

Scope Radiant panel characterization

1 Méthodology

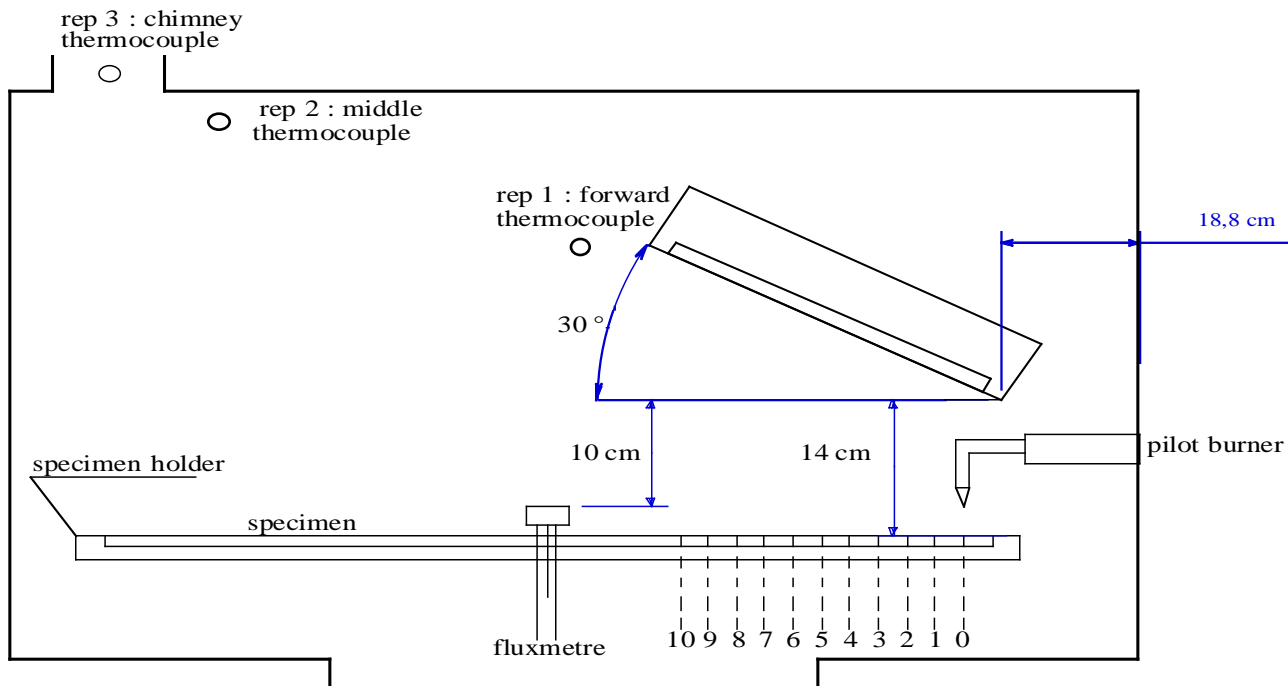
- 11 Time determination for a stable temperature in the chamber
- 12 Control tuning for a nominal flux value at position 0.
- 13 Flux profile determination

2 Means

- 21 Radiant panel WATLOW RAYMAX 1330 (triphased 380 V) .
- 22 Thyristor WATLOW
- 23 Microprocessor autotuning control WATLOW (factory tuned PID with K thermocouple)
- 24 THERMOGAGE fluxmeter from VATELL
- 25 Thermocouples type K (LABVIEW data acquisition chain.)
- 26 Chamber as defined in ASTM 648 and current FAA test procedure(available on internet)

3 Test results

- 31 First profil flux determination in the initial radiant panel mounting



ETABLI PAR (nom, fonction) :
J.GVAISSIER & V.BUFFARD

Visa

AUTRES CONTROLES (nom, fonction)

