EN 16430 (SN EN 16430) standard for trench convectors

- Information on improved design -

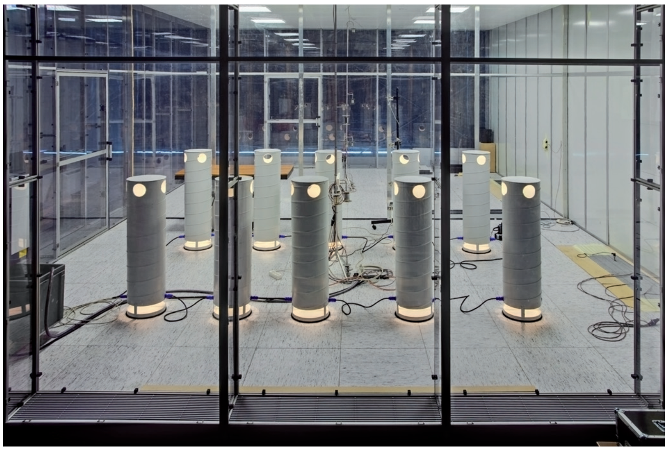
Before the introduction of EN 16430 in March 2015, there was no clear standard for determining the output of trench convectors. EN 16430 regulates the performance measurements of trench convectors under practical conditions and ends the uncertainties in planning and comparing the performance of different manufacturers. The strengths and weaknesses of EN 16430 are shown below.

Heat and cooling outputs

The standard regulates the performance measurements specifically of trench convectors based on EN 442. Three parts of EN 16430 describe the measurements.

Part 1: Technical specifications and requirements
Part 2: Test method and rating for thermal output
Part 3: Test method and rating for cooling capacity

The specific requirements for cooling mode are taken into account in EN 16430 Part 3. The reference air temperature is measured in the centre of the test chamber (2 metres from the external wall) at a height of 0.75 metres. This reference air temperature is not to be confused with the air inlet temperature. This may differ between the unavoidable short circuit between the air outlet and air intake.



Test set-up of 10 output-controlled dummies

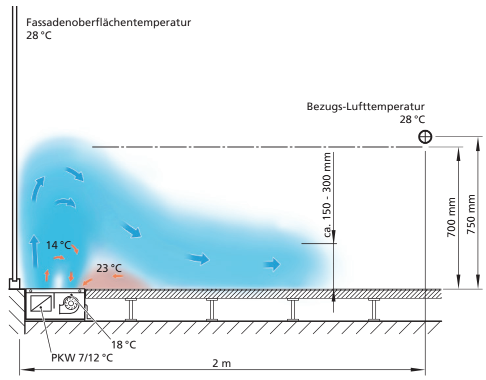
Comparison of air flow profiles

The graphic shows the main differences in the air flows of short circuit-optimised and non-short circuit-optimised trench convectors for cooling. With a short circuit-optimised variant, the air rises significantly higher on the façade, mixes and penetrates deeper into the room at a higher temperature. The result is a more even temperature distribution and comfort in the occupied zone.

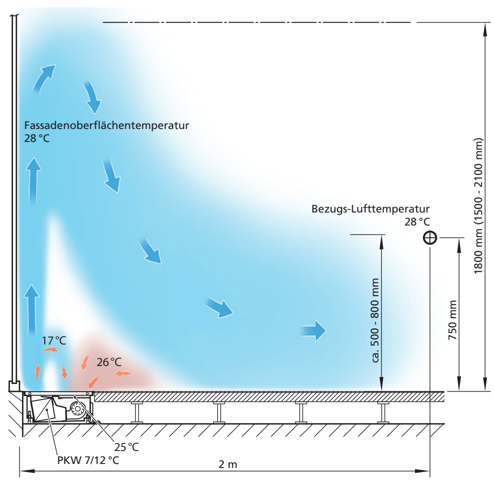
Trench convectors with a high proportion of short circuits provide only a small amount of the output to the room. Performance data based on the air inlet temperature are particularly misleag, as this can be significantly lower than the reference air temperature (room temperature).

Katherm HK units have been developed with short circuit optimisation in mind and minimise this short circuit as far as technically possible. The performance data refers to the reference air temperature, measured at a distance of 2 m from the façade.

Kampmann has been measuring the heat and cooling outputs of the trench convectors accorg to EN 16430 for years. The trench convectors were measured in the standard outputs accorg to EN 16430 and thus comply with the technically defined standards.



