



Institute of
Acoustics

CERTIFICATE OF COMPETENCE IN BUILDING ACOUSTICS MEASUREMENTS - SYLLABUS

Entry Requirements

The Institute of Acoustics is committed to an open access policy. The main principle is to admit all who will benefit from the Certificate programmes. However students will need to be numerate and to be able to carry out scientific calculations. The Certificate may be used towards satisfying the educational requirements for Technician membership of the IOA (**TechIOA**) but relevant passes at GCSE level may be necessary also.

Study Modes

Students take the Certificates at an Accredited Centre (see separate list). Attendance at the Centre is usually for four days, plus the examination day. Examinations for CCBAM take place twice per year, usually on a Friday in April and September. It is important to check on the local arrangements for the examination.

Assessment

To obtain a Certificate, a candidate is required to;

- 1) Pass both parts of a written examination
- 2) Produce a competent report following a practical test.

The written examination papers are set by the Chief Examiner, who is responsible to the CCBAM Committee. Members of the Committee review and moderate the marking of all papers at their meetings held shortly after each course.

The detailed logistical arrangements for the practical test and report submission are made by the Accredited Centre. However the requirements for the practical test and the report are overseen by the CCBAM Committee.

Aims and Scope

The main aim of CCBAM is to train delegates to carry out and report upon sound insulation tests on walls and floors, in accordance with relevant standards and regulatory instruments.

Although the course is specifically centred around measurements according to the requirements of ISO 140 parts 4 and 7, it is also relevant for other situations including Building Regulation requirements (Annex B of Approved Document E in England, Booklet G in Northern Ireland, Technical Handbook 2010 Section 5 in Scotland), and acoustics in schools, hospitals (Health Technical Memorandum 08-01) and offices, but will not cover in detail wider aspects contained in other parts of ISO 140 such as sound insulation of façades, ceilings, small building elements or laboratory testing.

Although the design and detailed specification of sound insulation of walls and floors is beyond the scope of this course, it is expected that delegates will gain some understanding of the principles and practice involved in achieving good sound insulation, and familiarity with some of the standard forms of construction commonly encountered, sufficient for them to recognise and report on the types of construction tested and any obvious defects affecting sound insulation performance.

Learning outcomes

At the end of the course delegates should be able to:

- Combine, average and subtract decibel values.
- Set up and calibrate sound source and measuring equipment and perform simple routine checks to ensure that the equipment is working properly.
- Select suitable measurement numbers, locations and durations and ensure suitable measurement conditions.
- Measure octave and 1/3 octave band sound pressure levels, and, where necessary make correction for background noise.
- Calculate dBA and dBZ levels from octave or 1/3 octave band levels.
- Measure reverberation time using both a steady state source (loudspeaker) and transient source, and be able to critically assess the reasonableness of the results.
- Correctly use the available dynamic range of equipment and avoid measurement problems caused by overload and under range of equipment.
- Carry out airborne and impact sound insulation tests in accordance with BS EN ISO 140 parts 4 and 7.
- Use proprietary software or a spreadsheet (supplied or self-generated) to calculate relevant metrics in accordance with associated standards, (for example $D_{nT,w} + C_{tr}$ and $L'_{nT,w}$ values in accordance with BS EN ISO717 parts 1 and 2.)
- Understand the difference between ISO 140 and other guidance, including Appendix B of Approved Document E.
- Understand the concepts of direct, reverberant, near and far sound fields and explain their relevance to sound insulation testing.
- Understand the principles of sound transmission for single and double leaf constructions (the effects of mass, coincidence, flanking secondary layers, holes and gaps, etc.)
- Identify and report any deviations from the recommended measurement and calculation procedure.
- Write a report of sound insulation tests to meet the requirements of BS EN ISO 140 parts 4 and 7.

