



IT Cooling Solutions

## DFC<sup>2</sup> Direct Free Cooling for Data Centres

Energy-efficient, reliable and available around the world

**STULZ**

# Worldwide Green Engineering – with Direct Free Cooling from STULZ

## Forward thinking and cost-efficient from years of experience

The trend is towards densely packed server rooms, which generate ever more computing power over an ever smaller surface area – and the resulting power is almost completely converted into heat. Without the use of energy-efficient air-conditioning solutions, the running costs of air-conditioning climb dramatically and can exceed the entire purchase cost of the technology in the data centre in just a few years.

With every new product development, therefore, our engineers are dedicated to the pursuit of further reducing the running costs of air-conditioning. We have repeatedly led the field of precision air-conditioning for almost 20 years now, and continue to develop new, even more efficient systems. Now and in the future, we are focused on one vision: Mission Energy from STULZ.



## It pays to have energy efficiency with STULZ air-conditioning systems:

The air-conditioning of a Hamburg data centre with a surface area of 800 m<sup>2</sup> and a heat load of 1 MW costs only € 34,000.- a year with Direct Free Cooling, as opposed to € 296,000.- a year with compressor cooling only. This corresponds to savings of € 262,000.- a year.

Source: STULZ comparison of system costs, basis for calculation 13 ct/kWh

# Energy-saving potential thanks to ambient air

With Direct Free Cooling, conditioned ambient air below 18°C is used to keep the data centre cool. This brings huge potential savings, but challenges as well. With this cooling method, a large volume of ambient air enters the rooms, so that extended temperature and humidity tolerances must be permitted. If the ambient temperature rises above 18°C, either an integrated DX system with compressors or a separate chiller assumes the task of cooling the data centre, depending on the air-conditioning solution that is installed.

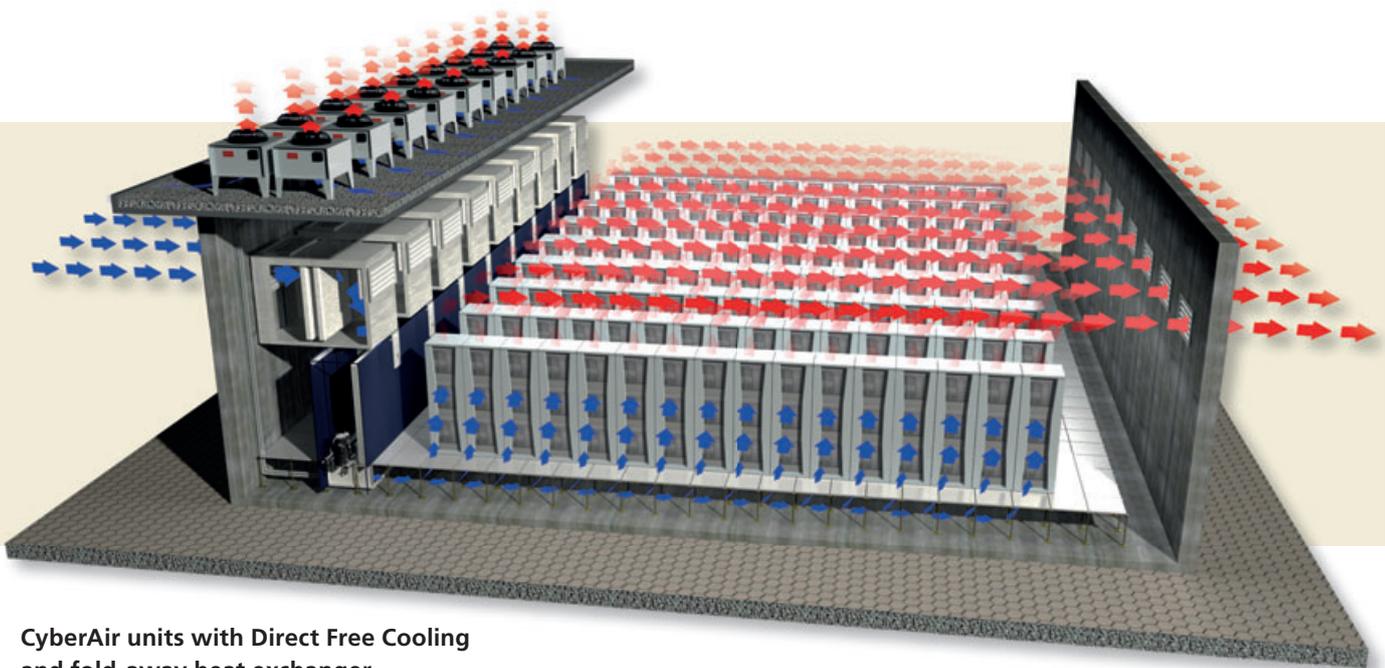
Thanks to our many years of experience with precision air-conditioning solutions, we have succeeded in optimising all components for Direct Free Cooling, ensuring compliance with the specifications for data centre temperature tolerances according to **ASHRAE TC 9.9 – 2011**. In addition, the cooling unit and mixing and filtration box are available in various sizes, so they can be selected precisely to suit your requirements and to achieve optimum energy efficiency.

