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INTERNATIONAL STANDARD

**Sound system equipment –
Part 16: Objective rating of speech intelligibility by speech transmission index**

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

SOUND SYSTEM EQUIPMENT –

Part 16: Objective rating of speech intelligibility by speech transmission index

FOREWORD

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International Standard IEC 60268-16 has been prepared by IEC technical committee 100: Multimedia equipment and systems.

This fourth edition cancels and replaces the third edition, published in 2003, and constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

- development of more comprehensive, complete and unambiguous standardization of the STI methodology;
- the term STI_r is discontinued. A new function for the prediction of auditory masking effects is introduced;
- the concept of 'speech level' and the setting of the level of the test signal have been introduced;

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- additional information has been included on prediction and measurement procedures.

NOTE See Introduction for a historical summary referring to the various changes from the first to the fourth edition (current edition).

The text of this standard is based on the following documents:

FDIS	Report on voting
100/1812/FDIS	100/1849/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all the parts in the IEC 60268 series, published under the general title *Sound system equipment* can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

A bilingual version of this publication may be issued at a later date.

INTRODUCTION

The Speech Transmission Index (STI) is an objective measure to predict the intelligibility of speech transmitted from talker to listener by a transmission channel. The STI method has been the subject of ongoing development and refinement since its introduction in the 1970s. Major improvements of the STI have been consolidated by incorporating them in successive revisions of IEC 60268-16.

The history of revisions is as follows.

- Revision 1: 1988. In the first version of the STI standard, a gender-independent test signal spectrum was used.
- Revision 2: 1998. Gender specific test signals were introduced, for male and female talkers, each gender relating to a specific set of weighting factors. In addition, weightings were introduced for redundancy factors. The term STI_r was introduced to signify the use of these redundancy factors.
- Revision 3: 2003. Important differences between Revision 2 and Revision 3 are the introduction of
 - level dependent masking functions,
 - the STI derivative STIPA.STIPA was specially developed as a fast measurement method that could deal with electro-acoustic and acoustic effects while determining the speech transmission quality of PA systems.
- Revision 4: 2010. The aim of Revision 4 (this revision) is to provide a more comprehensive, complete and unambiguous standardization of the STI methodology. The term STI_r is now discontinued. A new function for the prediction of auditory masking effects is introduced.

Speech is considered to be the major method of communication between humans. In many situations the speech signal is degraded by the signal path or the transmission channel between talker and listener, resulting in a reduction of the intelligibility of the speech at the listener's location.

To quantify the deterioration of the speech intelligibility induced by the transmission channel, a fast and objective measuring method was developed; the Speech Transmission Index (STI). The STI method applies a specific test signal to the transmission channel and by analysing the received test signal; the speech transmission quality of the channel is derived and expressed in a value between 0 and 1, as the Speech Transmission Index (STI). Using the obtained STI-value, the potential speech intelligibility can be determined.

Although there are limitations to the STI method, the use of STI has proved useful in many situations and has gained international acceptance.

Items that have changed in this revision

Specific changes that have been incorporated in this revision are:

- refinement of the STI model with respect to the level dependent masking function;
- Room Acoustic Speech Transmission Index (RASTI) has become obsolete and should not be used;
- calculations to add or remove the effects of background noise and to change the speech level and a worked example;
- notes regarding limitations of the STI method;
- methods to predict the STI performance of transmission channels based on the predicted (as distinct from measured) performance of parts or all of the transmission channel;

- introduction of STI corrections for non-native language listeners;
- introduction of STI corrections for listeners with some specific forms of hearing loss;
- relationships between STI and 'Listening Difficulty' scale.

Potential applications of STI

STI may be used to measure the potential intelligibility of a wide range of electronic systems and acoustic environments. Typical applications include:

- measurement of Public Address and Sound Reinforcement Systems;
- measurement and Certification of Voice Alarm and emergency sound systems;
- measurement of communication channels / systems such as intercoms and wireless communication;
- measurement of potential speech intelligibility and communication in rooms and auditoria;
- evaluation of direct speech communication (situations without electronic amplification) in rooms or acoustic spaces including vehicles;
- evaluation of the potential intelligibility of Assistive Hearing Systems;

NOTE The STI method is not validated for the measurement and evaluation of speech privacy or speech masking systems.

Potential users of STI

The range of users of STI measurements is diverse. Among the users who may apply this method are:

- certifiers of voice alarm and other types of emergency systems;
- certifiers of sound reinforcement and audio systems;
- audio and telecommunication equipment manufacturers;
- audio and communication engineers;
- acoustical and electro-acoustical engineers;
- sound system installers;
- researchers into STI methods and developers of instruments to measure STI.

To avoid misinterpretation of STI results, it is important that all users have an understanding of the basic principles, the application domain and its limitations.

SOUND SYSTEM EQUIPMENT –

Part 16: Objective rating of speech intelligibility by speech transmission index

1 Scope

This part of IEC 60268 specifies objective methods for rating the transmission quality of speech with respect to intelligibility.

The objective of this standard is to provide a comprehensive manual for all types of users of the STI method in the fields of audio, communications and acoustics.

This standard does not provide STI criteria for certification of transmission channels (e.g. criteria for a voice-alarm system).

Three methods are presented, which are closely related and are referred to as STI, STIPA, and STITEL. The first two methods are intended for rating speech transmission performance with or without sound systems. The STITEL method has more restricted uses.

NOTE None of the methods are suitable for the measurement and assessment of speech privacy and speech masking systems, as STI has not been validated for conditions that represent speech privacy applications [1]¹.

The following information is included:

- measurement techniques;
- prediction techniques.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies:

IEC 61260:1995, *Electroacoustics – Octave-band and fractional-octave-band filters*
Amendment 1 (2001)

ISO 18233:2006, *Acoustics – Application of new measurement methods in building and room acoustics*

¹ Figures in square brackets refer to the Bibliography.