

# TECHNICAL SPECIFICATION



## AMENDMENT 1

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### High voltage direct current (HVDC) substation audible noise

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## FOREWORD

This amendment has been prepared by IEC technical committee 115: High voltage direct current (HVDC) transmission for DC voltages above 100 kV.

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

DTS	Report on voting
115/197/DTS	115/207/RVDTS

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

The committee has decided that the contents of this amendment and the base 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

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## 2 Normative references

Add the following new normative references:

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*

### 3.1.5 average sound pressure level

$\bar{L}_{pA}$

Replace the formula in Note 1 with the following:

$$\bar{L}_{pA,TOT} = 10 \lg \left( \frac{1}{N} \sum_{i=1}^N 10^{0,1L_p(f_j)} \right)$$

### 5.4.2 At the fence surrounding the HVDC substation or at the border of the substation owner's property

Delete, under "Disadvantages", the fifth bullet point "Affected by background noise".

### 6.2.2 Comparison with a.c. power transformers

Replace Formula (3) and its explanation with the following:

$$L_{WA,lr} \approx 39 + 18 \lg \left( \frac{S_r}{S_p} \right) \text{ for 50 Hz power frequency} \quad (31)$$

$$L_{WA,lr} \approx 44 + 18 \lg \left( \frac{S_r}{S_p} \right) \text{ for 60 Hz power frequency} \quad (32)$$

where

$L_{WA,lr}$  is the estimated A-weighted sound power level of the transformer at rated current and rated frequency at the short-circuit condition;

$S_r$  is the rated power in MVA;

$S_p$  is the reference power of 1 MVA.

### 7.2.1 General

Add, at the end of the subclause, the following text:

The typical twelve-pulse and dual twelve-pulse HVDC substation layouts are shown in Annex B.

### 10.3.4 Sound intensity measurement

Replace, in the explanation for Formula (28) " $\bar{I}_r$  is sound intensity in direction  $r$ " with the following new explanation:

$\bar{I}_r$  is sound intensity in direction  $r$ ;

Replace Formula (30) with the following:

$$W = \oint_A \bar{I} \bar{dA}$$

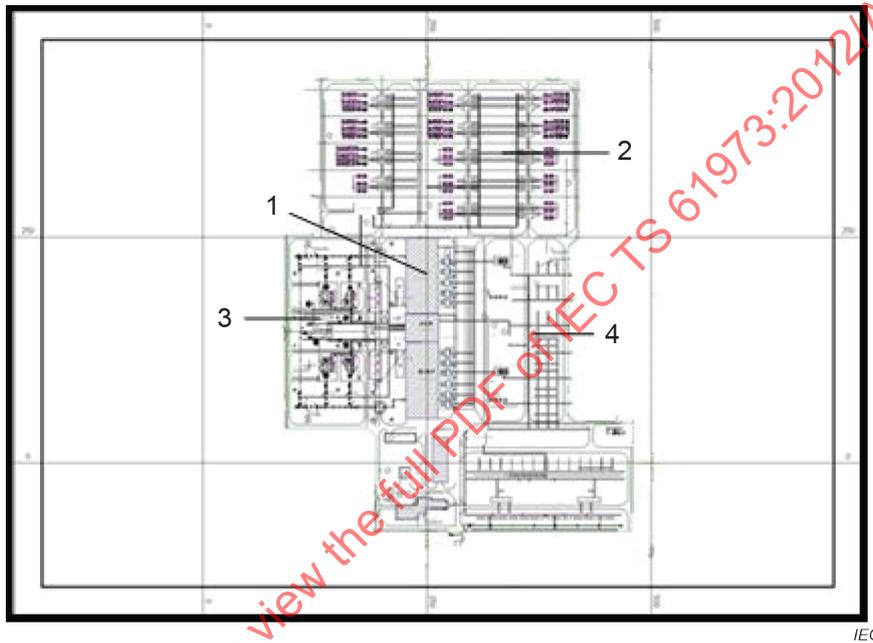
## Annexes

Add, after Annex A, the following new Annex B:

### Annex B (informative)

#### Typical twelve-pulse and dual twelve-pulse HVDC substation layouts

The converter valve hall is the largest building in the HVDC substation, so its layout is very important. The typical twelve-pulse HVDC substation layout is shown in Figure B.1.



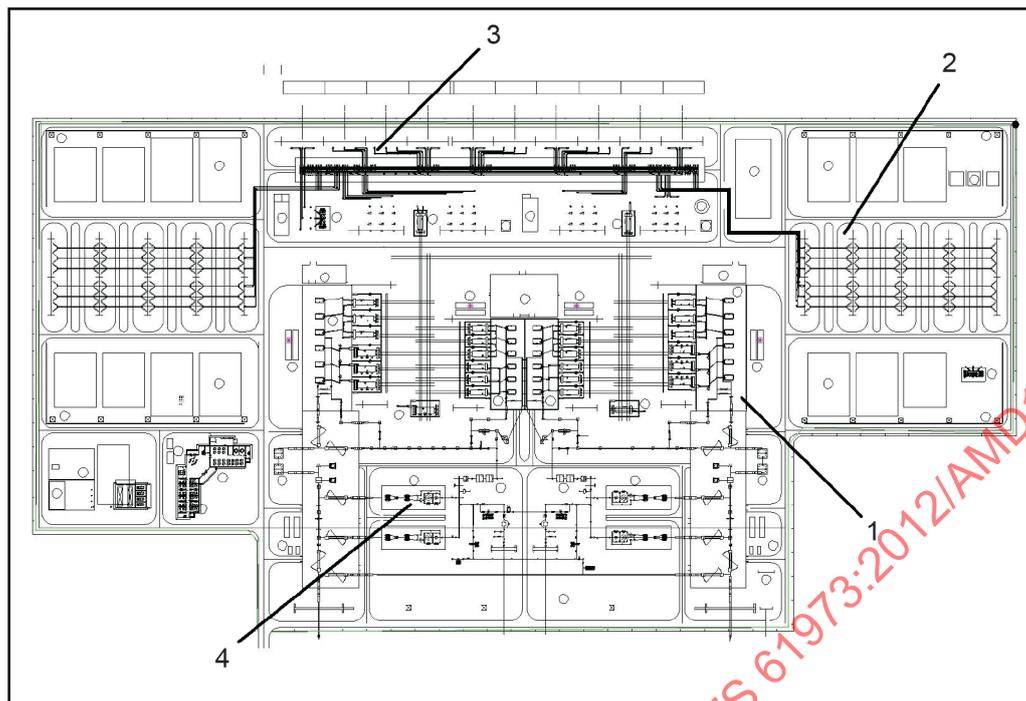
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#### Key

- 1 valve hall and transformer
- 2 AC filter
- 3 DC switch yard
- 4 AC switch yard

**Figure B.1 – Example of typical twelve-pulse HVDC substation layout**

For the dual twelve-pulse forms, the valve hall can be arranged in face-to-face form, the converter transformers arranged on the inside of the buildings, which have significance for controlling the noise of the HVDC substation. The typical dual twelve-pulse HVDC substation layout is shown in Figure B.2.



#### Key

- 1 valve hall and transformer
- 2 AC filter
- 3 AC switch yard
- 4 DC switch yard

**Figure B.2 – Example of dual twelve-pulse HVDC substation layout**

#### Bibliography

Delete references [5] IEC 60076-10, *Power transformers – Part 10: Determination of sound levels and* [6] IEC 60076-10-1, *Power transformers – Part-10-1: Determination of sound levels – Application guide*

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