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**Equipements et systèmes électroacoustiques haute fidélité;
Valeurs limites des caractéristiques**

Sixième partie : Amplificateurs

**High fidelity audio equipment and systems;
Minimum performance requirements**

Part 6: Amplifiers



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En ce qui concerne la terminologie générale, le lecteur se reporterà à la Publication 50 de la CEI: Vocabulaire Electrotechnique International (V.E.I.), qui est établie sous forme de chapitres séparés traitant chacun d'un sujet défini, l'Index général étant publié séparément. Des détails complets sur le V.E.I. peuvent être obtenus sur demande.

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- la Publication 117 de la CEI: Symboles graphiques recommandés.

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L'attention du lecteur est attirée sur la page 3 de la couverture, qui énumère les autres publications de la CEI préparées par le Comité d'Etudes qui a établi la présente publication.

Revision of this publication

The technical content of IEC publications is kept under constant review by the IEC, thus ensuring that the content reflects current technology.

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- **IEC Bulletin**
- **Report on IEC Activities**
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- **Catalogue of IEC Publications**
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- IEC Publication 117: Recommended graphical symbols.

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Other IEC publications prepared by the same Technical Committee

The attention of readers is drawn to the inside of the back cover, which lists other IEC publications issued by the Technical Committee which has prepared the present publication.

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I N T E R N A T I O N A L E L E C T R O T E C H N I C A L C O M M I S S I O N
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Descripteurs: électroacoustique, haute fidélité, mesure, amplificateurs, exigences, propriétés, rapport signal/bruit.

Descriptors: electro-acoustic problems, high fidelity, measurement, amplifiers, requirements, properties, signal-to-noise ratio.



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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**HIGH FIDELITY AUDIO EQUIPMENT AND SYSTEMS ;
MINIMUM PERFORMANCE REQUIREMENTS**

Part 6 : Amplifiers

FOREWORD

- 1) The formal decisions or agreements of the IEC on technical matters, prepared by Technical Committees on which all the National Committees having a special interest therein are represented, express, as nearly as possible, an international consensus of opinion on the subjects dealt with.
- 2) They have the form of recommendations for international use and they are accepted by the National Committees in that sense.
- 3) In order to promote international unification, the IEC expresses the wish that all National Committees should adopt the text of the IEC recommendation for their national rules in so far as national conditions will permit. Any divergence between the IEC recommendation and the corresponding national rules should, as far as possible, be clearly indicated in the latter.

PREFACE

This standard has been prepared by Sub-Committee 29B, Audio Engineering, of IEC Technical Committee No. 29, Electro-acoustics.

Work was started at the meeting held in Moscow in 1974.

A first draft was discussed at the meeting held in Gaithersburg in 1976. As a result of this meeting, the draft, Document 29B(Central Office)54, was submitted to the National Committees for approval under the Six Months' Rule in July 1976.

The following countries voted explicitly in favour of publication:

Australia	Germany	Spain
Belgium	Hungary	Sweden
Brazil	Italy	Switzerland
Czechoslovakia	Japan	Turkey
Denmark	Netherlands	United Kingdom
Egypt	Norway	
France	Romania	

The revised draft on Clauses 11 and 12 was discussed at the meeting held in Gaithersburg in 1976. As a result of this meeting, the draft, Document 29B(Central Office)64, was submitted to the National Committees for approval under the Six Months' Rule in May 1977.

The following countries voted explicitly in favour of publication:

Australia	Hungary	Spain
Belgium	Netherlands	Switzerland
Brazil	Norway	Turkey
Czechoslovakia	Poland	United Kingdom
Denmark	Romania	
Germany	South Africa (Republic of)	

Amendments, Document 29B(Central Office)73, were submitted to the National Committees for approval under the Two Months' Procedure in February 1978.

