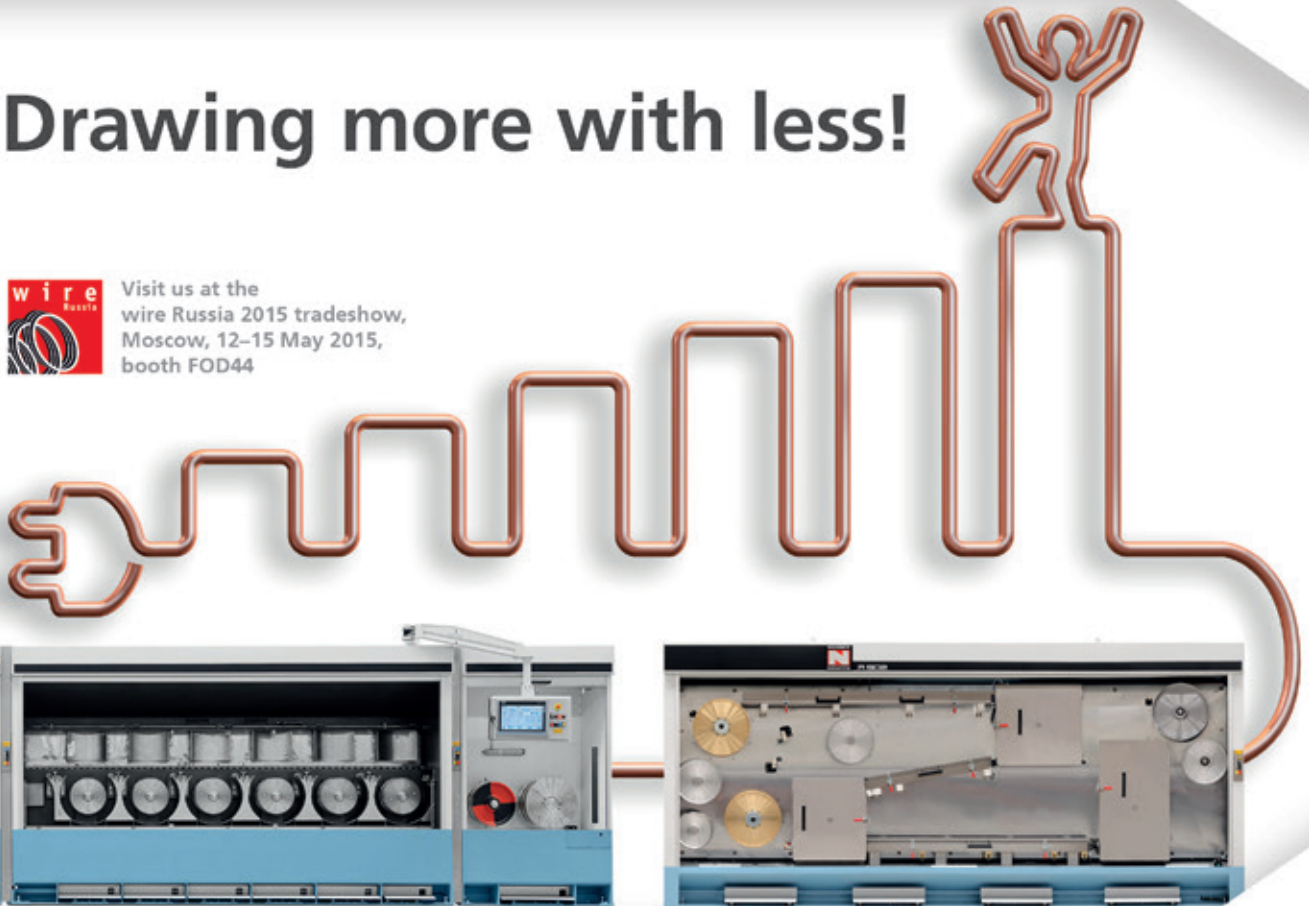


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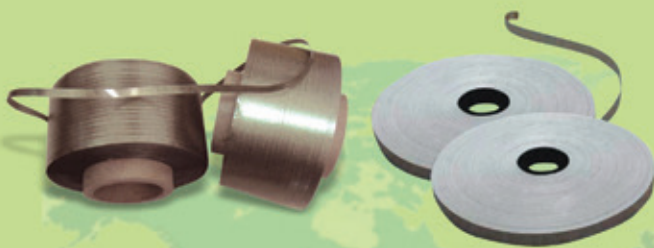
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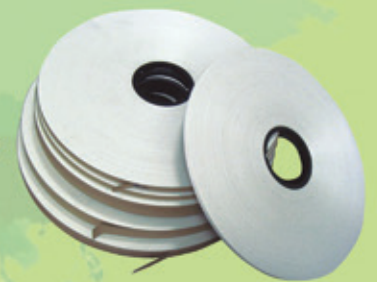
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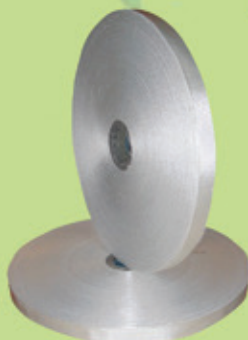
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科麦特光电材料有限公司（无锡）成立于 2005 年，是一家致力于研发及制造电线电缆用屏蔽绝缘材料的高科技企业。工厂占地面积 15000 平方米，年销售 2000 万美金，主要生产各类铝箔聚酯带，铜箔聚酯带，热融 PET 及热融铝箔。

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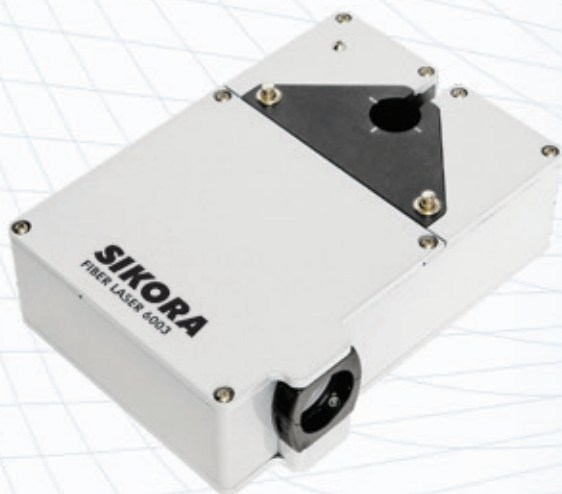
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See page 112 for further details

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# The industry heads to wire Russia

The Kremlin. Red Square. St Basil's Cathedral. We are obviously talking about Moscow as wire Russia prepares to welcome the wire and cable industries in May.

Thousands of visitors are expected at the ZAO Expocentr from 12<sup>th</sup> to 15<sup>th</sup> May, and our coverage in this issue starts on page 60 where you can find some of the exhibiting companies attending.

Excitement is also gathering for wire Southeast Asia in Bangkok, Thailand, and wire South America in São Paulo, Brazil. Organisers Messe Düsseldorf look forward to the exhibitions on pages 18 and 24, respectively.

Rosendahl and Nextrom have opened a new technology centre in Austria, which they claim is the world's fastest secondary coating line. Catch up on the details on page 27.

On the jobs front, Swiss company X-Compound, a member of the Troester group, has appointed a new chief executive. The full story is on page 21.

And remaining on the careers front, Wesco Distribution has trebled its headcount with the opening of its third office in the UK. Turn to page 30 for the story.

