

EUROMET PROJECT 722

BILATERAL COMPARISON OF PRESSURE BALANCES, 2 TO 7 MPa, IN OIL, BETWEEN IMGC – ITALY AND INM - ROMANIA

1. Description of the comparison method

The method used was direct comparison method and consisted in the determination of A_o and λ for INM standard, used as transfer standard, with the formula:

$$A_e = A_o (1 + \lambda \times p)$$

The reference level was the lower end of working part of the cylinder for the INM standard.

The piston – cylinder assembly for each standard was leveled using a spirit level mounted on top of the weights table.

The pistons were balanced at mid distance between the upper and lower limits of the travel, rotating freely in a clockwise direction at approximately 30 revolutions per minute.

The temperature at the time of the measurements was between 20°C and 21°C. Buoyancy corrections were made for each standard.

The comparison was made in the pressure range from 2 to 7 MPa, in 6 points, 2 – 3 – 4 – 5 – 6 – 7 MPa, with 5 repetitions for each point.

2. Results of the comparison

The values A_o and λ , for INM B7 transfer standard, are:

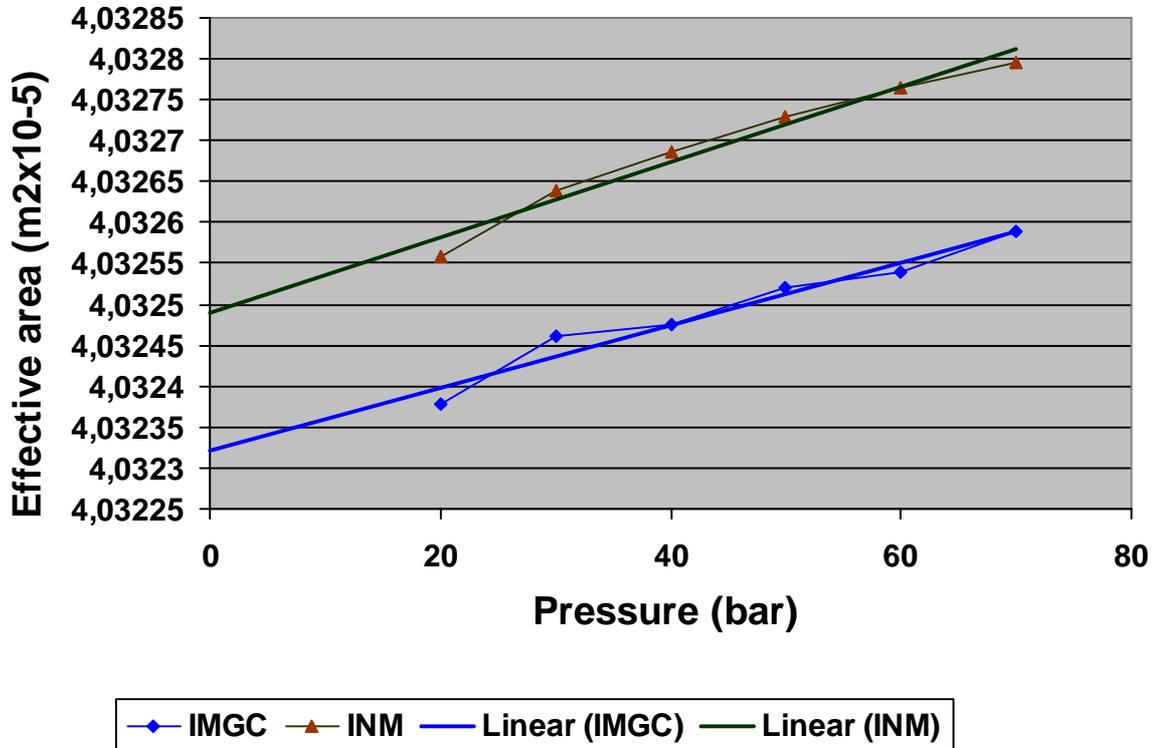
- at IMGC – Italy

- $A_o = 4,032\,320 \times 10^{-5} \text{ m}^2$ and $U(A_o)/A_o = 36 \text{ ppm}$
- $\lambda = 9,5 \times 10^{-12} \text{ Pa}^{-1}$ and $U(\lambda)/\lambda = 18 \%$

