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## CALIBRATION CERTIFICATE PYRANOMETER

- PYRANOMETER MODEL** : CMP 11
- SERIAL NUMBER** : 060039
- SENSITIVITY** : 9.62  $\mu\text{V}/\text{W}/\text{m}^2$   
at normal incidence on  
horizontal pyranometer
- IMPEDANCE** : 25 Ohm
- CALIBRATION PROCEDURE** : The indoor calibration procedure is based on a side-by-side comparison with a reference pyranometer under an artificial sun fed by an AC voltage stabiliser. It embodies a 150 W Metal-Halide high-pressure gas discharge lamp. Behind the lamp is a reflector with a diameter of 16.2 cm. The reflector is 110 cm above the pyranometers producing a vertical beam. The reference and test pyranometers are mounted horizontally on a table, which can rotate. The irradiance at the pyranometers is approximately 500  $\text{W}/\text{m}^2$ . During the calibration procedure the reference and test pyranometer are interchanged to correct for any non-homogeneity of the beam. The dark offsets of both pyranometers are measured before and after the interchange and taken into account.
- REFERENCE PYRANOMETER** : Kipp & Zonen CM 11 sn913550 active from 01/01/2006.
- hierarchy of traceability** : This pyranometer was compared with the sun and sky radiation as source under mainly clear sky conditions using the "continuous sun-and-shade method". The readings are referred to the World Radiometric Reference (WRR) as stated in the WMO Technical Regulations. The measurements were performed in Davos (latitude: 46.8143°, longitude: -9.8458°, altitude: 1588m above sea level).
- The inclination of the receiver surfaces versus their horizontal position were set to 0.0 degrees, the instrument signal wire to the north. During the comparisons, the instrument received global radiation intensities ranging from 620 to 989 with a mean of 844  $\text{W}/\text{m}^2$ . The angle between the solar beam and the normal of the receiver surface varied from 23 to 50 with a mean of 36 degrees. The instrument temperature ranged from +11.4 to +27.3 with a mean of +18.8°C. The sensitivity calculation and the single measurements deviation ( $\sigma$ ) are based on 738 individual measurements. The obtained sensitivity value and its expanded uncertainty (95% level of confidence) are valid for similar conditions and are:  $4.67 \pm 0.06 \mu\text{V}/\text{W}/\text{m}^2$  (but is corrected by Kipp & Zonen to 4.71  $\mu\text{V}/\text{W}/\text{m}^2$ . See "correction applied" below.)  
Dates of measurements: June 23, July 14, 20, 28, August 5, 9 and 12, 2005.
- Global radiation data were calculated from the direct solar radiation as measured with the absolute cavity pyrhemometer HF18748 (member of the WSG, WRR-Factor:0.99568, based on the last International Pyrhemometer Comparison IPC-2000) and from the diffuse radiation as measured with a continuous disk shaded pyranometer Kipp & Zonen CM 22 sn020059 with sensitivity 8.91 (ventilated with heated air, instrument-wire to the north).
- correction applied** : +0.8 %  
This correction was necessary to correct for the mean directional errors of the reference CM 11 in Davos. This error is estimated at Kipp & Zonen measuring the cosine error for the mean angle of incidence at azimuth S-30° and S+30°. The reference CM 11 now measures the vertical directed beam of the indoor calibration facility more correctly.
- IN CHARGE OF TEST** : F. de Wit Date: Monday, September 04, 2006 Kipp & Zonen, Delft, Holland

### Notice

The calibration certificate supplied with the instrument is valid from the date of shipment to the customer. Even though the calibration certificate is dated relative to manufacture or recalibration the instrument does not undergo any sensitivity changes when kept in the original packaging. From the moment the instrument is taken from its packaging and exposed to irradiance the sensitivity will deviate with time. See also the 'non-stability' performance (max. sensitivity change / year) given in the radiometer specification list.