The following countries voted explicitly in favour of publication:

Belgium	Norway	Switzerland
Canada	Poland	Turkey
Denmark	Romania	Union of Soviet Socialist Republics
France	South Africa (Republic of)	
Germany	Spain	United Kingdom
Netherlands	Sweden	United States of America

Other IEC publications quoted in this standard:

- Publications Nos. 179: Precision Sound Level Meters.
- 268-1: Sound System Equipment, Part 1: General.
- 268-1B: Second supplement to Publication 268-1.
- 268-3: Part 3: Sound System Amplifiers.
- 268-3C: Third supplement to Publication 268-3.
- 268-14A: First supplement to Publication 268-14.
Chapter II: Connecting Devices. Section One: Circular Connectors for the Interconnection
of Sound System Components.
- 268-15: Part 15: Preferred Matching Values for the Interconnection of Sound System Components.
- 581-1: High Fidelity Audio Equipment and Systems; Minimum Performance Requirements,
Part 1: General.

HIGH FIDELITY AUDIO EQUIPMENT AND SYSTEMS ; MINIMUM PERFORMANCE REQUIREMENTS

Part 6 : Amplifiers

1. Scope

This part applies to linear and equalizing preamplifiers, power amplifiers and integrated amplifiers and primarily intended for high quality reproducing systems for home use.

2. Object

To lay down the minimum requirements for amplifiers falling within the scope of this part.

Terms and definitions correspond to those of IEC Publication 268-3, Sound System Equipment, Part 3: Sound System Amplifiers.

3. Measuring conditions

- 3.1 All measurements shall be made in accordance with the general measuring conditions stated in IEC Publication 581-1, Part 1: General, and the rated conditions for measurement given in IEC Publication 268-3, Clause 12.
- 3.2 When, during the measurements, an input has to be terminated with the rated source impedance, this shall be as follows:
- non-equalized high voltage/impedance inputs: 22 kΩ/250 pF
 - equalized low voltage inputs (velocity sensitive pick-up inputs and the like): 2.2 kΩ
 - microphone inputs: to be stated by the manufacturer
- 3.3 When, during the measurements, the rated source electromotive force has to be applied, the following values of source electromotive forces shall be used instead of any other value stated by the manufacturer:
- non-equalized high voltage/impedance inputs: 500 mV
 - equalized low voltage inputs (velocity sensitive pick-up inputs and the like): 5 mV at 1 000 Hz
 - microphone inputs: 10 dB higher than the value of the minimum source electromotive force as stated by the manufacturer for the relevant microphone input

SECTION ONE — MINIMUM REQUIREMENTS FOR CHARACTERISTICS
DIRECTLY RELATED TO THE REPRODUCING QUALITY

Clause	Characteristic	Method of measurement	Minimum requirement
4	Effective frequency range	According to IEC Publication 268-3, Sub-clause 19.2.2	<p>From 40 Hz to 16 000 Hz within the tolerance of ± 1.5 dB for non-equalized inputs related to 1 000 Hz ± 2.0 dB for equalized inputs related to 1 000 Hz</p> <p>If the claimed effective frequency range is wider than the minimum requirement of 40 Hz to 16 000 Hz, the above tolerances shall still apply.</p>
5	Gain alignment	According to IEC Publication 268-3, Sub-clause 27.1	<p>≤ 4 dB within the frequency range of 250 Hz to 6 300 Hz</p> <p>This applies at volume control settings from maximum down to -46 dB</p> <p><i>Note.</i> — The requirements for multichannel equipment are under consideration.</p>
6	Total harmonic distortion	According to IEC Publication 268-3, Sub-clause 20.2.1	<p>$\leq 0.5\%$ for preamplifiers $\leq 0.5\%$ for power amplifiers $\leq 0.7\%$ for integrated amplifiers</p> <p>The total harmonic distortion at rated output power for amplifiers and at rated output voltage for preamplifiers shall not exceed the above values over the minimum effective frequency range of 40 Hz to 16 000 Hz</p> <p>Furthermore the specified distortion values shall not be exceeded at any output level above -26 dB referred to rated output power or voltage</p> <p>For power and integrated amplifiers the output power is allowed to fall by 3 dB (relative to the rated value) at the above specified values of distortion for frequencies between 40 Hz and 63 Hz and between 12 500 Hz and 16 000 Hz</p>
7	Rated output power	According to IEC Publication 268-3, Sub-clause 16.4	<p>≥ 10 W per channel, specified for the total harmonic distortion in Clause 6</p> <p>Multi-channel amplifiers shall be rated with all channels operating simultaneously at rated output power</p> <p>The amplifier shall be able to deliver the rated output power at rated distortion for at least 10 min with all channels operating simultaneously at rated output power, and at ambient temperature between 15°C and 35°C</p> <p><i>Note.</i> — To achieve a correct combination of amplifier output power and loudspeaker</p>