Visa

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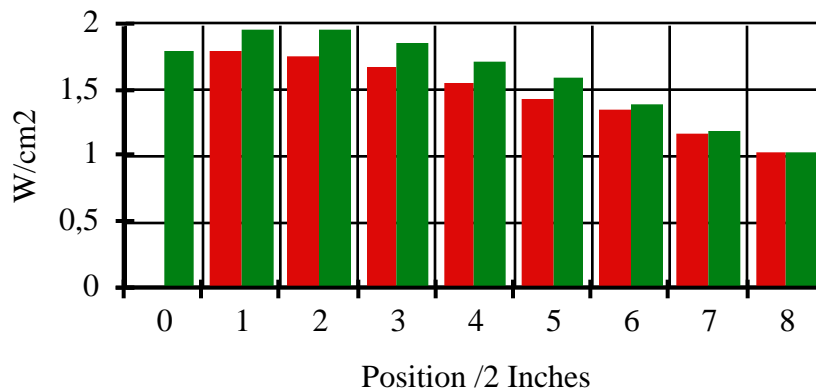
Radiant panel position is 30 ° away from horizontal . In this position a sample for testing is located 140 mm from the lowest heated point of the electrical panel.

Radiant panel position is noticed to be 188 mm away from the inside panel chamber (figure 1)

Fluxmètre position (inches)	Flux FAA en W/cm2	Flux JEHIER en W/cm2
0	-	1,8
1	1,8	1,96
2	1,76	1,96
3	1,68	1,85
4	1,56	1,72
5	1,43	1,59
6	1,36	1,39
7	1,16	1,2
8	1,03	1,02

Heating set at 500°C on the Watlow PID control leads to 470°C on the panel surface.

Flux profile at 500°C set point



The maximum flux 1.96 W/cm2 starts at position 1 (ie 2 inches away from position 0)
The radiant panel has to be moved by 2 inches along the horizontal line.

The flux is too high (1.96 W/cm2) instead of 1.8 W/cm2. So panel heat has to be set to meet the requested value 1.8 W/cm2.

32 Temperature set point determination in order to get the nominal flux in position 1

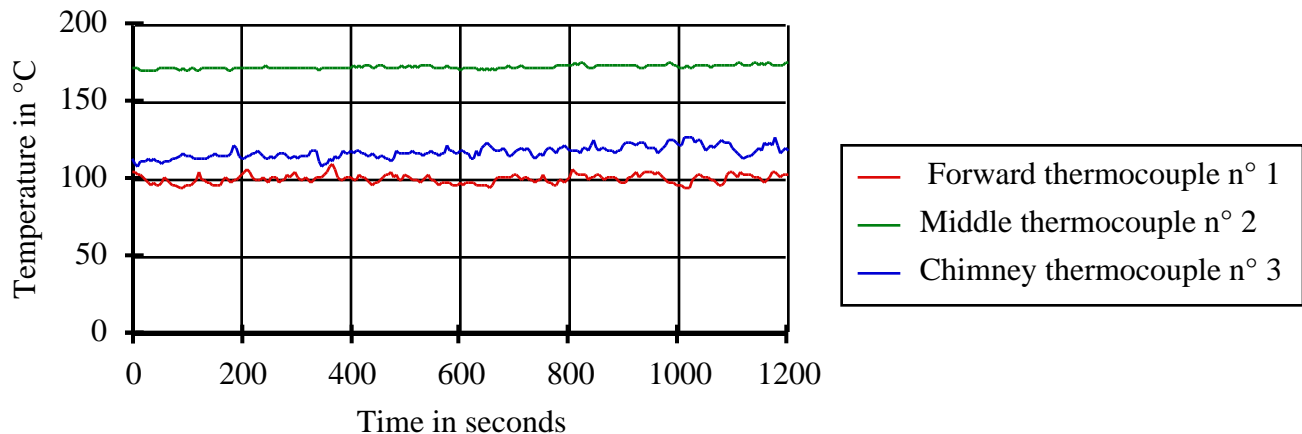
Set point	Regulated temperature response	Flux W/ cm2 in position 1
500	465	1,96
490	465	1,96
480	459	1,93
470	451	1,83
465	445	1,8

465 ° C is the appropriate setpoint to get the nominal flux in position 1 and consequently the radiant power.

Nota: See appendix 1 showing regulation at the set point over 5 hours . The flux quickly reaches the set point and keeps steady within the fluxmeter tolerances. So the PID parameters are well tuned.

33 Measurement of temperature inside the chamber (thermocouples 1, 2 ,3 as shown in figure 1)

At least heating the radiant panel during one hour is necessary to get stabilized temperatures in the chamber.



