GE Energy

Variable Frequency Transformer™

fact sheet

Overview

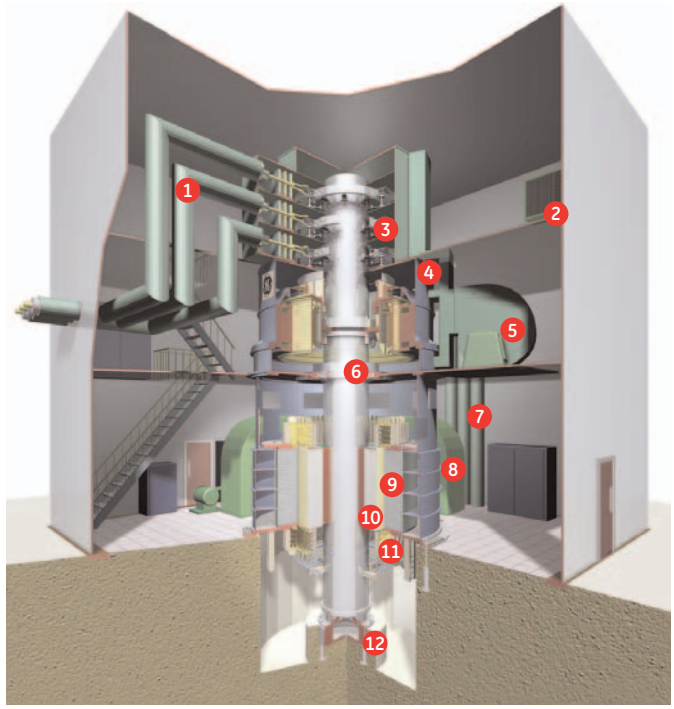
GE Energy advances the world of transmission solutions with its new Variable Frequency Transformer™ (VFT™). This new product, when compared with HVDC back-to-back provides unparalleled flexibility for utilities and transmission system developers to create viable economic business models to meet the ever-changing energy markets. The VFT provides a simple and controlled path between electrical grids, while retaining many of the inherent virtues of an AC interconnection. This permits power exchanges that could not previously be accomplished, due to technical constraints such as asynchronous boundaries or congested systems. The low grid interaction of the VFT, in terms of harmonics, control interactions, and impact on nearby generators, allows the installation and operation to be decoupled from other grid issues.

The VFT system, based on a combination of hydro-generator and transformer technologies, consists of a rotary transformer, for continuously controllable phase shift at any angle. This with a drive system and control that adjusts the angle and speed of the rotary transformer to regulate the power flow through the VFT. Smooth power control comes from regulating the torque through the drive system. Rotational speed is dictated by the difference in grid frequencies and generally will be below 3 rpm.

Features

Rotary Transformer

The rotary system is the heart of the VFT. It is comprised of well-proven components and sub-systems to form this new product. The rotating machine has a stator core and winding very similar to that of high efficiency synchronous rotating machines, such as hydro-generators. The rotor design features are the same as those of the stator, including bar windings and low loss laminated cores. The machine design is based on a vertical, air-cooled concept for simplicity and reliability.



VFT Rotary System:
Rotating transformer, DC drive and collector

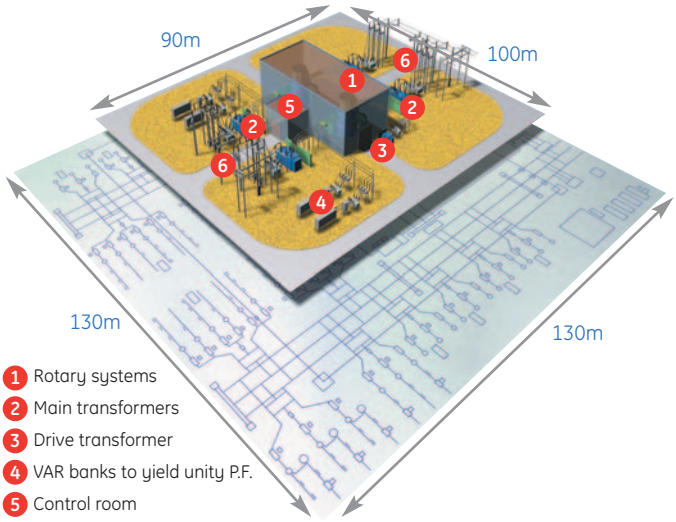
1. Rotor bus duct
2. Air housing
3. Three-phase collector
4. DC Torque drive motor
5. DC Motor ventilation fan
6. Upper bearing
7. Stator bus duct
8. Rotating transformer ventilation fan
9. Stator core
10. Rotor core
11. Windings/connections
12. Lower thrust and guide bearing

High Power Collector

Transferring 100MW from the rotor to stationary bus is accomplished with well-proven carbon-brush slip rings. The low speed permits large diameter slip rings to attain adequate insulation while simultaneously providing a substantial surface area for spreading the current among many parallel brushes.

Drive Motor

The drive machine is a proven DC torque motor, well established within the industry. Previous models have been used for mine hoists, telescope and antennae tracking, turret drives, and steel rolling mills.



Characteristics

Lower Project Risk

The ability of the VFT to be developed and installed without costly studies and mitigation efforts, which have historically had an impact on similar interconnection projects, is a benefit unique to the VFT and allows the owner/developer to proceed with low risk of delays and cost impacts from affected parties.

Efficiency

The VFT is designed for high efficiency. The rotary system approaches 99% efficiency at full load, including cooling fans. This low-loss design brings a side benefit of low machine temperatures to enhance reliability.

Availability

Many inherent features of the VFT lead to excellent availability expectations. These include:

- Highly reliable machine design, based upon established proven performance
- Low speed of operation resulting in low maintenance requirements
- Redundancy in auxiliary services; e.g., cooling fans, control system
- Use of widely available and familiar substation components; e.g., transformers, capacitors, and breakers, which allow normal utility maintenance crews to be highly proficient
- All main components selected for low stress, resulting in high reliability

Low Maintenance

The simple design of the VFT components, based on established and widely used rotating machinery, ensures its long-term maintainability. The slow operating speed of the unit keeps maintenance requirements low. Independent operating channels allow maintenance on one unit, while others remain operational.

System Life Expectancy

VFT uses a conventional power system with no specialized electronics. The VFT technology will remain current and applicable in the future transmiation & distribution (T&D) market. HVDC back-to-back requires specialized electronics and control systems, where are subject to become obsolete in a developing T&D market. This equates to continuous capital investment to remain current and operational.

VFT Offers Compact Substation Layout

Unlike traditional HVDC back-to-back technology, the VFT does not require high voltage filters and allows for a more compact and simple substation design. The drawing above illustrates this comparison, with a 200MW VFT back-to-back station layout superimposed on a 200MW HVDC layout. The VFT was also designed as a modular system in 100 MW channels, that can be operated independently, providing for maintenance flexibility.

For more information about this product, contact your GE Energy sales representative, visit gepower.com/vft or email us at energy.vft-marketing-ge.com

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