

TECHNICAL SPECIFICATION



High voltage direct current (HVDC) substation audible noise

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

HIGH VOLTAGE DIRECT CURRENT (HVDC) SUBSTATION AUDIBLE NOISE

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In this Redline version, a vertical line in the margin shows where the technical content is modified by amendment 1. Additions are in green text, deletions are in strikethrough red text. A separate Final version with all changes accepted is available in this publication.

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Technical specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

IEC 61973, which is a technical specification, has been prepared by subcommittee 22F: Power electronics for electrical transmission and distribution systems, of IEC technical committee 22: Power electronic systems and equipment, with the participation of IEC technical committee 115: High voltage direct current (HVDC) transmission for DC voltages above 100 kV.

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

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HIGH VOLTAGE DIRECT CURRENT (HVDC) SUBSTATION AUDIBLE NOISE

1 Scope

This technical specification applies to the specification and evaluation of outdoor audible noise from high voltage direct current (HVDC) substations. It is intended to be primarily for the use of the utilities and consultants who are responsible for issuing technical specifications for new HVDC projects with and evaluating designs proposed by prospective contractors. It is primarily intended for HVDC projects with line-commutated converters. Part of this technical specification can also be used for the same purpose for HVDC projects using voltage sourced converters, and for flexible a.c. transmission systems (FACTS) devices such as static Var compensators (SVCs) and static synchronous compensators (STATCOMs).

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60076-10, *Power transformers – Part 10: Determination of sound levels*

IEC 60076-10-1, *Power transformers – Part-10-1: Determination of sound levels – Application guide*

IEC 61672-1, *Electroacoustics – Sound level meters – Part 1: Specifications*

IEC 61672-2, *Electroacoustics – Sound level meters – Part 2: Pattern evaluation tests*

ISO 1996-2, *Acoustics – Description, assessment and measurement of environmental noise – Part 2: Determination of environmental noise levels*

ISO 266:1997, *Acoustics – Preferred frequencies*

ISO 3740, *Acoustics – Determination of sound power levels of noise sources – Guidelines for the use of basic standards*

ISO 3743-2, *Acoustics – Determination of sound power levels of noise sources; engineering methods for small, movable sources in reverberant fields – Part 2: Methods for special reverberation test rooms*

ISO 3744, *Acoustics – Determination of sound power levels and sound energy levels of noise sources using sound pressure – Engineering methods for an essentially free field over a reflecting plane*

ISO 3745, *Acoustics – Determination of sound power levels of noise sources using sound pressure – Precision methods for anechoic and hemi-anechoic rooms*

ISO 3746, *Acoustics – Determination of sound power levels and sound energy levels of noise sources using sound pressure – Survey method using an enveloping measurement surface over a reflecting plane*

ISO 8297, *Acoustics – Determination of sound power levels of multisource industrial plants for evaluation of sound pressure levels in the environment – Engineering method*

ISO 9613-1, *Acoustics – Attenuation of sound during propagation outdoors – Part 1: Calculation of the absorption of sound by the atmosphere*

ISO 9613-2, *Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation*

ISO 9614-1, *Acoustics – Determination of sound power levels of noise sources using sound intensity – Part 1: Measurement at discrete points*

ISO 9614-2, *Acoustics – Determination of sound power levels of noise sources using sound intensity – Part 2: Measurement by scanning*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1 Sound and noise terms

3.1.1 sound

any pressure variation in air, water or other elastic medium

Note 1 to entry: Sound is expressed as sound pressure, sound intensity or sound power (see 3.1.3).

Note 2 to entry: In this technical specification, the medium is assumed to be air.

3.1.2 sound waves in air

traveling sound pressure fluctuations [IEC TS 61973:2012](https://standards.iteh.ai/catalog/standards/iec/e19cee33-6677-4ccd-a0bc-fb3a1fc02073/iec-ts-61973-2012)

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3.1.3 sound pressure

p
fluctuating pressure superimposed on the static pressure

Note 1 to entry: Sound pressure is expressed in pascal.

Note 2 to entry: Sound pressure is usually expressed through the use of a decibel scale, as sound pressure level (see 3.1.4).

3.1.4 sound pressure level

L_p
logarithm of the ratio of the r.m.s. value of a given sound pressure to the reference sound pressure

$$L_p = 10 \lg \left(\frac{(p)^2}{(p_0)^2} \right) = 20 \lg \left(\frac{p}{p_0} \right)$$

where:

p is the measured r.m.s. sound pressure in pascal;

p_0 is the reference r.m.s. pressure of 2×10^{-5} pascal, which corresponds to the 0 dB as threshold of audibility.