In comparison to the preliminary test method described by FAA, temperature levels are much lower.

-> thermocouple 2 is at 170°C instead of 230°C mentioned in the referenced test procedure.

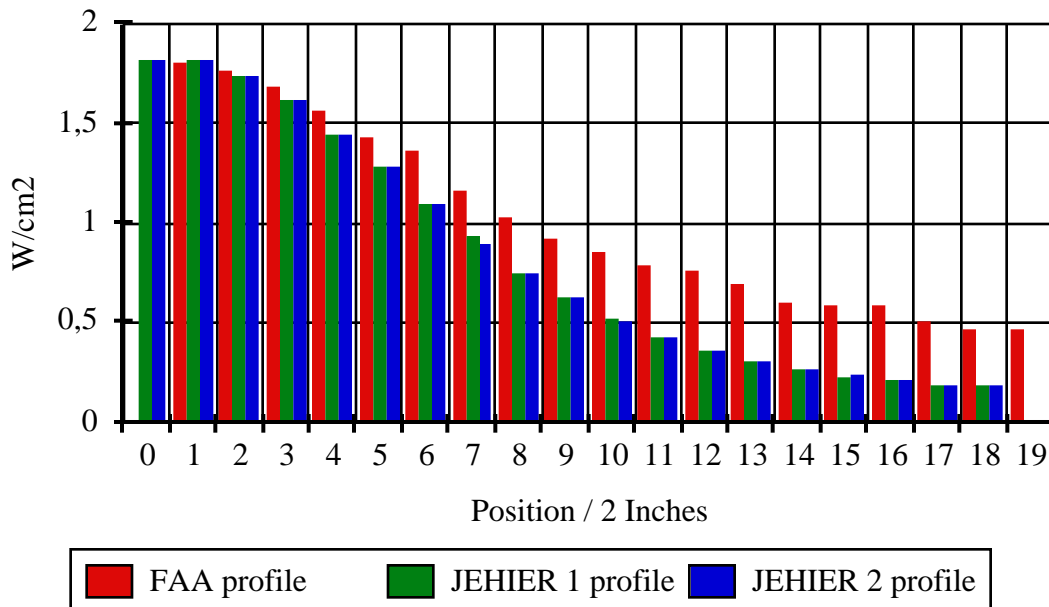
-> thermocouple 3 is at 125°C instead of 135°C mentioned in the referenced test procedure.

35 Flux profile determination after set up of the radiant panel (position and set point)

Test conditions; radiant test panel position 30 ° angle and 138 mm away from the internal side of the chamber

Position in inch	FAA profile in W /cm2	JEHIER 1 profile in W / cm2	JEHIER 2 profile in W/cm2
0		1,81	1,81
1	1,8	1,82	1,82
2	1,76	1,73	1,73
3	1,68	1,61	1,61
4	1,56	1,44	1,44
5	1,43	1,28	1,28
6	1,36	1,09	1,09
7	1,16	0,93	0,9
8	1,03	0,75	0,75
9	0,92	0,63	0,62
10	0,85	0,52	0,51
11	0,78	0,43	0,42
12	0,76	0,36	0,36
13	0,69	0,31	0,31
14	0,6	0,27	0,27
15	0,58	0,23	0,24
16	0,58	0,21	0,21
17	0,5	0,19	0,19
18	0,47	0,18	0,18
19	0,47		

Nota : Profile JEHIER 1 and Profile JEHIER 2 are two profiles established at two different days. The results are presented hereafter.



Comments

- 1) The two flux profiles established at two different days show a good repeatability.

- 2) Fluxmeter tolerancy equals 2% with a repetability of 1%. The test procedure is asking for a tolerance which is too stringent compared to the fluxmeter tolerancy.

- 3) Flux profile determination is possible over 19 positions from 0 à 18.

- 4) FAA flux profile is recorded with the use of gas panel. On the over hand JEHIER flux profile is realized with the use of an electrical radiant panel.

- 5) JEHIER profile is lowering faster than the requested profile by the referenced procedure. As a suggestion flux profile correction could be done by diminishing the angle of the radiant panel (to be checked).

Appendix 1

Recording of the flux in position 0 during 5 hours