## Percentage and number of hours per year of temperatures up to and including 18°C (up to 27°C possible according to ASHRAE TC 9.9 – 2011)

	Hamburg	London	Moscow	Canberra	Madrid	Istanbul	New York	Beijing	Johannesburg
Annual no. of hours below 18°C <sup>1</sup>	8247	8014	7805	7786	6338	6224	5997	5563	4833
Percentage <sup>2</sup>	95 %	91 %	89 %	89 %	72 %	71 %	68 %	63 %	55 %

<sup>1</sup>Hours per year of temperatures up to and including 18°C

<sup>2</sup>Percentage of hours with temperatures up to and including 18°C over the year

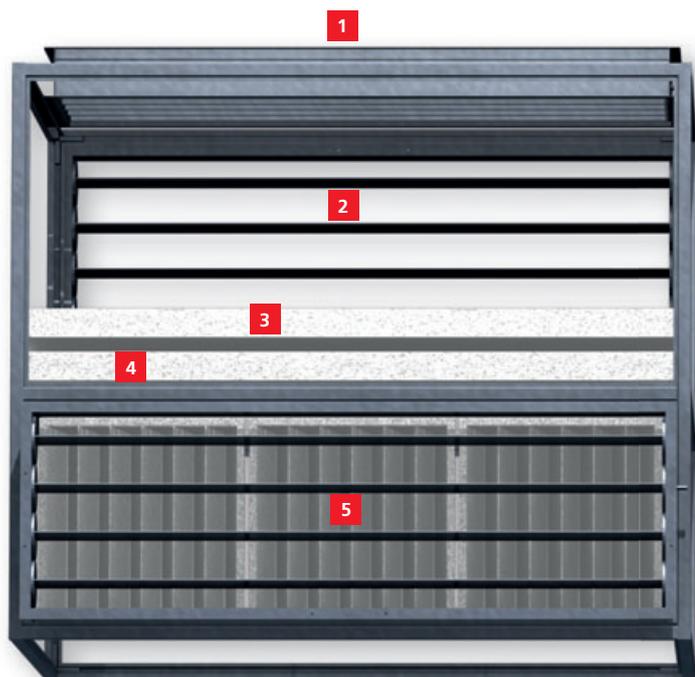


CyberAir units with Direct Free Cooling and fold-away heat exchanger

# Two systems and three sizes – for flexibility to suit all requirements

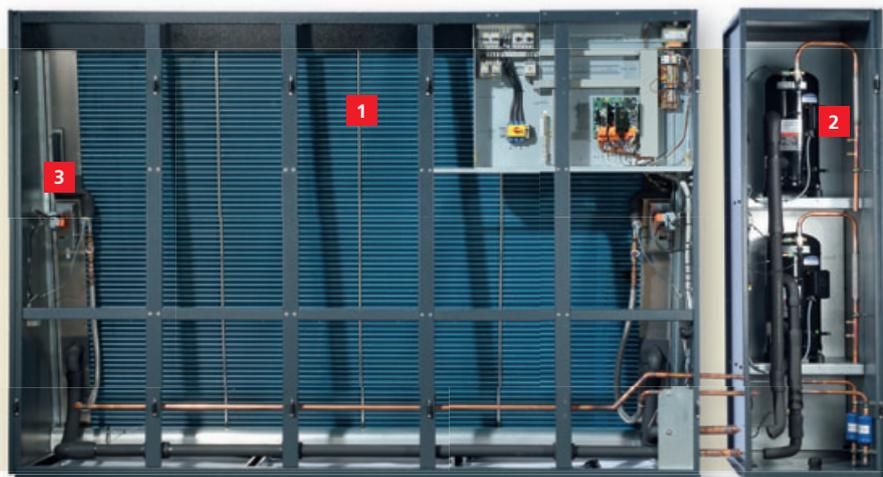
Room size, noise protection, redundancy – every project has requirements of its own. This is why CyberAir with Direct Free Cooling is available in both an air-cooled and a liquid-cooled version. What's more, we have divided the

