A short update on IEC works concerning the FRA-Standard

Dr. Alexander Kraetge, Convenor MT IEC 60076-18

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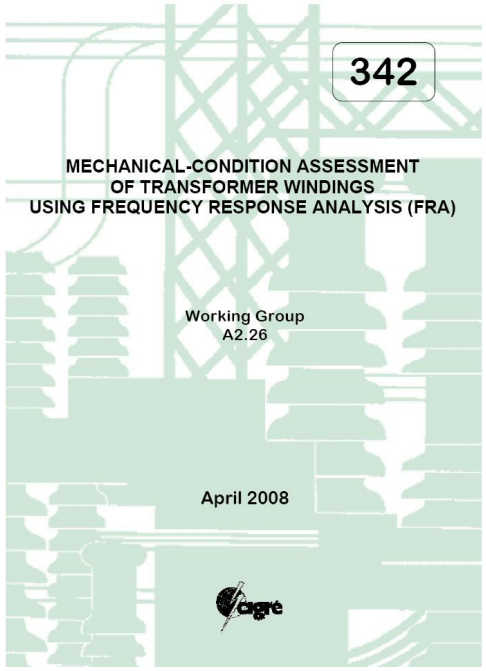
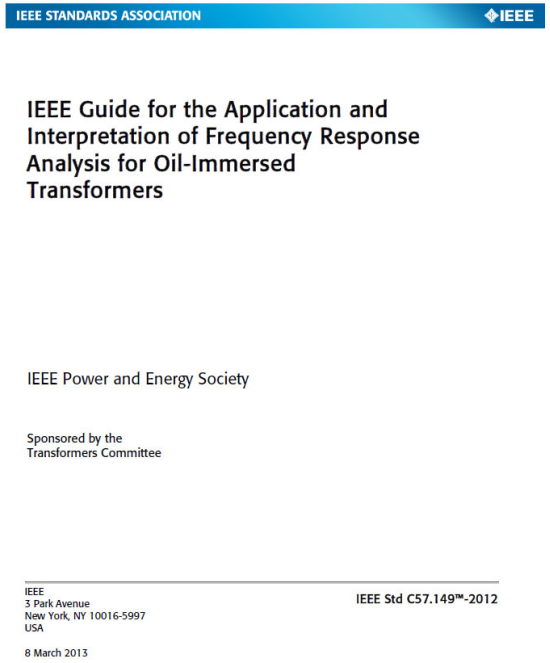
Timing of first editions – Cigré, IEEE & IEC



