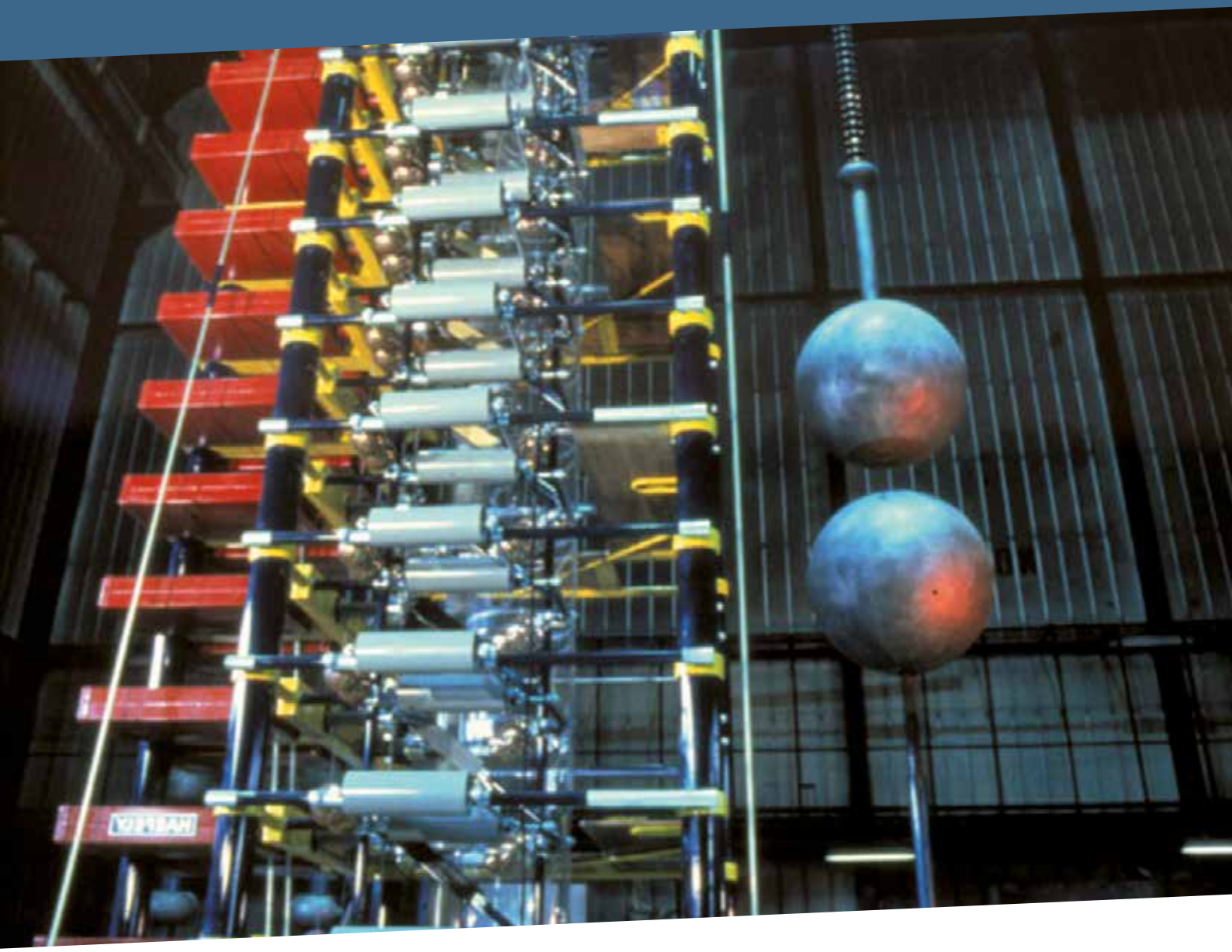
Prysmian Group

Transition Joints



PRYSMIAN

Draka

Prysmian Group

Linking the future

As the worldwide leader in the cable industry, Prysmian Group believes in the effective, efficient and sustainable supply of energy and information as a primary driver in the development of communities.

With this in mind, we provide major global organisations in many industries with best-in-class cable solutions, based on state-of-the-art technology. Through two renowned commercial brands - Prysmian and Draka - based in almost 100 countries, we're constantly close to our customers, enabling them to further develop the world's energy and telecoms infrastructures, and achieve sustainable, profitable growth.

In our energy business, we design, produce, distribute and install cables and systems for the transmission and distribution of power at low, medium, high and extra-high voltage.

In telecoms, the Group is a leading manufacturer of all types of copper and fibre cables, systems and accessories - covering voice, video and data transmission.

Drawing on over 130 years' experience and continuously investing in R&D, we apply excellence, understanding and integrity to everything we do, meeting and exceeding the precise needs of our customers across all continents, at the same time shaping the evolution of our industry.

What links power grids to sustainability?

