Revolutionising Rail Electrification

Furrer+Frey®
Overhead contact lines

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The Furrer+Frey story began in 1923 when engineers Emil Furrer and Arnold Frey founded the company to develop and produce overhead line systems in which the firm were true pioneers. Since then, the company has taken a strategic decision to focus solely on overhead line technology; a stance that has seen it recognised as a leader in the field.

We have accumulated our experience from the building of overhead contact line systems over the years, passing it on from one generation to the next. As ever, the installation teams are the capital of our company. Continuous training, a high level of availability and wide professional knowledge characterise our teams.

Series-1 System at Old Dalby Test Track with Hitachi's Javelin Train, UK

The landscape of Switzerland, where the company was founded, has provided Furrer+Frey with a unique opportunity. The challenging topography and the sheer variety of systems in use in the country - mountain lines, intercity lines, urban traffic, rack railways, normal and narrow gauge railways, and narrow tunnels – facilitated the company's strategy to develop a wide range of technologies.

Switzerland's Alpine terrain has also allowed Furrer+Frey to become world experts in providing electrification for tunnels, which provide a particular challenge to rail engineers, especially where high speeds are concerned. For example, in 2003 Furrer+Frey provided electrification technology for the Zimmerberg tunnel, the first 200 kph tunnel in Switzerland, with its new FL200T catenary system. In 2014, Furrer+Frey achieved 300kph in the Sittenberg Tunnel with the Rigid Overhead Conductor System they developed.

Now, approaching its 100th year in business and with the fourth generation of the Furrer family still leading the business, Furrer+Frey is recognised as one of the most expert, most experienced, and most trusted companies in the industry. With offices in Italy and China as well as the Swiss HQ and engineering facilities, Furrer+Frey in the UK is a proven technological leader in development and deployment of rail electrification overhead line systems – demonstrated by its recent win in the Electrification Category at the UK Rail Industry Awards. The company operates a truly wrap-around service in the UK including system and component design, consulting, planning, development, prototyping, supply of materials, simulations, testing, engineering supervision and the publication of specifications and manuals.

In the UK, Furrer+Frey has worked on a number of high profile projects including:

- Developing the new system design for Great Eastern Rail from London to Chelmsford and Southend-on-Sea, and doing the detailed design for this project.
- Designing works on Crossrail West and East.
- Developing the new system design for Great Western Electrification, and carrying out a large amount of detailed design including areas covering Bath, Reading to Didcot, as well as a number of tunnels on Great Western such as Box Tunnel, Middle Hill Tunnel and Sydney Gardens Tunnel.
- Designing a number of Tunnels on the EGIP project in Scotland such as Winchburg, Queen Street and Falkirk.

UK's first high speed conductor rail system at Old Dalby

Furrer+Frey's work in the UK has allowed them to revolutionise rail electrification. Developing and implementing electrification across a huge swathe of the UK, from Southend-on-sea in the East across the whole UK to Swansea in the West, to Edinburgh-Glasgow route in the North.

Total Service

Today Furrer+Frey has the resources, technical know-how and logistical wherewithal to tackle the most difficult installations in the most demanding conditions.

The work the company carries out on-site can often be challenging – in all locations, and always with very tight schedules. Furrer+Frey are often called in to design electrification in especially complex or challenging environments or locations. For example, Furrer+Frey are a global leader in electrifying small tunnels, mountain railways, areas of outstanding natural and historical beauty, bascule and swing bridges, complex junctions and metro systems. This places tough demands on Furrer+Frey's engineers and technicians, but allows them to provide an unchallenged breadth of service in electrification.

The Company's aim is to keep interference with the smooth running of the railway to an absolute minimum and this approach starts at the planning stage. Furrer+Frey's engineers and technicians are experienced in working with a huge range of global standards, legislation, and regulations.

Conductor Rail System at Stanton Tunnel, UK

Furrer+Frey Meet The High Speed Challenge

Safety, reliability and innovation were three of the key criteria for the new overhead line system on the test track facility for IEP trains for Great Western Mainline and East Coast Mainline in Leicestershire. The UK's first ever Rigid Overhead Conductor Rail System (ROCS) for high speeds from Furrer+Frey formed a key part of the scheme in a key tunnel section.