Clause	Characteristic	Method of measurement	Minimum requirement
7	Rated output power <i>(Continued)</i>		<p>sensitivity reference is made to IEC Publication 581-8, Combination Equipment.</p> <p>Pending the drafting of IEC Publication 581-8, the combination of amplifier and loudspeaker should be capable of producing a sound pressure level of at least 94 dB ref. $2 \cdot 10^{-6}$ Pa at a distance of 1 m.</p>
8	Overload source e.m.f.	According to IEC Publication 268-3, Sub-clause 17.1	≥ 2 V for non-equalized inputs ≥ 30 mV for equalized inputs } at 1 000 Hz
9	Crosstalk attenuation (between stereo channels)	<p>According to IEC Publication 268-3, Amendment No. 1, Clause 26, as follows:</p> <p>Crosstalk attenuation from channel L into channel R:</p> $20 \log \frac{(U_L)_L}{(U_R)_L} \text{ dB, or}$ <p>Crosstalk attenuation from channel R into channel L:</p> $20 \log \frac{(U_R)_R}{(U_L)_R} \text{ dB}$ <p>where:</p> <p>$(U_L)_L$ = output voltage of channel L</p> <p>$(U_R)_R$ = output voltage of channel R</p> <p>$(U_L)_R$ = output voltage of channel L due to input voltage applied to channel R</p> <p>$(U_R)_L$ = output voltage of channel R due to input voltage applied to channel L</p>	≥ 30 dB between 250 Hz and 10 000 Hz ≥ 40 dB at 1 000 Hz <p>These figures apply at volume control settings from maximum down to -40 dB</p> <p><i>Note.</i> — The requirements for multi-channel sets are under consideration.</p>
10	Crosstalk attenuation (between inputs)	<p>According to IEC Publication 268-3, Amendment No. 1, Clause 26 as follows:</p> <p>Crosstalk attenuation from channel A into channel B:</p> $20 \log \frac{(U_A)_A}{(U_B)_A} \text{ dB, or}$ <p>Crosstalk attenuation from channel B into channel A:</p> $20 \log \frac{(U_B)_B}{(U_A)_B} \text{ dB}$	≥ 40 dB between 250 Hz and 10 000 Hz ≥ 50 dB at 1 000 Hz

