

R&D for short circuit withstand capability of transformers

SUMMARY

Powertech Transformers is engaged in a major R&D project to develop knowledge, empirical factors and engineering models representing the short circuit characteristics of transformers.

This collaborative undertaking with the DST, CSIR and University of Pretoria is aimed at providing a sound platform to boost local transformer engineering design and manufacturing capabilities.



Powertech Transformers

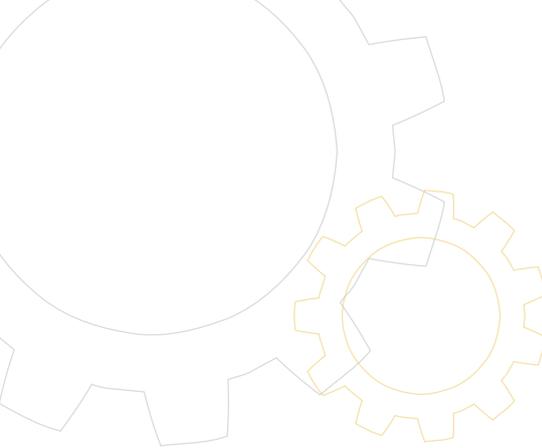
Powertech Transformers (PTT) is a wholly owned subsidiary of Allied Electronics Corporation Limited (Altron). It is South Africa's leading local supplier of power and distribution transformers. Powertech has a long history of supplying state-owned companies with not only critical equipment and services but also with support through knowledge sharing

and research and development relevant to the broader market.

The power transformer factory in Pretoria West is among the biggest and most sophisticated transformer manufacturing plants within the Southern Hemisphere and one of two large manufacturers within sub-Saharan Africa. The range of transformers

manufactured by Powertech Transformers covers three-phase and single-phase units, auto-transformers, shunt reactors, rectifier transformers, and includes many others which are tailor-made to meet customers' specific demands.

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Niche offering

Powertech Transformers is one of South Africa's largest and most experienced manufacturers of distribution transformers. Distribution transformers and miniature substations are designed and tested for African conditions. Products are designed and manufactured to satisfy the requirements of local conditions while meeting all major national and international standards. These products are in use in utilities, local authorities, mines, industrial plants and motor manufacturers.

Technology Assistance Package (TAP)

PTT's first major TAP (R&D) project relates to the short-circuit withstand capability of transformers. The collaborative R&D opportunities through the CSIR, DST and University of Pretoria provide a platform to boost local transformer engineering design and manufacturing capabilities.

Through this project PTT is developing knowledge, empirical factors and engineering models representing the short circuit characteristics of transformers. While an in-house state-of-the-art integrated design system allows for short circuit stress calculation, the effects of short circuits on windings are difficult to calculate and computer models are necessary.

In this project the University of Pretoria's Sasol Laboratory for Structural Mechanics (headed by Prof Stephan Heyns) is collaborating with PTT to achieve laboratory-verified simulations of the effects of short circuits on transformer windings. This is done by accelerated testing of large complex structures.

Outcomes and impact

Transformer design engineering in South Africa will drastically change due to knowledge and data established in the following areas:

- Improved current insulation design and dielectric analysis;
- Ability to predict of the behaviour of large power transformers when subjected to lightning and switching surges;



- Improve cooling characteristics due to the effects of continuously transposed cable epoxy paper bulging in transformer windings;
- Full-scale virtual testing to evaluate hazardous hotspot temperatures and insulation degradation;
- Developing a representative computer model of the mechanical performance of transformer windings as well as a generic and adaptable methodology;
- Prediction of leakage flux hazards and tank losses;
- Developing guidelines for optimum spacer coverage; determination of the optimal number of go-through yoke bolts and their placement on shunt reactors; and
- Determination of the optimal yoke to limb ratio of a five-limb transformer.

The results of this project allow PTT to expand the short-circuit withstand capability of South African-built power transformers.



For more information contact:

TLIU • email: ABhugwandin@csir.co.za • Tel: +27 12 841 4241 • www.csir.co.za