Test Report

about laboratory tests for

Determining technical parameters using carrier compound for air-cooling with water intake

Tested type: FKP 158

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1 Objective

Main goal of the tests was to determine technical parameters of the carrier compound FKP 158 used for air cooling with water intake.

The carrier compound serves as component for humidification of aerated fresh air in order to cause a cooling down of the vicinity.

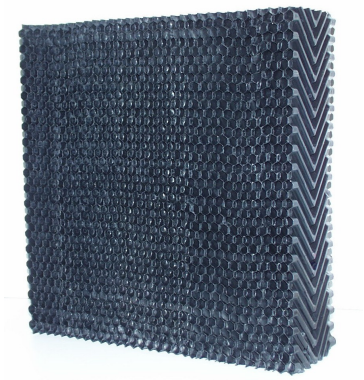
2 Test material

Test material was provided by the customer.

Technical data and a brief description of the tested type are listed below in table 1.

Table 1: carrier compound FKP 158 – description and technical data

material:	polypropylene	
description:	– consisting of moulded plastic panels with a honeycombs surface structure on both sides permeable to air, – each panel has a duct-shaped profile with 45° and 90° redirections, – panels are arranged crosswise and are welded among eachother punctiform	
main data sample:	dimensions, l x w x h:	approx. 500 x 500 x 150 mm
	weight, dry:	approx. 1,38 kg
	specific:	approx. 5,5 kg/m²



3 Test conditions

The test was solely carried out on a DLG test rig setup in a heated laboratory during December 2004.

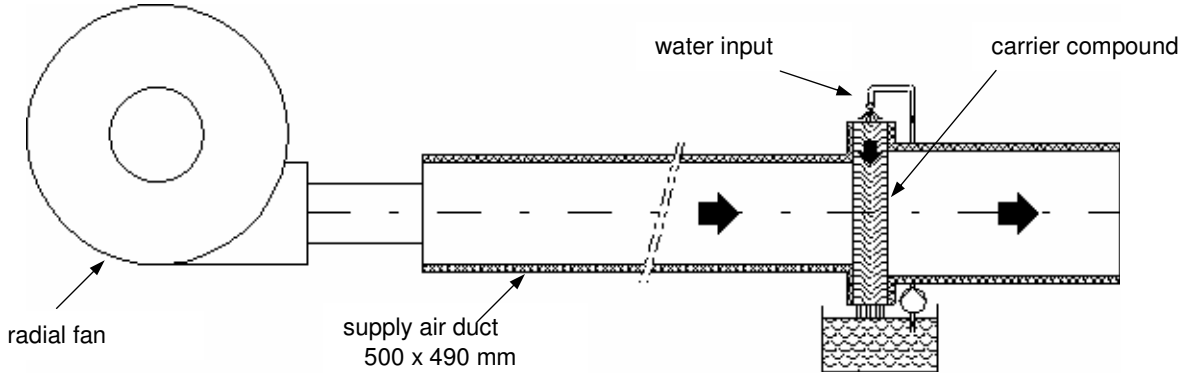


Fig. 1: test setup

The test facility was a cross flow measuring section. The carrier compound was installed without incline. For humidification water was added through a spray duct from above into the carrier compound. Different flow rates were set via two different pump sizes and two duct inserts respectively. Table 2 summarises the test conditions.

Table 2: Test conditions

calibration:	– water throughput:	0,4 / 0,8 /1,2 and 1,7 m³/h
	– air speeds:	1,0 / 1,5 / 2,0 / 2,5 and 3,0 m/s
environmental conditions:	– temperature:	29 to 31 °C
	– relative humidity:	29 to 40 %
	– air density:	1,18 to 1,19 kg/m³
test procedure:	– positioning of air speeds with adjustable supply air tunnel – positioning of water throughput (choose pump and flow limiter respectively) – record performance data: - temperature, humidity*) and - pressure loss Measured data were collected after an equilibrium condition was reached, i.e. from the time when the temperature values remained constantly. *) using psychrometric measuring method, with Pt 100-pickup sensor before and after the carrier compound.	

