

# MAKING A LASTING MARK:

Cable Identification Products

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How TE Connectivity's systematic approach and rigorous testing ensures that idents remain in place and readable in harsh rail environments

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**AS A TECHNOLOGY LEADER, TE CONNECTIVITY DESIGNS AND MANUFACTURES THE ELECTRONIC CONNECTORS, COMPONENTS AND SYSTEMS INSIDE PRODUCTS THAT ARE CHANGING THE WORLD, MAKING THEM SMARTER, SAFER, GREENER AND BETTER CONNECTED. IN THE WORLD OF RAIL, TE CONNECTIVITY DELIVERS THE BROADEST PORTFOLIO AND SYSTEMS EXPERTISE REQUIRED TO CONNECT POWER AND DATA SAFELY AND RELIABLY, FROM THE HIGH-VOLTAGE SUPPLY AND ON THROUGHOUT THE ENTIRE TRAIN.**

In this white paper, Materials Engineering Manager Martyn Priddle explains why a cable identification system is more than the sum of its parts and how TE Connectivity uses a rigorous approach to testing to guarantee the long-term performance of its ident products.

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## WHY CABLE IDENTIFICATION IS VITAL

No matter how simple the project, cable identification is of paramount importance. The act of labelling cables at the point of installation pays dividends over the life of a train. Clear and readable markers represent safe and efficient maintenance.

But it's not as simple as it might seem at first glance. Identification markers have only one job: to remain in place and be clearly readable. But they must do this while meeting a complex and evolving set of standards.

Identification products are specified to withstand the rigours of their operating environment. They may be exposed to fluids such as diesel or lubricants, spend a significant portion of time in the glare of the sun or have to perform reliably in spite of high temperatures. In many environments, Low Fire Hazard (LFH) identification products must not introduce any risk of toxic fumes should fire occur.

## THE VALUE OF IDENTS

As tiny scraps of material attached to cables during installation, identification products look relatively insignificant at first glance. However, their value is during the life of a railway system, when railway schedules call for minimum down time. The ability to find a cable terminal quickly and efficiently can make a huge difference in resolving issues and minimising delays or outages.

If a single identifier can save one second of a maintenance engineer's time, then multiplied over many thousands of cable runs on board trains, in signalling systems and elsewhere across a railway network, cable identification systems can be worth their weight in gold. Their importance is expected to grow significantly as increased connectivity is driven by more demand for power and data and the trend towards predictive maintenance.

Since the only role of a cable marker is that it remains in place and remains legible, it is vital that the identification system has been tested and proven to meet the standards set by the train operator and builder even after many years in the field and environmental exposure.

One Scandinavian rail operator understands the value of cable idents. After discovering during routine maintenance that its cable identification products were no longer legible, it committed to the cost of calling in TE Connectivity to replace all of the identification markers on its entire fleet of trains, whether or not they were still legible. This meant disconnecting and reconnecting every terminal to replace the heat-shrink markers, with the cost of replacing the markers being less than the hidden costs associated with having an unreliable marking system. At its root, the problem was that the original installers had not used the identification system in full.

## A SYSTEMATIC APPROACH

Failure of an identification product may come from many sources. Printing may rub off after time or exposure to fluids, the marker material itself may grow brittle and cable ties may fail long before the identifier itself. Any product is only as strong as its weakest part.

To overcome this, TE Connectivity uses a systematic approach to ensure that its products are developed and fully tested to fulfill their role: to remain in place and readable in a specified environment.

Ident products are based on a system that incorporates:

- Heat Shrink Sleeve or Cable Marker product
- Printer ribbon
- Printer and printer settings
- WINTOTAL software

By controlling every element of a product's manufacturing process, print quality and testing regime, TE Connectivity ensures that its identification products have consistent and predictable quality in terms of their material, printing and adherence to cable.

## MATERIAL PROPERTIES

TE Connectivity's heritage as a materials science business stretches back to its time developing radiation cross-linked polymers under the Raychem brand.

The Raychem identification products were developed from the same materials as its wire and cable insulation products, with the insulation materials having been developed to withstand extreme operating environments. These products are produced in sheet or tubing formats that customers can print and attach to cable or other components.

Dedicated printers and thermal transfer ribbons complete a cable identification system. Only by using the right form of ink and printer will a customer be able to guarantee that the product will continue to be legible after environmental exposure.

## THE DEVELOPMENT PROCESS

Developing polymer products is a complex process with many variables. TE Connectivity has decades of experience and knowledge of manufacturing radiation cross-linked polymers.

The starting point is selecting and sourcing the raw ingredients and designing a compound for a particular application. The process should take account of the many variables associated with manufacturing, where temperatures, time, flow rates, mixing and many more factors can impact the quality of the final product.