Testing of the new Hitachi IEP stock is now underway on the Old Dalby test track near Melton Mowbray, including the key Stanton Tunnel which opened, on time, in March 2015. The test track has a long tradition of testing new railway technology stretching back to the 1960s when it was used to test the Advanced Passenger Trains of the time. It is used to test prototypes and new technology away from the constraints of the active network and without the limitations of operating only in 'engineering hours'. It features gradients, tunnels and curves of a typical mainline railway, so provides an ideal test bed for traction and rolling stock.

The refurbishment of the 1.2km long Stanton Tunnel part of the line has recently been completed and features Furrer+Frey's high speed ROCS system which has been fitted here for the first time in the UK at higher speeds - although it has been installed on more than 1900 track km worldwide and tested up to 302kmph line speeds.

"This really is the ultimate 'fit and forget' system," says Furrer+Frey's Engineering Manager Ankur who has literally lived at the Stanton Tunnel for the duration of the project to ensure its smooth and timely completion. *"There are no moving parts and no tensioning so there is very significantly reduced risk profile compared to traditional OLE systems. In addition, with no moving parts, the ROCS system needs much less maintenance which can often prove problematic in tunnels."*

To add to its impressive safety credentials, the system has been tested to withstand fire for more than half an hour - as opposed to traditional contact wire which can snap in less than five minutes in fire conditions. This can allow enough time to move a train out of the tunnel in the critical timeframe significantly reduced risk profile compared to traditional OLE systems a fire occur.

Behind the deceptive simplicity of the rigid system, lies a raft of innovation and engineering ingenuity which make the system so effective, even on high speeds and ballasted track. A specialist Furrer+Frey drilling rig allows the high degree of accuracy and precision that are vital for high speed systems. A transition bar allows for smooth interface between the conventional OLE and the Furrer+Frey ROCS system at higher speeds, while state-of-the-art expansion joints accommodate movements caused by temperature variations. The system is manufactured with stainless steel components for better performance in corrosive environments with additional protection covers for areas where water ingress is likely.

The benefits of the system are not lost on client Network Rail. Network Rail's Project Manager, Graham Denny has welcomed the opportunity to see new innovation in action at Stanton Tunnel. *"Installation of conductor beam through Stanton Tunnel has provided Network Rail the opportunity to work alongside leading industry partners to trial high speed running on ballasted track under the Rigid Conductor Rail System, which is a much more reliable overhead contact system,"* he says. *"This will build on previous UK experience of conductor beams which have only been used in low speed tracks. In addition to gaining valuable experience about installation techniques including automated drilling, it also provides the opportunity for the new IEP trains to be introduced to this novel infrastructure."*

Reduced Risk, Improved Performance With ROCS

Furrer+Frey's Rigid Overhead Conductor Rail System (ROCS) is changing the way overhead line systems are specified. The system is based on a rigid bar design, not the traditional tensioned catenary conductor, so there is a significantly reduced likelihood of a de-wirement or snapping of overhead contact line. Absence of mechanical tension also means reduced number of components and much lower loads on the support structures. This all makes it particularly suited to installation in tunnels due to its intrinsic improved reliability, safety and overall performance.

Although the system is relatively new to the UK, having only been previously used in a few locations, the company has developed and utilised the system, fault-free, around the world since 1984. It has been used at speeds up to 250kph in over 130 tunnels, 120 depots, a dozen bridges and numerous special applications on more than 1900 kilometres of track. In fact, in test runs the speed of 302 kph was reached using the ROCS system.

The ROCS system was initially developed to solve space constraints and allow electrification of smaller tunnels originally built for steam or diesel traction. The system's major advantage is its low overall height, plus the fact that there is no contact wire uplift even if operated with multiple pantographs. The use of conductor rail has now evolved to solve various electrification problems. The latest application of conductor rail systems include: moveable conductor rails for bascule and swing bridges, and moveable conductors for electrification of train depots and container terminals.

Benefits of the ROCS System:

- Saves space: vital in confined tunnel applications.
- The conductor rail is robust: the ultimate 'fit and forget' system.
- Conductivity is high.
- Allows operation up to 250 kph.
- Can be installed in tunnels and on open rails.
- Elegant
- Retractable and can be raised or pivoted for bridges and depots.
- Resistant to fire for up to half an hour, allowing for improved safety as trains can still exit tunnels under electric traction.
- No moving parts: reduced maintenance and improved reliability.
- No tensioning: significantly reduced risk of de-wirement or snapping of overhead contact lines.

F+F Automated Drilling Rig used at Stanton Tunnel

Conductor Rail system blends with Salzburg Station architecture

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