

TNO: your partner in air cooler development

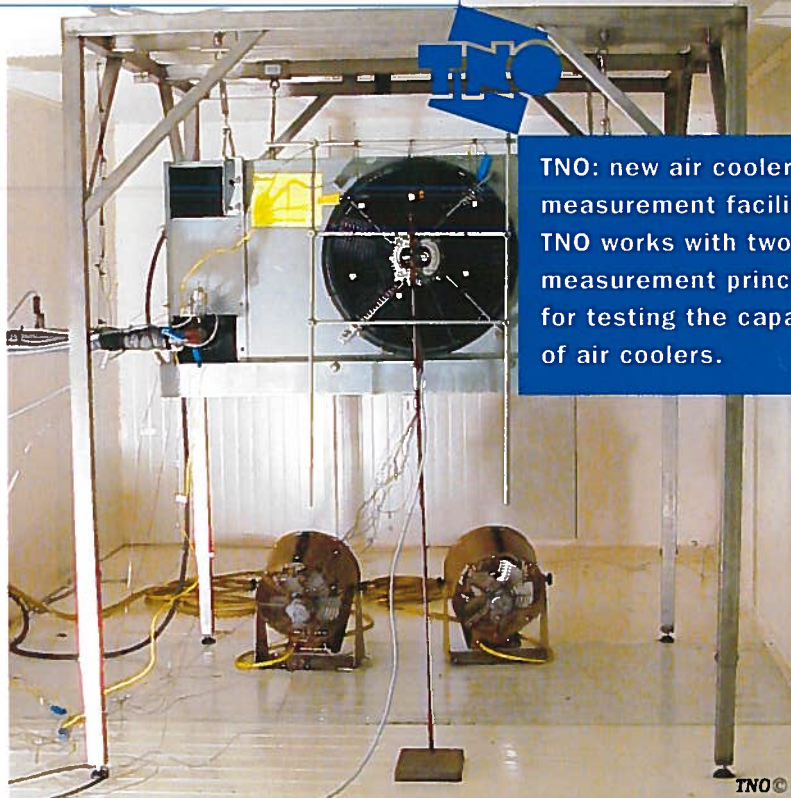
At TNO we know that manufacturing air coolers is a highly competitive business. With TNO's trusted expertise solidly behind you, your company can focus on reaching your target market with supporting product development through TNO's research, consultancy and independent test data in conformity with European standards.

Developing air coolers and/or condensers requires extensive product testing. At TNO's institute, our comprehensive test facilities are capable of measuring cooler and condenser capacities very accurately. You'll be glad to know that we can measure the effects of even small modifications on their performance. In the process, TNO can help explain the science of thermodynamic effects while giving your company sound practical advice, too – all at the same time.

Independent laboratories such as TNO continue to inspect products of Eurovent certified members within strict scientific standards. Plus TNO's collaborative working relationship with organizations such as Eurovent provides product performance certification. It guarantees customer satisfaction with our client's manufactured products.

Explaining technical features

At TNO we are very excited about our test facilities especially our new calorimeter chamber. Our calorimeter chamber meets today's strictest measurement requirements. The new facility gives us two separate ways to determine air cooler or condenser capacity based on two different principles. Using two different measurement principles – calorimeter and coolant – results can be compared with each other which assures very accurate



TNO: new air cooler measurement facilities. TNO works with two measurement principles for testing the capacity of air coolers.

results. Therefore TNO guarantees satisfaction, and our results meet the highest standards possible. In Figure 1, here is a diagram of TNO's measurement facilities.

TNO's measurement facilities can test heat exchanger capacity for continuity including or excluding heat supplied by the fan.

The calorimeter chamber measurement method

With TNO's calorimeter chamber method, we measure all heat flows going to the inner cell. Total heat flow is cooled away by the cooler and hence the capacity of the cooler is determined. The most difficult measurement challenge we face in this process is to determine an accurate heat flow through the cell wall. In order to determine and calculate the heat flow through the wall, a stable and controlled temperature profile over the wall is

Test facility of the air coolers at TNO's laboratories.