4 Test Results

Table 3 outlines the results for temperature measurements and table 4 lists the results for humidity measurements. In both cases the measured values for air before and after passing the carrier compound are indicated. The results point out that at equal water throughput difference in temperature and relative humidity respectively decline with increasing air speeds. The level of cooling and humidity increase if the water throughput is enhanced. A cooling down of the aerated air between 4,6 and 9,4 K at the same input temperature was measured (fig. 2).

Table 3: temperatures

water throughput	air speeds	temperature		
		before	after	difference
m³/h	m/s	° C	° C	K
0,4	1,0	30,1	22,6	7,5
	1,5	30,0	23,9	6,1
	2,0	30,0	24,8	5,2
	2,5	30,0	25,4	4,6
	3,0	29,8	25,1	4,7
0,8	1,0	29,7	21,2	8,5
	1,5	29,8	22,0	7,8
	2,0	30,3	23,4	6,9
	2,5	29,5	22,0	7,5
	3,0	30,2	23,2	7,0
1,2	1,0	30,4	21,2	9,2
	1,5	30,1	22,0	8,1
	2,0	30,0	22,6	7,4
	2,5	30,0	22,9	7,1
	3,0	30,1	22,7	7,4
1,7	1,0	30,0	20,6	9,4
	1,5	29,9	21,3	8,6
	2,0	30,1	22,0	8,1
	2,5	30,0	22,4	7,6
	3,0	29,9	22,0	7,9

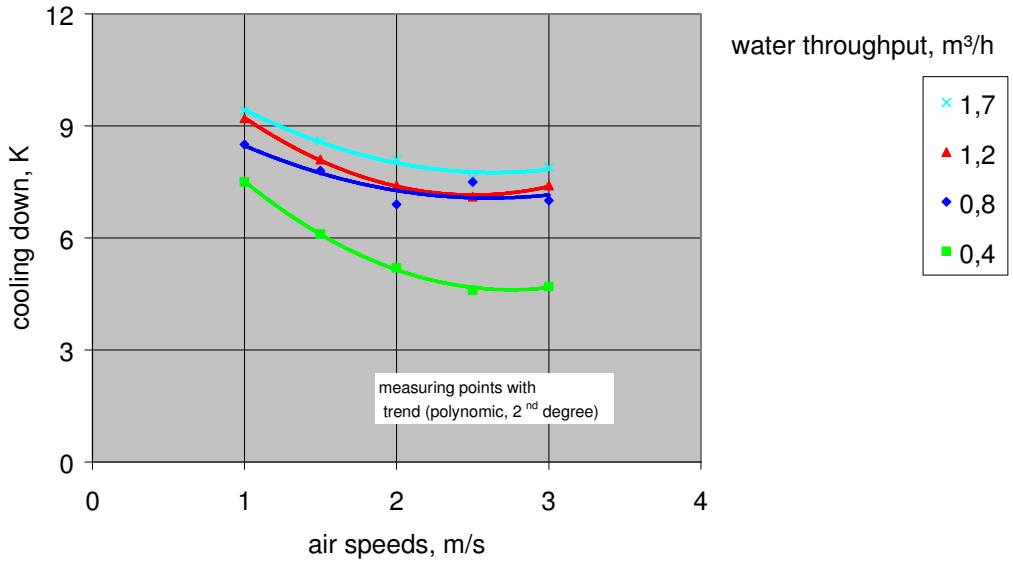


Fig. 2: cooling down of air subject to air speeds and water throughput

Relative humidity increased compared to the input values (29 to 40 %) at difference values in the range of approx. 18 to max. 48 %. Humidity values of ≥ 80 % were not determined. Figure 3 indicates the achieved humidity values after passing the carrier compound.

