

Temporary site cables maintain power supply during alteration work on the high-voltage grid

# The professional temporary solution

For conversion work or new construction in transformer substations, work on overhead lines, or temporary power supply when cables are damaged – if a temporary connection is required within the high-voltage power grid, temporary site cables are the ideal solution. They are robust, quick to install, and represent a fully adequate electrical replacement: which is why Bayernwerk AG, for example, has been using these interim solutions for decades.

Whenever alterations and extensions of transformer substations, switchgear, overhead lines, or other components of the high-voltage grid are required, temporary site cables can be used as an interim replacement for standard cables or overhead line sections (Figure 1). These cables, which are specifically designed for temporary applications, can be used at busbars, portals, and towers and can make it possible to cut off power to regular cables or supply lines to enable individual control panels or entire transformer substations to be replaced without interruption. In this way, long-term power downtimes can be avoided, and the systems must be switched off only briefly for temporary site cables to be installed or removed.

As Thomas Wasser of Bayernwerk AG reports, these special cables are commonly used in conjunction with scheduled construction projects. As head of the 110 kV Overhead Lines/Cable Construction/Documentation Department, he has worked for decades on various alteration and construction projects involving his company's high-voltage systems, and he appreciates the benefits of using tempo-

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rary site cables in these contexts – both in terms of time and cost savings.

“We currently have more than 80 sets of 110 kV temporary site cables, in lengths ranging from 100 to 400 meters,” says Wasser. A small number of these cable sets are reserved for emergencies and are not scheduled for use in construction projects. This allows Bayernwerk to react to grid faults – such as overhead line outages due to inclement weather conditions – in less than a day and to install temporary replacement connections. “We need to use these reserves only on rare occasions, thank goodness,” Wasser explains. “But for scheduled work we are using the temporary site cables more and more often.” That is why Bayernwerk recently placed an order with Nexans Deutschland GmbH for 18 new sets.

## High-capacity and up to 500 m in length

Nexans temporary site cables are available in lengths of 50 to 500 meters (or longer by special order), with voltage ratings of 110 kV to 220 kV. Copper conductors of 150 mm<sup>2</sup> and 300 mm<sup>2</sup> allow current transmission up to 750 A, depending upon cable laying and grounding methods. For greater transmission performance, it is possible to install temporary site cables of equal length and identical conductor cross-section in parallel.

In principle the design of temporary site cables is the same as for high-voltage cables. They consist of a round, stranded copper conductor, an insulating layer of cross-linked polyethylene (XLPE), copper wire shielding, and a PE outer sheath. The thicknesses of the insulation layer and of the PE sheath are reduced for greater flexibility. The cables are easy to handle due to their reduced diameter and weight, and can be transported in lengths of up to 500 m on galvanized steel drums with a diameter of 2.4 m. Drums of this size can be transported on a normal cable trailer or small truck.

A special feature of the prefabricated, factory-tested cable system is the lightweight, flexible silicone terminations that show no detectable partial discharge up to a tested voltage of 160 kV. Partial discharge measurement can therefore also be carried out as repeat testing to check the integrity of the pre-assembled cables as necessary.

## Robust design for decades of use

The experience of Bayernwerk confirms the durability of temporary site cables. “The oldest cable set we are currently using,” Wasser says, “is almost 30 years old. Of course,” he adds, “we check all cables for evidence of external damage following every deployment.” After a certain number of installation projects, or whenever there are indications of potential damage, cables are returned to the



Figure 1: Thanks to a versatile set of accessories and pre-installed terminations, temporary site cables are easy to install.

Source: PNR

cable factory, where they are inspected and subjected to electrical tests to ensure the highest levels of operational safety.

### Quick to install and remove

Wasser's recipe for long life is to handle cables with care, both during installation and assembly work and also during operation and re-spooling. Such careful treatment presents no difficulties, since the cables are easy to handle. To simplify procedures for the installers, special pouches for the terminations are supplied along with the cables, which make them easier to carry when installing with the aid of cable reels. Wherever possible, the cables are unwound directly from the drum carrier and laid out neatly on fleece matting (Figure 2). The flexible terminations are connected directly at the top bolt via terminal connectors and stranded conductors.



Source: Bayernwerk

Figure 2: To achieve the optimum compromise between thermal radiation and unavoidable asymmetric screen currents, Bayernwerk has determined that temporary cables should be installed around 7 cm apart (for 110 kV).

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Bayernwerk has already acquired substantial experience with the optimum installation of three-phase systems. In triangle formation, the cables can carry around 10% less power than in flat formation; they are therefore installed accurately wherever possible. As Wasser reports: "To achieve the best compromise between thermal radiation and asymmetric screen currents, the cables should be installed with an interval of about 7 cm." In his experience, installing the cables with an interval of half a meter would reduce their current-carrying capacity by up to 50 A. To avoid reducing the transmission performance when laying cables under streets, appropriate measures should be implemented to ensure sufficient ventilation of the cables – and therefore a good level of thermal dissipation.

### Save time with temporary site cables

At the transformer substation in Altdorf near Landshut (Germany), for example, temporary site cables were in use for about one year. The two cable sets installed there (2 × 3 phases, each 400 m) made it possible to interrupt the power to a 110 kV double overhead line that runs above the building. This was necessary because a new switchgear building was

being built on the site. The construction crane had to be able to work under non-hazardous conditions to erect the building rapidly, with no major obstructions from the overhead conductor lines. This would not have been possible, or the crane's range of movement would have been severely restricted, had the overhead line at the building site remained in service. Therefore, bypassing the construction site with the temporary site cables enabled two benefits: it reduced the risk of accidents while expediting the building works – resulting, in the final analysis, in lower construction costs. The team from the company Hörmann Kommunikationsnetze GmbH, which was contracted by Bayernwerk to carry out the installation, took around two days to complete the job, from delivery to commissioning of the temporary site cables. The subsequent decommissioning and recovering was just as quick. As Wasser remarks: "A cost-effective solution compared with the construction cost savings, even accounting for the proportional capital cost of the cables."

### Increasing demand at home and abroad

The installation at the Altdorf transformer substation is typical for the way Bayernwerk uses the system. According to Wasser, temporary site cables are often deployed at a given location for several months or even years, usually in conjunction with building conversion, substantial renova-

tions, or new building projects. With a power grid covering some 40,000 km<sup>2</sup>, Bayernwerk is always finding new ways to use its system.

The increasing use of temporary site cables is due, among other factors, to the current situation that lengthy power outages are often no longer feasible. The integration of renewable energy sources into the grid and the increased load on distribution and transport grids are making it difficult to do without temporary cable lines. And it is not only Bayernwerk that is affected in this way. According to Nexans, demand for temporary site cables is increasing throughout Germany, but grid operators in other European countries are also currently ordering more of these cables than in previous years. Thanks to the many application possibilities and the potential cost savings, these temporary solutions are now well-established as a professional alternative.



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