New is also a theme in our technology section, with Italian manufacturer Samp producing a new double-twist bunching machine. All the details are on page 46.

Helukabel has also added two new motor connection cables to its Topflex product family. Turn to page 51 for the full story.

It was also good to catch up with old friends at the recent Interwire exposition in Atlanta, Georgia, USA. A big thank you to everyone who stopped by our stand to say hello.



David Bell  
Editor



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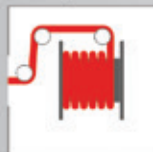
group twinner



buncher



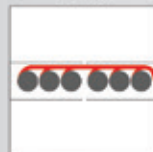
single twist



skip wire



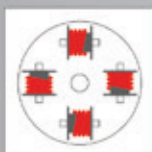
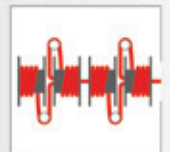
tubular



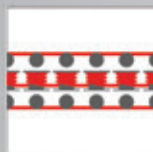
double twist



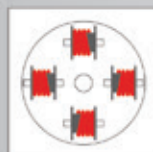
concentric



rigid cage



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### Getting Technical:

Ultra-fast, high resolution, surface quality measurement (SQM), for wires, optical fibres and cables

### Feature

16<sup>th</sup> Guangzhou Tube and Wire Fair

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dates for your diary . . .

# Guangzhou Tube and Wire Fair 2015

16-18 June:

## 16<sup>th</sup> Guangzhou Tube and Wire Fair –

trade exhibition –  
Guangzhou, China

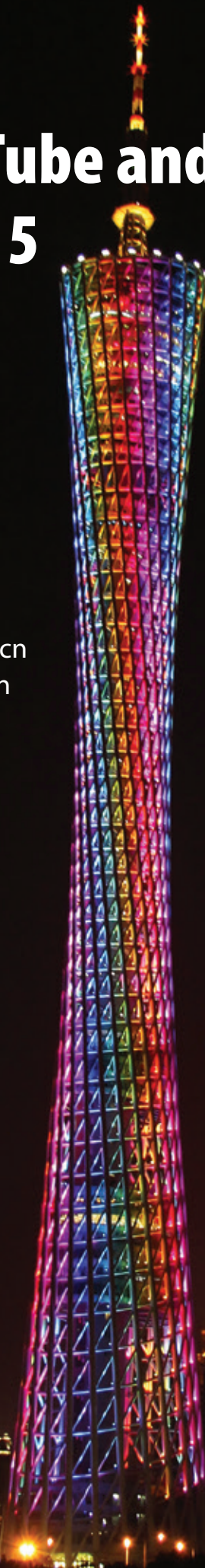
### Organisers:

Julang Exhibition Co Ltd

**Fax:** +86 203 862 0790

**Email:** meiwen@julang.com.cn

**Website:** www.julang.com.cn



2015

### September

15-17 September:

**wire Southeast Asia** – trade exhibition  
– Bangkok, Thailand

#### Organisers:

Messe Düsseldorf Asia Pte Ltd

**Fax:** +65 6337 4633

**Email:** wire@mda.com.sg

**Website:** www.wire-southeastasia.com

### October

5-10 October:

**EMO** – trade exhibition – Milan, Italy

#### Organisers:

EFIM-ENTE Fiere Italiane Macchine

**Fax:** +39 226 255 882

**Email:** info@emo-milano.com

**Website:** www.emo-milano.com

5-8 October:

**IWCS Technical Symposium** –  
conference and exhibition –

Atlanta, Georgia, USA

#### Organisers: IWCS

**Tel:** +1 717 993 9500

**Email:** phudak@iwcs.org

**Website:** www.iwcs.org

6-8 October:

**wire South America** – trade exhibition  
– São Paulo, Brazil

#### Organisers:

Messe Düsseldorf GmbH

**Fax:** +49 211 4560 668

**Email:** info@wire-south-america.com

#### Website:

www.wire-south-america.com

### November

3 November:

**Cabwire Conference** – conference –  
Düsseldorf, Germany

#### Organisers:

IWMA, WAI, ACIMAF, CET IWCEA

**Fax:** +44 121 781 7404

**Email:** info@iwma.org

**Website:** www.cabwire.com

2016

### April

4-8 April:

**wire/Tube Düsseldorf** – trade  
exhibition – Düsseldorf, Germany

**Organisers:** Messe Düsseldorf GmbH

**Fax:** +49 211 45 60668

**Email:** wire@messe-duesseldorf.de

**Website:** www.wire.de

### May

11-14 May:

**Lamiera** – trade exhibition –  
Bologna, Italy

**Organisers:** Ucima-Systems

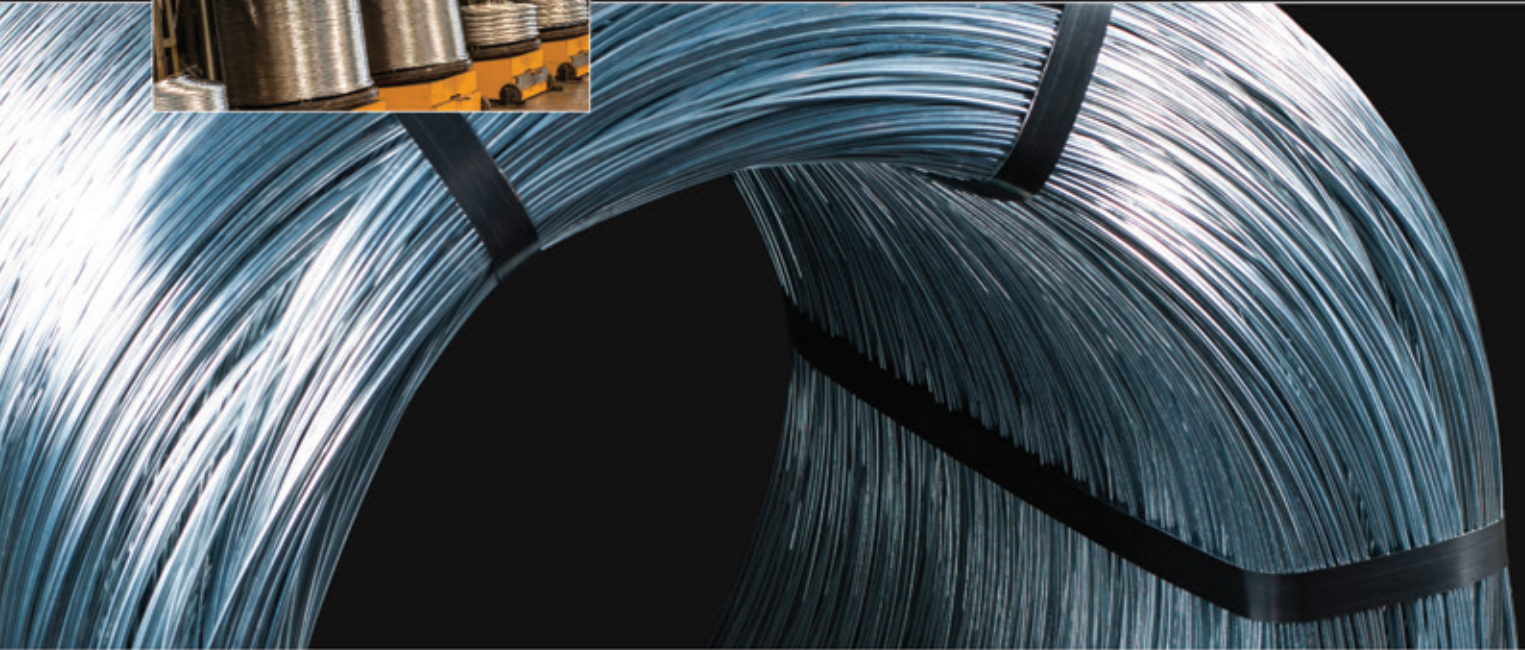
**Fax:** +39 0226 255 894

**Email:** lamiera.esp@ucimu.it

**Website:** www.lamiera.net

Image courtesy of www.digstockphoto.com "Canton Tower on the Pearl River, Guangzhou, China", Photographer: sculler

# Wires for every need



From Construction Industry, to Agriculture, to Book Binding, to Electrical Appliances, **Tecnofil Wire Division** has the best solution for your needs.

