Vertical integration

down Rio way

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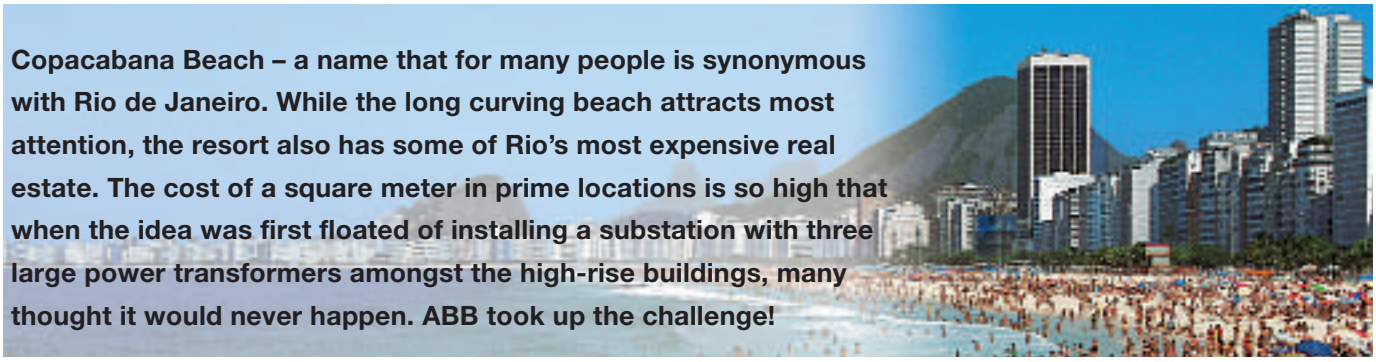

Copacabana Beach – a name that for many people is synonymous with Rio de Janeiro. While the long curving beach attracts most attention, the resort also has some of Rio's most expensive real estate. The cost of a square meter in prime locations is so high that when the idea was first floated of installing a substation with three large power transformers amongst the high-rise buildings, many thought it would never happen. ABB took up the challenge!

The large footprint and high noise level – those were the main objections to placing the proposed electricity substation with three 40-MVA transformers in Rio's highly populated Copacabana resort.

The solution was to build a 'vertical' substation with the transformers at ground level in a noise-reducing enclosure and the cooling batteries installed above them. All in all, the structure would measure 16 meters from the floor to the top of the oil conservators above the radiators!

Oil issues

First, some questions had to be answered. Would the oil flow upwards and downwards without having to be pumped? Tests showed that the natural oil flow is in fact so good that something would have to be done to limit the flow rate. The original idea of using an 8-inch (200 mm) pipe was reconsidered and it was decided to use a 5-inch (125 mm) pipe instead. Only one oil circuit is needed for a battery with 18 radiators.

The tanks have reinforced walls and welds due to the higher oil pressures produced by the elevated radiators. Also, a new pressure-relief valve had to be specified. To ensure the same pressure on both sides of the on-load tap changer barrier, the oil conservator for the tap changer was installed at the same level as the main conservator (on top of the cooling battery).

Although conventional bushings would certainly have withstood the higher pressure, it was decided to avoid any risk and use GSA polymeric bushings. These are solid and contain no oil. Efficient cooling is of the utmost importance, and heat runs were carried out in the lab to verify the radiator performance (figure, left). To ensure accurate results, the components had to be placed in exactly the same positions as in the substation. This involved some considerable effort and required special lifting equipment to raise the radiators to a height of 10.5 meters.

The close agreement between the recorded temperatures and the calculated figures provided final proof that this unique solution worked. And that the resort's residents would have no cause for complaint.

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