Changing times

The demands of the market for gas-insulated switchgear (GIS) in the 21st century are more complex than ever before. On the one hand, the operators require the latest technology, and on the other hand they still demand compliance with traditional specifications.

In the course of product streamlining and the introduction of the Global Focused Factory principle, ABB has evolved a powerful, dynamic MV Gas-Insulated Switchgear (GIS) family, called ZX. Its sealed pressure system is characteristic of SF₆-insulated switchgear for rated voltages of 12 to 40.5kV in terms of safety, economy, and availability. Their compact design permits the use even in constricted space. The encapsulation makes the switchgear shockproof and resistant to all environmental influences.

Recent applications, that took advantage of these features, include the power supply system for two Chinese metro lines, awarded in April 2003. ABB will supply 237 units of 33kV-GIS switchgear, valued US$11 million, to the Guangzhou Metro line 3 project. In addition, 152 switchgear units of the same specification valued US$7 million, will be supplied to the Shenzhen Metro Line 1. This is the largest order ever received in by ABB's medium-voltage business in China.

Products

ZX0 is the most economical and compact system in metal enclosed design. ZX1.2 is the optimised metal clad switchgear for single busbar applications with user friendly features such as very high cable fixing point of 1,250mm. ZX2 completes the ZX family for high end solution with single and double busbar applications.

The arc fault tested panels with vacuum circuit-breakers are suitable for service under onshore and offshore conditions. The factory-assembled switchgear has maintenance-free components in a gas-tight stainless steel enclosure, reliably protected from ageing and ambient influences.

With rated short-circuit breaking currents up to 40kA and rated currents up to 2,500A, the ZX family covers a very broad market segment in the medium voltage range. The modular switchgear system is notable for its compact structure with high performance parameters. It combines futuristic solutions with progressive and established concepts and technologies.

The ZX products, tested on both the primary and secondary systems, contain all the maintenance-free live components such as switching devices, busbars under SF₆ in a gas-tight stainless steel enclosure so that ageing processes and environmental influences are ruled out. The gas-tight modules are combined in various ways, depending on the requirements and the panel type, and are connected from panel to panel by plug-in connection systems. Work with gas outside the manufacturing location is completely avoided.

Metal clad solution

Each panel consists of two (three for double busbar application) gas filled cubicles – the busbar compartment (s) and the circuit breaker compartment. Power cables are connected to the circuit breaker compartment using the inner cone plugs size two or three. It is also possible to use surge arresters as well as plug-in voltage transformers. Both appropriately rated sensors and conventional instrument transformers can be used for the monitoring of current and voltage.

The rod-type 3-position-disconnector in the busbar compartment secures, through its simple construction, a maintenance-free operation. All gas compartments are being supervised.
through gas density switches so that the necessary gas amount, independently from the temperature and the assembling height, is secured. The low voltage compartment is located in front of the core modules.

Ambient environmental influences – such as humidity, dust, foreign bodies, animals, light which could harm materials or salty air – cannot affect the high-voltage live conductors and their electrical fields as these are in hermetically sealed compartments filled with SF$_6$, so called sealed pressure systems.

The high voltage components have their own atmosphere, independent of the outside conditions. The technical characteristics remain constant throughout the life of the systems and components. The SF$_6$-insulated high voltage systems and components can also be set up at altitudes greater than 1000m without deterioration of technical characteristics or restrictions to operation.

This imperviousness to environmental influences means that maintenance work is reduced to a minimum throughout the service life of the system, and no maintenance at all is required on installations with a sealed pressure system for the high voltage section.

**Operator safety**

With the independence from external environmental influences and the sealed pressure system, the probability of internal faults is minimised. Unintentional and impermissible approaches to live parts when operating or working on the system are totally precluded by the design.

The switchgear has all-round metal protection against accidental contact which cannot be removed during operation even unintentionally. As the probability of faults is extremely low, the GIS has high availability and a very low probability of failure. Downtime for servicing and repairs is very short throughout the life of the switchgear, and as a rule these are not necessary at all on switchgear with sealed pressure systems on the high voltage section.

Minimum maintenance requirement means extreme savings in operating costs. This imperviousness to environmental influences means that maintenance work is reduced to a minimum throughout the service life of the system.

Maximum system service life as independent of the environment means less investment cost into additional substations. European utilities are calculating presently ten years longer life time for GIS than other switchgear types. This leads to potential savings in new investments.

Thanks to the SF$_6$ technology, the necessary high voltage systems and components – and thus also the buildings and rooms required – can be kept extremely compact.

Installation is therefore possible, for example, in areas with energy density, in factories, pedestrian precincts, public buildings or railway stations etc. Aesthetically attractive building structures can be used for indoor installation. Noise emission from switching operations is minimised.

In many cases, this compact technology and its integration in other buildings and facilities can make a separate building for electric power distribution superfluous. This compact design reduces building cost of each operator.

The compact switchgear design described above creates great freedom to select a location as close as possible to the energy demand. This reduces the losses in power transmission and conserves energy resources.

**Prospects**

The ZX-GIS unites progressive and futuristic concepts and techniques. The use of vacuum circuit-breakers ensures unrestricted mechanical and electrical functionality throughout the service life of the system. In conjunction with computerized, digital, bay control and protection systems, operator convenience, safety and system reliability are increased, and project planning, production and commissioning are simplified. The plug-in technology reduces assembly times at site to a minimum.

The implementation of the ZX concept results in unrestricted flexibility with a high degree of standardization, a high level of operator and system safety, reliability of power supply, service-friendliness and economy. These benefits have been confirmed by extensive experience in service.

Several thousand panels of the ZX series have been in use reliably and without faults since the end of 1995. Very soon, also the metro passengers in China's boomtowns will benefit from a reliable public service – without taking notice of an ABB innovation called ZX.