sizes into different units, in order to enlarge the heat exchanger surfaces and enable a standardised, modular construction.



- 1** Louver for circulating air and filter pre-warming
- 2** Louver for outside air
- 3** F5 Filter (compact type)
- 4** F7 Filter (compact type)
- 5** Louver for circulating air and return air compressor mode, equipped with G4 filter (compact type)

Mixing and filtration box (available in size 1, 2, and 3). The special filters, placed in the outside air path, remove unwanted particles from the incoming air ensuring that clean filtered air, flows into the Data Center and through the sensitive servers. Bag-type filters are used for sizes 2 and 3, which further reduces air-side pressure losses.



- 1** Heat exchanger unit
- 2** Compressor unit
- 3** Motors for heat exchanger folding mechanism
- 4** Fan unit with EC fans

The air-cooled version consists of 4 components in the data centre (mixing and filtration box, heat exchanger unit, compressor unit and fan unit). The liquid-cooled CW version consists of 3 components in the data centre (mixing and filtration box, heat exchanger unit and fan unit), plus a chiller outside the data centre.



CyberAir AMD 1102 AU with fold-away heat exchanger

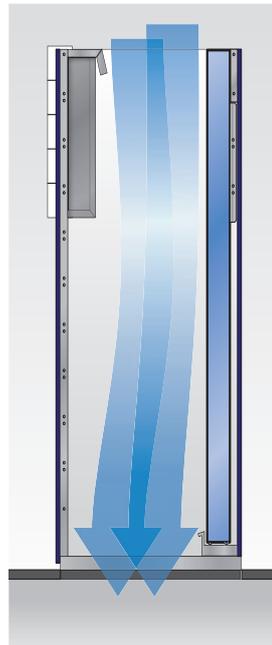
# CyberAir – keeping your running costs down



Our new CyberAir air-conditioning unit with Direct Free Cooling for medium-sized to large data centres slims down on demand, saving even more energy! This works thanks to a special heat exchanger – a new design that we have developed and patented for the CyberAir AMD units.

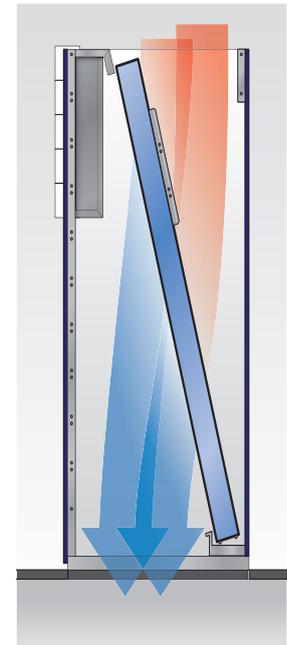
When Direct Free Cooling is used, the heat exchanger automatically folds away to the side. The filtered ambient air can then flow into the void under the raised floor unhampered and without further losses. This brings a further improvement in efficiency.

In "Direct Free Cooling" mode, the heat exchanger moves to the side, enabling the conditioned ambient air to flow unimpeded and without losses into the cavity under the raised floor. This technique brings about a further improvement in energy efficiency.



**CyberAir AMD in Free Cooling mode**

In "DX" or "CW" mode, the heat exchanger automatically moves back into position, and air-conditioning continues reliably in compressor mode or with chilled water from the outdoor chiller.