Clause	Characteristic	Method of measurement	Minimum requirement
10	Crosstalk attenuation (between inputs) (Continued)	<p>where:</p> <p>$(U_A)_A$ = output voltage of channel A</p> <p>$(U_B)_B$ = output voltage of channel B</p> <p>$(U_A)_B$ = output voltage of channel A due to input voltage applied to channel B</p> <p>$(U_B)_A$ = output voltage of channel B due to input voltage applied to channel A</p>	
11	Wideband signal-to-noise ratio	<p>According to IEC Publications 268-3, Sub-clause 21.1, and IEC Publication 268-3C, Sub-clause 21.6 as follows:</p> <p><i>Preamplifier:</i></p> $20 \log \frac{U_x}{U'_2} \text{ dB}$ <p>where:</p> <p>U_x = reference output voltage U'_2 = noise output voltage</p> <p><i>Power and integrated amplifier</i></p> $10 \log \frac{P_x}{P'_2} \text{ dB}$ <p>where:</p> <p>P_x = reference output power P'_2 = noise output power</p> <p><i>Notes 1.</i> — The wideband filter used for the noise measurement is specified in IEC Publication 268-1, Clause 7.</p> <p>2. — All appropriate controls are to be set to such a position that the requirements of Clause 4 are met.</p>	<p><i>Preamplifier</i></p> <p>$\geq 58 \text{ dB}$</p> <p>The requirement shall be met at all settings of the volume control; from that giving the rated output voltage with the relevant rated source electromotive force (Sub-clause 3.3), down to that position giving an attenuation of 23 dB</p> <p><i>Power amplifier (without volume control)</i></p> <p>$\geq 81 \text{ dB}$</p> <p>The reference output power P_x shall be the rated output power</p> <p><i>Integrated amplifier (power amplifier with integrated preamplifier)</i></p> <p>a) $\geq 58 \text{ dB}$</p> <p>This requirement shall be met at that setting of the volume control which gives the rated output power; the amplifier being fed with the relevant rated source electromotive force (Sub-clause 3.3).</p> <p>The reference output power P_x shall be the rated output power</p> <p>b) $\geq 78 \text{ dB}$</p> <p>This requirement shall be met at that setting of the volume control which gives an output power of 23 dB below the rated output power; the amplifier being fed with the relevant rated source electromotive force (Sub-clause 3.3)</p> <p>The reference output power P_x shall be the rated output power.</p>

Clause	Characteristic	Method of measurement	Minimum requirement
12	Weighted signal-to-noise ratio	<p>According to IEC Publication 268-3, Sub-clauses 21.1 and IEC Publication 268-3C, Sub-clause 21.6, as follows:</p> <p><i>Preamplifier:</i></p> $20 \log \frac{U_x}{U_2} \text{ dB}$ <p>where:</p> <p>U_x = reference output voltage U_2 = noise output voltage</p> <p><i>Power and integrated amplifier</i></p> $10 \log \frac{P_x}{P_2} \text{ dB}$ <p>where:</p> <p>P_x = reference output power P_2 = noise output power</p> <p><i>Notes 1.</i> — The weighting filter used for the noise measurement shall have a frequency response in accordance with IEC Publication 179 (weighting curve A)</p> <p>2. — All appropriate controls are to be set to such a position that the requirements of Clause 4 are met</p>	<p><i>Preamplifier</i></p> $\geq 63 \text{ dB}$ <p>The requirement shall be met at all settings of the volume control from that giving the rated output voltage with the relevant rated source electromotive force (Sub-clause 3.3) down to that position giving an attenuation of 23 dB</p> <p>The reference output voltage U_x shall be the output voltage given by the rated source electromotive force at the particular volume control setting</p> <p><i>Power amplifier (without volume control)</i></p> $\geq 86 \text{ dB}$ <p>The reference output power P_x shall be the rated output power</p> <p><i>Integrated amplifier (power amplifier with integrated preamplifier)</i></p> <p>a) $\geq 63 \text{ dB}$</p> <p>This requirement shall be met at that setting of the volume control which gives the rated output power; the amplifier being fed with the relevant rated source electromotive force (Sub-clause 3.3).</p> <p>The reference output power P_x shall be the rated output power</p> <p>b) $\geq 83 \text{ dB}$</p> <p>This requirement shall be met at that setting of the volume control which gives that output power of 23 dB below the rated output power, the amplifier being fed with the relevant rated source electromotive force (Sub-clause 3.3)</p> <p>The reference output power P_x shall be the rated output power</p>