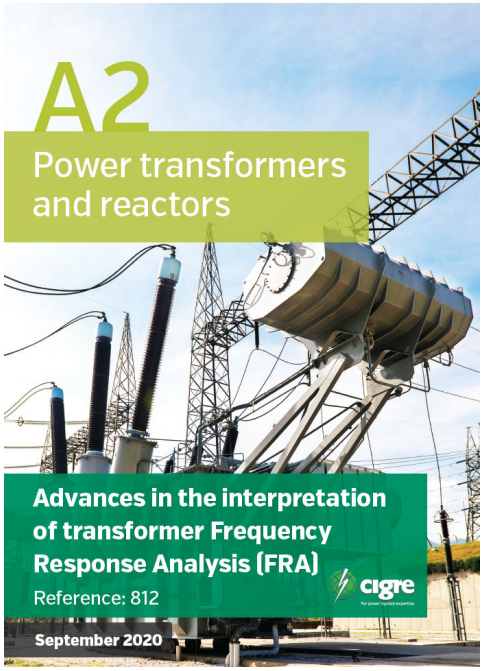
2008

2012

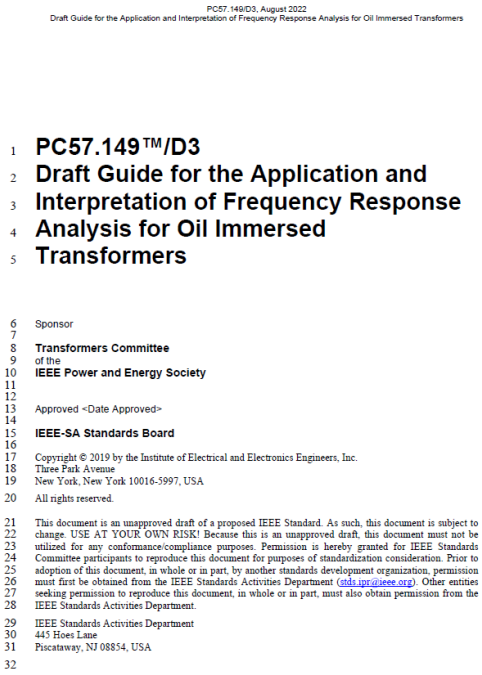


2012

Timing of second editions – Cigré, IEEE & IEC



2020


PC57.149/D3, August 2022
Draft Guide for the Application and Interpretation of Frequency Response Analysis for Oil Immersed Transformers

PC57.149™/D3
Draft Guide for the Application and Interpretation of Frequency Response Analysis for Oil Immersed Transformers

Sponsor

Transformers Committee
of the
IEEE Power and Energy Society

Approved <Date Approved>

IEEE-SA Standards Board

Work finished, publication Q2/Q3 2025


IEC 60076-18
Edition 1.0 2012-07

INTERNATIONAL STANDARD

NORME INTERNATIONALE

colour inside

Power transformers –
Part 18: Measurement of frequency response

Transformateurs de puissance –
Partie 18: Mesure de la réponse en fréquence

Valid since 13 years, under revision since 2023

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Some changes, already agreed upon within MT Team

4.3 Measurement connection and checks

- Ground loop test will become mandatory
- Reproducibility check will be removed

4.4.2.1 Type of measurement

- Open circuit test is madatory, short-circuit test will become mandatory, too. (Harmonization with IEEE C57.149)

4.4.2.2 Tap-position

- Highest and lowest raise is mandatory, transport position will become mandatory, too. This will effect transformers with coarse-fine regulated tap changers

Further discussions

4.4.4 Delta windings and other windings without an accessible neutral

- IEC order of connections for delta windings or star windings without accessable neutral is indipendent of vector group (internal connections): Example transformer D-yn-0: A-B, B-C, C-A
  IEEE specifies „head to tail“ that means for same transformer: H1–H3, H2-H1, H3-H2

B.4 Factors that influence frequency responses

- Will be re-worked and expanded for better guidance of users.

B.4.10 Evaluation of frequency response

- More examples will be included, covering more failure cases and examples.

New business in the document?

Non-normative chapter about automated assessment?

- Cigré TB 812 gives good guidance but MT team sees too much uncertainty, still.

References to other diagnostic measurements?

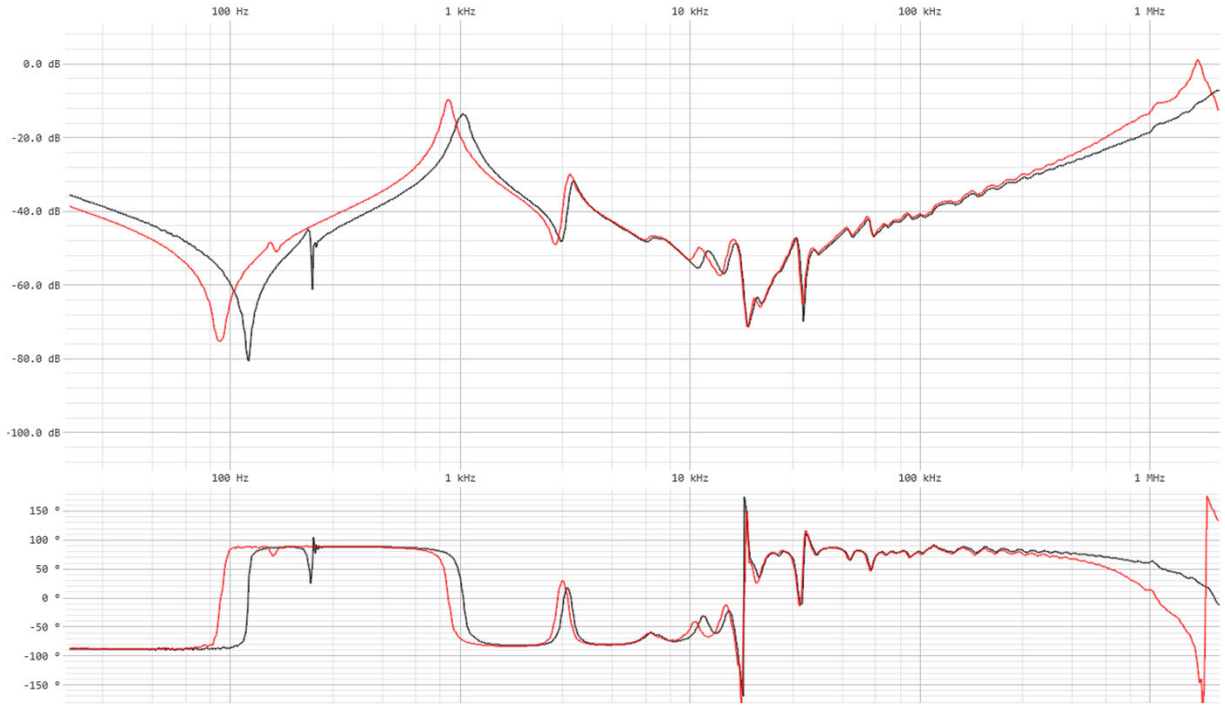
- IEEE C57.149 contains good guidance with respect to complementary tests:

  Paragraph 6.4: FRA relationship to other transformer diagnostics

FRA as Pass/Fail-Criterion for High Power short circuit tests?

- IEC 60076-5 was just under revision, too late to include FRA. Will be considered for the next revision.

Bushing influence to be considered comparing FAT-SAT

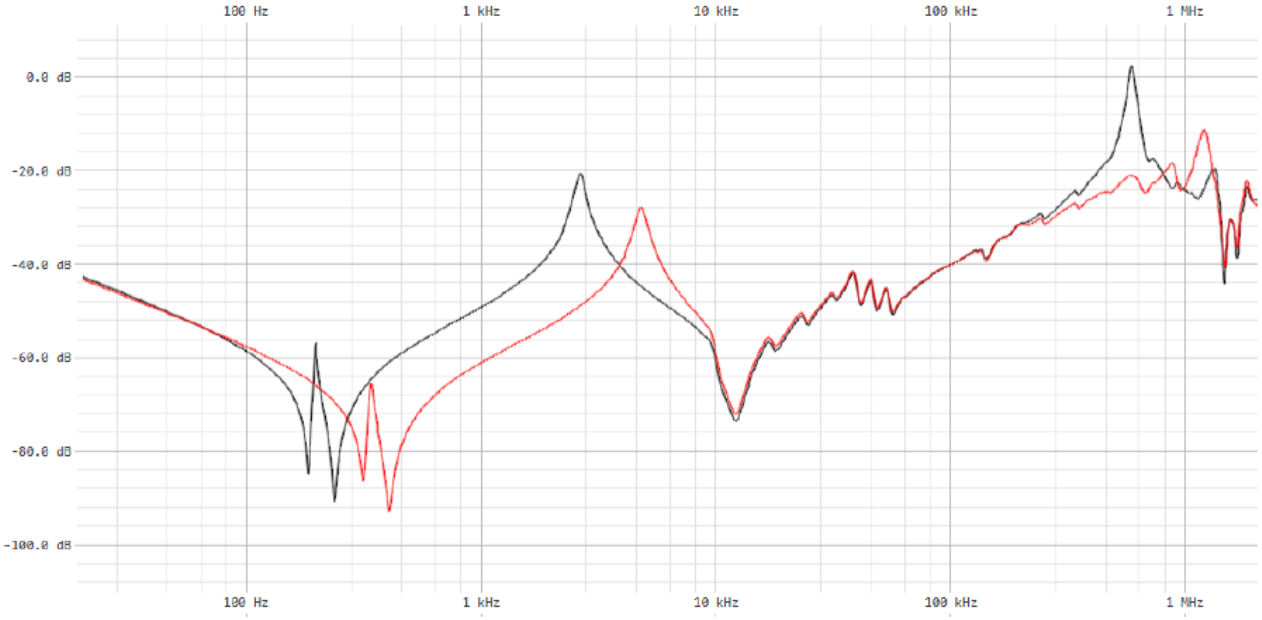


Transformer characteristics		
YNa0d11	U_m [kV]	S_r [MVA]
HV	420	150
LV	245 (OLTC with 21 positions)	150
TV	24	25

Example provided by Swiss NC

1U-2u (OLTC 21 max. voltage): FAT (oil-air bushings on HV and LV)
1U-2u (OLTC 21 max. voltage): SAT (oil-SF_6 bushings on HV and LV)

Fingerprinting if connections cannot be removed on site?