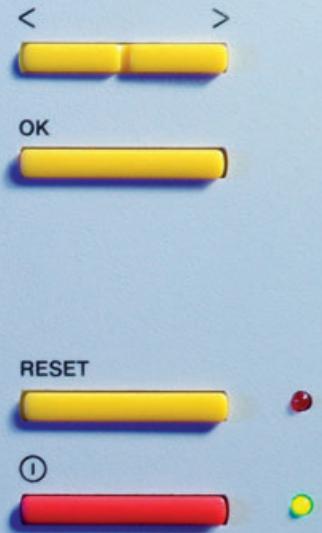
**CyberAir AMD in DX (compressor) mode or CW mode, with chillers**

In the CyberAir ASD units, both ambient air and return air flows through the heat exchanger in FC, DX or CW mode. The CyberAir AMD units, on the other hand, are equipped with a folding heat exchanger, which automatically folds away in "Free Cooling" mode, so that no pressure is lost.

## Advantages

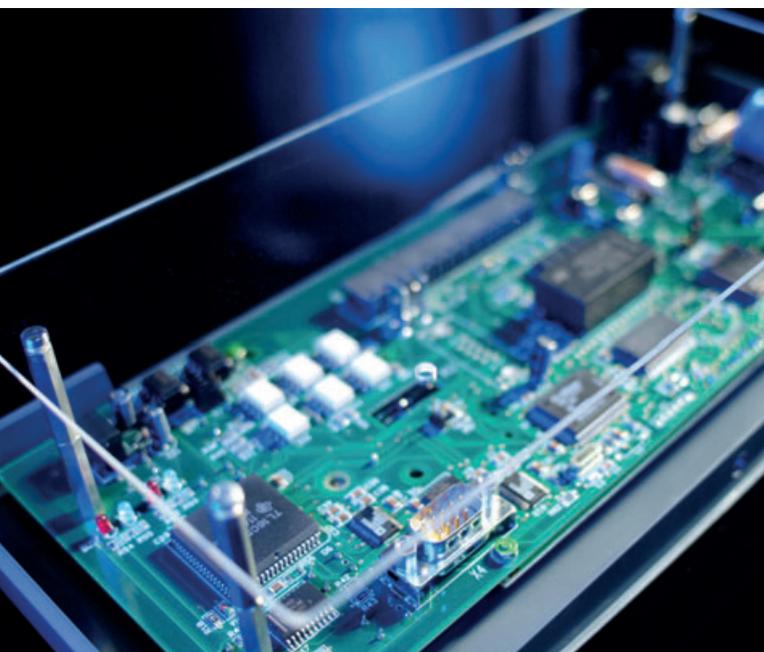
- High energy efficiency through the direct use of Free Cooling
- Fold-away heat exchanger in the CyberAir AMD for additional energy efficiency
- Additional savings opportunities in Mixed and DX mode, thanks to enlarged heat exchanger surfaces and low condensing temperature
- Excellent system scalability – "Build as you grow!"  
No hydraulics (pipework, pumps, fittings)
- Maximum reliability thanks to self-contained, simply constructed air-conditioning systems
- Drastically lower energy consumption than all conventional systems
- High-quality materials and perfectly harmonised components
- Lower capital investment than with conventional Indirect Free Cooling systems

# Intelligent control matters



Without intelligent control, the advantages of Direct Free Cooling and the resulting energy savings are simply not achievable. Our C7000 microprocessor, which we have been using for years for our CyberAir and MiniSpace units and Indoor Data Chillers, also controls the DFC<sup>2</sup> system.

The C7000 microprocessor controls and monitors the entire DFC<sup>2</sup> system, comprising air-conditioning units, filter and mixing units, humidification systems, heat exchangers, compressors and chillers, and it recognises any opportunity to make use of Direct Free Cooling.



## All active components in perfect balance

- Supply air control with return air limitation
- A settable number of units has to be connected and configured into one zone. All zones are independent from each other and are controlled in accordance to the average values
- Differential pressure control (raised floor)
- All three louvers of the "mixing and filtration box" are controlled from the C7000 (0-10V signal) in dependence of the ambient temperature and the room conditions
- Humidification control by the controller: in the event of low humidity in the room, a signal is sent to the external ENS humidifier, in the event of excessively high humidity in the room, one unit in the zone is set to compressor (dehumidification) mode.

