

A Primary Dead-Weight Tester For Pressures in the Range (0.05-1.0) Mpa

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ABSTRACT

This paper describes a 35 mm diameter piston/cylinder assembly (known within NIST as PG-39) in which both the piston and the cylinder have been accurately dimensioned by Physikalisch Technische Bundesanstalt (PTB). Both artifacts (piston and cylinder) appeared to be round within ± 50 nm and straight within ± 100 nm over a substantial fraction of their engagement length. Based on these accurate diameters provided by PTB (± 15 nm) and on good geometry of the artifact, the relative uncertainties for the effective area were estimated to be very low, between 3×10^{-6} and 5×10^{-6} (2σ) over the pressure range (0.05 to 1.0 MPa), even after possible crevice effects were included. The area based on the measurements from PTB coincides with the area based on measurements from NIST's Precision Engineering Division in 1990 within 1.0×10^{-6} and with preliminary values obtained by the Pressure and Vacuum Group's Ultrasonic Interferometer Manometer within 2.5×10^{-6} .