

PC57.136 – Guide for Audible Sound of Liquid-Immersed Power Transformers

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Background

- C57.136 was the “Sound Abatement Guide” and the document expired several years ago
- 2019/2020 was decided to resurrect/update it
- The PAR was approved in early 2021
- An early draft was circulated to TF participants in April 2021
- Some feedback was received and incorporated
- The draft was updated Summer/Fall 2021



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Tasks to do

- We are considering this the first meeting of the C57.136 Working Group, so let me know if you want to be a Member. Email or chat.
- Brief overview of content of latest draft
- Send draft to interested people for comment
- Update draft
- Finalize it



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Overview of Content



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Chapter 3: Basics and Standards of Transformer noise

3.1 General

3.2 Sources and characteristics of transformer noise

3.2.1 Core noise

- 3.2.1.1 Impact of Core design & material
- 3.2.1.2 Frequency spectrum
- 3.2.1.3 Impact of Core and Tank resonances
- 3.2.1.4 Impact of Tap Changer position
- 3.2.1.5 Impact of load and load power factor
- 3.2.1.6 Impact of core temperature



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Chapter 3: Basics and Standards of Transformer noise, cont'd

3.2.2 Load noise

- 3.2.2.1 Sources of load noise
- 3.2.2.2 Design factors impacting load noise level
- 3.2.2.3 Impact of load
- 3.2.2.4 Frequency components
- 3.2.2.5 Impact of tap changer position
- 3.2.2.6 Impact of temperature

3.2.3 Cooling system noise

3.2.4 Contribution of components of transformer noise to the total noise level of transformers



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Chapter 3: Basics and Standards of Transformer noise, cont'd

3.3 Transformer industry standards related to noise

- 3.3.1 IEEE Standards
- 3.3.2 IEC Standards
- 3.3.3 Sound level information used in the IEEE & IEC Standards



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Chapter 4: Factors affecting sound levels in field operation

- 4.1 Operating voltage and tap-changer settings
- 4.2 Noise of auxiliary transformers and reactors
- 4.3 Load noise
- 4.4 Load power factor
- 4.5 Voltage and load current harmonics
 - 4.5.1 Load current harmonics
 - 4.5.2 Harmonics in the excitation voltage
- 4.6 DC and GIC current
- 4.7 Contribution from vibrations of structures attached to the transformer
- 4.8 Contribution of sound build-up from surrounding sound / fire walls
- 4.9 Impact of transformer mounting
- 4.10 Other sources of noise on site
- 4.11 Operating temperature



Chapter 5: Transformer noise reduction in the design stage and factory

5.1 Methods to reduce core noise

- 5.1.1 Lower core flux density
- 5.1.2 Usage of high permeability grain-oriented core steel
- 5.1.3 Avoiding core resonance
- 5.1.4 Filling tank stiffeners with sand
- 5.1.5 Other means

5.2 Methods to reduce / eliminate cooling equipment noise

5.3 Methods to reduce load noise

5.4 Methods to reduce both core and load noise

- 5.4.1 Low noise tank design
- 5.4.2 Vibration isolation between active part and tank
- 5.4.3 Tank mounted external sound panels
- 5.4.4 Sound enclosures

5.5 Older methods of transformer noise reduction



Chapter 6: Methods to reduce noise on site

6.1 Sound enclosures

6.2 Sound barriers and walls

6.3 Other field installed techniques



Chapter 7: Determination of required sound levels of power transformers on-site

7.1 Simplified relationship between sound level of a transformer and sound level at specific receiver locations on the far field

7.2 Determination of appropriate noise level of a transformer on site