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Tecnofil offer is composed of wires from 0.40 to 8.00 mm diameter in the following finishes: bright, galvanized, heavy galvanized, copper coated, annealed, coated wires for bookbinding, wire band for staples and the *new zinc-aluminum wires*.

In specific, Tecnofil galvanized wire production is made by two galvanizing lines with a total of 70 wires, working diam. from 0.50 mm to 8.00 mm. The latest technology galvanizing plant can manufacture galvanized wire with ordinary zinc quantity, heavy zinc quantity through a gas wipe system and zinc-aluminium.

The line production capacity makes Tecnofil reach a monthly output of 6,000 tons of galvanized wire. In the galvanizing department, a quality control unit is constantly supervising the correct zinc coating of wires. The final part of our line is equipped with static spoolers (coilers) and dynamic spoolers.

**Tecnofil** with its **Wire Division** is a prominent market player in the wire industry, manufacturing low-medium carbon steel wires and wirebands.

**Tecnofil** is the ideal partner thanks to its ability to create tailor-made solutions, its commitment to innovation and its overall control of production.

Come and visit us at:

**Wire Russia** 12<sup>th</sup> to 15<sup>th</sup> May 2015 - Moscow, Russia - Booth FO/C47

**Made In Steel** 20<sup>th</sup> to 22<sup>nd</sup> May 2015 - Milan, Italy - Booth 12P/D25



**Tecnofil S.p.A.** - via Brescia 49 - 25023 Gottolengo (BS) Italy  
Tel. +39 030 9517655 / 57 - Fax +39 030 9517571  
tecnofil.net - info@tecnofil.net





▲ The Reelex machine with supply reel at ICE Cable Systems

## ICE invests in latest Reelex cable coiling machine

ICE Cable Systems, a manufacturer of premium low-voltage wire and cable products, has invested in a new Reelex coiling machine for its factory.

Reelex's tangle-free technology is a patented method of winding wire and cable into a figure-eight coil. In optimising each coil, factors such as gain, payout hole control and the density of the wind, along with progressive coil tension, are all instrumental to producing tangle-free packages. This unique coil can only be produced on a specially designed and patented Reelex machine and accompanying customised software.

The Reelex II coil within the bulk wire carton does not rotate during payout, nor does any inertia take place. Void of any moving parts, the coil dispenses from the inside-out with a clear path and avoids the typical twists, tangles and snags that plague bulk wire cartons.

This technology is a key element in ICE Cable Systems Big Mouth Payout bulk wire carton, that along with other conveniences such as ascending and descending foot markers on the cable jackets, and extremely durable 24kg burst-tested cardboard with dual-layer handles, have made it very popular among installers.

"We've taken something good and made it even better," said ICE president Brian Rizzo.

"We've invested in a machine that represents the state-of-the-art in wire and cable technology and custom-configured it for our cables.

"The net result for our dealers will be perfect pulls, from the first foot to the last."

**ICE Cable Systems – USA**  
**Website:** [www.icecable.com](http://www.icecable.com)

**Reelex – USA**  
**Website:** [www.reelex.com](http://www.reelex.com)

## Extra accreditation for BASEC

THE British Approvals Service for Cables (BASEC), an expert in product certification services for electrical, data and signal cables and ancillary products, has extended its United Kingdom Accreditation Service (UKAS) accreditations to include ISO/IEC 17025:2005, an international standard that specifies the competence and quality management system requirements for laboratories that provide testing and calibration services.

ISO/IEC 17025:2005 accreditation is one of the highest levels of recognised quality any testing or calibration laboratory can attain.

Laboratories that are accredited to this international standard must have demonstrated that they are staffed, equipped, technically competent and able to produce precise and repeatable test and/or calibration data. They will also have the correct quality systems in place to manage everything from administration through to technical operations.

BASEC's scope of accreditation to 17025 includes its electrical, mechanical, chemical and fire/smoke tests on cables, and further test categories will be added over time.

Since the launch of its cable testing laboratory in 2012, BASEC has continued to make substantial investments in its laboratory equipment with the introduction of three new re-configurable fire test labs, and a 3.5m tall ladder rack rig for vertical fire tests on cables (IEC 60332-3-22 to 24 and BS EN 50399) complementing BASEC's existing three-metre cube chamber for smoke emission tests (EN 61034-2) and halogen testing facilities.



▲ Cable testing in the BASEC laboratory

BASEC also holds UKAS accreditation to ISO/IEC 17021 for both quality and environmental management systems, and to EN 45011 for product certification.

**BASEC – UK**

**Website:** [www.basec.org.uk](http://www.basec.org.uk)



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## Brazilian customers benefit from local service

HIGHVOLT'S Brazilian agency LPEng will be working more closely with Highvolt Prüftechnik Dresden GmbH to operate the first local Highvolt Service Centre worldwide. The new centre will be sharing offices with LPEng in São Paulo, Brazil.

Brazilian customers of Highvolt can now use many of the available services directly on their doorstep, for example consulting services, training opportunities and technical support during preparations for commissioning.

"This enables us to react much faster and much more efficiently to customer enquiries," said Highvolt sales engineer Dan Keller.

"The responsible service technician is also the customer's first point of contact for standard repairs. He can be on site in next to no time to solve minor problems, to perform maintenance or to replace spare parts."

Another point not to be overlooked is that a local contact naturally simplifies language communication with the customer's staff.

Highvolt and LPEng have already been cooperating successfully for more than 15 years.

High service quality is guaranteed not least by the extensive practical experience of the employees on both sides, alongside their excellent technical knowledge in the field of high voltage testing equipment.

**Highvolt Prüftechnik Dresden GmbH – Germany**  
Website: [www.highvolt.de](http://www.highvolt.de)



▲ LPEng director João Carlos Sanches, second from left, and service engineer Alex Bernardi, third from left, invited about 40 customers and business partners, including Highvolt managing director Ralf Bergmann, right, and sales engineer Dan Keller, left, to celebrate the official opening of the new service centre

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Email: [anbao@anbao.net](mailto:anbao@anbao.net) Website: [www.anbao.net](http://www.anbao.net)

## Ovako buys Tibnor

Ovako has signed an agreement with SSAB to acquire steel and metals distributor Tibnor Oy in Finland.

The deal has been approved by the European Commission and will now be examined by competition authorities in Finland and Estonia for final approval. The acquisition is expected to have a slightly positive impact on Ovako's operating profit and a slightly negative impact on cash flows for 2015.

"Tibnor Oy is a successful company with extensive experience as a distributor for companies including Ovako in the Finnish market. The acquisition of Tibnor Oy means that Ovako can broaden our customer offering in the Finnish market and enhance our contact with end customers regarding all of Ovako's products," said Tom Erixon, president and CEO of Ovako.

