



Vacuum cast coil type transformers hi-T Plus series

ABB hi-T Plus vacuum cast coil transformers

High insulation transformers

Foreground

Nowadays, special applications such as rolling mills, paper mills or traction systems, require the most demanding conditions for operation.

Sudden overloading due to extreme working conditions can decrease transformer insulation lifetime if not correctly considered.

High ambient temperature during summertime can generate unexpected trips in the distribution lines, stopping production and/or damaging the transformer insulation.

In order to overcome all these problems, ABB has developed the new transformer concept hi-T Plus, adding to ABB transformers known performance the advantages of a superior class H insulation system.

What does hi-T Plus concept mean?

ABB hi-T Plus transformer is a superior product with upgraded insulation able to work at higher temperature than the one that it will reach at its rated power, with the benefit of an increased insulation lifetime and overloading capability.

While its H-class insulation allows 125 K average temperature rise, the rated temperature rise is limited by design to 100 K for 40 °C max. ambient temperature.

This enhanced insulation makes ABB hi-T Plus transformers the best choice for networks with high harmonic distortion, load peaks, sudden overloads and high ambient temperatures. ABB hi-T Plus transformers do not require additional over sizing with the consequent saving in cost and with size reduction compared to a traditional class F transformer.



hi-T Plus transformer applications

hi-T Plus for wind

The wind turbine application is one of the most demanding environment where transformers are installed, either onshore or offshore.

ABB hi-T Plus for wind transformers are specially designed for wind turbine applications, combining the experience of ABB in wind applications with the superior capabilities of the hi-T Plus concept.

This new concept will help wind turbine manufacturers to simplify their transformer designs, since the overloading capabilities of hi-T Plus will cover required grid codes in terms of reactive power without additional size increase, or working at higher ambient temperature without stopping energy production.

ABB hi-T Plus for wind transformers are designed for voltage variations of $\pm 10\%$ and for highly polluted environments.

Optional designs can be made for harsh vibrations and for ambient temperature down to $-40\text{ }^{\circ}\text{C}$.

hi-T Plus for traction

Typically, the transformer rated power for a traction application is identified with one of the cycles included within the EN 50329 or IEC 60146 standards. Moreover, harmonics shall be taken into consideration and if no information is available, standard values are taken as reference; this fact leaves an uncertainty, usually solved by oversizing the transformer or by reducing its temperature rise.

ABB hi-T Plus for traction transformers are particularly designed for this application, adding to the ABB vacuum cast coil traction transformers the superior performance of the hi-T Plus concept, helping engineering companies and end users to reduce the additional cost and dimensional impact of traditional oversizing of class F transformers by working at class B temperature rise.

ABB hi-T Plus transformers for traction applications are designed to work under overloading at a temperature which never exceeds the maximum temperature of the H-class insulation, thus granting that no degradation will occur during these cycles.

hi-T Plus for industrial applications

ABB hi-T Plus transformers are the best option for high harmonic content networks, like in datacenters, paper mills, and any application where variable speed drives or rectifiers are involved.

Certain applications such as rolling mills, can generate current peaks that can be higher than expected under special production or environmental conditions.

Transformers without any design oversize will face deterioration if not used at lower ratings afterwards, which may affect the productivity of the plant.

ABB hi-T Plus transformers are able to withstand additional losses generated by non foreseen harmonics or sudden overloads without life impact or temperature alarms and allow continuous operation after overload without increased thermal ageing of the insulation.



hi-T Plus at a glance



hi-T Plus concept

Main advantages

Longer insulation life

According to IEC 60076-12 both insulation classes, F and H will have the same expected insulation life provided that the hot spot temperature is:

- Class F: 145 °C
- Class H: 170 °C

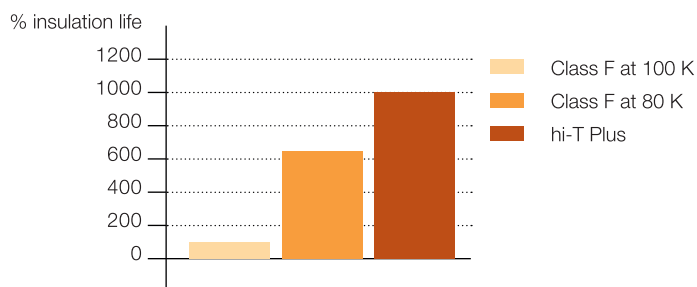
ABB hi-T Plus transformers guarantee a much higher insulation lifetime than an equivalent class F transformer with the same temperature rise (100 K) and even compared with an oversized class F transformer with a temperature rise limited to class B (80 K).

ABB hi-T Plus transformers with insulation class H are designed to work with a hot spot temperature of 145 °C, much below their insulation limits, with the consequence of an increased insulation lifetime.

According to IEC 60076-12, average insulation working hours for the different insulation systems are calculated based on the Arrhenius equation. Every 6 K degree that the hot spot temperature of a transformer is reduced, the expected insulation life is doubled.

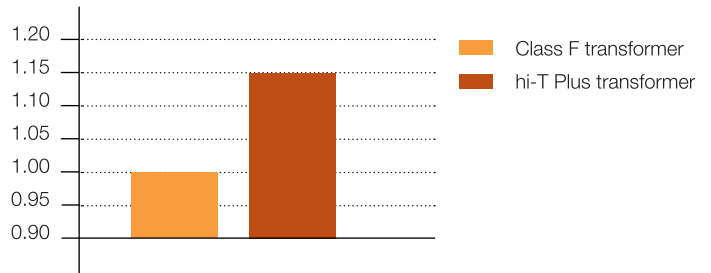
Since the hot spot temperature of ABB hi-T Plus transformers is reduced by 25 K, the expected average insulation lifetime is more than ten times higher than a standard class F transformer working at the same hot spot temperature and nearly two times higher compared to a bigger and more expensive class F transformer with temperature rise limited to 80 K.

Expected insulation lifetime taking F 100 K as 100%



Overloading capability of ABB hi-T Plus transformers

Overloading

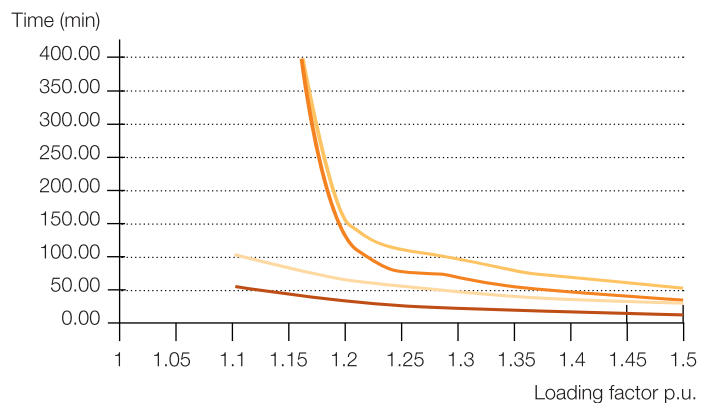


Continuous overloading

ABB hi-T Plus transformers can be overloaded continuously without additional life consumption up to 115% of their nominal load. With this overload the maximum hot spot temperature would reach 170 °C, which is the temperature according to the IEC 60076-12 standard.

hi-T Plus overloading capabilities without loss of life

- hi-T Plus previous loading 0.9
- hi-T Plus previous loading 0.7
- Class F previous loading 0.7
- Class F previous loading 0.9



Overload curves of ABB hi-T Plus transformers vs. standard class F transformers

ABB hi-T Plus transformers allow much longer overloading compared to a class F transformers.

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