



Compact and eco-efficient

Meeting the need for a more environmentally friendly ring main unit with the innovative SafeRing Air

TOM-RUNE BJORTUFT – As a leader and pioneer in power technologies, ABB is always looking for ways to design and manufacture products that improve grid reliability with the lowest environmental impact. Concerns related to the greenhouse effect of SF₆ are driving the development of a new generation of power distribution products based on alternative insulating gases. From an environmental perspective, dry air is one of the most desirable alternatives seen today. In order to meet the increasing demand for

solutions with lower environmental impact, ABB developed SafeRing Air, a compact ring main unit within the SafeRing/SafePlus portfolio. Using dry air as the insulation medium and with vacuum technology for current interruption, SafeRing Air is available for up to 12 kV in circuit breaker and load-break switch configurations. This new offering is intended for a selected market segment in addition to the traditional RMUs, which cover the complete portfolio in secondary distribution gas-insulated switchgear.



The recent introduction of SafeRing Air → 1 enables ABB to provide another ring main unit (RMU) alternative to its customer base. The traditional SF₆ solution already meets the requirements of customers who are looking for closed SF₆ handling and a very low leakage rate. The innovative SafeRing Air is the perfect solution for customers who seek to lower the carbon footprint even further. For the 12 kV RMU market, SafeRing Air is a solution that has the same physical dimensions, operation sequence, technical performance and quality as the traditional SafeRing with SF₆. It also comes with a new feature – the ability to upgrade a load-break switch panel to a circuit breaker panel on-site. This is an important differentiator that is not seen elsewhere in today's marketplace and is made possible by the use of vacuum technology for current interruption on both fault currents as well as load currents. The physical weight is reduced by 6 to 7 percent on high-volume configurations (typical CCV) and up to 19 to 20 percent on less common configurations (typical VVVV), compared with the tradi-

Title picture

ABB is creating technologies with greatly improved environmental measures.

tional technology. This also has additional advantages for transport or installation, for example.

Unique gas

SF₆ is used as an electrical insulator, as a thermal conductor and to interrupt current flow. The current technology obtains the necessary compactness and

Challenges

The main technical challenge in developing an RMU with an alternative environmentally friendly insulation gas has been to maintain the same physical size. Maintaining the outer physical dimensions of the unit is vital since this places strict conditions on the dielectric and thermal performance.¹

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technical performance within gas-insulated switchgear (GIS). No alternative gas has been identified that exhibits the excellent properties of SF₆. During the last decade, several gases have been explored, but many tend to suffer from high liquefaction temperature and/or reduced dielectric strength. SF₆ is well known for its excellent properties within applications and products for the electrical distribution industry, but it is also classified as a greenhouse gas.

Dielectric design targets the distribution of electrical fields within the unit, aiming to reduce the field strength of weak points to compensate for the reduced dielectric strength of alter-

native insulating gases. Key parameters for optimization include choice of insulating materials, geometrical shape of conducting surfaces and definition of conductor/insulator interfaces. Advanced simulation tools are used for this pur-

Footnote

¹ These challenges have recently been discussed in CIRE paper 0463, "Dielectric and thermal challenges for next generation ring main units," 2013.

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pose, and results are validated by dielectric tests in full-scale units.

Thermal design is critical due to the lower thermal properties of alternative insulating gases, compared with SF₆, and has two main objectives. The first is to reduce ohmic losses to a minimum by utilizing a sophisticated design of select materials, surface treatment, contact forces, etc. Reducing ohmic losses increases energy efficiency.

The second objective is to distribute the heat-generated losses through a combination of conduction, convection and radiation. Computational fluid dynamics (CFD) analysis is needed to understand and optimize the temperature distributions inside the switchgear. Such simulation results are validated by temperature rise tests in full-scale units.

Besides these key challenges, other factors have been considered in developing the SafeRing Air RMU. ABB is committed to providing customers with the safest products and Safering Air is no different. Technical parameters and tests set by the IEC and other relevant standards were done to ensure safety when operating the RMU.

Another aspect is keeping the simple mimic, easy and logic operation of the RMU. To take this fully into account, Safe Ring Air has been designed using the same logic that was used for traditional RMUs with SF₆, leading to a well-known operating sequence. And of course environmental measures such as life-cycle assessment (LCA), environmental product declaration (EPD), and environmental product information (EPI) have been met.

Environmental measures

Clearly, meeting environmental measures are of great importance when introducing an environmentally friendly offering to the marketplace. ABB undertook a detailed LCA analysis of the SafeRing Air RMU. The main intention of such analysis is to provide a base for customer information. This base is established by using the experience from the LCA analysis to set product category rules (PCRs) in order to establish a standard for the MV switchgear business. The overall goal was to provide relevant and comparable product information to meet various customer and market needs.

Commercial perspectives

A recent figure released by the World Energy Outlook 2013² states that the energy sector represents two-thirds of global greenhouse-gas emissions, and hence is an important sector for improvement for reaching the globally agreed 2 °C target. The energy industry is therefore under pressure in terms of global energy/climate policies. The European Union also has strict regulations for the use of f-gases, where SF₆ is one of the most important greenhouse gases (GHGs). This regulation is linked to the EU climate policy with the overall objective of cutting GHG emissions by 80 to 95 percent by 2050. This, together with new policies in, eg, China, opens up a demand for proven and readily available products with lower environmental impact. The shift of technology with improved environmental measures will require heavy investments and years of development to enhance and complete today's global product portfolio. With this first product launch for secondary GIS, ABB shows that this global challenge is on top of its agenda.

Customer feedback prior to the launch of SafeRing Air confirms ABB's strategy and shows an increasing demand for such solutions in the low-end portfolio (12 kV).

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Footnote

² WEO 2013 executive summary, International Energy Agency, 2013.