A 220 kV power corridor is under construction in Angola, to interconnect the country’s hitherto unconnected Northern and Central parts of the E.N.E. national grid system (Empresa Nacional de Electricidade), thereby enabling better and more widespread use of the country’s hydro resources in the north, as well as making hydro power available to the expansive coastal regions of the country.

By means of the interconnector, the central parts of Angola get access to the hydro power generated in the Kwanza river in the north. At present, the generating capacity is 560 MW, but several new dams are in the planning stage, with a future hydro power potential of 12,000 MW.

The power interconnector has a length of 250 km. To enable sufficient amounts of power to be transmitted under stable conditions over the interconnector, a series capacitor is part of the project. The series capacitor, rated at 30 Mvar at 220 kV, is located at the Gabela substation in the northern end of the Cambambe-Quileva interconnector. It went into operation in 2011.

**Main circuit design**

During normal operating conditions, all power flows through the series capacitor. To protect the series capacitor against overvoltages that may be caused by faults in the surrounding network, the series capacitor is equipped with a MOV (Metal Oxide Varistor), enabling immediate re-insertion of the series capacitor following clearance of external faults. For internal faults, i.e. faults occurring in the line segment containing the series capacitor, the series capacitor is by-passed. By-pass is performed by means of a by-pass switch and a current limiting reactor for limiting the inrush current to safe values. After the fault has been cleared, the series capacitor is re-inserted into operation by opening the by-pass switch.

The series capacitor can be disconnected from the line by two isolating disconnectors and one by-pass disconnecter.
As the series capacitor is operated in series with the 220 kV line, it must have full system level insulation to ground. This is achieved by having the series capacitor mounted on fully insulated steel platforms, one platform for each phase.

**Control system**

The control system is based on the ABB MACH 2 concept, which is a system of both hardware and software, specifically developed for power applications. MACH 2 is built around an industrial PC with add-in boards and I/O racks connected through standard type field buses like CAN and TDM.

The series capacitor can be controlled from two different locations. Locally in the series capacitor control room there is an Operator Work Station (OWS) based on a personal computer. As an option, control can also be obtained via a Gateway Station (GWS), which is a protocol converter that enables communication with the series capacitor by means of a standard protocol.

The current measurements for control and protective functions are attained by use of OCTs (Optical Current Transformers). The OCT consists of a current transducer in the high voltage busbar and an optical interface module in the control room. Signal transmission between the transducer and the interface is by means of an optical fibre system including platform links, high voltage signal columns and fibre optic cables.

### Main technical data

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<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td><strong>System voltage</strong></td>
<td>220 kV</td>
</tr>
<tr>
<td><strong>Rated reactive power</strong></td>
<td>30 Mvar</td>
</tr>
<tr>
<td><strong>Rated reactance</strong></td>
<td>37.5 Ω</td>
</tr>
<tr>
<td><strong>Rated current</strong></td>
<td>517 A</td>
</tr>
<tr>
<td><strong>30 min overload current</strong></td>
<td>698 A</td>
</tr>
<tr>
<td><strong>Type of protection</strong></td>
<td>MOV, gapless</td>
</tr>
</tbody>
</table>

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