

**Testing Laboratories Department  
Central Office of Measures (GUM)  
Warsaw, POLAND**

**Brief report on acoustics and vibration  
to the 5<sup>th</sup> Meeting of CCAUV (September 2006)**

As a result of second widespread rebuilding of the structures of Central Office of Measures (GUM) in 2005 the Acoustics Laboratory and the Vibration Laboratory have been incorporated with new division Testing Laboratories Department, but the current activities of these laboratories have not changed.

Both the Acoustics and the Vibration Laboratories continue to hold the responsibility for development and maintaining the national measurement standards for sound pressure and vibration acceleration. They are mainly active in calibration of measuring instruments for acoustical and vibration measurements, also they are still involved in works concern legal metrology issues (type approval and verification of sound level meters and human vibration meters and type approval of sound calibrators). In 2006, a service of pattern approval of sound level meters according to standard IEC 61672-2 was introduced.

**Accreditation**

In September 2006 the Acoustics Laboratory and the Vibration Laboratory have been assessed by the Polish Center of Accreditation with participation of technical experts from NPL (in acoustics) and PTB (in vibration). The assessment of the system and technical competence of laboratories was performed against the requirements specified in PN-EN ISO/IEC 17025. The following services in acoustics and vibration fields were submitted for accreditation:

**1. Acoustics**

- Calibration of laboratory standard microphones types: LS1, WS1 (converted to LS1), and LS2, WS2 (converted to LS2) by reciprocity method according to PN-EN 61094-2 at frequency range from 63 Hz up to 10 kHz for LS1 and WS1 microphones and up to 20 kHz for LS2 and WS2 microphones,
- Calibration of laboratory standard microphones types: LS1, LS2 and working standards microphones types: WS1, WS2 and WS3 at frequency 250 Hz by calibrated class LS sound calibrator according to PN-EN 60942, using insert voltage technique,
- Determination of frequency response of measurement microphones by electrostatic actuator according to PN-EN 61094-6,
- Calibration of sound calibrators by calibrated LS1 and LS2 microphones according to PN-EN 61094-1 or WS1 and WS2 microphones according to PN-EN 61094-4, using insert voltage technique,
- Calibration of sound calibrators by comparison with class LS reference sound calibrator according to PN-EN 60942,
- Calibration of sound level meters originally manufactured in accordance with PN-EN 60651 and PN-EN 60804; calibration covers: sound level meter response to sound calibrator signal and to electrical test signals determined in PN-EN 60651 i PN-EN 60804; free field frequency response of sound level meter determined by electrostatic actuator or multifrequency sound calibrator with appropriate free-field corrections added,
- Calibration of bandpass filters according to PN-EN 61260.

## 2. Vibration

- Calibration of accelerometers and acceleration measuring chains by absolute method (10 Hz -10 kHz) according to ISO 16063-11,
- Calibration of accelerometers by comparison method (0,5 Hz – 5 kHz) according to ISO 16063-21,
- Calibration of acceleration measuring chains by comparison method (0,5 Hz – 5 kHz) according to ISO 16063-21,
- Calibration of vibration calibrators by standard accelerometer,
- Calibration of acceleration measuring instruments (0,5 Hz – 5 kHz),
- Calibration of human response to vibration measuring instruments originally manufactured in accordance with ISO 8041:1990 and Amd. 1999

### Calibration activities

In Poland, 6 acoustical calibration laboratories and 3 vibration calibration laboratories are accredited. Each accredited calibration laboratory requires its own one or more LS1P or LS2P laboratory standard microphone and/or one or more standard accelerometers to be calibrated at least once a year. In 2005 more than 20 primary calibrations of laboratory standard microphones and standard accelerometers and sound calibrators were performed. The number of other calibrations and verifications ordered by end users (industrial and environmental laboratories) was considerably higher (about 600 in acoustics and 260 in vibration field).

Since 2006 GUM has started to conduct national interlaboratory comparisons. The first one concerning calibration of accelerometers by comparison method according to ISO 16063-21 was provided with 5 participants: GUM as a pilot laboratory, 2 laboratories from Regional Verification Offices of Measures (Gdansk and Wrocław), 2 laboratories from research institutions: Central Institute of Mining in Katowice and Institute of Heat Technology in Łódź.

The results of comparison will be useful for establishing the degree of equivalence of participant laboratories.

### Research works

The most important development project in 2006 is implementation of low-frequency pressure chamber system for determination of microphone response within infrasound frequency range.

The design of low-frequency acoustical chamber together with electromechanical exciter and special method for junction edges sealing is unique construction developed by GUM Acoustical Laboratory. This chamber enables to determine the sensitivity of microphone with its preamplifier by comparison with reference microphone within infrasound frequency range.

The Acoustics Laboratory participates in EUROMET project No. 791 *Measurement of the acoustical impedance of artificial ears*.

Nine ear simulators conformable to IEC 60318-1 have been measured using two different methods:

- calibrated microphones method derived from reciprocity technique of measurement microphones calibration,
- reference impedance method based on comparison of ear simulator acoustical transfer impedance with known acoustical transfer impedance.

The processing of results obtained is now in progress. Results of measurements will be included into materials collected for the purpose to determine new specifications for ear simulators to be placed in revised version of IEC 60318-1.

The publication containing description of both measurement methods and results obtained is now in preparation.