Course Content and Approximate Timings

Basic Concepts

(1/2 day)

- The nature of sound waves, sound pressure, frequency, wavelength.
- Pure tones, broad band noise, frequency spectra, white and pink noise
- The decibel scale. Octave and 1/3 octave bands, dBA and dBZ (un-weighted overall level).
- Combination (addition), averaging and subtraction of sound pressure levels.
- Continuous equivalent noise level, L_{AeqT} . Arithmetic and linear averaging.
- The '10 dB above' rule of thumb for the effect of background noise level on measurements, use of decibel subtraction (in octave or 1/3 octave bands) for correction for effect background noise level. Near and Far field of sources.

Room Acoustics Concepts

(1/4 day)

- Reflection, diffusion, absorption of sound by surfaces. Absorption (in m^2) and absorption coefficient of surfaces.
- Reverberation time, direct and reverberant sound fields, standing waves, room modes.

Sound Transmission Concepts

(1 day)

- Direct and Indirect transmission between adjacent spaces, flanking paths. Examples of flanking transmission between dwellings, flats and offices.
- Factors affecting transmission - partition area, receive room absorption, mass (and surface density in kg/m^2), stiffness, damping, separation and isolation, effects of holes and gaps. Single and double-leaf constructions, floating floors and suspended ceilings
- Airborne and structure-borne sound. Comparison between Laboratory and Field sound transmission tests.
- Level difference, Sound Reduction Index/Transmission Loss.
- Outline of measurement methodology: D , D_{nT} , R , R' , L'_{nT} , $D_{nT,w}$, C_{tr} and $L'_{nT,w}$

[Preferred delivery of Sections 1 2 and 3: Presentation of factual information (lecture), practical demonstrations and practical measurement exercise, tutorial question sheets and exercises for individual completion and for group discussion.]

Standardised measurement methodology (Standards and Legislation) (1 day)

This part of the course deals with the detailed requirements of BS EN ISO 140 parts 4 and 7, BS EN ISO 717 parts 1 and 2, and The Building Regulations 2003 Edition – Approved Document E (Resistance to the passage of Sound). Reference will also be made to other documentation and guidance related to buildings and testing (e.g. Robust Details).

- Health & Safety: noise exposure, source-room levels, hearing protection.
- Requirements of sound measurement instrumentation. Calibration.
- Loudspeaker requirements: directionality, spectrum shape, source qualification procedures.
- Impact source requirements: hammer specifications, drop height, timing, setup procedures.
- Source (airborne and impact) and microphone positions (fixed and moving).
- Measurement of source, receive and background levels: averaging time, number of measurements, single and multiple (uncorrelated) sources, minimum receive-room levels, adherence to the 6 dB rule.
- Measurement of reverberation times using both interrupted steady state (loudspeaker) and transient sound sources. Comparison of methods, assessment of quality of decay curve, background noise levels, overload and under-load of instrumentation.
- Implications of carrying out measurements over the extended frequency range.
- Measurement uncertainties.

Comparison between ISO 140 and other guidance including:

- Approved Document E.
- Acoustics in Schools.
- HTM08-01.
- Scottish Building Regulations.
- Northern Ireland regulations (Booklet G).
- Irish Building Regulations.

Comparison between different accreditation schemes including:

- UKAS
- ANC
- Scottish Scheme

Practical Aspects

(1 day)

Preparatory work:

- Selection of sample partitions for testing from plans and drawings, in accordance with sampling requirements (including grouping and sub-grouping) of ADE.

Equipment check lists

- Liaison with client/residents to ensure suitable on-site conditions for testing (availability of power supplies, unoccupied test rooms, absence of high levels of background noise, complete building finishes, etc.)

On-site:

- Preparation and use of measurement procedure checklists.
- Calibration and other preliminary checks of equipment prior to measurements. Equipment trouble-shooting, problems with leads and cables, etc.
- Recording results of visual and aural inspection of test site: aurally identifiable sound transmission paths, inadequate building finishes (e.g. seals to doors and windows, etc.), sources of background noise and variability with time during the test programme, constraints in meeting room size and other requirements of ADE/ISO 140.
- Restraints on selection of source (loudspeaker and tapping machine) and microphone positions.
- On-site 'reasonableness' check on collected data.

Report writing

(1/4 day)

- What to include, what not to include, what is essential, what is optional.