**Autres publications de la CEI préparées
par le Comité d'Etudes N° 29**

- 90 (1973) Dimensions des fiches pour appareils de correction auditive.
118: — Appareils de correction auditive.
- 118 (1959) Méthodes recommandées pour la mesure des caractéristiques électroacoustiques des appareils de correction auditive. Modification N° 1 (1973).
- 118-I (1975) Méthodes de mesure des caractéristiques des appareils de correction auditive comportant une entrée à bobine d'induction captrice.
- 123 (1961) Recommandations relatives aux sonomètres.
- 126 (1973) Coupleur de référence de la CEI pour la mesure des appareils de correction auditive utilisant des écouteurs couplés à l'oreille par des embouts.
- 150 (1963) Essai et étalonnage de générateurs d'ultrasons à usage thérapeutique.
- 177 (1965) Audiomètres à sons purs pour diagnostics généraux.
- 178 (1965) Audiomètres de dépistage à sons purs
- 179 (1973) Sonomètres de précision.
- 179A (1973) Premier complément.
- 184 (1965) Méthodes de spécification des caractéristiques relatives aux transducteurs électromécaniques destinés aux mesures de chocs et de vibrations.
- 222 (1966) Méthodes de spécification des caractéristiques relatives à l'équipement auxiliaire pour les mesures de chocs et de vibrations.
- 224 (1966) Marquage des positions de réglage sur les appareils de correction auditive.
- 225 (1966) Filtres de bandes d'octave, de demi-octave et de tiers d'octave destinés à l'analyse des bruits et des vibrations.
- 263 (1975) Echelles et dimensions des graphiques pour le tracé des courbes de réponse en fréquence et des diagrammes polaires.
- 268: — Equipements pour systèmes électroacoustiques.
- 268-1 (1968) Première partie: Généralités.
- 268-1A (1970) Premier complément.
- 268-1B (1972) Deuxième complément.
- 268-2 (1971) Deuxième partie: Définition des termes généraux. Modification N° 1 (1975).
- 268-3 (1969) Troisième partie: Amplificateurs pour systèmes électro-acoustiques. Modification N° 1 (1978).
- 268-3A (1970) Premier complément.
- 268-3B (1977) Deuxième complément.
- 268-3C (1978) Troisième complément.
- 268-4 (1972) Quatrième partie: Microphones.
- 268-5 (1972) Cinquième partie: Haut-parleurs.
- 268-6 (1971) Sixième partie: Éléments auxiliaires passifs.
- 268-8 (1973) Huitième partie: Dispositifs de commande automatique de gain.
- 268-9 (1977) Neuvième partie: Equipements de réverbération artificielle, de retard et de transposition de fréquence.
- 268-10 (1976) Dixième partie: Appareils de mesure du niveau de la modulation.
- 268-10A (1978) Premier complément.
- 268-12 (1975) Douzième partie: Connecteurs circulaires pour radiodiffusion et usage analogue.
- 268-14 (1971) Quatorzième partie: Éléments mécaniques de construction.
- 268-14A (1973) Premier complément: Chapitre II: Dispositifs de connexion. Section un: Connecteurs circulaires pour l'interconnexion de s'éléments de systèmes électroacoustiques.
- 268-15 (1978) Quinzième partie: Valeurs d'adaptation recommandées pour le raccordement entre composants des systèmes électro-acoustiques.
- 303 (1970) Coupleur de référence provisoire de la CEI pour l'étalonnage des écouteurs utilisés en audiомétrie.
- 318 (1970) Une oreille artificielle de la CEI, à large bande, pour l'étalonnage des écouteurs utilisés en audiомétrie.
- 327 (1971) Méthode de précision pour l'étalonnage en pression des microphones étais à condensateur d'un pouce par la technique de la réciprocité.
- 373 (1971) Un coupleur mécanique de la CEI destiné à l'étalonnage des ossivibrateurs ayant une surface de contact spécifiée appliqués avec une force statique spécifiée.
- 402 (1972) Méthode simplifiée pour l'étalonnage en pression des microphones à condensateur d'un pouce par la technique de la réciprocité.
- 486 (1974) Méthode de précision pour l'étalonnage en champ libre des microphones étais à condensateur d'un pouce par la technique de la réciprocité.
- 500 (1974) Hydrophone étalon CEI.
- 537 (1976) Pondération en fréquence pour la mesure du bruit des aéronefs (pondération D).
- 561 (1976) Equipements électroacoustiques de mesure pour la certification acoustique des aéronefs.
- 565 (1977) Etalonnage des hydrophones.
- 581: — Equipements et systèmes électroacoustiques haute fidélité; Valeurs limites des caractéristiques.
- 581-I (1977) Première partie: Généralités.
- 581-3 (1978) Troisième partie: Platines tourne-disques et têtes de lecture.

