direct evaporation – get rid of your water loop!

two-phase cooling directly with the refrigerant

- eliminates water
- no corrosion/erosion
- high heat flux
- low mass flow
- small coolant lines
waterless and effective cooling technology

With the functional principle of Two-Phase Direct Evaporation, AMS Technologies is promoting a new cooling approach for use in photonics and power electronics that offers significant potential savings in installation space, cost and energy consumption. Flexible refrigerant tubes connect the refrigerant circuit of the compressor directly with the application to be cooled, where the refrigerant is evaporated in a coil, an evaporator plate or directly in the macro or micro channels of laser diodes. This principle of Direct Evaporation therefore does completely without water, which in the case of commercially available recirculating chillers can lead to problems due to erosion, corrosion or germination and even to water leakage with consequential damage to optics or electronics. Because the refrigerant used for direct evaporation (R134a) is inert, these effects cannot occur here.

- no water pump
- no water tank
- no water level sensor
- no water filter
- no de-ionisation cartridge
- no germination

high temperature stability with linear compressors

Compared to water, the mass flow of the refrigerant is reduced to less than a quarter, which means that the technology can get by with smaller pipe diameters, among other things. However, the lack of water also means that its “buffering effect” is lost, so the reaction speed of the entire system must increase in order to guarantee reliable temperature stability. The use of Direct Evaporation technology, even for rapidly changing loads of high power (such as laser diode stacks), is only possible with linear compressors that can be controlled within wide limits and, above all, practically without delay. In combination with microchannel geometries in the evaporator, which ensure particularly good heat transfer to the application, very precise temperature control within narrow limits can be achieved.

microchannel cold plate and laser diode stack examples

superior COP values, higher output

Direct Evaporation also offers COP values (Coefficient of Performance) that are two to three times higher than compressor-based recirculating chillers. Tests have shown that two-phase cooling in microchannels of a laser diode stack increases the solid-fluid heat transfer coefficient dramatically by around 100% - resulting in an optical output increase by approximately 20% compared to conventional single phase water cooling technology.

compressor/condenser unit for rapid prototyping

For Direct Evaporation applications in a cooling capacity range between 100 W and about 800 W, AMS Technologies has developed a unit based on an oil-free linear compressor. This unit (dimensions: 200 mm wide x 380 mm deep x 170 mm high without controller) is made up of a condenser, a fan, a filter-dryer, accumulator and a control board and can optionally be equipped with a high-pressure switch and suction gas heat exchanger. On the application side, AMS Technologies provides a broad portfolio of cold plates (tubed, roll-bond, friction stir welded, performance fin, microchannel), that can be used as evaporator plates.

process & instrumentation diagram

optimum design of geometry and control required

Every application of Direct Evaporation technology must be optimally designed by experts. This applies not only to the selection of suitable components (compressor, condenser, fan, evaporator, etc.) and the design of the geometries in the cooling circuit (including expansion valve or capillary), but also to the control of the entire cooling system. Here the AMS Technologies team with its many years of expertise is at your disposal – get in touch with us!

custom Direct Evaporation solutions tailored to your cooling challenge

Our experts are happy to develop direct evaporation refrigeration solutions and evaporator solutions that are tailored to the exact requirements of your refrigeration application. Our Thermal Design Center in Krakow, Poland, together with our manufacturing facility, will take care of turning your custom thermal solution into practice. Get in touch with us!
enabling your ideas.
Optical, Power and Thermal Management Technologies

- **GERMANY**
  AMS Technologies AG
  Frauenhoferstr. 22
  82152 Martinsried, Germany
  Phone + 49 (0) 89 895 77 0

- **FRANCE**
  AMS Technologies S.A.R.L.
  Silic 649 – Bâtiment Magnolia 16, avenue du Québec
  91945 Courtabœuf Cedex
  Phone + 33 (0) 1 64 86 46 00

- **ITALY**
  AMS Technologies S.r.l.
  Corso Sempione, 215/B
  20025 Legnano (MI), Italy
  Phone + 39 0331 596 693

- **POLAND**
  AMS Technologies Sp. z o.o.
  Mogilska 69 St, Floor 2
  31-545 Krakow, Poland
  Phone + 48 (0) 12 346 24 16

- **SPAIN**
  AMS Technologies S.L.
  C/Faladors 35, 3°, 08208 Sabadell, Spain
  Phone + 34 93 380 84 20

- **SWEDEN**
  AMS Technologies Nordic
  Aspect Photonics AB
  Aminogatan 34
  43153 Mölndal, Sweden
  Phone + 46 (0) 8 55 44 24 80

- **UNITED KINGDOM**
  AMS Technologies Ltd.
  Nene House, Drayton Way
  Daventry, Northamptonshire NN11 8EA, United Kingdom
  Phone + 44 (0) 1455 556360

info@amstechnologies.com
www.amstechnologies.com
www.amstechnologies-webshop.com