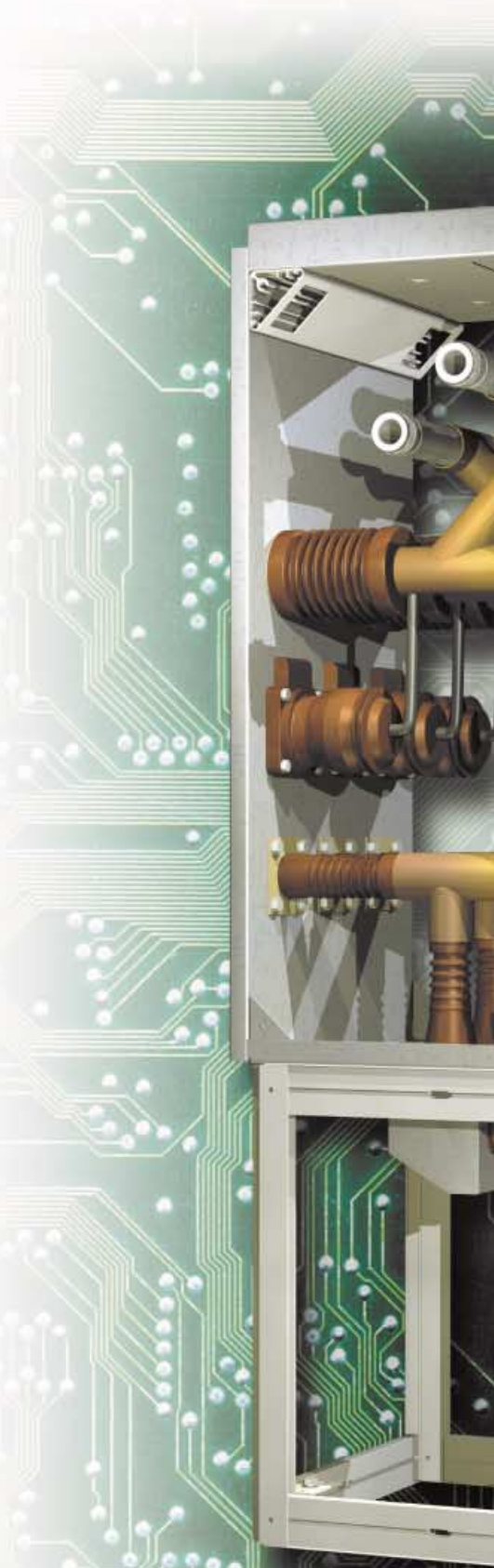
AX1 Air-insulated Medium Voltage Switchgear



"Great curiosity was shown when AX1 was presented for the first time. Many people wondered and asked themselves: can switchgear really be intelligent?

The answer is yes – AX1 is provided with artificial intelligence. Using data from different sensors, the bay computers can execute intelligent actions such as tripping, interlocking, sounding the alarm, providing information about operating data and different events, announcing when maintenance is needed, and so forth. The bay computers communicate on their own initiative or answer questions from the operating staff via remote control, a concentrator or station computer. This ensures highly effective control and monitoring of the switchgear system, which leads to greater service reliability and better operating economy. Periodic maintenance can be completely replaced by maintenance on demand.

Computer technology and electronics are playing an increasingly important role in modern switchgear design. One example of the interplay between electronics and electrical/mechanical engineering is the arc eliminator, which eliminates an arc within less than 10 ms. This consequently eliminates the risk of injury due to an arc fault inside the switchgear. Mechanical damage does not have time either to occur. The switchgear can therefore be immediately taken back into service after an arc fault. Because pressure relief is no longer necessary, installation of the switchgear will be both simpler and the costs lower.

A special feature of AX1 is that it is of main-circuit-encapsulated design, where earthed sheet-steel panels protect all medium-voltage parts against accidental contact. The circuit-breaker operating mechanism is located outside the main-circuit enclosure and is easy to remove or replace during maintenance, without the bay having to be taken out of service.