**Other IEC publications prepared by
Technical Committee No. 29**

- 90 (1973) Dimensions of plugs for hearing aids.
118: — Hearing aids.
- 118 (1959) Recommended methods for measurements of the electro-acoustical characteristics of hearing aids. Amendment No. 1 (1973).
- 118-I (1975) Method of measurement of characteristics of hearing aids with induction pick-up coil input.
- 123 (1961) Recommendations for sound level meters.
- 126 (1973) IEC reference coupler for the measurement of hearing aids using earphones coupled to the ear by means of ear inserts.
- 150 (1963) Testing and calibration of ultrasonic therapeutic equipment.
- 177 (1965) Pure tone audiometers for general diagnostic purposes.
- 178 (1965) Pure tone screening audiometers.
- 179 (1973) Precision sound level meters.
- 179A (1973) First supplement.
- 184 (1965) Methods for specifying the characteristics of electro-mechanical transducers for shock and vibration measurements.
- 222 (1966) Methods for specifying the characteristics of auxiliary equipment for shock and vibration measurement.
- 224 (1966) Marking of control settings on hearing aids.
- 225 (1966) Octave, half-octave and third-octave band filters intended for the analysis of sounds and vibrations.
- 263 (1975) Scales and sizes for plotting frequency characteristics and polar diagrams.
- 268: — Sound system equipment.
- 268-1 (1968) Part 1: General.
- 268-1A (1970) First supplement.
- 268-1B (1972) Second supplement.
- 268-2 (1971) Part 2: Explanation of general terms. Amendment No. 1 (1973).
- 268-3 (1969) Part 3: Sound system amplifiers.
- Amendment No. 1 (1978).
- 268-3A (1970) First supplement.
- 268-3B (1977) Second supplement.
- 268-3C (1978) Third supplement.
- 268-4 (1972) Part 4: Microphones.
- 268-5 (1972) Part 5: Loudspeakers.
- 268-6 (1971) Part 6: Auxiliary passive elements.
- 268-8 (1973) Part 8: Automatic gain control devices.
- 268-9 (1977) Part 9: Artificial reverberation, time delay and frequency shift equipment.
- 268-10 (1976) Part 10: Programme level meters.
- 268-10A (1978) First Supplement.
- 268-12 (1975) Part 12: Circular connectors for broadcast and similar use.
- 268-14 (1971) Part 14: Mechanical design features.
- 268-14A (1973) First supplement: Chapter II: Connecting devices. Section One: Circular connectors for the interconnection of sound system components.
- 268-15 (1978) Part 15: Preferred matching values for the interconnection of sound system components.
- 303 (1970) IEC provisional reference coupler for the calibration of earphones used in audiometry.
- 318 (1970) An IEC artificial ear, of the wideband type, for the calibration of earphones used in audiometry.
- 327 (1971) Precision method for pressure calibration of one-inch standard condenser microphones by the reciprocity technique.
- 373 (1971) An IEC mechanical coupler for the calibration of bone vibrators having a specified contact area and being applied with a specified static force.
- 402 (1972) Simplified method for pressure calibration of one-inch condenser microphones by the reciprocity technique.
- 486 (1974) Precision method for free-field calibration of one-inch standard condenser microphones by the reciprocity technique.
- 500 (1974) IEC standard hydrophone.
- 537 (1976) Frequency weighting for the measurement of aircraft noise (D-weighting).
- 561 (1976) Electro-acoustical measuring equipment for aircraft noise certification.
- 565 (1977) Calibration of hydrophones.
- 581: — High fidelity audio equipment and systems; Minimum performance requirements.
- 581-I (1977) Part 1: General.
- 581-3 (1978) Part 3: Record playing equipment and cartridges.