1 AFILS requirements

Supply and install the complete systems, detailed within this specification. Provide Audio Frequency Induction Loop Systems (AFILS) at the following locations and areas:

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Insert locations to suit your project's needs – here are some examples of 'typical' areas:

Reception Counters (one local AFILS for each service position); Auditorium 1 and 2; Meeting rooms A, B, C

The AFILS extent of supply shall incorporate all necessary components and works, including but not limited to the following:

- AFIL system design including loop layout design;
- AFILS drive equipment, ancillary components and mounting accessories;
- Appropriate Audio Input systems;
- AFILS Loop wire or tape with appropriate fixings or containment and associated feed cables;
- AFILS test equipment.

2 Compliance

The AFILS shall comply with:

- IEC 60118-4:2006 (also referred to as EN 60118-4:2006)

A Certificate of Conformity to this standard shall be issued for each AFILS in the project.

In addition the system shall comply with:

- BCA Code on Accessibility 2013

3 System design

The Contractor shall:

- At the earliest opportunity in the project, provide evidence that the background magnetic noise in the areas designated for loop coverage is within the limits defined in the standard, BS EN 60118-4:2006. Where the background magnetic noise exceeds -32dB re: $400mAm^{-1}$ [-22dB for short-term use/localised applications], the contractor shall not proceed without client approval.
- Prior to installation, show that cross-talk between adjacent looped areas (whether part of this contract or not), and that magnetic spill from any AFILS where the signal is defined as 'confidential' will, by design, be less than -40dB with normal signal levels.
- Prior to installation, provide evidence that the effect of metal within the structure of the building has been adequately assessed and compensated for by loop design and / or appropriate loop driver selection. Where necessary, the effect of metal shall be assessed by site survey and test using trial loops on relevant construction, carried out by a competent test specialist.
- Prior to installation, provide calculations to demonstrate that the field strength of the proposed systems will meet the requirements of the standard IEC 60118-4:2006.

4 Audio input

Audio inputs shall provide clear pick up of all wanted audio signals whilst minimising unwanted audio and background noise.

- Signal-to-noise improvement is important to provide benefit to the hearing aid user
- The input system design shall provide selective amplification of the intended audio signal above the general sound level in the area
- Where a sound reinforcement system is installed, a line level feed from the system to the induction loop should be used where this is appropriate, which may include feeds from emergency evacuation systems.
- A single boundary microphone mounted on the ceiling is unlikely to provide sufficient rejection of background acoustic noise in most rooms and should not be used unless it can be demonstrated that the system delivers tangible benefit to the hard of hearing.
- Input levels shall not be adjustable at the signal source or connection point.

5 AFILS drivers

AFILS drivers shall be provided to amplify input audio signals and to drive the induction loops appropriately. The drivers shall meet the requirements for a type A or type B driver as defined below.

5.1 Type A: Area coverage loop driver

Where the horizontal loop area that must be covered is in excess of 2m x 2m, for either a one-phase or two-phase (phased array) system:

Each induction loop driver shall have the following characteristics:

- ‘current drive’ output
- rated current and voltage capable of driving the designed loop without clipping or distortion of the signal with full power bandwidth up to at least 1.6kHz
- capable of delivering the rated current and voltage into a load with 1kHz sinewave signal for at least 20 seconds continuously without damage to the unit or interruption of the output signal
- Frequency response from 80Hz to 6.5kHz
- THD+N less than 0.2% at 1kHz sine at full current
- Automatic gain control (AGC) optimised for speech, with a dynamic range greater than 36dB
- Metal loss correction with an adjustable gain slope range of at least 0dB to +3dB per octave
- Input facilities of a type and connection suitable for the intended audio inputs to the system. Where input connections are to exceed 3m length, balanced inputs shall be available. Balanced microphone inputs shall have phantom power available.
- Front panel indication of audio signal activity on the output of the unit and where possible the input
- Adjustment of controls for commissioning shall be achievable without exposure of terminals carrying hazardous voltages
- Height no greater than 45mm (i.e. 1U of standard 19” rack space) per system

Where two-phase systems are required, a single unit shall be provided (height no greater than 45mm or 1U of standard 19” rack space) that is capable of driving two separate outputs with a 90° phase shift accurate to ±1° from 100Hz to 5kHz. The driver must also include the following:

- Front panel indicators to indicate separate fault conditions of overload, overheat and loop error

5.2 Type B: Counter / local area loop driver

Where the loop system is to assist a single end user in a defined location such as a retail counter or information point:

Each induction loop driver shall have the following characteristics:

- 'Current drive' output with current capability of at least 2.2A rms with 1KHz sine signal
- Voltage output of no less than 4.5V peak at maximum current.
- Frequency response from 80Hz to 6.5KHz
- Automatic gain control (AGC) optimised for speech with a dynamic range greater than 36dB
- Metal loss correction with an adjustable gain slope range of at least 0dB to +4.5dB / octave
- 2 inputs: 1 microphone input and 1 input switchable between microphone or line
- Panel / wall mounting capability (using screws or other appropriate and reliable fixing)