Table 4: relative humidity

water throughput	air speeds	relative humidity		
		before	after	difference
m³/h	m/s	%	%	%
0,4	1,0	32,9	63,6	30,7
	1,5	34,8	59,4	24,6
	2,0	36,7	58,1	21,5
	2,5	38,6	58,1	19,6
	3,0	34,5	53,1	18,6
0,8	1,0	34,8	77,5	42,7
	1,5	35,2	73,8	38,6
	2,0	38,6	72,3	33,7
	2,5	29,0	61,5	32,5
	3,0	32,4	62,9	30,5
1,2	1,0	33,8	79,2	45,4
	1,5	35,7	77,1	41,4
	2,0	37,6	73,8	36,2
	2,5	40,0	76,2	36,2
	3,0	33,3	66,4	33,1
1,7	1,0	31,0	78,5	47,5
	1,5	32,4	74,6	42,2
	2,0	34,8	73,1	38,3
	2,5	38,6	76,2	37,6
	3,0	33,8	70,8	37,0

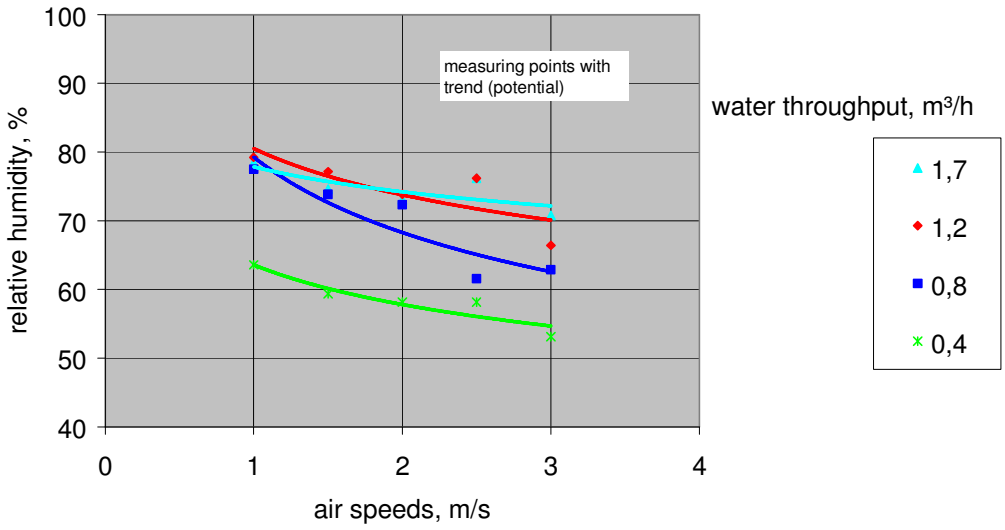


Fig. 3: relative humidity subject to air speeds and water throughput

The humidifying capacity was calculated from the measured values. The results are tabulated in table 5 and diagrammed in figure 4.

Table 5: humidifying capacity

air speeds	hmidifying capacity at a water throughput of			
	0,4 m³/h	0,8 m³/h	1,2 m³/h	1,7 m³/h
m/s	g/h	g/h	g/h	g/h
1,0	616	909	954	1068
1,5	517	860	935	948
2,0	477	755	778	813
2,5	451	774	781	775
3,0	444	718	741	805