Tibnor Oy purchases, stores, processes and distributes steel and other metals for the engineering, process and construction industries. The company has approximately 50 employees and sales amounted to €66.6m in 2013.

Ovako's acquisition of the company has been approved by the European Commission and the next step is for the deal to be examined by competition authorities in Finland and Estonia for final approval.

The acquisition of Tibnor Oy in Finland should be seen as a component of Ovako's efforts to enhance its presence and collaboration with customers in new and existing markets. During 2012 and 2013, Ovako opened new sales offices in Italy, Eastern Europe and China.

**Ovako AB – Sweden**  
Website: [www.ovako.com](http://www.ovako.com)

**Tibnor OY – Finland**  
Website: [www.tibnor.fi](http://www.tibnor.fi)



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- Extruders
- Cross- Head
- Haul-Off Caterpillar
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## Pure passion from Polytec

POLYTEC Thelen GmbH in Bochum, Germany, and its affiliated company Polytec Elastoform in Marchtrenk, Austria, are both companies in the Polytec Group, developers and manufacturers of polyurethane customised moulded components and spray coatings.

In 30 years, the company has grown to be a competent partner with customised solutions for many applications made of polyurethane for almost every branch of industry.

Thelan polyurethane has stood the test of time as wear protection in highly stressed machine parts and production facilities. In many cases these kinds of coatings and components show a greater lifespan in comparison to steel or rubber.

A benefit is the opportunity to customise or individually design components.

For wire and coil storage and wire and coil handling, the company offers wire and coil mats and protective modules for forklift made of Thelan polyurethane. Polytec coil mats are a solution for flexible stocking of coils or wire and sheet metal.

Additionally, to preventing damage of external layers and windings, they can contain up to ten litres of fluid in the collecting channels.

Coil mats are made of extremely firm and wear-resistant Thelan polyurethane, and offer extensive applications possibilities.

New in the range are coil mats with single-sided special fabric coating, which are heat resistant up to 200°C (392°F).

Protective modules made by Polytec are suitable for protecting the coil eye and the external windings of coils. The modular design allows flexible handling of various diameters and lengths.

Polytec protective modules for forklift mandrels are made of extremely firm and wear-resistant Thelan polyurethane. The top module is additionally reinforced with a perforated sheet steel basket.

The company is also a full-service partner for repair and coating of all components of vibratory finishing equipment.

Its service includes the thermal removal of existing coatings, repairs of the steel construction and complete blast derusting, as well as the replacement or adjusting of PUR parts.

The special Thelan polyurethane coating reliably protects systems against wear.

In addition to more than 25 years' experience in noise, wear and corrosion protection coatings, the company can complete exterior painting of equipment.

**Polytec Thelen GmbH – Germany**  
**Polytec Elastoform – Austria**  
**Website:** [www.polytec-industrial.com](http://www.polytec-industrial.com)

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- Pay-off and take-up*

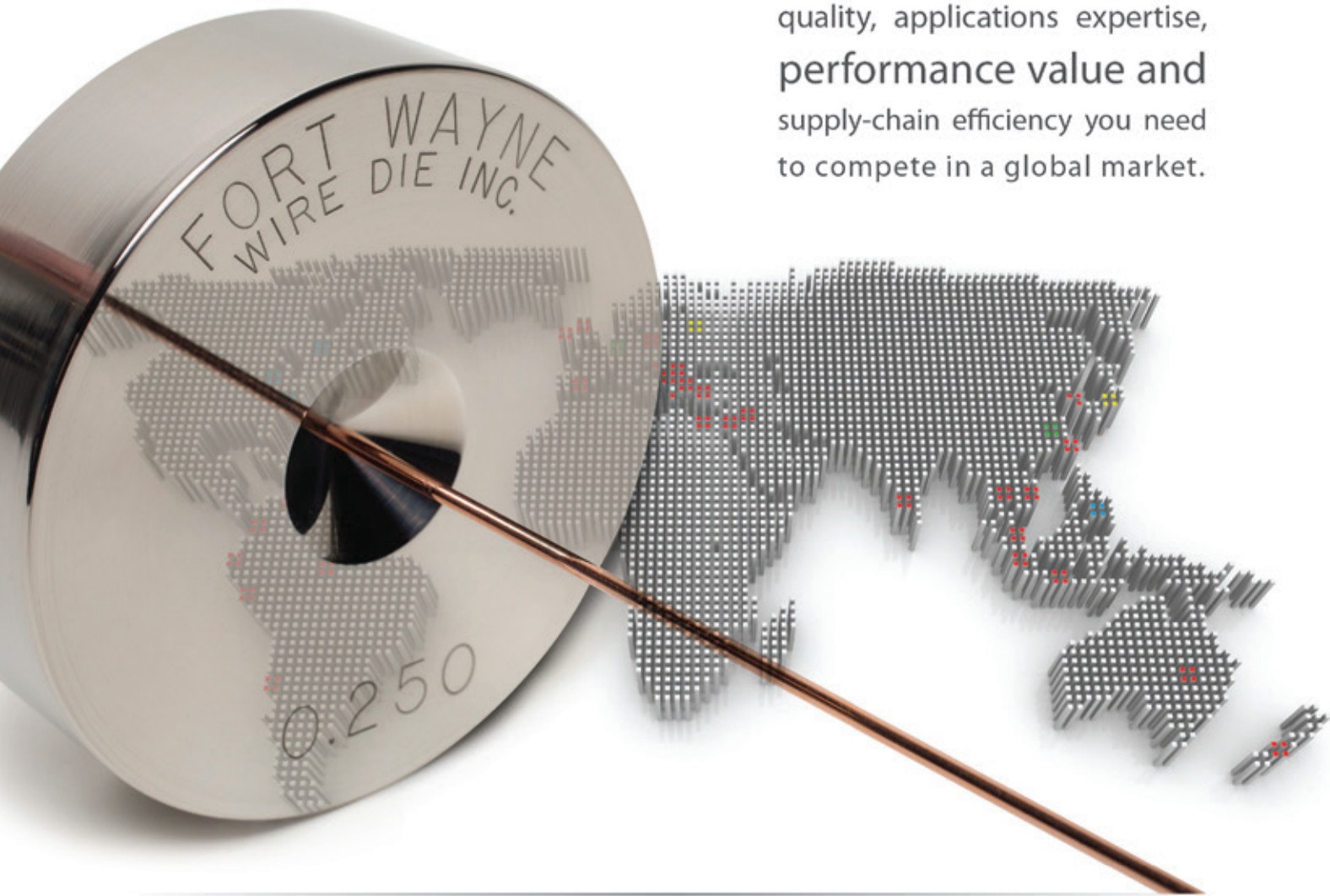
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## Central's deal for Hempel Wire

CENTRAL Wire Industries has acquired Hempel Wire Limited, a manufacturer and distributor of stainless and nickel alloy wire, based in Rotherham, UK.

The business was purchased from Hempel Special Metals Holding GmbH, an international distributor of speciality metals, part of the F W Hempel & Co Group of companies, headquartered in Oberhausen, Germany.

Hempel Wire manufactures and distributes both round and profile wire in a wide variety of alloys, including virtually all stainless steels and nickel alloys.

Founded in Rotherham in 1983, Hempel Wire reported sales of £9m last year and has approximately 45 employees.

Central Wire Industries, founded in 1955 and headquartered in Perth, Ontario, Canada, manufactures and distributes stainless steel, nickel alloy, and copper and brass wire products throughout the world.

