

# Humidity Regulation Solution

## For Oil-Filled High Voltage Instrument Transformers

Performance and lifetime of a instrument transformer can be strongly impacted by the humidity contained in oil-impregnated cellulosic insulation. The main factor leading to moisture recapture is a premature aging of the membrane used for oil dilatation. The latter loses its tightness and humidity from the atmosphere enters in the insulation system.

### GE Solution

GE provides a solution to decrease humidity in oil-impregnated cellulosic insulation by adding in the oil a molecular sieve packaged in special bags into the oil. The solution is deployed in the following steps:

- **Condition assessment** of the instrument transformer through tangent delta measurement coupled with oil analysis. GE specialist evaluates the humidity level in the cellulose and determine if the instrument transformer is worth being refurbished.
- **Replacement of ageing flexible membrane** by either metallic cell or new membrane and **addition of molecular sieve** in oil
- **Oil sampling and analysis** performed every 5 to 8 years to control the humidity level contained in the oil impregnated cellulosic insulation

### Smart Method

By directly adding molecular sieve in the oil, humidity contained in the cellulosic insulation is absorbed through exchanges with the oil. A humidity equilibrium exists between oil and cellulose: the molecular sieve dries the oil then the humidity from the cellulose is absorbed by the oil. With a molecular sieve, humidity remains trapped even when temperature changes, contrary to desiccant.

### Applications

The addition of molecular sieves, directly in the oil, can be applied to all brands of current and combined transformers equipped with a flexible membrane after internal volume pre-study.

The solution is applicable to the following GE's models: EJ33-xx, J33-xx, CM72-33-xx, CTA72-33, CMS72-33-xx, CM100-33-xx, CTS72-33-xx ranges.



### Easy to Install

- Molecular sieve bags are placed over the transformer active part
- No need for specific tools
- 1 working day to install the solution in 3 instrument transformers on the same bay

### Proven Results

- Tangent delta ratio decreased by 150% in 20 months after adding molecular sieve
- Expand instrument cell lifetime up to 10 years

### Cost Effective

- Avoid transformer replacement with adaptation and civil work
- The installation is done at the same time as a replacement of dilatation membrane



## A Proven Solution

Molecular sieve efficiency has been evaluated in small flasks, in presence of cellulose and oil with ratios similar to real conditions. Figures 1 and 2 present the different results. Compatibility of molecular sieves as well as conditioning bag with the insulating liquid have also been checked.

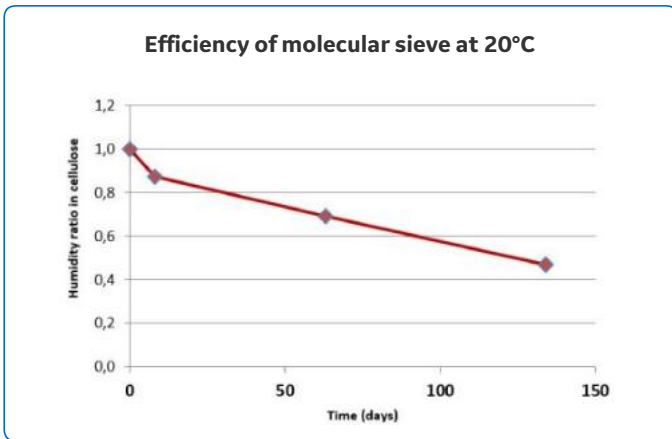


Figure 1 presents the ratio between humidity in cellulose in presence of molecular sieve versus humidity of cellulose without the GE solution. The humidity decreases in the cellulose along the time at room temperature during several months.

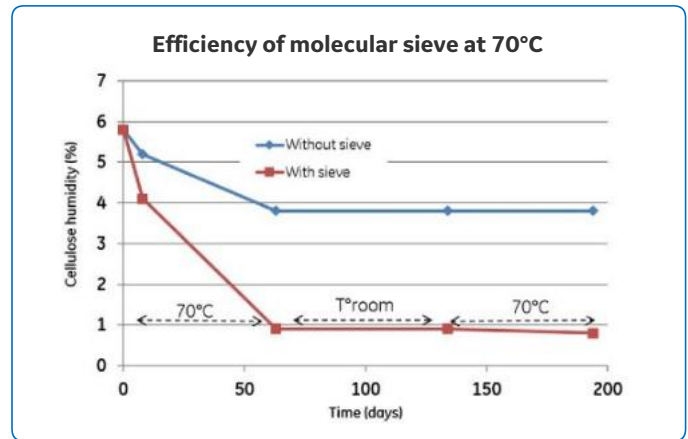


Figure 2 shows the influence of temperature on humidity decrease in cellulose with the molecular sieve. The drying process is clearly sped-up with temperature increase. When trapped, humidity remains blocked even when the temperature continues to vary.

## Tangent delta analysis

A wet 72 kV instrument transformer has been filled with molecular sieve and stored inside and outside during 20 months with regular monitoring of the tangent delta measurement.

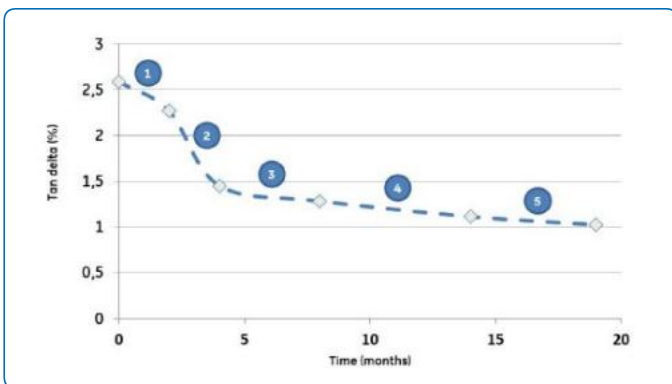


Figure 3 presents the results with the different storage conditions. A regular decrease has been observed and at the end of the test period, the tangent delta reached an acceptable value of 1%.

Test condition	Condition description
1	From initial stage (wet) until 2 months at $\pm 20^{\circ}\text{C}$ with molecular sieve
2	From initial stage (wet) until 2 months at $\pm 20^{\circ}\text{C}$ with molecular sieve
3	Condition 1 + 1 month at $\pm 20^{\circ}\text{C}$ + 20 days at $40^{\circ}\text{C}$ + 1 week at $\pm 20^{\circ}\text{C}$
4	Condition 3 + 6 months outside (summer) with $T^{\circ}$ up to $40^{\circ}\text{C}$
5	Condition 4 + 5 months outside (winter) with $T^{\circ}$ down to $0^{\circ}\text{C}$

For more information please contact  
GE Energy Connections  
Grid Solutions

### Worldwide Contact Center

Web: [www.GEGridSolutions.com/contact](http://www.GEGridSolutions.com/contact)  
Phone: +44 (0) 1785 250 070

## GEGridSolutions.com

GE and the GE monogram are trademarks of General Electric Company.

GE reserves the right to make changes to specifications of products described at any time without notice and without obligation to notify any person of such changes.

Grid-SER-L3-Humidity\_Regulation-1598-2017\_08-EN. © Copyright 2017, General Electric Company.



Imagination at work