When we were developing AX1, one of our main goals was to create a switchgear system that could distribute electricity in as a cost-effective and environmentally sound way as possible. Now that we are introducing a new model of the AX1 switchgear system, we are naturally not changing a winning concept. We have nevertheless refined certain details. What is new and important is that we have increased the current rating to 3150 A at 12 kV and 2500 A at 24 kV.

Let us demonstrate the competitiveness of AX1."

Christer Arnborg
Manager responsible for the design of AX1

Main-circuit-encapsulated design

AX1 is an air-insulated medium-voltage switchgear system built up from three enclosure modules: main-circuit enclosure, operating enclosure and lower frame. All medium-voltage parts are housed in the main-circuit enclosure and consequently protected against accidental contact.

Measurement

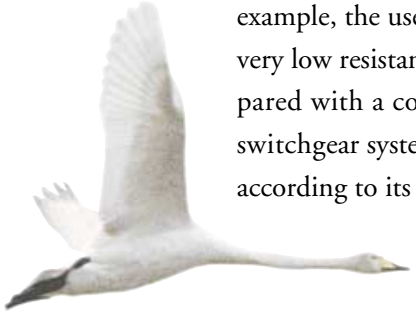
Measuring sensors without any iron core are used instead of conventional instrument transformers. They consist of Rogowski coils for current measurement as well as resistive and capacitive voltage dividers for voltage measurement. The Rogowski coil is linear over its entire measuring range and can measure currents ranging from a few amps to short-circuit currents.