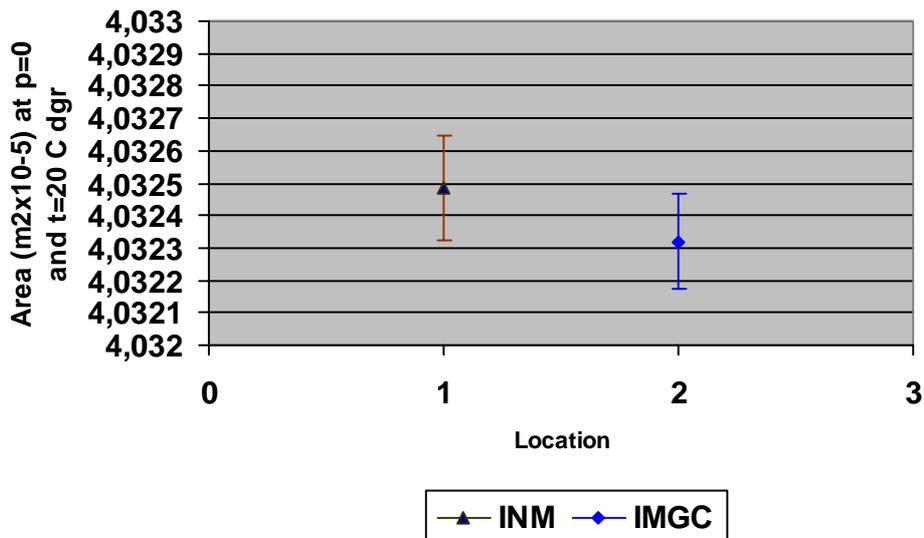
- at INM – Romania

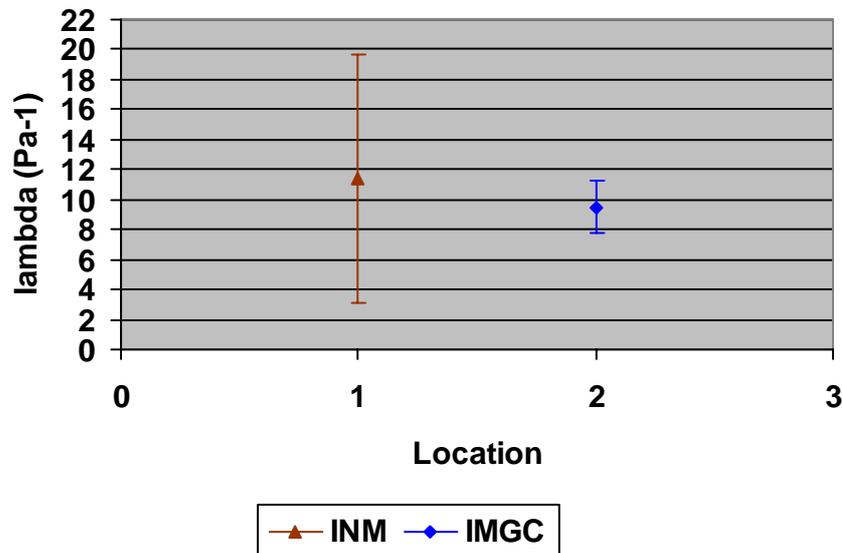
- $A_o = 4,032\,486 \times 10^{-5} \text{ m}^2$ and $U(A_o)/A_o = 40 \text{ ppm}$
- $\lambda = 11,4 \times 10^{-12} \text{ Pa}^{-1}$ and $U(\lambda)/\lambda = 73 \%$

3. Diagram of results



4. Uncertainties for A_0 and λ





5. Conclusions

Between IMGC and INM there is a difference of:

- 41 ppm in the value of A_0
- 20 % in the value of λ

The values for A_0 determined at IMGC are overlapping for 49 % of the values determined at INM.

NOTE: In addition the INM-B7 piston and cylinder were also dimensionally measured at IMGC-CNR. The obtained results are:

$A_0 = 4,032\ 113 \times 10^{-5} \text{ m}^2$ with $U(A_0)/A_0 = 42 \text{ ppm}$
 in good agreement with the results obtained in the comparison.

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