In a step that differentiates TE Connectivity from others in the sector, it creates test batches in significant sizes, not just to perform tests on the material itself but also on the consistency of the manufacturing process.

At this stage, products undergo rigorous testing before being extruded to the format required and then irradiated to transform the material into a cross-linked polymer.

After being assembled in their final formats, more testing ensures they meet the customer's specifications. They are then packaged and supplied with the printer and printer ribbon that will ensure a quality and long-lasting system.

## A COMPLEX SET OF STANDARDS

Internationally, there is complexity in the standards adopted. Historically, individual countries created and specified product using their own national standards. However, standards are being harmonised and in Europe, national standards have been replaced by the Euronorm EN 45545.

Whilst operators should theoretically be satisfied with the Euronorm, in reality their engineers use not only the new standard but also the old national standards that it replaced. Only products that are tested and evaluated to meet each of these standards can be guaranteed to meet these standards, which is why TE Connectivity carries out multiple sets of tests to demonstrate that its products meet the multiple standards set by those buying its products.

It is only by carrying out these tests that TE Connectivity can guarantee its products and its products deliver value.

## RIGOROUS TESTING

Ident products need to remain in position and readable. Without either of these, the product will identify nothing.

A set of relatively straightforward tests of the mechanical properties will confirm whether a product remains in place. Properties such as tensile strength, elongation and brittleness. Re-testing products after time or exposure to fluids or light will show whether the product is likely to stay in position.

Readability of a mark calls for a more complex set of tests that examine the quality and contrast of the print immediately after printing as well as after environmental exposure. This exposure takes the form of exposure to fluids such as diesel and oil as well as cleaning fluids, and mechanical rubbing.

TE Connectivity has developed its own set of tests to measure the performance of print after rubbing. These put forward a standard rubbing method that guarantees that print is exposed to the same pressure, type of cloth and duration.

TE's rub test has been submitted to the European Committee for Standardization as part of the standard used for cable identification in the aerospace industry. Should it be adopted, it will be an important milestone in the standardisation of cable identification products and will enshrine TE Connectivity's test in an international standard, from which it can be borrowed by other industries.



## TE CONNECTIVITY'S OFFER

As the pioneer of cross-linked polyethylene, TE Connectivity developed cable identification systems that are tested and guaranteed to remain in place and legible in the most demanding environmental conditions.

It supplies heat shrink tubing products as well as wrap-around and tie-on products that are tested to national and international standards and are guaranteed to last for rail, automotive, aerospace and other industries.

TE Connectivity introduced ladder format products and continues to supply them in the form of System 6 and System 90 heat shrink tubing, They are also supplied as continuous heat shrink tubing or sheet products that can be tied on or retrofitted to cable installations.

No cable identification is complete without the specialist printer and printer ribbon that the customer can use to apply a mark that is guaranteed to remain legible.

## PRODUCT FORMATS

Customers select products based on the application. Heat shrink tubing is a popular choice but wrap-around and tie-on products are also available and each has its relative merits.

Heat shrink tubing can be purchased in a continuous spool or in a ladder format. Because it is a self contained product that is threaded onto cables and heat shrunk into place, it is the most reliable format of identification product.

Continuous spool has no limit to the length of the label that can be printed and there is minimal waste product but each individual label must be handled individually, which takes time for installers to sort.

In ladder formats like system 6 and system 90, which were introduced by TE Connectivity, sleeves are supplied as individual markers connected by adhesive tape along each edge like rungs on a ladder. They come in a pre-determined size and can be printed off in batches that can be pinned to a terminal board. As an electrician works, he can quickly find and attach the right marker for each cable, saving time during installation.

The same materials are also supplied in flat sheet formats as wrap-around and tie-on labels/cable markers. These are popular with customers who need to retrofit identification onto an existing installation.

## ABOUT THE AUTHOR

Materials Engineering Manager Martyn Priddle is a leading polymer expert for TE Connectivity and has been instrumental in developing a number of breakthrough products over his career. His career started in 1979 when he joined Raychem as a graduate and since then he has been central to polymer science and technology at Raychem and subsequently TE Connectivity.

## HISTORY OF TE CONNECTIVITY

TE Connectivity is a technology leader that designs and manufactures the electronic connectors, components and systems inside the products that are changing the world - making them smarter, safer, greener and more connected.

It is a leading supplier of high-voltage components to the rail industry that deliver proven longevity and performance in diverse and harsh environments. TE Connectivity's unique knowledge of materials science positions it at the forefront in developing the insulation materials that perform the essential task of insulating line power from the train structure.

Its legacy dates back to the 1950s when Raychem, which has since joined the TE Connectivity group, first used the technique of radiation chemistry to develop products. Since then, the firm has undergone a number of changes of name and structure. These include the name of Tyco Electronics, which the firm bore until March 2011 when it took the name TE Connectivity to reflect its role as a component and communications manufacturer.



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