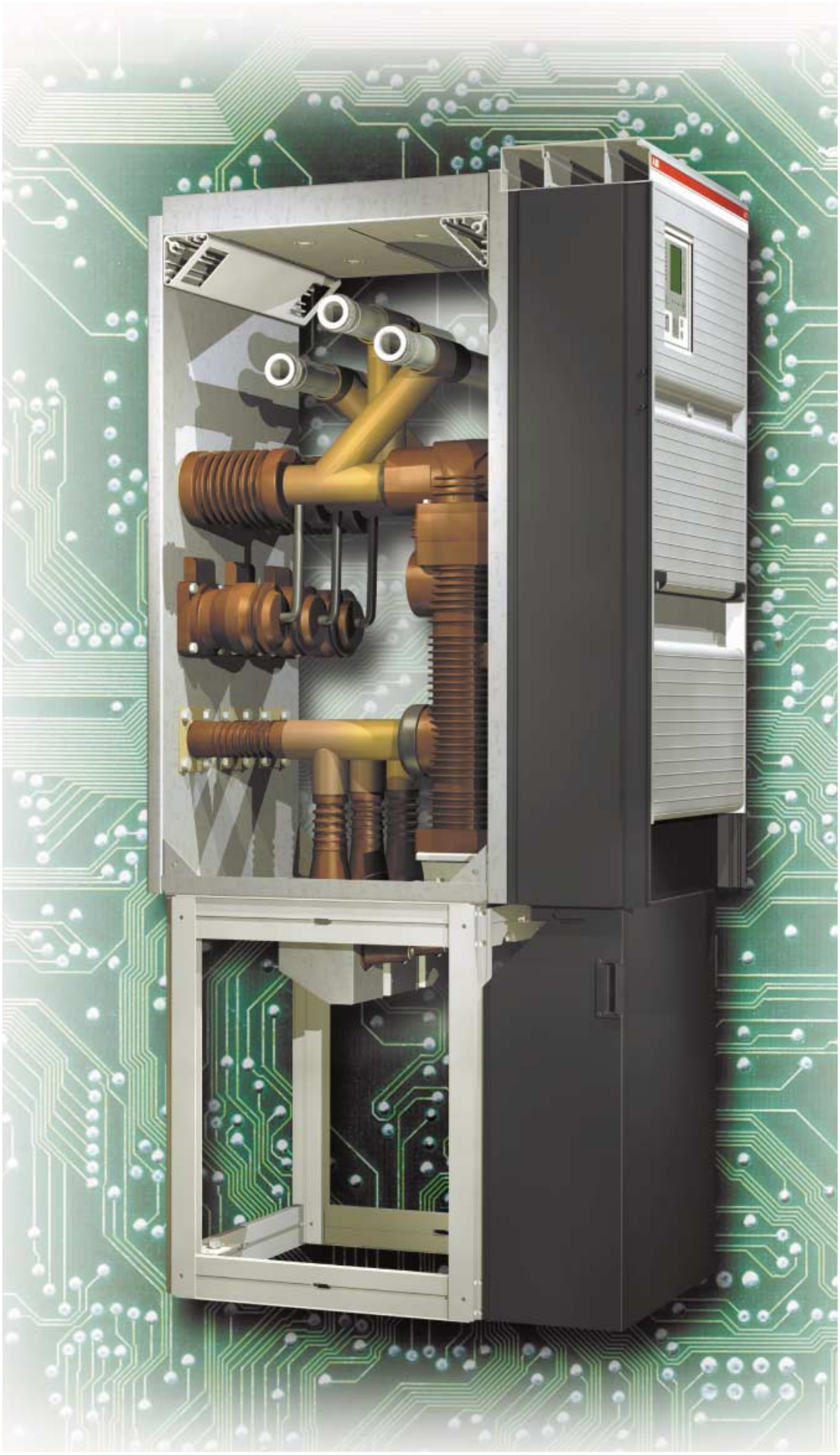
Accessible circuit-breaker

The circuit-breaker's operating mechanism is accessible and can be removed or replaced during any maintenance, without the bay having to be taken out of service. The operating mechanisms of the circuit-breaker and disconnector/earthing switch are housed in the operating enclosure, which is kept safely separate from the main-circuit enclosure by an earthed sheet-steel panel.

Designed for the environment

AX1 has been optimized to give a low environmental load. Recyclable materials having a low environmental impact are used as much as possible. They include aluminium, sheet steel and bare copper. In addition, the operating losses have been reduced to a minimum as a result of, for example, the use of the lossless measuring sensors and the very low resistance of the compact busbar system. Compared with a conventionally designed medium-voltage switchgear system, the total environmental load of AX1 according to its LCA has been halved.



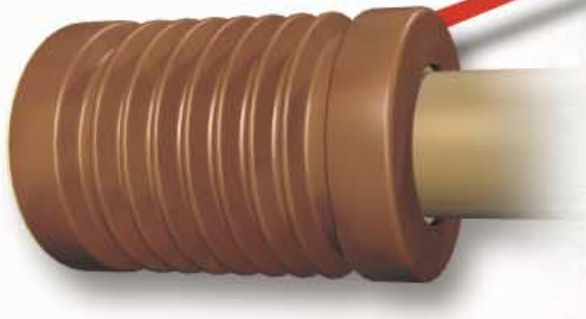


Tubular busbars with coil spring contacts

Tubular busbars give a robust and compact bay design with low surrounding magnetic fields. Coil spring contacts without any bolts are used to join together the busbars between the bays. The coil spring contacts have IP 6X degree of protection, which prevents environmental degradation.

