be controlled to the least energy-intensive set points for each location.
- Reference 2011 ASHRAE Thermal Guidelines for Data Processing Environments to review standardized operating envelope for the recommended IT operating temperature.
- Identify the class of your data center to determine the recommended and allowable environmental envelopes:
  - “Recommended” combines energy-efficient operation with high reliability.
  - “Allowable” outlines boundaries tested by IT equipment manufacturers for functionality.
  - Keep in mind that operating outside the recommended envelope may cause server fans to operate at higher speeds and therefore consume more power.
- Implement effective air management to minimize or eliminate mixing air between the cold and hot air sections. This includes configuration of equipment’s air intake and heat exhaust paths, location of air supply and air return and the overall airflow patterns of the room. Benefits include:
  - Reduced operating costs
  - Increased IT density
  - Reduced heat related processing interruptions or failures
- Under-floor and over-head cable management is important to minimize obstructions within the cooling air pattern.
- Prevent mixing of hot and cold air by implementing a hot aisle / cold aisle configuration. Create barriers and seal openings to eliminate air recirculation. Supply cold air exclusively to cold aisles and pull hot return air only from hot aisles.
  - Higher return air temperatures extend the operating hours of air economizers
- Using fan speed control to supply only as much air as IT equipment requires can reduce energy use by up to 66%.
- Carefully consider the location of floor tiles to optimize air distribution and prevent short-circuiting.
- Managing a uniform static pressure in the raised floor, by careful placement of the A/C equipment, allows for even air distribution to the IT equipment.
- Create a low pressure drop design to minimize fan power consumption by keeping ducts as large and short as possible, in addition to a generous raised floor.

What Has Changed

Updates to ASHRAE TC9.9 - 2011

Recommended
Server Inlet Air Temperature:
64-80.6 °F DB
Relative Humidity:
41.9 °F DP to 60% RH and 59 °F DP
Allowable (A1)
Server Inlet Air Temperature:
59-89.6 °F DB
Relative Humidity:
20-80% RH up to 62.1 °F DP

Raising air temperatures:
1. Increases CRAH sensible capacity up to 66%
2. Same or better sensible capacity with up to 33% less fan power
3. Allows higher chilled water temperature for more efficient chiller operation

Updates to ASHRAE 90.1 - 2010

1. Use of air or water-side economizers to provide free cooling
2. Water economizer must meet 100% of the expected load at:
   a. Cooling towers: 40 °F DB / 35 °F WB
   b. Dry coolers: 35 °F DB

Common Calculations

- **Tons to kW**
  \[ \text{Tons} \times 3.513 = \text{kW’s} \]
- **Tons to BTU/hr**
  \[ \text{Tons} \times 12,000 = \text{BTU/hr} \]
- **kW to BTU/hr**
  \[ \text{kW} \times 3,412 = \text{BTU/hr} \]
- **kW to Tons**
  \[ \text{kW} \times 0.2843 = \text{Tons} \]
- **BTU/hr to Tons**
  \[ \text{BTU/hr} / 12,000 = \text{Tons} \]
- **BTU/hr to kW**
  \[ \text{BTU/hr} / 3,412 = \text{kW} \]
- **BTU/hr to MBH**
  \[ \text{BTU/hr} / 1,000 = \text{MBH} \]
- **MBH to kW**
  \[ \text{MBH} / 3.41 = \text{kW} \]
STULZ Global Presence

STULZ Air Technology Systems is a member of the global STULZ family, with two major divisions, seven production plants, and hundreds of sales and service partners around the world.

Production Facilities: U.S.A. • Germany • Italy • China • India

globally close to you

ISO-9001 Quality Registered

STULZ Products are Proudly Designed & Manufactured in the USA

1572 Tilco Drive, Frederick, Maryland 21704
Phone: 301.620.2033, Fax: 301.662.5487
E-mail: info@stulz-ats.com

www.STULZ.com

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