

# CALIBRATION OF SPECIALISED MEASURING INSTRUMENTS UTILIZED IN RAILWAY TRANSPORT

## The essence of calibration

Calibration is a set of activities, which enables the determination of a relationship between the measurement standard (master), which represents a reference value, and the measuring instrument, which is being calibrated [2]. If this relationship is determined, information about the metrological characteristics of the instrument is obtained, which reflects the technical state of the instrument and enables the decision to continue using the instrument or to withdraw it from use to be taken. Moreover, calibration by an accredited laboratory is regarded by all metrological institutions as a basic activity for maintaining traceability, in other words, referencing to national or international measurement standards (masters) [1].

Thanks to information about instrument errors and the uncertainty of performed calibration, users of the instrument can estimate the uncertainty of the measurements being made. Data concerning errors collected regularly at constant intervals constitutes a source of information about measuring instrument stability and the metrological characteristics over the time of wear.

The benefits from performing measuring instruments calibration, which are mentioned above, are especially important for measurements of the railway infrastructure components. It is obvious that all errors which occur during the production of railway vehicles or construction of railway tracks may lead to danger for passengers' health and personal safety. Therefore, it is necessary to continuously improve measurement accuracy and minimize the value of uncertainty.

## Calibration in accredited laboratories

Calibration laboratories can be divided into accredited and non-accredited. Accredited laboratory fulfils the requirements of the currently applicable issue of PN EN ISO 17025 [4] standard. This means, in practice, that the laboratory:

- has qualified and experienced staff, which permanently improve their competencies,
- uses high quality measurement standards (masters), which are continuously supervised thanks to periodic checks and calibrations for maintaining traceability,
- uses procedures which are consistent with actual national and international standards,
- is involved in national and international interlaboratory comparisons aimed at proving the credibility of obtained results and appropriate estimation of values of uncertainty,
- permanently improves its management system,
- has appropriate procedures ensuring impartiality and confidentiality,
- subjects itself to annual assessment by the accreditation body

## Calibration of measuring instruments for railway transport

There are more than 100 accredited laboratories in Poland but only one, Metrological Laboratory of Railway Research Institute, is accredited laboratory that performs calibration of specialized measuring instruments utilized for railway applications.

The main reasons why other polish accredited laboratories do not decide to calibrate this measurement equipment mentioned below:

- high costs for laboratories connected with must to the design and construction of a dedicated calibration stand, which enables the most efficient reproduction of real conditions in the case of measurements performed with a measuring instrument being calibrated. However reproduction of real conditions is not always possible
- design and construction of dedicated calibration stands and the preparation of methodologies for checking instruments requires highly competent staff, with knowledge not only of metrological aspects but also regarding railway transport
- still low metrological awareness of people using or supervising measuring instruments, and the consecutive thoughtless view regarding the costs of calibration, instead of focusing on the quality of the obtained results. Because of that they very often choose dubious reputation laboratories which are the cheapest