From Asia-Pacific to the Americas, and from Europe to the Middle East to Africa, Prysmian cable solutions sit at the heart of the development of power grids worldwide, helping major utilities in transmitting and distributing power to their customers.

Unmatched in our manufacturing capabilities and with unwavering commitment to R&D, we design, produce and install low, medium, high and extra-high voltage underground and submarine cables and systems, along with network components and value-added engineering services.

Always aware of the need to minimize our impact on the planet, we're constantly driving innovation in our industry, aiming to optimize supply chain processes, reduce total cost of ownership for our customers and help them achieve sustainable, profitable growth.

Introduction

Low pressure fluid filled cable technology has largely been superseded by the advent of XLPE cable systems, however many utilities and transmission operators still have significant quantities of fluid filled systems within their network and will continue to do so for many years to come.

Almost all cable companies have ceased to make fluid filled cables with only a handful of manufacturers remaining. As the switch to XLPE cable systems across all voltages is largely complete, it is likely that in time, these manufacturers will also cease to manufacture fluid filled cables. Despite this fluid filled cables are generally very reliable and provided that they are properly maintained, they will continue to be a critical part of many cable networks for many years to come.

As a result of this, there will be an on-going requirement to repair, divert and replace parts of fluid filled cable networks in the future. This is where transition joints come in as they provide the vital bridge between fluid filled cable systems and XLPE cable systems. Prysmian has been manufacturing transition joints since the 1980's and in more recent years has updated its product range to take into account the latest material technology.

Prysmian now have range of transition joints from 33 kV up to 400 kV, covering fluid filled to XLPE and also a range of gas type cables to XLPE.

Products

33 kV Range

In most cable systems around the world, the 33 kV cable designs are 3 core and therefore the appropriate transition joint must be able to joint a range of 3 core fluid filled cables to 3 single cores of XLPE cables.

At this voltage, return to service is critical for network operators and therefore Prysmian have incorporated its Elaspeed™ joints (of which over 2 million have been sold worldwide) into its transition joint, to allow for quick and easy jointing of the XLPE side of the joint. The fluid filled side it jointed using traditional paper jointing technology and enclosed in an aluminium case. There is a solid barrier between the XLPE side of the joint and the fluid filled joint, to prevent leakage during service.

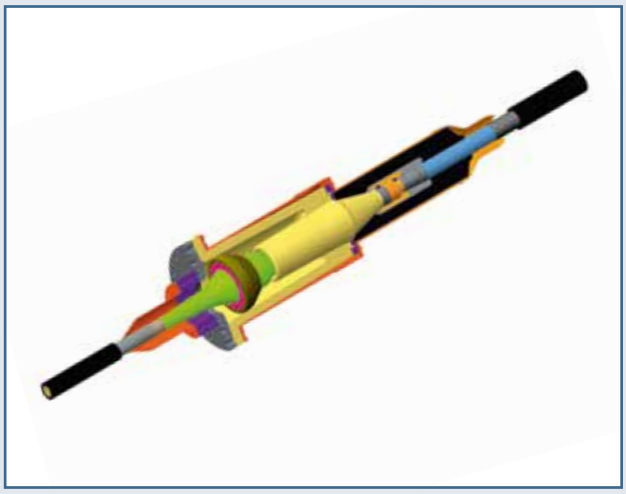
Up to 145 kV

At these voltages, cables sizes from 185 mm^2 to 630 mm^2 fluid filled cables can either be single core or three core cable designs. Above 630 mm^2 the fluid filled cables tend to be single core cables. Therefore there are two designs of joints to cover these two scenarios. However the same basic design principles apply – compact, easy installation using proven technologies.

Up to 145 kV - 3 Core

To simplify the jointing of the XLPE side of this range of transition joints, CLICK-FIT® technology is used. The CLICK-FIT® rubber mould is incorporated into the joint in the factory, which means that only the XLPE cable need preparation on site. This reduces the installation time and reduces the risk of jointer error during installation. XLPE cable preparation is quick and easy and once ready, it is plugged into the CLICK-FIT® rubber moulding. The cable is locked into the joint to prevent any movement of the cable relative to the joint during service.

The fluid filled cores are jointed using traditional paper cable technology. These cores are then locked and restrained within the joint using dual cable spreader supports, ensuring that any mechanical forces during operation (e.g. from cable thrust) are properly controlled to prevent premature failure of the joint.