The company, which maintains eight manufacturing facilities – six in the United States and two in Canada – has

360 employees. Central Wire provides products to many major industries, including aerospace, petrochemical, food-processing, medical, automotive and marine.

The acquisition comes after Hempel Wire's recent purchase of certain trademarks, trade names, and intellectual property from Fox Wire Limited in neighbouring Sheffield.

Included in this transaction were the rights to the SUPA family of alloys, including SUPA 75, for oil and gas industry applications.

Central Wire Industries looks forward to augmenting its product lines with the capabilities and know-how of Hempel Wire as well as utilising Hempel Wire's distribution network for Central Wire's wide range of product offerings.

As a result of the transaction, Hempel Wire Limited plans to change its name to Central Wire Industries UK Limited in the near future.

Hempel Wire's managing director, James Roper, will continue in that role and

manage the on-going business for Central Wire Industries.

"This acquisition significantly broadens the product offerings of CWI, expands our reach in existing markets, and enables new market opportunities," said Paul From, president and CEO of Central Wire Industries.

"We are truly pleased to make this announcement and are delighted to welcome James Roper and the Hempel Wire team and business into the CWI Group."

André Hempel, managing director of Hempel Special Metals, said: "The sale of Hempel Wire to Central Wire Industries allows us to focus on and further develop our core specialism of international distribution of corrosion and heat-resistant high-performance materials and components.

"We wish the team at Hempel Wire all the very best for the future and we are sure that the benefits of past cooperation will be transferred to the new organisation."

**Central Wire Industries – Canada**  
**Website:** [www.centralwire.com](http://www.centralwire.com)

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## PWM launches new videos on its website

BRITISH cold welding machine manufacturer PWM has launched a corporate video to give wire and cable manufacturers a 'snapshot' of the products and services it offers.

The two-minute video, which can be viewed on the company's website, highlights PWM's 30 years of specialist expertise in the design and manufacture of cold pressure welding machines and dies, which are produced in the company's workshops in Kent, UK.

PWM has also added eight new product demonstration videos to its web library. The videos show five manually operated and three powered cold welders in action.

The machines, for wire sizes 0.1mm to 5mm (0.0039" to 0.197"), all use the proven multiple upset technique to produce strong permanent welds on non-ferrous materials.

**PWM Ltd – UK**  
Website: [www.pwmltd.co.uk](http://www.pwmltd.co.uk)

## New sales role for Jill

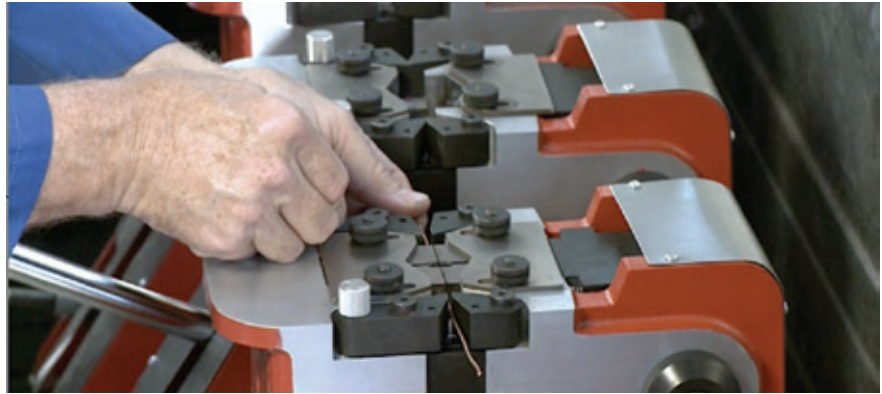
Jessica Roberts has taken over as south central regional sales manager for Miltec UV. Known as Jill, she lives in Grapevine, just outside of Dallas, Texas, with her three children.

A graduate of Texas A & M University, where she received a BS in industrial distribution, she has worked as a sales engineer and technical sales consultant within multiple technology and manufacturing market segments.

Fred Beu, global director of sales and marketing for Miltec, said: "Jill brings many years of industry experience from the electronics, semi-conductor and multiple technical applications where she successfully developed complex solutions and supported major accounts from both a technical and sales perspective."

"We look forward to growing our market share in many industries we serve throughout the south central territory and are very pleased to have Jill represent Miltec UV with our key customers."

**Miltec UV Corp – USA**  
Website: [www.miltec.com](http://www.miltec.com)



▲ A snapshot from one of the company's videos on its website



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# All set for wire Southeast Asia and Bangkok

wire Southeast Asia, the 11<sup>th</sup> international wire and cable trade fair for Southeast Asia, will return from September 16<sup>th</sup> to 18<sup>th</sup> at the Bangkok Trade & Exhibition Centre (BITEC) in Thailand.

Driven by wire Düsseldorf, the industry's leading international trade fair organised by Messe Düsseldorf, wire Southeast Asia will provide a platform for companies presenting the latest wire and cable processing machinery as well as equipment and new technology and manufacturing solutions to a trade audience from the ASEAN wire, cable, automotive, construction, computer manufacturing and electrical engineering sectors.

A special feature at the event will be the USA group exhibit, organised by Messe Düsseldorf North America (MDNA) and supported by the Wire & Cable Industry Suppliers Association (WCISA).

wire Southeast Asia will be organised by Messe Düsseldorf Asia, the subsidiary of Messe Düsseldorf in Germany – with the support of the International Wire & Machinery Association (IWMA), the Italian Wire Machinery Manufacturers



▲ Visitors at the 2013 exhibition

Association (ACIMAF), the International Wire & Cable Exhibitors Association (IWCEA), the Austrian Wire and Cable Machinery Manufacturers Association (VÖDKM-AWCMA), the International Wire and Cable Exhibitors Association – France (IWCEA-France), the German Wire and Cable Machine Manufacturers Association (VDKM) and the Wire and Cable Industry Suppliers Association (WCISA).

When wire Southeast Asia was last held in 2013 in conjunction with Tube Southeast Asia, the two exhibitions attracted 387 exhibitors from 31 countries, and over 6,880 visitors from 55 nations – a 28 per cent increase compared to the 2011 staging.

**Messe Düsseldorf Asia – Singapore**  
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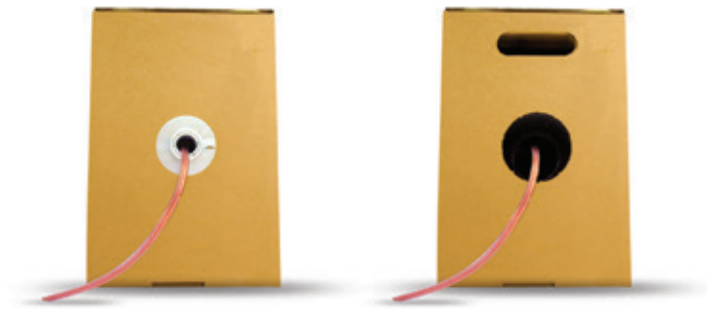
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▲ The X-Compound site at Kaisten, Switzerland

## New CEO at X-Compound

SINCE 2011 the compounding plant manufacturer X-Compound GmbH in Kaisten, Switzerland, has been a part of the German Troester Group. After a four-year transitional period, the original X-Compound founders and owners have now stepped down from their positions as managing directors.

Mr Raul Friedrich, a senior manager from Troester, has taken over the responsibility as CEO of X-Compound.