6 AFILS loops

Loops connected to the AFILS system shall meet the following requirements:

- Be designed and implemented to meet all requirements of section 3 above.
- The implementation of the loop design shall take into account the layout and fabric of the building
- Appropriate materials for the installation location shall be used (e.g. wire in the floor/ceiling, flat copper tape under floor coverings, or a purpose-designed loop coil inside a counter vertical front)
- Loop wire containment shall be of non-metallic construction (to avoid short circuit earth paths parallel with the loop wire). This restriction does not apply to the loop feed wiring between a loop amplifier and the start of the loop itself, which may be installed in metal or non-metal containment.
- Where flat copper tape is accepted for use under carpet or other floor coverings, this does not require the use of containment and shall be installed according to the manufacturer's recommendations and current best practice.
- Implementation of the loops shall in general follow best practice

7 AFILS test equipment

7.1 Loop receivers

For each loop location a loop receiver shall be provided for operational staff to check and monitor the performance of the AFILS system. The receiver shall have the following characteristics:

- Headphone output and be provided with headphones
- Low frequency cut filter
- Field strength indicators at 0dB and -6dB (As required by the standard IEC 60118-4:2006)

7.2 Field Strength Meter

The Client or operational staff are required to set up, commission or carry out annual maintenance, a field strength meter shall be provided capable of commissioning to the requirements of IEC 60118-4:2006. The meter shall have the following characteristics:

- Calibrated reading of 0dB at 400mA/m rms as per IEC 60118-4:2006
- True RMS measurement with 125mS time constant
- Class 2 meter as defined in EN 61672-1:2003 (Electroacoustics – Sound level meters)
- A-weighted background noise range of at least -42dB to -12dB

- Field strength measurement range of at least -22dB to +8dB, with increments of 1dB from -3dB to +3dB
- Frequency band mode with 1/3 octave frequency bands centred on at least 100Hz, 1kHz and 5kHz meeting EN61260:1996 and IEC 60118-4:2006
- Headphone output for listening to the loop signal
- Instructions for setting up an AFILS to IEC 60118-4:2006 by use of the field strength meter
- All testing instrument including signal generator shall be calibrated by accredited agent with proof of certificate.

8 Installation

The contractor shall:

- Co-ordinate with other relevant contactors to ensure that all appropriate audio signals are connected to the induction loop system and transmitted clearly.
- Provide appropriate cabling and/ or connection points for system integration.
- Wire and connect to all items of equipment in accordance with the manufacturers' recommendations.
- Ensure complete segregation of the ELV wiring system, from any other ELV or LV wiring system.
- Provide all necessary equipotential and supplementary earth bonding conductors and connections to each component or item of equipment.
- Follow good audio and other relevant practice to ensure that earth bonding and other cable system design does not cause degradation of this or other system performance by allowing interference in inappropriate paths.
- Confirm locations of all local power supply requirements and equipment spatial requirements.
- All wiring of loops and between equipment locations shall be installed and concealed in appropriate containment.
- All wiring, including that inside equipment enclosures or racks, will be of a neat and tidy appearance. Wiring shall be identified at both ends of each cable.

9 Commissioning

The contractor shall:

- Include for testing and commissioning of the complete system(s) in accordance with IEC 60118-4:2006.
- Provide a method statement for testing and commissioning. Provide all necessary test equipment to complete the works, all test results to be fully recorded and copies provided with the Operation and Maintenance manuals.
- Provide a minimum of 14 days notice of all testing in order that a Client's representative may have reasonable option to attend and witness tests.
- Provide operating instructions for all items of equipment and installed systems. Demonstrate all systems and methods of use to the end user.
- Provide "As Installed" drawings and Operation and Maintenance manuals for all AFILS
- When carrying out commissioning tests, use a Field Strength measurement tool with a minimum specification as in section 7.2 above.
- Issue Certificates of Conformity to IEC 60118-4:2006 that clearly state the results of testing and whether the system performance meets the relevant requirements of the standard.

Where the induction loops are to be installed prior to the drive/amplifier equipment, the loops shall be tested for continuity and for isolation from electrical ground and metal structures/containment. The Client shall have the opportunity to witness these tests which shall be recorded and documented.

10 Training and maintenance

Training and instruction documentation shall be provided that enables operational staff to understand the proper use of the AFILS system and how to ensure that people with hearing aids can make use of the system effectively.

A test and maintenance schedule shall be provided.

Training and instruction documentation shall be provided for operational staff such that they can use and perform regular functional tests on the system(s). This training shall include, but not be limited to, demonstrating the correct use of the test equipment and AFILS drivers provided.

11 Installer Accreditation

AFIL installer shall be factory trained and certified to carry out the works. Factory training shall comprises of both theory and practical. Copy of Certification shall be submitted for proof.