



## 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*

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

**Reference: IEC TS 60076-14-2004**



## ***TEMPERATURE LIMITS FOR TRANSFORMERS WITH HIGH-TEMPERATURE LIQUIDS***

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