Furthermore, Frank Knittel has been appointed director of sales and marketing and Stefan Nägele has joined the company

as head of process technology and research and development. Both have many years' experience with continuous kneader compounding systems.

X-Compound was founded in 1996 and manufactures complete solutions in the field of demanding plastic compounding systems.

The compounding plants provide a high level of excellence with customised, individual solutions, high quality standards of components, failsafe handling, and a high degree of automation.

As a part of the Troester Group, which is a supplier of machines and complete plants for the cable, rubber and plastics industry, X-Compound offers multiple possibilities for synergies in the field of sales, marketing and manufacturing.

After a successful participation as a co-exhibitor at the K 2013 and the wire Düsseldorf fair last year, X-Compound will again participate with Troester at important fairs this year for the cable and plastic industry.

**X-Compound GmbH – Switzerland**  
**Website:** [www.x-compound.com](http://www.x-compound.com)



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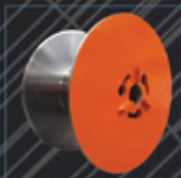
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▲ The VNT die from Ajex and Turner

## VNT dies for cable manufacturers

AJEX and Turner has introduced a new concept of VNT dies which are a completely new type of diamond dies. The cable being compacted passes through the hardness of diamond, but the cost of the VNT dies is less than the cost of a solid diamond nib. Here, lower cost does not indicate low quality; what matters is the raw material being utilised by cost-effective model technology.

Moreover, VNT dies run cooler because they have lower friction than other dies, so they do less damage to the microstructure of the conductors during the compacting process. This results in significantly lower electrical resistance in the cable conductors. Hence, conductors may be bright while maintaining fully compliant cable.

These dies are made with multi-layer coatings of nanocrystalline diamond composites on PCD/hard metal, which provides an extremely smooth surface with very low friction. The VNT die can be used for compacting copper, aluminium or aluminium alloys.

It is well known that the quality of a PCD die deteriorates over time due to two related factors. The relatively soft filler materials like cobalt and tungsten wear out, exposing the jagged edges of the diamond particles and increasing surface friction.

As this process continues, the work piece begins to 'pull out' bits of diamond material from the PCD material and this is what causes the bore diameter to increase. By comparison, a VNT die holds a +0 tolerance during its entire life. This is due to the extreme hardness of the nanocrystalline diamond surface.

When a VNT die fails, it is not like a tungsten carbide or PCD die in which a process of steady wear causes the die to go out of tolerance. A VNT die typically holds its diameter +0.00 for 600-900km of cable compacted. In some cases, the die will run for 1,000km of cable compacted.

The VNT die working life is between 15 and 20 times longer than carbide dies. The surface finish of the drawn conductor is also superior compared to carbide dies.

**Ajex and Turner – India**  
**Website:** www.ajexturner.com



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Learn More



## Second staging of wire South America

AFTER the successful premiere in 2013, Messe Düsseldorf and its partner Grupo Cipa Fieras & Congressos is organising the second staging of wire South America from 6<sup>th</sup> to 8<sup>th</sup> October at the Imigrantes Exhibition Center in São Paulo, Brazil.

The event will be supported by the International Wire & Machinery Association (IWMA), the Wire and Cable Industry Suppliers Association (WCISA), and the Italian Wire Machinery Manufacturers Association (ACIMAF).

The main exhibit categories at wire South America will include wire manufacturing and finishing machinery, process technology tools, auxiliary process technology materials, special wires and cables as well as measuring and control technology and test engineering.



▲ The entrance to wire South America in São Paulo, Brazil

Brazil's boom in the construction, automotive and consumer electronics industries has led to a marked increase in the demand for wire and cable products, and wire South America will provide a platform for international

companies to access this growing market.

At the first staging of wire South America in 2013, 173 exhibitors from 26 countries showcased their latest technologies for the

sector. Together with the concurrently held TUBOTECH trade fair, wire South America attracted about 15,000 trade visitors.

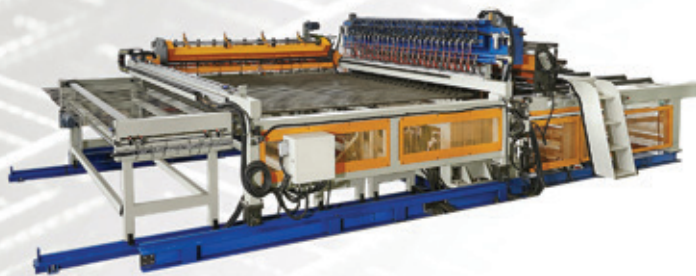
**Messe Düsseldorf GmbH – Germany**  
**Website:** [www.wire-south-america.com](http://www.wire-south-america.com)

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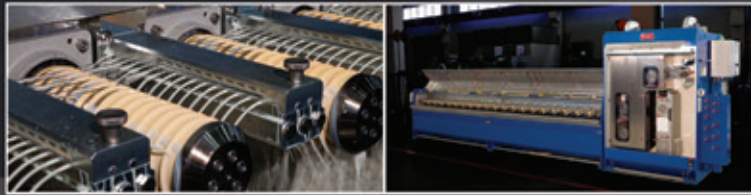
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## New technology centre opens

THE world's fastest secondary coating line came about when Rosendahl and Nextrom launched its new generation of loose tube lines, which is not only small in its footprint but also the first to beat the 1,000-metres-per-minute mark. But it didn't come without its share of investment.

Rosendahl and Nextrom have invested heavily to bring the high-speed production line to market, but the line itself isn't the only major improvements they have made. The companies have also invested in the production facility in Pischelsdorf, Austria.

Besides the three existing technology centres – one laboratory for cable production, one for battery machine manufacture and one clean room laboratory for optical fibre technology in Vantaa, Finland – a fourth one has been established for exclusive customer demonstrations in a highly professional environment.

The newly established technology centre is home to inspirations and ideas of visionaries and technologists and includes the opportunity for customers to see the running lines in demonstration. The facility covers 700m<sup>2</sup> for the set-up and testing of the newly developed production lines and includes a meeting room for technical workshops.



▲ The management: Johann Jäkel, Gerhard Jakopic, Ernst Altmann and Siegfried Altmann (from left to right)

Through the new technology centre, Rosendahl and Nextrom are developing all the processes that will make state-of-the-art cable manufacturing reality. Rosendahl Nextrom are pushing the limits of regular cable production and enabling customers to visit and see the performing lines themselves.

"Our new technology centre will allow us to innovate locally for our customers and promote those innovations to the world," said CEOs Siegfried Altmann and Gerhard Jakopic.

"Over the past decade, we have risen our R&D investment and expanded our global network of sales and service units to address customers' growing needs for breakthrough technology that we develop together with them. We see significant performance opportunities and having the best technology will ensure we maintain our quality in our solutions."

### African move

JDR, a developer and producer of steel and thermoplastic subsea production umbilicals and subsea power cables, has established a new service and maintenance facility in Port Harcourt and Lagos, Nigeria, in partnership with Royal Niger Emerging Technologies.

Under the agreement JDR will provide local content to the West African oil and gas market, with Nigeria as its first location for services in the region.