With air outlet not optimised in terms of short-circuiting



With air outlet optimised in terms of short-circuiting

You should pay attention to this when designing trench convectors:

1. **Important!** Laminar flows due to low water volume flows are not considered in EN 16430. The heat and cooling outputs of trench convectors must be measured accorg to EN 16430 in order to ensure the comparability of performance data from different manufacturers.

After the introduction of EN 16430, it was determined through numerous project requirements that the sole calculation of performance accorg to the standard does not always do justice to practice and the requirements in the object. Regardless of the manufacturer, care must be taken to ensure that laminar flow does not occur when the water volume flow is too low. In particular, EN 16430 does not take the following points into account when determining the cooling outputs:

» The cooling outputs are measured at the standard measuring point 17/19/28 °C, this corresponds to an undertemperature Δt = 10 K or a 2 K spread between flow and return temperature. Deviating points and areas with larger spreads at constant undertemperature are not recorded in the calculation rule in a practice-oriented manner. EN 16430 only takes into account conversions of the standard outputs with determined coefficients.

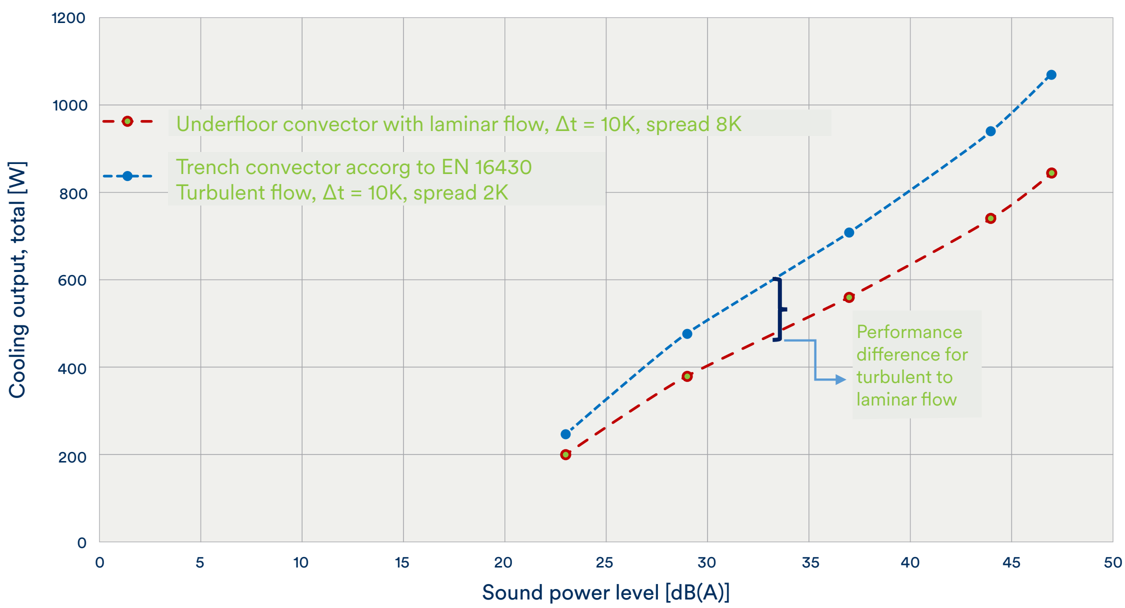
» Turbulent and laminar flow conditions are not differentiated/considered.

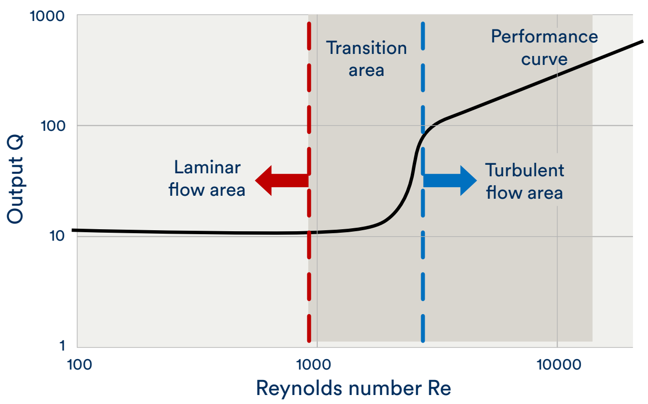
» The scope of EN 16430 prohibits measurements in wet cooling with condensate accumulation. A concrete procedure for what to do in the case of wet cooling is not specified in the standard.