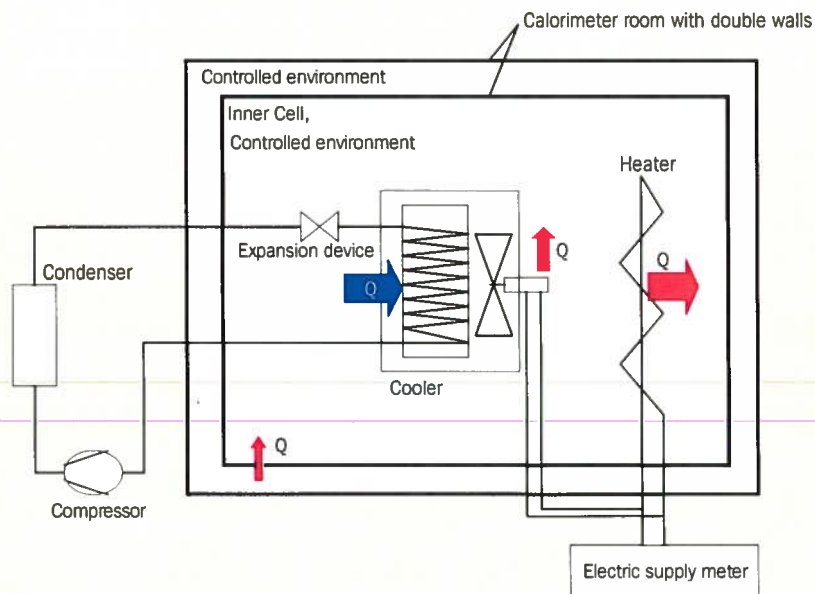


Figure 1
Facilities diagram.

necessary. Therefore a facility is build with double walls so that, between these two walls, the chamber's climate conditions – as well as those within the inner cell – are controlled. With TNO's innovative approach, the ΔT over the inner wall together with the heat flow through the wall is accurately, and completely, controlled. Together with the measured consumed electric power of the heaters and fans, all flows are known. The sum of all energy flows is the coolers capacity.

The coolant flow measurement method

AT TNO, we also measure the enthalpy difference between the incoming and outgoing coolant. With this conventional method, you can trust TNO to measure the capacity that simply follows from $\Delta H \times$ mass flow.

Results

Using both measurement methods – calorimeter and coolant – we can compare these results. The difference between these two methods is (and should be) less than 4 percent. Using this method of comparing the measurement results meet highest European standards possible.

Measurements, in general, are taken under dry conditions so that the dew point is less than the coolant's evaporation temperature. However controlled dew point measurements are also possible. TNO's current test package meets the most important standards EN 328, EN 327 for air coolers, condensers and heat exchangers. Tests can be carried out under a variety of standard conditions (SC):

Standard conditions	Ambient temperature	Evaporation temperature
SC1	10	0
SC2	0	-8
SC3	-18	-25
SC4	-25	-31
SC5	-34	-40

TNO Apeldoorn is already the only testing facility recognized by Eurovent for refrigerating and freezing cabinets. Together with this new test facility, TNO has expanded it's test and research package to nearly all existing cooling appliances (Transport, domestic, commercial and industrial).

TNO-MEP is committed to quality living conditions, competitive production processes and sustainable use of energy. To this end we develop and apply knowledge and innovative technologies.

TNO Environment, Energy and Process Innovation
Refrigeration and Heat Pump Technology

Visiting address
Laan van Westenenk 501
7334 DT Apeldoorn
The Netherlands

Postal address
P.O. Box 342
7300 AH Apeldoorn
The Netherlands

www.mep.tno.nl/ktw

Information
J.G.B. Fransen, M.Sc.
P +31 55 549 31 18
F +31 55 549 37 40
KTW.Secretariaat@mep.tno.nl