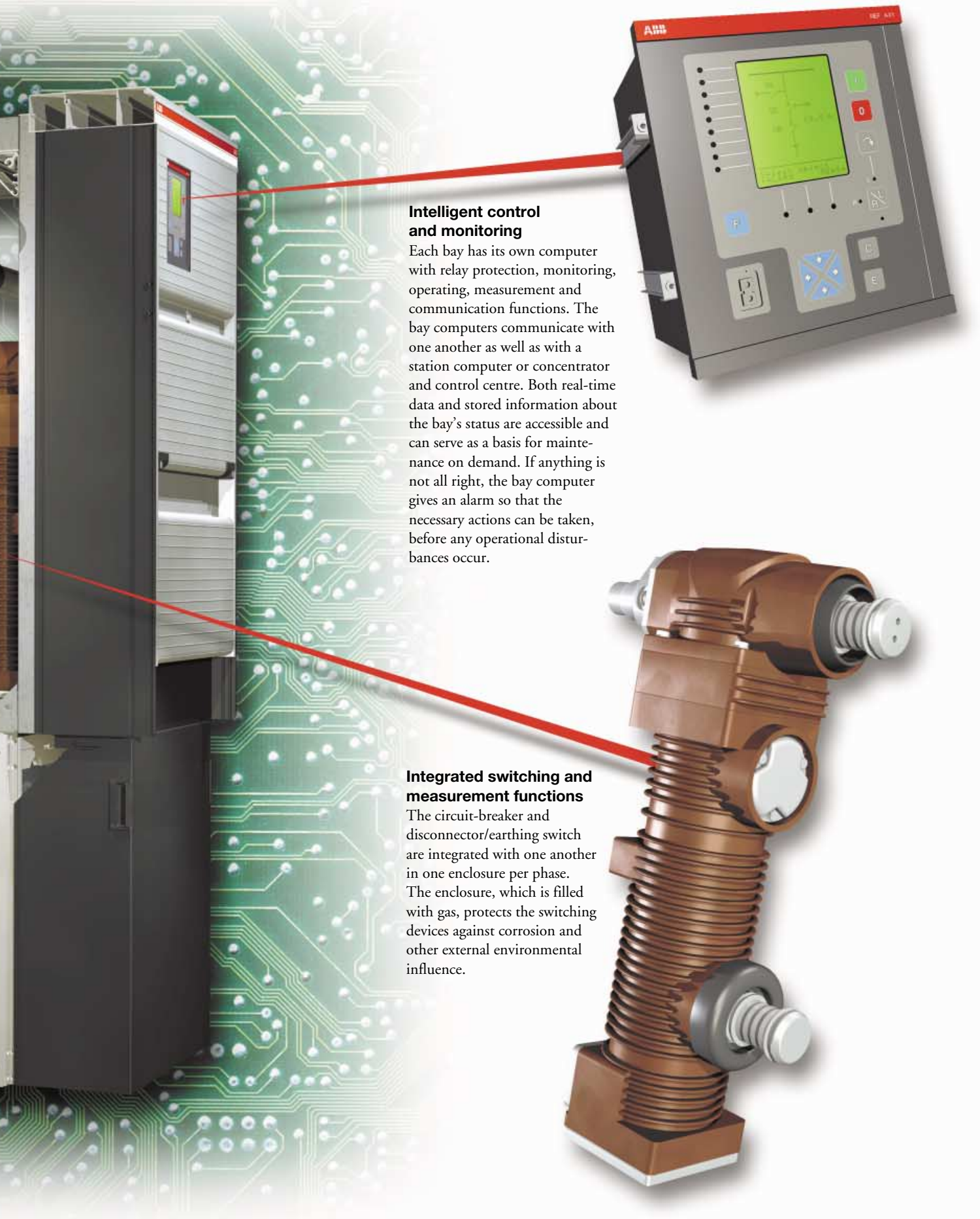
Active arc eliminator

The arc eliminator short-circuits any arc to earth within 10 ms and consequently prevents personal injury and mechanical damage to the switchgear. The arc eliminator is connected to the busbar and therefore protects the entire switchgear system.



Power cable connection

Earthed connectors, with protection against accidental contact, are used for the cable connections. An outer cone connector is used for a rated current of 1250 A and an inner cone connector for higher current ratings.



Intelligent control and monitoring

Each bay has its own computer with relay protection, monitoring, operating, measurement and communication functions. The bay computers communicate with one another as well as with a station computer or concentrator and control centre. Both real-time data and stored information about the bay's status are accessible and can serve as a basis for maintenance on demand. If anything is not all right, the bay computer gives an alarm so that the necessary actions can be taken, before any operational disturbances occur.

Integrated switching and measurement functions

The circuit-breaker and disconnector/earthing switch are integrated with one another in one enclosure per phase. The enclosure, which is filled with gas, protects the switching devices against corrosion and other external environmental influence.

Technical Data

Rated voltage	12 kV	24 kV
Rated current	630 - 3150 A	630 - 3150 A
Short-time current	16 - 40 kA, 3 s	16 - 40 kA, 3 s
Open arc test	16 - 40 kA, 1 s	16 - 40 kA, 1 s
Dimensions, H x D x W	2040/2240 x 1050 x 650/975 mm	

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