For these reasons, Kampmann measures accorg to an extended measuring procedure, the so-called DOE (design of experiment). This measurement procedure goes far beyond the measurement regulations of the standard. Here Kampmann can measure areas that are not taken into account by the standard but are required in the projects. This is important in order to be able to provide reliable and practical design data even in areas that are not well covered by the standard.

2. The standard data only takes cooling outputs outside the standard point into account to a limited extent, laminar flow conditions are not considered.

Performance comparison - influence of laminar flow





The diagrams clearly show the influence of laminar and turbulent flow on performance.

An important parameter is the Reynolds number (Re) for determining laminar and turbulent flow.

Turbulent flow in pipes = low temperature spreads = water volume flow or flow velocity high.

Laminar pipe flow = significant decrease in output = high temperature spreads = water volume flow or flow velocity low.

Significant increase of the performance curve when leaving the laminar flow area into the turbulent flow area!

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3. Practical planning with the Kampmann design program KaDATA – design accorg to fixed water volume flow

Cooling design example: Requirement 520 W at sound power level 35 dB(A),
Specified: System temperatures 14/18/26 °C, 2-pipe, length 1700 mm

A: Design accorg to fixed flow and return temperatures.
Undertemperature Δt 10 K, spread 4K.
Output and sound power level suitable for control voltage 5.5 V.

Important!
Information for control voltage 5.5 / 4 / 2 V = low efficiency with laminar flow

Calculate performance data

Medium
Water

Cooling

Flow temperature: 14
Return temperature (°C): 18
Room air temperature (°C): 26
Relative humidity (%): 50

Control voltage

[V] 10 | [V] 8 | [V] 5.5 | [V] 4 | [V] 2

Control voltage V	10	8	5.5 (!)	4 (!)	2 (!)
SFP value Ws/m³	146	125	120	125	163
Air volume flow m³/h	411	363	259	196	113
Power consumption W	16.7	12.6	8.6	6.8	5.1
Current consumption mA	172	130	89	70	53
Sound pressure level dB(A)	38	36	27	20	20
Sound power level dB(A)	46	44	35	28	28
Glycol content %	0				
Flow temperature °C	14				
Return temperature °C	18				
Room air temperature °C	26				
Rel. air humidity %	50				
Cooling output, total W	896	785	545	401	208
Cooling output, sensitive W	896	785	545	401	208
Inlet air temperature °C	25.2	24.9	24.3	23.9	23
Outlet air temperature °C	18.9	18.7	18.3	18	17.7
Water volume flow l/h	193	169	118	86	45

Cooling: Low efficiency due to laminar flow is taken into account

B: Design accorg to fixed water volume flow selected. Water volume flow at control voltage 8 V = 169 l/h.

Sufficient turbulent flow in pipes and output available.
Adjusted return temperature in the control stages.

Calculate performance data

Medium
Water

Cooling

Flow temperature: 14
Water volume flow (l/h): 169
Room air temperature (°C): 26
Relative humidity (%): 50

Control voltage

[V] 10 | [V] 8 | [V] 5.5 | [V] 4 | [V] 2

Control voltage V	10	8	5.5	4	2
SFP value Ws/m³	146	125	120	125	163
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Sound power level dB(A)	46	44	35	28	28
Glycol content %	0				
Flow temperature °C	14				
Return temperature °C	18.3	18	17	16.2	15.3
Room air temperature °C	26				
Rel. air humidity %	50				
Cooling output, total W	859	781	591	461	256
Cooling output, sensitive W	859	781	591	461	256
Inlet air temperature °C	25.1	24.8	24.1	23.5	22.1
Outlet air temperature °C	19.1	18.6	17.5	16.7	15.5
Water volume flow l/h	169	169	169	169	169

4. Support from Kampmann for the practical design of trench convectors

» By means of its own extended DOE measuring procedure, Kampmann has verified the technical data in detail and can provide detailed information for practical dimensioning.

» This means that Kampmann can also measure the points that deviate from the standard in order to provide authentic and practical design data for these areas.

» Use the Kampmann design programme! This explicitly shows when the units are at an efficient design point with turbulent flow.

» Design the units at a constant water volume flow that ensures turbulent flow at all relevant design stages.
This corresponds to the practice in the projects on site.

The Kampmann technical advisors are available for a personal consultation for the practical design of specific projects!