



# Building on success

FSK II outdoor vacuum circuit breakers make the connection for UK rail projects

KAREN STRONG, BRYCE DENBOER – Outdoor circuit breakers form a vital part of the power infrastructure that supplies electricity to mainline trains via the overhead catenaries. They are used for isolating the supply to the catenaries, as well as for sectionalizing parts of the track during inspection and maintenance. ABB's FSK I outdoor vacuum circuit breakers have established a significant global

reputation for their reliability, performance and long life, especially in projects in the United Kingdom. So when ABB launched the new FSK II with a range of innovative features, such as a maintenance-free combination of magnetic actuator and electronic controller, it was natural that it would quickly attract the interest of contractors working on Network Rail projects.

1 Part of Birmingham's cross-city electrification project included the replacement of old circuit breakers with new ones from ABB



1a ABB's FSK II vacuum circuit breakers



1b New electronic controller at ground level

**A**BB has developed the FSK II outdoor vacuum circuit breaker specifically for single (1 × 25 kV) and two-phase (2 × 25 kV) 50 Hz traction power supply switching applications (see picture on page 48). The design builds on the success of the earlier FSK I currently in widespread use around the world. The FSK II, however, features an important new development that replaces the mechanical linkage, traditionally used on this type of switchgear to couple the control box (at ground level) with the elevated vacuum interrupter, by an electronic controller linked by cable to a magnetic actuator at the base of the interrupter.

The main advantage of the FSK II's magnetic actuator and cable connection approach is that it eliminates several moving parts, creating an installation that is essentially maintenance-free, robust and reliable. This in turn significantly reduces service time and costs. In addition, the simple flexible design makes the FSK II easy to adapt and integrate into new or existing installations. It is also fast and simple to install and commission as there is no need for mechanical adjustment on site.

ABB has paid particular attention to the design of the connections between the

FSK II and its associated cables or bus-bars. This ensures a particularly neat and compact solution that minimizes the required installation footprint and reduces environmental impact. The FSK II also utilizes environmentally friendly nitrogen and vacuum insulating technology.

One of the first UK contractors to adopt the FSK II was Carillion plc, a leading support services and construction com-

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pany that had two major rail infrastructure projects underway for Network Rail, the owner and operator of the United Kingdom's rail infrastructure.

The projects were concerned with the replacement of life-expired circuit-breakers on structure mounted outdoor switchgear (SMOS) installations. The first proj-

ect was carried out in the North West Leeds area and the second focused on the first two phases of Birmingham's cross-city electrification.

Carillion decided to use ABB's FSK II circuit breakers because, as Darryl Hackett, Carillion Project Manager for Power Systems explains, "After considering a number of options it was apparent that ABB's new FSK II would offer the ideal solution for us. This was based on its simplicity, elegance and compact design, especially with respect to electrical clearances, so it required a smaller installation footprint. It was also easy to install (and) requires very low maintenance."

The Carillion project moved swiftly from the time the first purchase order was made in July 2007 to the factory acceptance test (FAT) in Geneva in November 2007. The first batch of 50 circuit breakers was delivered in February 2008, and to date well over 100 FSK II circuit-breakers have been delivered to Carillion.

#### Engineering support

The key to the success of the Carillion projects was not just confined to the technical advantages of the FSK II design; ABB's high level of engineering support was also a crucial factor, in particular the attention given to ensure the circuit breakers were correctly installed. Carillion was operating within tightly defined periods of "possession," ie, when the sites could be taken out of service. By ensuring that the circuit-breakers were delivered in a ready-to-fit condition, ABB helped Carillion reduce the duration

## 2 ABB used a modified cable extension between the control box and interrupter



of the required outage by a third! So for example, larger feeder sites with six or seven breaker replacements were completed in just four weeks. This fast-track approach was well received by Network Rail as it helped minimize the potential disruption to rail services.

### Customized solutions

The Leeds project was relatively straightforward as the new FSK II circuit breakers were replacing older ABB circuit breakers of a similar design. The

## 3 Network Rail Certificate of Acceptance

Recently, ABB received Network Rail's formal Certificate of Acceptance for use of the FSK II 27.5 kV outdoor vacuum breaker in electrical traction power systems. This formal certification follows the successful installation of a large number of FSK II circuit breakers under trial conditions for several major UK projects, including the Carillion projects as well as the West Coast Main Line (WCML) power upgrade.

breakers was required and as much of the original cabling as possible should be retained.

In answer to the mounting requirement, ABB, in close cooperation with Carillion's experienced site installation team, devised a special adaptor interface that used the same terminations and bolt spacings → 1. Effectively, it became a like for like replacement but one which incorporated the latest technology. To retain as much of the original cabling as possible,

ABB provided a control cable extension for the FSK II and reused the existing field cables → 2.

### The final verdict

Darryl Hackett would have no hesitation in recommending ABB's FSK II circuit breakers for similar projects → 3. Com-

plementing the company's professional approach, he said there had been a seamless interface between Carillion and ABB's own operations in the UK and Switzerland. This, he added, provided a smooth transition from the initial FAT to final delivery.

"What was particularly impressive was ABB's flexibility in adapting the FSK II de-

sign to meet the individual preferences of both Carillion and Network Rail, such as in the positioning and labelling of switches. It was also particularly refreshing to be kept fully informed of progress, even to the finest detail such as when a shipment was leaving the factory, to when it was arriving in the UK and when it could be expected to reach our warehouse – all without us ever needing to chase or follow up."

The FSK II is available either as loose equipment or complete with mounting brackets. It has achieved over 5,000 operations under test conditions, which is equivalent to a service life of well over 20 years in most normal railway applications.

The connections between the FSK II and its associated cables or busbars ensures a compact solution that minimizes the required installation footprint and reduces environmental impact.

Birmingham project, however, was more challenging for several reasons:

- The new circuit breakers were replacing a significantly different design from another manufacturer.
- They had to be mounted onto the existing steel skeleton superstructure.
- Network Rail was keen that only the physical replacement of the circuit-

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