Transformer characteristics		
YNd5	U_m [kV]	S_r [MVA]
HV	420 (DECT with 5 positions)	400
LV	24	400

Example provided by Swiss NC

1U-1N (DECT in pos. 5, max. voltage): SAT (only transformer)
1U-1N (DECT in pos. 5, max. voltage): SAT (transformer + 50 m GIS bus bar on the HV side)

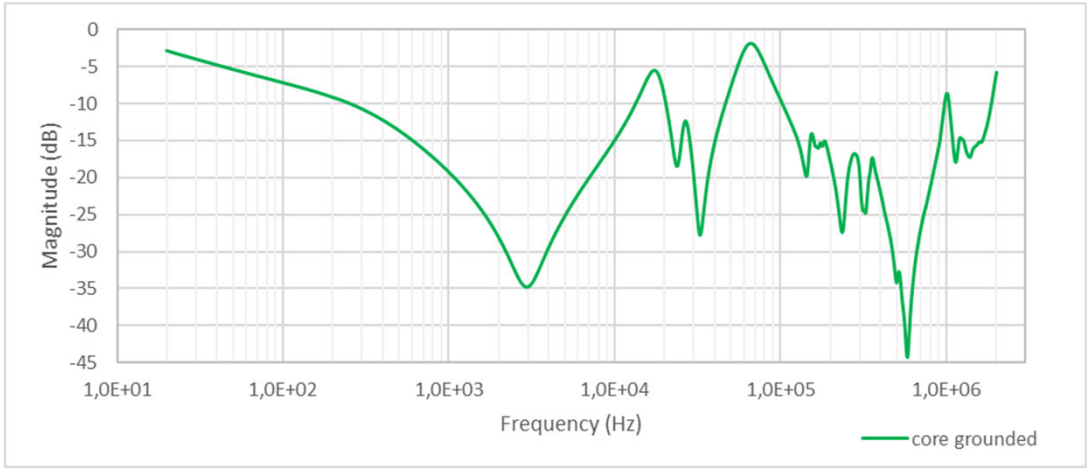
Example from Sweden:

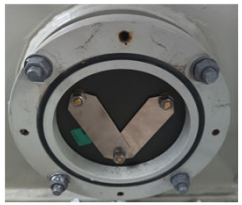
Transformer characteristics

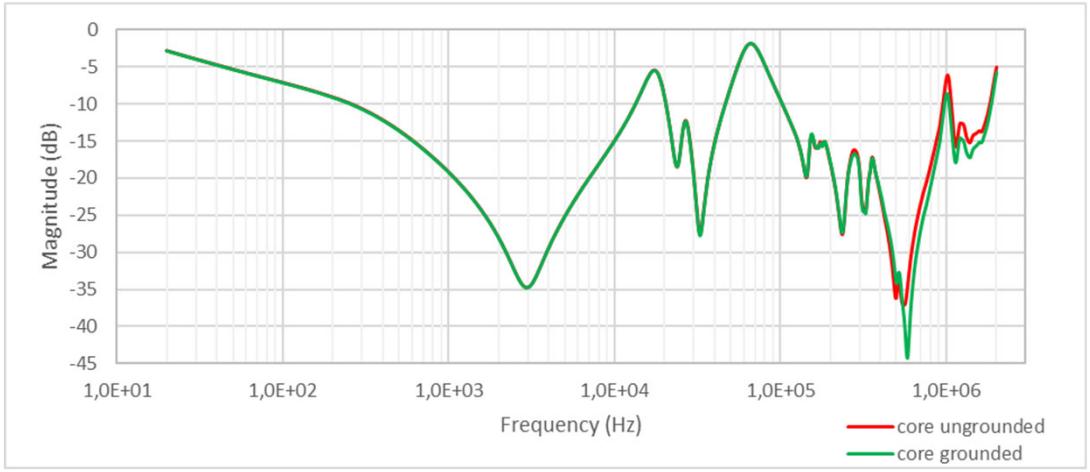
- Three-phase
- D yn yn (1U1V1W / 2u2v2w2n / 3u3v3w3n)
- 40 MVA
- 130 kV

