INTERNATIONAL STANDARD

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AMENDMENT 1
AMENDEMENT 1
2007-04

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Mineral oil-impregnated electrical equipment in service – Guide to the interpretation of dissolved and free gases analysis

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Matériels électriques imprégnés d'huile minérale en service – Guide pour l'interprétation de l'analyse des gaz dissous et des gaz libres

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FOREWORD

This amendment has been prepared by IEC technical committee 10:Fluids for electrotechnical applications.

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

FDIS	Report on voting
10/685/FDIS	10/693/RVD

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 maintenance result 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- withdrawn,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.

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Annex A – Equipment application notes

Replace the existing text of these notes with the following new text:

WARNING: “Limit values” of gas concentrations and rates of gas increase in service are not the responsibility of TC10 but of IEC equipment committees.

“Typical values” in the following application notes **are not limit values**. They are given for information only, as a maintenance tool. In a given transformer population, they indicate for example that 90 % of DGA values in service are below the 90 % typical values and 10 % are above. When typical values are exceeded, the only action recommended in this standard is to increase the frequency of DGA analyses.

Typical values depend on several parameters (age, type and manufacturer of equipment, operating and loading practices, climate, etc.), and are not exactly the same for all electrical networks. Ranges of typical values are therefore indicated in the following application notes, covering the different individual values observed worldwide and surveyed by IEC and CIGRE.

Individual networks are strongly encouraged to calculate the typical values corresponding to their own specific transformer population, using DGA data meeting IEC 60567 specifications for accuracy and following methods indicated in Clause 8 and in CIGRE Brochure # 296 (2006).

The ranges of typical values indicated in these application notes should be used only by default, when individual values are not available, and should not be used in a contract without a special agreement between the user and manufacturer of the equipment.

A.1 Power transformers

Delete the text of the paragraph under the title.

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Subclauses A.1.4 and A.1.5

Replace the text of these subclauses with the following new text:

A.1.4 Typical concentration values

Important note: the "WARNING" clause at the beginning of Annex A shall be consulted before using A.1.4.

Ranges of 90 % typical gas concentration values observed in power transformers, from about 25 electrical networks worldwide and including more than 20 000 transformers, are given in Table A.2. For hydrogen for example, one network reported a typical value of 50 µl/l, another one 150 µl/l and the 23 others reported values between 50 µl/l and 150 µl/l. These ranges of values have been reported by CIGRE SC D1 and A2 (TF11) and approved by IEC TC 10 and TC 14.

Table A.2 – Ranges of 90 % typical gas concentration values observed in power transformers, in µl/l

	C_2H_2	H_2	CH_4	C_2H_4	C_2H_6	CO	CO_2
All transformers		50 - 150	30 - 130	60 - 280	20 - 90	400 - 600	3 800 - 14 000
No OLTC	2 - 20						
Communicating OLTC	60 - 280						

"Communicating OLTC" in Tables A.2 and A.3 means that some oil and/or gas communication is possible between the OLTC compartment and the main tank or between the respective conservators. These gases may contaminate the oil in the main tank and affect concentration values in these types of equipment. "No OLTC" refers to transformers not equipped with an OLTC, or equipped with a tap changer not communicating with or leaking to the main tank.

Typical values in Table A.2 apply to both breathing and sealed transformers, and correspond mostly to core-type transformers. Values in shell-type transformers are likely to be higher. In two countries, values for C_2H_6 are higher. In one country where transformers are operated below nominal load, values for CH_4 and CO and particularly for C_2H_4 are lower. In one country, values of 0,5 µl/l for C_2H_2 and 10 µl/l for C_2H_4 are reported. Values for H_2 may be higher in transformers where reactions between oil and transformer components (paints, metals) are occurring. Values in transformers frequently degassed, a practice used in a few countries, should not be compared with values of Table A.2.

A.1.5 Typical rates of gas increase

Important note: the "WARNING" clause at the beginning of Annex A shall be consulted before using A.1.5.

Ranges of 90 % typical rates of gas increase observed in power transformers, from four electrical networks and including more than 20 000 DGA analyses, are given in Table A.3. These ranges of values have been reported by CIGRE SC D1 and A2 (TF11) and approved by IEC/TC 10 and TC 14.

Table A.3 – Ranges of 90 % typical rates of gas increase observed in power transformers (all types), in µl/l/year

	C_2H_2	H_2	CH_4	C_2H_4	C_2H_6	CO	CO_2
All transformers		35 - 132	10 - 120	32 - 146	5 - 90	260 - 1060	1 700 - 10 000
No OLTC	0 - 4						
Communicating OLTC	21 - 37						

Typical values in Table A.3 are valid for large power transformers with an oil volume >5 000 l. Values in small transformers (<5 000 l) are usually lower. Values in the early and late years of the equipment tend to be higher than the average values of Table A.3.

Values of Table A.3 may be converted into ml/day when the transformer oil volume is known. Values in Table A.3 should not be used to calculate concentration values after several years and compare them to values in Table A.2, since values in these two tables are affected differently by the shape of their respective cumulative curves and gas losses.

When calculating typical rates of increase of individual networks, intervals should be chosen to provide an acceptable accuracy of results.