# Technical data

<b>CyberAir DX with Direct Free Cooling</b>							
<b>Unit type ASD xxx AU with fixed heat exchanger</b>		<b>742</b>	<b>822</b>	<b>882</b>	<b>952</b>	<b>1002</b>	<b>1102</b>
Airflow	m <sup>3</sup> /h	25,000	25,000	33,000	33,000	35,000	35,000
DX cooling capacity (total) <sup>1)</sup> R407C	kW	75.3	82.2	89.0	95.4	99.4	108.1
DX cooling capacity (sensible) <sup>1)</sup> R407C	kW	75.3	82.2	89.0	95.4	99.4	108.1
Compressor power consumption <sup>1)</sup> R407C	kW	14.4	16.4	16.4	18.6	18.6	22.4
DX cooling capacity (total) <sup>1)</sup> R410a	kW	75.7	82.2	88.9	95.9	98.9	110.1
DX cooling capacity (sensible) <sup>1)</sup> R410a	kW	75.7	82.2	88.9	95.9	98.9	110.1
Compressor power consumption <sup>1)</sup> R410a	kW	14.6	16.6	16.6	18.8	18.8	22.6
Noise level <sup>3)</sup>	dBA	59.8	59.8	60.5	60.5	59.9	59.9
<b>Unit type AMD xxx AU with fold-away heat exchanger</b>							
Airflow	m <sup>3</sup> /h	25,000	25,000	33,000	33,000	37,000	37,000
DX cooling capacity (total) <sup>1)</sup> R407C	kW	75.3	82.2	89.0	95.4	100.8	109.4
DX cooling capacity (sensible) <sup>1)</sup> R407C	kW	75.3	82.2	89.0	95.4	100.8	109.4
Compressor power consumption <sup>1)</sup> R407C	kW	14.4	16.4	16.4	18.6	18.6	22.4
DX cooling capacity (total) <sup>1)</sup> R410a	kW	75.7	82.2	88.9	95.9	100.3	111.5
DX cooling capacity (sensible) <sup>1)</sup> R410a	kW	75.7	82.2	88.9	95.9	100.3	111.5
Compressor power consumption <sup>1)</sup> R410a	kW	14.6	16.6	16.6	18.8	19.0	22.6
Noise level <sup>3)</sup>	dBA	58.1	58.1	59.4	59.4	59.3	59.3
Fan power consumption in DX mode <sup>4)5)</sup>	kW	3.5	3.5	7.6	7.6	6.0	6.0
Fan power consumption in DX mode <sup>4)6)</sup>	kW	3.5	3.5	7.6	7.6	6.0	6.0
Fan power consumption in DX mode <sup>4)7)</sup>	kW	3.5	3.5	6.3	6.3	5.5	5.5
Fan power consumption in FC mode <sup>4)5)</sup>	kW	3.3	3.3	5.8	5.8	7.7	7.7
Fan power consumption in FC mode <sup>4)6)</sup>	kW	3.3	3.3	6.0	6.0	7.8	7.8
Fan power consumption in FC mode <sup>4)7)</sup>	kW	3.2	3.2	5.3	5.3	5.3	5.3
Number of fans		2		3			
Width	mm	2,710		3,110		3,460	
Height	mm	2,495					
Depth	mm	890					
<b>Mixing and filtration box</b>							
Width	mm	1,930		2,330		2,660	
(Size 1) Height x depth	mm	2.000 x 1.980					
(Size 1) Filter class pre filter, main filter and return air filter		compact type F5, compact type F7, compact type G4					
(Size 2) Height x depth	mm	3.000 x 1.980					
(Size 2) Filter class pre filter, main filter and return air filter		bag type F5, bag type F7, bag type G4					
(Size 3) Height x depth	mm	3.840 x 1.980					
(Size 3) Filter class pre filter, main filter and return air filter		bag type F5, bag type F7, bag type G4					

Remarks: All data apply at 400V/3 ph/50 Hz with 20 Pa ESP

<sup>1)</sup> Return air conditions: 27 °C / 30 % r. h.; condensing temperature: 45 °C

<sup>2)</sup> Return air conditions: 27 °C / 30 % r. h.; water: 10/15 °C, 0 % glycol

<sup>3)</sup> Noise level of unit (without mixing and filtration box) at 2 m distance under free-field conditions