Example provided by Swedish NC

2u-2v open measurement







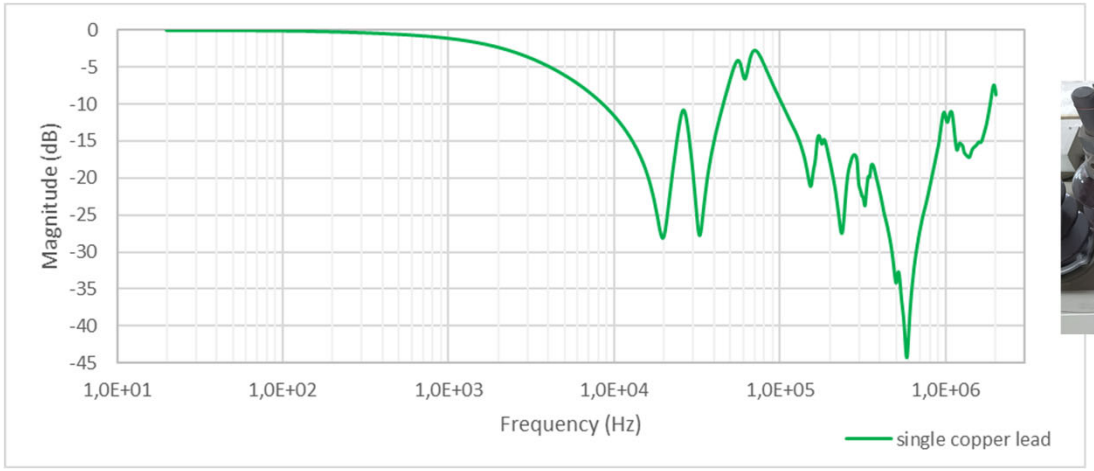
Influence of shorting

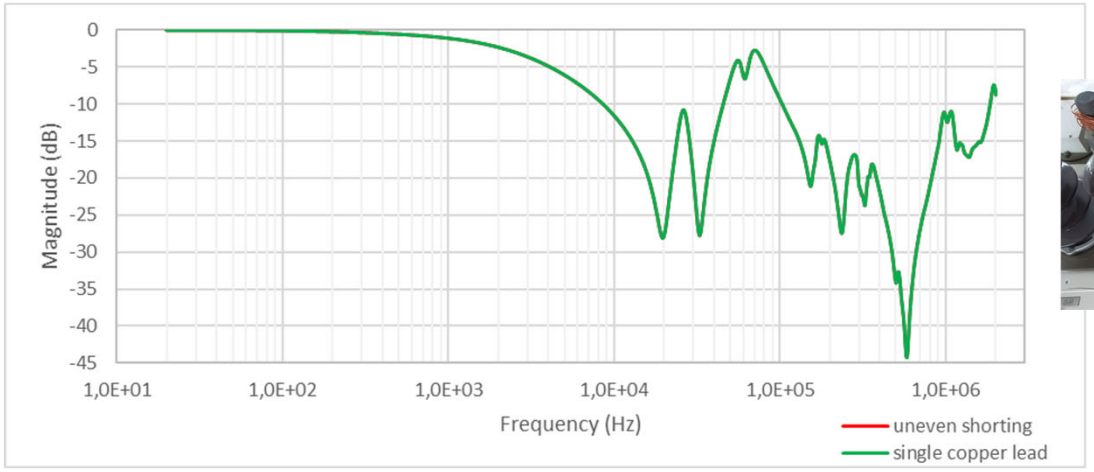
Transformer characteristics

- Three-phase
- D yn yn (1U1V1W / 2u2v2w2n / 3u3v3w3n)
- 40 MVA
- 130 kV

Example provided by Swedish NC

2u-2v measurement, 3u3v3w shorted





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Vielen Dank für Ihre Aufmerksamkeit!

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