



Proposal to Initiate a New WG on High-Temperature Liquid-Immersed Transformers

Insulation Life Subcommittee





IEEE Documentation Supporting Higher Hot Spot Temperatures in Mineral Oil

IEEE Working Group Report, “Background Information on High-Temperature Insulation for Liquid-Immersed Power Transformers

IEEE Std 1276-1997 Guide for the Application of High-Temperature Insulation Materials in Liquid-Immersed Power Transformers

- **Good guide but limited to mineral oil**
- **Does not address distribution**



IEC Documentation Supporting Higher Hot Spot Temperatures in Mineral Oil

IEC/TS 60076-14-2004 Design and application of liquid-immersed power transformers using high-temperature insulation materials

IEC/TS 60076-14 Revision

- In progress now
- Loading guidance has been added
- Completion expected by end of this year



IEC 60076-14 Proposes Four High-Temperature Insulation Systems

Homogeneous

- High-temperature materials for all solid insulation
- High-temperature insulating liquid

Hybrid

- High-temperature solid insulation only when contacting conductor
- Conventional insulating liquid

Semi-Hybrid

- High temperature solid insulation on conductor only
- Conventional insulating liquid

Mixed

- High-temperature insulation only at localized hot regions
- Conventional insulating liquid

TEMPERATURE LIMITS FOR TRANSFORMERS WITH MINERAL INSULATING LIQUID

	Conventional insulation system	Mixed insulation system	Semi-hybrid insulation system	Hybrid insulation system
Minimum High-temperature solid insulation thermal class	N/A	130	120	155
Top oil temperature rise over ambient temperature, (K)	60	60	60	60
Top oil temperature at maximum ambient, (°C)	100	100	100	100
Average winding temperature rise over ambient temperature, (K)	65	65	75	95
Conventional hot-spot temperature at maximum ambient, (°C)	118	118	118	118
High-temperature insulation hot-spot temperature at maximum ambient, (°C)	N/A	150	130	170
Reference temperature, (°C)	75	75	95	115
Maximum ambient temperature, (°C)	40	40	40	40

Reference: IEC TS 60076-14-2004



TEMPERATURE LIMITS FOR TRANSFORMERS WITH HIGH-TEMPERATURE LIQUIDS

	High-temperature homogeneous insulation system with ester liquid or equivalent	High-temperature homogeneous insulation system with silicone liquid or equivalent
Minimum High-temperature solid insulation thermal class	180	200
Top liquid temperature rise over ambient temperature, (K)	90	115
Top liquid temperature at maximum ambient, (°C)	130	155
Average winding temperature rise over ambient temperature, (K)	115	130
High-temperature material hot-spot temperature, (°C)	190	220
Reference temperature, (°C)	135	150
Maximum ambient temperature, (°C)	40	40

Reference: IEC TS 60076-14-2004



Expectations

Sponsored by IL SC

- Doesn't fit anywhere
- Crosses multiple SC

C57 Number Series

- More visible than 1276 document
- Trial use document to get started

Use IEC/TS 60076-14 as Reference

- Obtain formal permission
- 60% - 80% of document should be usable



Suggested Starting Point

Title – Trial use standard for the design and application of liquid-immersed power transformers using high-temperature insulation materials

Scope - This trial use standard applies to all liquid-immersed transformers as defined in the scope of C57.12.00 that are designed to operate at temperatures that exceed the limits of this standard.

Purpose - This trial use standard is intended to provide guidance and to standardize the design and application of liquid-immersed transformers that incorporate high-temperature insulation systems or systems that use a combination of high temperature and conventional insulation.