<sup>4)</sup> The electric power consumption of the fans must be added to the room load

<sup>5)</sup> Values apply to unit incl. size 1 mixing and filtration box

<sup>6)</sup> Values apply to unit incl. size 2 mixing and filtration box

<sup>7)</sup> Values apply to unit incl. size 3 mixing and filtration box

# Technical data

<b>CyberAir CW with Direct Free Cooling</b>				
<b>Unit type ASD xxx CWU with fixed heat exchanger</b>		<b>1300</b>	<b>1600</b>	<b>2000</b>
Airflow	m <sup>3</sup> /h	24,000	33,000	34,000
CW cooling capacity (total) <sup>2)</sup>	kW	107.7	145.7	150.3
CW cooling capacity (sensible) <sup>2)</sup>	kW	107.7	145.7	150.3
Noise level <sup>3)</sup>	dBA	58.2	57.4	58.5
Fan power consumption in CW mode <sup>4) 5)</sup>	kW	3.7	6.8	5.2
Fan power consumption in CW mode <sup>4) 6)</sup>	kW	3.7	6.8	5.2
Fan power consumption in CW mode <sup>4) 7)</sup>	kW	3.7	5.6	4.7
Fan power consumption in FC mode <sup>4) 5)</sup>	kW	4.3	6.2	7.9
Fan power consumption in FC mode <sup>4) 6)</sup>	kW	4.3	6.4	8.0
Fan power consumption in FC mode <sup>4) 7)</sup>	kW	4.2	5.6	5.7
<b>Unit type AMD xxx CWU with fold-away heat exchanger</b>				
		<b>1300</b>	<b>1600</b>	<b>2000</b>
Airflow	m <sup>3</sup> /h	24,000	33,000	35,000
CW cooling capacity (total) <sup>2)</sup>	kW	107.7	145.7	153.9
CW cooling capacity (sensible) <sup>2)</sup>	kW	107.7	145.7	153.9
Noise level <sup>3)</sup>	dBA	56.5	55.7	57.4
Fan power consumption in CW mode <sup>4) 5)</sup>	kW	3.7	6.8	5.7
Fan power consumption in CW mode <sup>4) 6)</sup>	kW	3.7	6.8	5.7
Fan power consumption in CW mode <sup>4) 7)</sup>	kW	3.7	5.6	5.2
Fan power consumption in FC mode <sup>4) 5)</sup>	kW	3.5	5.0	7.1
Fan power consumption in FC mode <sup>4) 6)</sup>	kW	3.5	5.2	7.2
Fan power consumption in FC mode <sup>4) 7)</sup>	kW	3.4	4.5	5.0
Number of fans		2		3
Width	mm	2,150	2,550	2,900
Height	mm		2,495	
Depth	mm		890	
<b>Mixing and filtration box</b>				
Width	mm	1,930	2,330	2,660
(Size 1) Height x depth	mm		2,000 x 1,980	
(Size 1) Filter class pre filter, main filter and return air filter			compact type F5, compact type F7, compact type G4	
(Size 2) Height x depth	mm		3,000 x 1,980	
(Size 2) Filter class pre filter, main filter and return air filter			bag type F5, bag type F7, bag type G4	
(Size 3) Height x depth	mm		3,840 x 1,980	
(Size 3) Filter class pre filter, main filter and return air filter			bag type F5, bag type F7, bag type G4	

Remarks: All data apply at 400V/3 ph/50 Hz with 20 Pa ESP

<sup>1)</sup> Return air conditions: 27°C/30% r. h.; condensing temperature: 45°C

<sup>2)</sup> Return air conditions: 27°C/30% r. h.; water: 10/15°C, 0% glycol

<sup>3)</sup> Noise level of unit (without mixing and filtration box) at 2 m distance under free-field conditions

<sup>4)</sup> The electric power consumption of the fans must be added to the room load

<sup>5)</sup> Values apply to unit incl. size 1 mixing and filtration box

<sup>6)</sup> Values apply to unit incl. size 2 mixing and filtration box

<sup>7)</sup> Values apply to unit incl. size 3 mixing and filtration box



That's how much energy efficiency and reliability are behind DFC<sup>2</sup> – Direct Free Cooling