**JDR – UK**

**Website:** [www.jdrglobal.com](http://www.jdrglobal.com)

**Rosendahl – Austria**

**Website:** [www.rosendahlaustria.com](http://www.rosendahlaustria.com)

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EFFE 2015 single-drive  
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### STRIP & FLAT Single and Tandem Rolling Mills



#### APPLICATIONS:

Electrical Contacts - Medical - Superconductor - Watch Making - Wire Reduction - Flattening

#### MATERIALS:

- Precious Metals
- Brazing Alloys
- Welding Wires
- Bi and Trimetallic
- Special Alloys



## ICE's BMP hits the streets

ICE Cable Systems – which serves integrators both directly and via more than 50 distributors in North America and internationally – is now shipping its new Big Mouth Payout (BMP) bulk wire and cable box.

BMP incorporates four distinct design advantages that help the integrator run more efficiently on the jobsite.

The BMP box combines a 4" payout hole with a proprietary cable-winding pattern. According to ICE president Brian Rizzo, the payout is more than 20 times larger than what is currently available on the market today.

"Our payout and wind pattern help eliminate everyday pull-problems like kinking, knotting, recoil and tangling.

"Removing these obstacles makes a one-man wire pull – for example from atop a ladder – significantly easier," said Mr Rizzo.

Incorporated on the cable jackets are



▲ The BMP from ICE Cable Systems

ascending and descending foot-markers which make it effortless for the integrator to identify how much cable has been used and how much remains. The result is optimal usage of the entire wind and the elimination of scrap; it also solves the common problem of tracking usage, which according to Mr Rizzo can often be

difficult when more than one technician pulls from the same box.

To withstand abuse on the jobsite, the BMP box is comprised of an extremely durable water resistant cardboard along with dual-layer reinforced handles. According to Mr Rizzo the cardboard is burst-tested to withstand 21kg of force.

"BMP is a great example of ICE Cable's understanding of what's important to the integrator" said Wally Whinna, principal of Allnet Distributing and board member of the Catalyst AV network, which distributes ICE Cable nationally.

"Advantages like this make it easier for integrators to finish their pre-wire jobs faster and with less hassle."

All box cables (category, speaker, coax, alarm, control, etc) ship in a BMP box, many of which are available in runs as long as 1,000 feet.

**ICE Cable Systems – USA**  
**Website:** [www.icecable.com](http://www.icecable.com)

**TURN TO PAGE 60 FOR OUR COVERAGE OF WIRE RUSSIA**

# The Wire Drawing Standard

## Why Use Paramount Die?

**Productivity** - Maximize die performance by increasing machine utilization and decreasing production cost.

**Speed** - Achieve drawing speeds up to 45% faster than conventional cased dies.

**Efficiency** - Dramatically lower material and shipping costs.

**Consistency** - Highly efficient and automated production equipment allows us to provide premium quality solutions at a competitive price.



**PARAMOUNT DIE**  
DRAWING SYSTEMS FOR THE WIRE INDUSTRY

[paradie.com](http://paradie.com)

## Headcount trebles with third UK office

WESCO Distribution, an industrial supplier with an extensive offering of electrical, data communications, general maintenance, repair and MRO, has opened a third UK office and tripled its headcount within its data communication sales team to help support growing demand.

The new office in Uxbridge, London, offers a convenient southern location for meetings and complements existing Wesco sites in Manchester and Aberdeen.

"The last two years has seen strong investment in our UK operation which has expanded from servicing a single customer to now supporting 20 global brands and a community of 500 integrators across the UK, Ireland and the Netherlands," said Richard Eichhorn, sales director EMEA, data communication and security.

"The growth is in part due to our unique position as a distributor across the widest portfolio of critical data centre technologies backed by an in-depth set of services that help our partners differentiate

in a competitive marketplace and meet tough implementation challenges."

WESCO has expanded its range of data communications products and services including on-site project management, project schedule development, just-in-time inventory as well as highly tailored job staging including assembly and shipping.

"What our partners and customers are saying is that they want a distributor to be engaged for the entire lifecycle of the installation," said Mr Eichhorn. "Our strategy has been to develop and offer a set of value added sales and technical skills that provide a viable framework across every aspect of the project backed up by professionally executed e-commerce and logistical processes."

Alongside a mature channel community, a growing number of FTSE 500 companies are also using WESCO as a preferred supplier. As Mark Burgess, senior data centre engineer at Salesforce.com, said: "We have partnered with WESCO over the last two years to ensure fulfilment of

over 1,000 product lines to three separate locations across Europe.

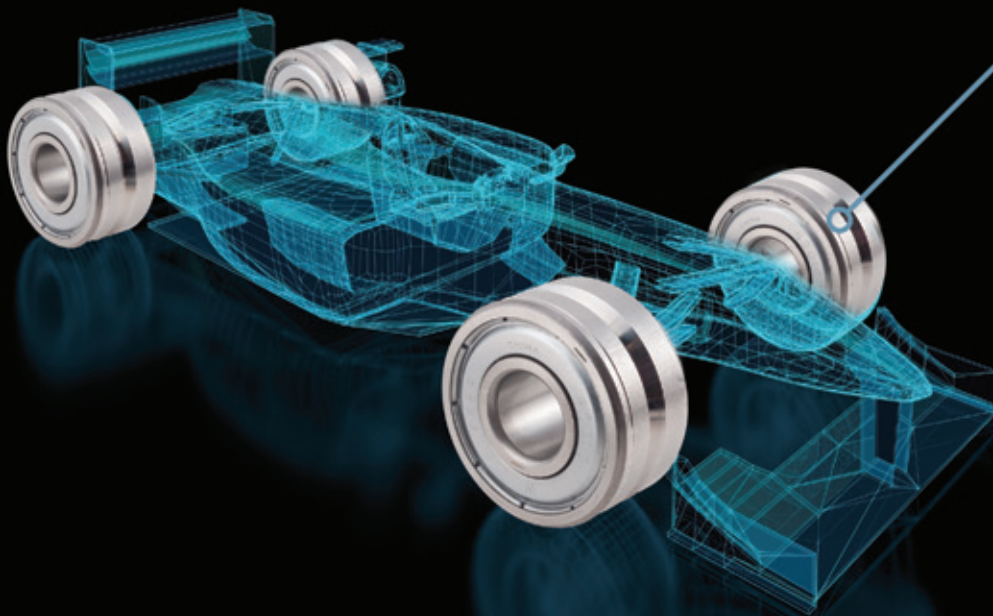
"The level of customer service has been second to none and the technical knowledge and strong vendor relationships combined with their global logistical capabilities have been crucial in helping us meet some challenging deadlines at projects across our state-of-the-art data centre facilities."

The success of the WESCO operation across the UK, Ireland and the Netherlands has also led to several exciting new vendor relationships.

"A great example of this is the decision last year by CommScope, one of the world's premier network infrastructure providers, to expand its UK distribution channel for the first time in over 25 years, resulting in WESCO becoming a fully accredited stockist and distributor," added Mr Eichhorn.

**WESCO Distribution – UK**  
**Website:** [www.wesco.com](http://www.wesco.com)

## Productivity wins







▲ New president Mike Canterino

## New Fluoropolymer president

FLUOROPOLYMER Resources, a supplier of reprocessed FEP, PFA and ETFE, has promoted Mike Canterino to president, succeeding David Ely who retires on 1<sup>st</sup> May.

Mr Canterino, who joined FRL in December 2014 as executive vice president, has already assumed his new leadership position while Mr Ely remains with the company to assist with a smooth transition of responsibilities until his retirement.

“While we will miss Dave’s subtle, calm approach, we are incredibly fortunate to have Mike now ready to step in and lead the company as we accelerate our plans for growth both in terms of technical innovation and expanded product offerings to our customers,” said Kevin Buchanan, CEO. “We all wish Dave the very best in his retirement.”