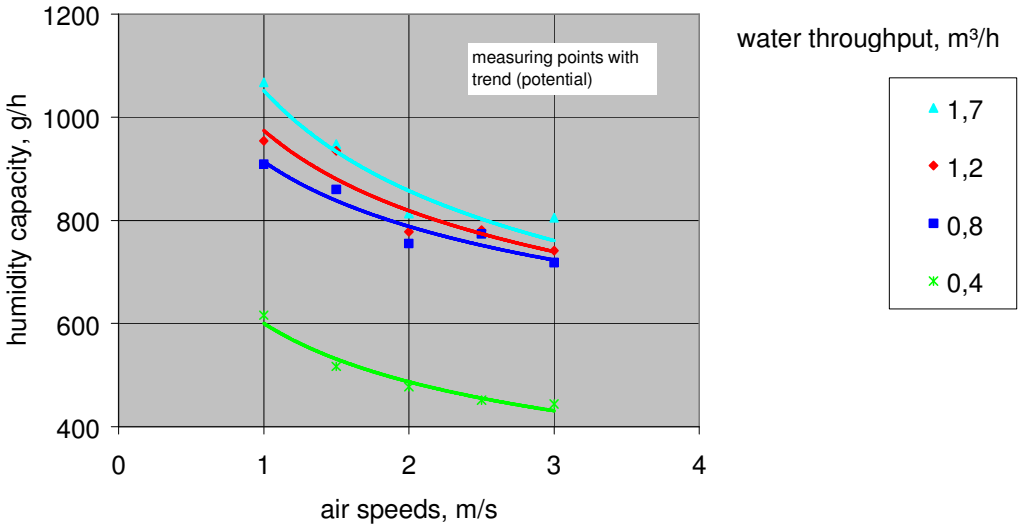


Fig. 4: humidifying capacity subject to air speeds and water throughput

The pressure loss primarily depends on the air speeds.

The measured values for pressure loss are summarised in table 6 and diagrammed in figure 5. At maximum preset air speeds (3 m/s) the pressure loss reaches values between 45 and 57 Pa. With ascending water supply the pressure loss increases depending on the air speed level between 8 and 12 Pa.

Table 6: pressure loss

air speeds	pressure loss at a water throughput of			
	0,4 m³/h	0,8 m³/h	1,2 m³/h	1,7 m³/h
m/s	Pa	Pa	Pa	Pa
1,0	4	7	11	12
1,5	14	12	20	26
2,0	20	21	32	36
2,5	32	31	41	47
3,0	45	55	56	57

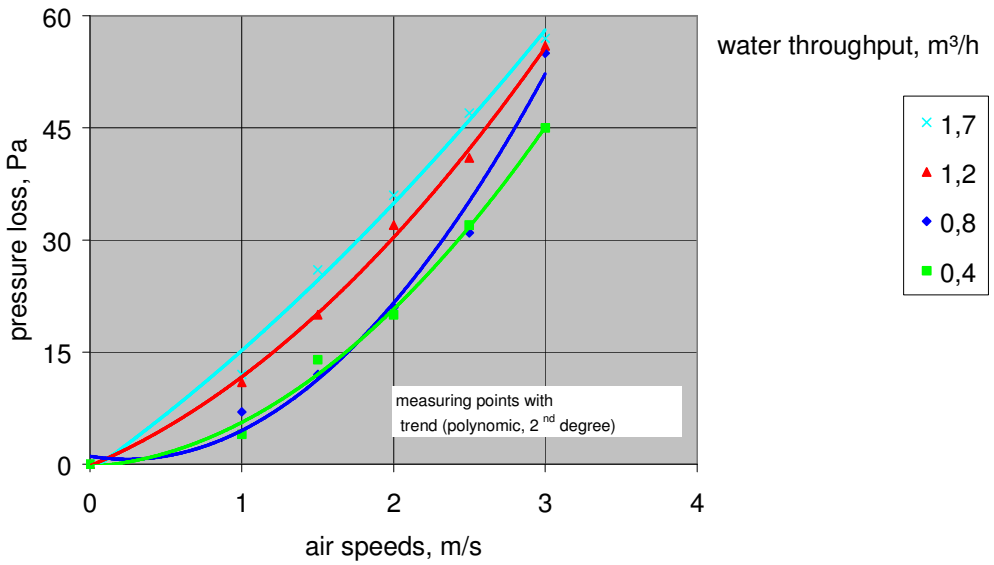


Fig. 5: pressure loss subject to air speeds and water throughput

5 Summary

The test results pinpoint the possible level of air humidification and the therewith aligned cooling down.
The test with the carrier compound FKP 158 was performed under laboratory conditions. Other criteria were not tested.

Groß-Umstadt; March, 8th 2005

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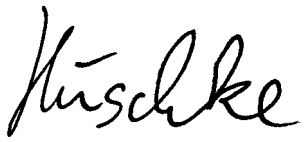

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