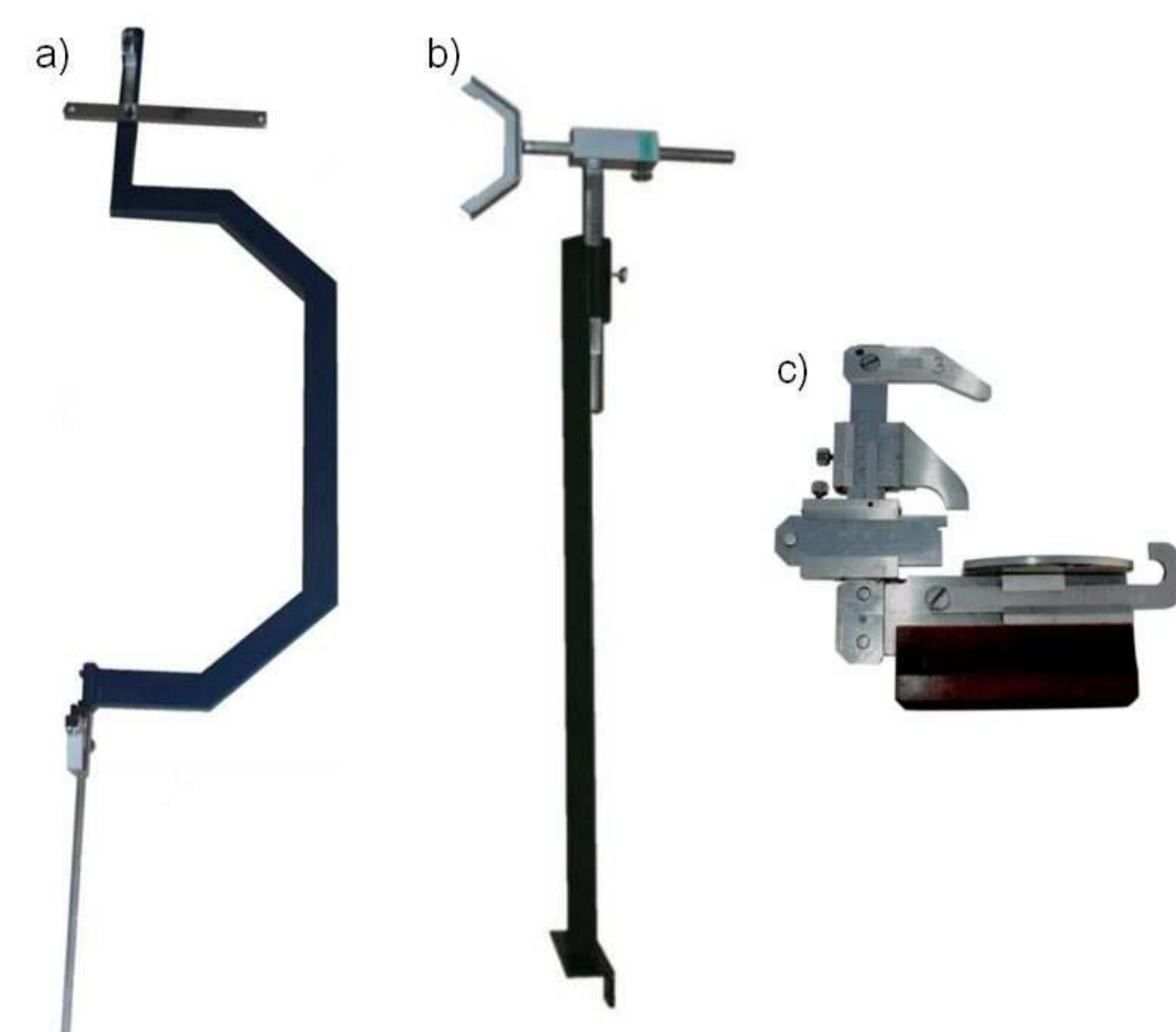


Fig. 1. Main instruments utilized for measurements for railway applications: a) instrument for wheel tread diameter measurements, b) instrument for buffer centre line height over rails running surface measurements, c) calliper for outer wheel wear profile and outer wheel rim wear profile measurements (for monoblock wheels and for rims utilized for wheels without tyres). Calibration of above instruments is performing by Metrology Laboratory of Railway Research Institute. Source: Asco Rail Ltd. catalogue available at [www.ascorail.pl/download/katalog-urzadzen-i-przyrzadow-pomiarowych.pdf](http://www.ascorail.pl/download/katalog-urzadzen-i-przyrzadow-pomiarowych.pdf), [access: 12 November 2017]

## Summary

The present situation would not change significantly if the metrological awareness of railway workers does not increase. It is essential to understand the goal of appropriate management, utilization and maintenance of measuring instruments. Otherwise, entities would still focus only on possessing appropriate documents, proving the fulfilment of assumptions of management systems, instead of whether such documents provide any substantial worth. Entities acting in the railway transport domain should invest in basic metrological training for their workers.

The demand for calibration performed by accredited laboratories will increase together with an increase in metrological awareness. This will stimulate laboratories to enlarge their scopes of accreditation by elaborating appropriate calibration methodologies for the increasing number of instruments and to minimise uncertainty.

## Bibliography

1. International Vocabulary of Terms in Legal Metrology, GUM, Warsaw 2015:
2. PN-EN ISO/IEC 17025:2005. General requirements for the competence of testing and calibration laboratories;
3. K. Bednaruk. Accreditation of calibration procedures for specialised measuring instruments utilized in railway transport; selected issues. Problemy Kolejnictwa. No 179 of June 2018.