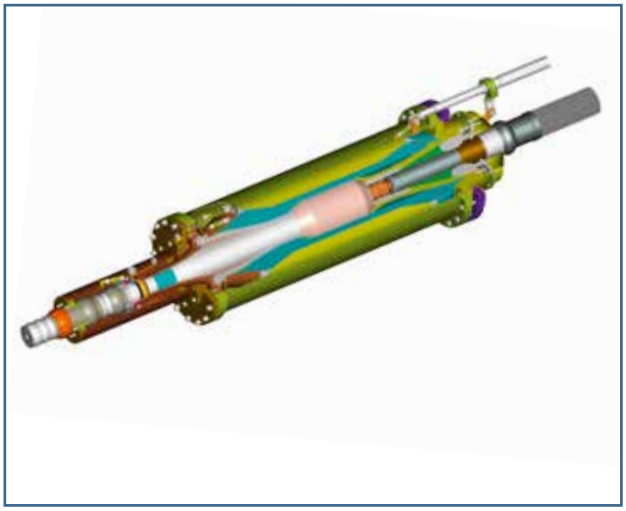
Up to 145 kV - 1 Core

Like the 3 core transition joint, the single core transition joint uses CLICK-FIT® technology for jointing of the XLPE cable. This allows a range of XLPE cables to be used to joint to the fluid filled cable.

Similarly there is a solid barrier between the XLPE side of the joint and the fluid filled side of the joint to prevent the cable fluid reaching the XLPE cables. The fluid filled side of the joint is installed using traditional paper technology.

The important feature of this joint is that it is compact and easy to install, reducing the time taken to install the joint on site.

220 kV and above (up to and including 400 kV)



At 220 kV and above, these cables systems form critical backbones to the operators EHV network and as such reliability it is critically important. Joint designs at these voltages still conform to the same basic design principles and to ensure reliability have been rigorously tested before being put into service.

The fluid filled part of the joint is based around a standard oil stop joint. These types of joint have been used all around the world and have an excellent service record. Importantly from a system design point of view, they can form the end of a hydraulic section and be connected to oil tanks to ensure that the correct hydraulic pressure is maintained in the circuit.

The XLPE part of the joint is based on a dry type GISE bushing. Again, this type of technology has an excellent service record. Importantly there is no fluid required for this part of the accessory and therefore there is no need for any additional expansion tanks or monitoring systems.

The joint features a solid barrier between the two cable technologies and both sides of the joint are plug-in and plug-out which means the system can be worked on in the future. The joint is also highly adaptable, depending on the nature of the cable system. For example designs have been manufactured to cope with higher than normal cable system pressures on the oil filled cable system. Prysmian have also manufactured design which include joint water cooling pipes, which are for use on fluid filled cable systems that have water cooling.

The design and qualification of these EHV transition joints was a thorough and robust process to ensure joint reliability. As well as undergoing a type test to ensure that all the elements of the joint gave the high levels of performance expected, the joints were also subjected to a 1 year pre-qualification test, to simulate real in service conditions and replicate mechanical forces that the joint may be subjected to in service.

All of this detailed development work, using components that had a proven service record, combined with a rigorous testing regime mean that Prysmian have developed a robust, adaptable, reliable EHV transition joint.

Other Transition Joint Products

As well as fluid filled cable systems, a number of network operators also have cable systems using pressurised gas as part of the insulation technology. There are two types of gas cable systems - internal gas pressure and external gas pressure. Typically this technology was put into service up to 150 kV.

Prysmian has a range of transition joints that cover these type of gas cable systems jointing on to XLPE cables.

Key Features

Whilst different voltages, different manufacturers and technologies lead to different approaches to transition joint design, there are a few key features that should be common to all types of transition joint:

- Solid barrier between the XLPE cables and the fluid filled cables or gas cables. This is required to prevent leakage to the XLPE side of the joint
- The joints must be able to take a wide range of cables
- Components pre-fabricated and factory tested
- Easy on-site installation
- Small and compact to fit into existing joint bays
- Suitable for a range of bonding applications
- Able to be connected to oil tanks

Supply History

Product	Sales
33 kV Three Core Fluid Filled to Three Single Core XLPE*	198 units
132 kV Single Core IP Gas to Single Core XLPE	9 Units
132 kV Three Core IP Gas to Three Single Core XLPE	2 Units
132 kV Single Core Fluid Filled to XLPE Single Core Joint	92 Units
132 kV Three Core Fluid Filled to Three Single Core XLPE	52 Units
275 kV Single Core Fluid Filled to Single Core XLPE	21 Units
400 kV Single Core Fluid Filled to Single Core XLPE	38 Units

* Note sales numbers based on previous design of joint, not the design shown in the literature

Linking power grids to sustainability

Prysmian Cables & Systems Limited
Chickenhall Lane
Eastleigh
Hampshire
SO50 6YU
United Kingdom

www.prysmiangroup.co.uk

Cables & Accessory Enquiries
Tel: +44 (0) 23 8029 5048
Fax: +44 (0) 23 8029 5146

Information hotline
Tel: +44 (0) 23 8029 5029
Fax: +44 (0) 23 8029 5437
networkcomponents@prysmiangroup.com

Prysmian Group
Viale Sarca 222, 20126 Milan, Italy
Email: marketing.energy@prysmiangroup.com

www.prysmiangroup.com

Prysmian Group

PRYSMIAN
Draka