## STULZ Company Headquarters

**D** **STULZ GmbH**  
Holsteiner Chaussee 283 · 22457 Hamburg  
Tel.: +49 (40) 55 85-0 · Fax: +49 (40) 55 85 352 · products@stulz.de

## STULZ Subsidiaries

**AUS** **STULZ AUSTRALIA PTY. LTD.**  
34 Bearing Road · Seven Hills NSW 21 47  
Tel.: +61 (2) 96 74 47 00 · Fax: +61 (2) 96 74 67 22 · sales@stulz.com.au

**AT** **STULZ AUSTRIA GmbH**  
Lamezanstraße 9 · 1230 Wien  
Tel.: +43 (1) 615 99 81-0 · Fax: +43 (1) 616 02 30 · info@stulz.at

**CN** **STULZ AIR TECHNOLOGY AND SERVICES SHANGHAI CO., LTD.**  
Room 5505, 1486 West Nanjing Road, JingAn · Shanghai 200040 · P.R. China  
Tel.: +86 (21) 3360 7133 · Fax: +86 (21) 3360 7138 · info@stulz.cn

**E** **STULZ ESPAÑA S.A.**  
Avenida de los Castillos 1034 · 28918 Leganés (Madrid)  
Tel.: +34 (91) 517 83 20 · Fax: +34 (91) 517 83 21 · info@stulz.es

**F** **STULZ FRANCE S. A. R. L.**  
107, Chemin de Ronde · 78290 Croissy-sur-Seine  
Tel.: +33 (1) 34 80 47 70 · Fax: +33 (1) 34 80 47 79 · info@stulz.fr

**GB** **STULZ U. K. LTD.**  
First Quarter · Blenheim Rd. · Epsom · Surrey KT 19 9 QN  
Tel.: +44 (1372) 74 96 66 · Fax: +44 (1372) 73 94 44 · sales@stulz.co.uk

**I** **STULZ S.P.A.**  
Via Torricelli, 3 · 37067 Valeggio sul Mincio (VR)  
Tel.: +39 (045) 633 16 00 · Fax: +39 (045) 633 16 35 · info@stulz.it

**IN** **STULZ-CHSPL (INDIA) PVT. LTD.**  
006, Jagruti Industrial Estate · Mogul Lane, Mahim · Mumbai - 400 016  
Tel.: +91 (22) 56 66 94 46 · Fax: +91 (22) 56 66 94 48 · info@stulz.in

**NL** **STULZ GROEP B. V.**  
Postbus 75 · 1180 AB Amstelveen  
Tel.: +31 (20) 54 51 111 · Fax: +31 (20) 64 58 764 · stulz@stulz.nl

**NZ** **STULZ NEW ZEALAND LTD.**  
Office 71, 300 Richmond Rd. · Grey Lynn · Auckland  
Tel.: +64 (9) 360 32 32 · Fax: +64 (9) 360 21 80 · sales@stulz.co.nz

**PL** **STULZ POLSKA SP. Z O.O.**  
Budynek Mistral · Al. Jerozolimskie 162 · 02 – 342 Warszawa  
Tel.: +48 (22) 883 30 80 · Fax: +48 (22) 824 26 78 · info@stulz.pl

**SG** **STULZ SINGAPORE PTE LTD.**  
33 Ubi Ave 3 #03-38 Vertex · Singapore 408868  
Tel.: +65 6749 2738 · Fax: +65 6749 2750 · andrew.peh@stulz.sg

**USA** **STULZ AIR TECHNOLOGY SYSTEMS (SATS), INC.**  
1572 Tilco Drive · Frederick, MD 21704  
Tel.: +1 (301) 620 20 33 · Fax: +1 (301) 662 54 87 · info@stulz-ats.com

**ZA** **STULZ SOUTH AFRICA PTY. LTD.**  
Unit 18, Jan Smuts Business Park · Jet Park · Boksburg · Gauteng, South Africa  
Tel.: +27 (0)11 397 2363 · Fax: +27 (0)11 397 3945 · aftersales@stulz.co.za

## IT Cooling Solutions

### Close to you all over the world.

... With specialist, competent partners in our subsidiaries and exclusive sales and service partners around the world. Our five production sites are in Europe, North America and Asia.