

Metrological Traceability During Calibration of Pressure Measuring Instruments

M.V. Golobokov¹, FBI Novosibirsk Center for Standardization and Metrology, PhD, Malachit_40@inbox.ru

¹ Leading Metrology Engineer of Thermal Measurements Department, Novosibirsk, Russia

Citation: Golobokov M.V. Metrological Traceability During Calibration of Pressure Measuring Instruments, *Kompetentnost' / Competency (Russia)*, 2022, no. 9–10, pp. 69–79.
DOI: 10.24412/1993-8780-2022-9-69-79

key words

calibration scheme, metrological traceability, measurement uncertainty, decision rule

The analysis of the sequence of transferring the pressure unit and the absolute pressure unit from the state primary standards to the calibration instruments used in the Novosibirsk CSM is carried out. The accumulation of measurement uncertainty caused by the used rule of decision-making on the compliance / non-compliance of the calibration tool with the established requirements is analyzed.

It is shown that cargo piston pressure gauges and micromanometers with end length measures are free from the accumulation of measurement uncertainty associated with the decision rule used. The extended uncertainty of the measurement by cargo piston pressure gauges is about 70 % of the limit of their basic permissible error. A reliable assessment of the uncertainty of measurements performed by various calibrators and digital devices requires taking into account the metrological characteristics of a higher standard. The traceability of a pressure of less than 1 kPa reproduced by the Metran-505 pneumatic calibrator has been questioned.

The research materials were used in the preparation of the FBI Novosibirsk CSM for accreditation for the right of calibration of measuring instruments and may be useful for demonstrating metrological traceability by other laboratories.

References

1. GOST ISO/IEC 17025–2019 General requirements for the competence of testing and calibration laboratories. — Moscow, *Standartinform*, 2021.
2. Federal Law of 26/06/2008 N 102-FZ On Ensuring the uniformity of measurements; http://www.consultant.ru/document/cons_doc_LAW_77904.
3. State verification scheme for measuring instruments of pressure difference up to $1 \cdot 10^5$ Pa, Moscow, *Rosstandart*, 2021, 6 P.
4. State verification scheme for measuring instruments of excess pressure up to 4000 MPa, Moscow, *Rosstandart*, 2019, 16 P.
5. HD 2.832.005 TO. Exemplary portable PMKM micromanometer. Technical description and operating instructions, *p/y A-1742*, 1981, 30 P.
6. GSSSD 2–77 Water. Density at atmospheric pressure and temperatures from 0 to 100 °C, Moscow, *Izdatel'stvo standartov*, 1978, 6 P.
7. Technical report on gravimetric measurements, Novosibirsk, *SGUGiT*, 2016, 5 P.
8. GOST 9038–90 End-plane parallel length measures. Technical conditions, Moscow, *Izdatel'stvo standartov*, 1990, 10 P.
9. GOST 8291–83 Cargo piston overpressure gauges. General technical requirements, Moscow, *Izdatel'stvo standartov*, 1998, 14 P.
10. Cargo piston pressure gauge SRV 5000. Operation manual, Germany, *WIKA*, 2014, 29 P.
11. MI 2429–97 Cargo piston pressure gauges. Metrological and technical characteristics. Types of metrological control, Moscow, *FGUP VNIIMS*, 1997, 34 P.
12. MP AP-01–2016 MP and MGP cargo piston pressure gauges. Verification procedure, Chelyabinsk, *Al'fapaskal'*, 2016, 14 P.
13. MP 231–0084–2021 Cargo piston pressure gauge I-600. Verification procedure, St. Petersburg, *VNIIM imeni D.I. Mendeleeva*, 2021, 11 P.
14. 1554.000.00 RE Pressure calibrator pneumatic Metran-504 Air-I. Operation manual, Chelyabinsk, *Promyshlennaya gruppa Metran*, 2010, 31 P.
15. 1559.000.00 RE Pressure calibrator pneumatic Metran-504 Air-II. Operation manual, Chelyabinsk, *Promyshlennaya gruppa Metran*, 2010, 29 P.
16. 1558.000.00 RE Pressure calibrator pneumatic Metran-505 Air. Operation manual, Chelyabinsk, *Promyshlennaya gruppa Metran*, 2010, 43 P.
17. Pneumatic pressure calibrators Metran-504 Air. Verification procedure, Chelyabinsk *Promyshlennaya gruppa Metran*, 2010, 19 P.
18. Pneumatic pressure calibrators Metran-505 Air. Verification procedure, Chelyabinsk, *Promyshlennaya gruppa Metran*, 2010, 25 P.
19. 1595.200.00 Pressure module reference Metran-518. Verification procedure, Chelyabinsk, *Promyshlennaya gruppa Metran*, 2009, 8 P.
20. NKGZh.406233.015 MP Reference pressure converter PDE-010, PDE-010I. Verification procedure, Moscow, *NPP Elemer*, 2012, 26 P.
21. NKGZh.408749.007 MP Automatic pressure calibrators Elemer-AKD-12K. Verification procedure, Moscow, *NPP Elemer*, 2016, 16 P.
22. 3111.000.00 MP Calibrator-pressure controller Metran-530. Verification procedure, Chelyabinsk, *Promyshlennaya gruppa Metran*, 2010, 10 P.
23. 5Sh0.283.342 MP Digital pressure gauges DM5002M, DM5002Vn. Verification procedure, Tomsk, *Manotom'*, 2017, 9 P.
24. GOST 34100.3–2017 Guide to the expression of measurement uncertainty. Part 3, Moscow, *Standartinform*, 2017, 104 P.
25. State verification scheme for absolute pressure measuring instruments in the range up to $1 \cdot 10^6$ Pa, Moscow, *Rosstandart*, 2021, 9 P.
26. IKLV.406525.001 D52 Exemplary portable barometers BOP-1M. Verification procedure. Appendix to the operating manual, Moscow, *Aeropribor-Voskhod*, 2004, 15 P.
27. State verification scheme for measuring instruments of electrical resistance of direct and alternating current, Moscow, *Rosstandart*, 2019, 16 P.
28. OIUSN.140.008 RE Calibrator-comparator KM300K. Operation manual, Krasnodar, *Zipnauchpribor*, 2013, 117 P.
29. 1595.000.00 Portable pressure calibrator Metran-517. Verification procedure, Chelyabinsk, *Promyshlennaya gruppa Metran*, 2009, 8 P.
30. GOST 22520–85 Pressure, discharge and pressure difference sensors with electrical analog output signals. General technical conditions, Moscow, *Izdatel'stvo standartov*, 2003, 23 P.