Before joining FRL, Mr Canterino served as vice president operations at Remeo Products, New York, USA, for over 20 years. Before that, he was manufacturing manager at Rockbestos Wire & Cable (now RSCC Wire & Cable), Connecticut, USA, from 1988-1996.

Mr Ely was named president of FRL in 2013 after serving as president of Chromatics, Connecticut, USA.

He had prior management and business development experience with ICI, LNP Plastics and DuPont Fluoropolymers, and has been active with the Society of Plastics Engineers.

**Fluoropolymer Resources LLC – USA**  
**Website:** [www.frlusa.com](http://www.frlusa.com)

## Driving Improvements in wire straightening



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## Wire drawing line for welding wire

TECNOFIL is a prominent market player in the wire industry, specialising in the production of low and medium carbon steel wires as well as the manufacture and supply of machines for the production of steel wire and wirebands.

Tecnofil is able to control production and deliver tailor-made solutions, starting from the specific needs of its clients.

The machine division produces every single part of the machines, from carpentry to high-precision mechanics, from electrical equipment to the software, following also the test phase.

Tecnofil will be at wire Russia, showing important innovations for both its wire and machinery divisions.

The exhibition will be an opportunity to announce the extension of the wire product offering to include zinc-aluminium wires, and to present the new TBL, its straight wet drawing line, now available also for welding wires and designed to bring the advantages of dry drawing system to wet drawing processes.

TBL increases the productivity of drawing plants while reducing the operation costs.

This result is achieved thanks to the exclusive design of the machine, which guarantees higher drawing speeds, drawing die lifespan (+35 per cent) and line efficiency (+30 per cent).

The best results can be achieved when drawing special materials like high/low alloy steels. In this case TBL working speed is seven times faster than traditional machines and grants flawless quality consistency.

TBL eliminates wire slip during wet drawing, reducing wire mechanical stress.

Moreover, each die and block is lubricated and cooled by dedicated high-pressure water sprays.

These exclusive features grant lower wire breakages, higher working speed and reduced die consumption.

Other advantages of Tecnofil TBL include:

- User friendly and highest operator accessibility for fast string-up
- Monolithic anti-vibration steel frame
- Wire drawing in one direction
- Heavy-duty bearings with exclusive waterproof system
- Fully adjustable reduction scale for maximum flexibility
- AC independent motors electronically controlled and perfectly synchronised
- Easy operator interaction with touch screen switch board
- Designed and successfully tested in intensive working conditions for more than three years

**Tecnofil SpA – Italy**  
**Website:** [www.tecnofil.net](http://www.tecnofil.net)



### CabWire 2015 world technical conference – a date for your diary!

The 7<sup>th</sup> biennial CabWire world technical conference will take place on Tuesday, 3<sup>rd</sup> November 2015 in Düsseldorf, Germany, home of the wire industry.



Dr Probst, retiring CEO of Leoni AG, will present a keynote paper and Arcelor/Mittal is preparing to host a visit for delegates to its rod mill in Duisburg on Wednesday, 4<sup>th</sup> November.

An evening event at a downtown Düsseldorf location will allow delegates the chance to network and socialise.

A great variety of opportunities are also available to promote your company's products and services at this conference, such as sponsorship and table top displays.



If you would like to be involved by presenting a paper at this exciting event, then forward by email a short abstract of up to 75 words to the IWMA office at [info@iwma.org](mailto:info@iwma.org)

Delegate bookings can be made via the conference website at [www.cabwire.com](http://www.cabwire.com)

[www.cabwire.com](http://www.cabwire.com)



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▲ *Galfan is commonly produced in-line with the galvanising bath*

## Taking galfanising off-line

COMMONLY, Galfan is produced in-line with the galvanising bath. Consequently, it requires space but it also imposes the use of one position per galfanised wire on your galvanising bath.

FIB has developed a technology that allows galvanising "off-line" of some galvanised wires in this compact solution, giving the advantage of flexibility in the manufacturing programme, and the number of wires in the galvanising line becomes independent of the Galfan programme.

This also allows the upgrade of existing galvanising lines with limited space.

**FIB Belgium sa – Belgium**  
**Website:** [www.fib.be](http://www.fib.be)

## Optimising systems order

Steel Dynamics has confirmed an order with Tenova Goodfellow for the supply and purchase of two EFSOP holistic optimisation® systems for both EAF batteries at its SDI, Butler, Indiana, USA, steelmaking facility.

Tenova's innovative technology and value proposition will provide full spectrum evaluation via upstream and downstream offgas analysis and water detection technology for all four EAF shells.

The scope of supply will also include newly developed optical sensors for the measuring of off-gas velocity and temperature.

The order, which was received in December 2014, included project work that was scheduled to begin immediately with the manufacturing of hardware and sensors at Nova Analytical Systems, TGI's Hamilton, Ontario, Canada, production facility. Installation and commissioning of the systems was scheduled to take place by April.

**Tenova Goodfellow Inc – Canada**  
**Website:** [www.tenovagroup.com](http://www.tenovagroup.com)

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Our Borlink™ technology creates the innovation links that secure world-class, step-changing solutions and benefit the whole industry from energy generation at the wind farm all the way to your home. Our cable solutions enable the undergrounding of more cables for more reliable energy supply from sustainable sources, reducing blackouts.

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## Boost for trade fairs in Middle East

THE two trade fairs Tube Arabia and Arabia Essen Welding & Cutting, a joint project of Messe Essen, Messe Düsseldorf and Al Fajer Information & Services, received a further boost through an additional event, Metal Middle East, in Dubai, UAE, in January.

The fifth Tube Arabia, the second Arabia Essen Welding & Cutting and the newly acquired Metal Middle East attracted 176 exhibitors from 21 countries, adding up to an important international trade and contact platform for the industry and for the future market of the Middle East and the United Arab Emirates.

A total of 3,541 trade visitors went to the Dubai International Convention and Exhibition Centre. Thanks to the parallel character of these events, numerous comprehensive solutions were offered for the requirements of this growing regional market, while also creating synergies on the visitors' side. Moreover, visitors were shown all the latest innovations in foundry, metalworking and thermal process engineering.

The United Arab Emirates and the Middle East are a highly attractive market for companies and investors alike. As major efforts have been made in the Gulf region to improve its transport infrastructure, the steel industry can look forward to substantial growth.



▲ The official opening of Tube Arabia and Arabia Essen Welding & Cutting in Dubai, in January

The projects which are now well underway include extensions of metro networks, multibillion-dollar road construction projects, numerous bridges as well as capacity expansions of harbours and airports, to name but a few.

Set against the background of EXPO 2020 in Dubai, projects in local transport and air traffic are of particular significance. In all, the Gulf states are investing US\$330

billion in the development of regional airports. All these projects and a booming gas and oil industry are producing an exponential increase in demand for manufacturers of steel products and tubes and for the latest in welding technology.

Metal Middle East was supported by VDMA's (German Engineering Federation) Foundry Machinery, Metallurgical Plants and Rolling Mill specialist associations as well as the Thermo Process Engineering specialist association, CECOF (the European Committee of Industrial Furnace and Heating Equipment Associations), CEMAFON (the European Foundry Equipment Suppliers Association) and EUnited Metallurgy (the European Metallurgical Equipment Association), while Arabia Essen Welding & Cutting had the support of DVS (the German Welding Society).

The Federal German Ministry of Economics and Technology (BMWi) was again an official participant of all three events, providing German enterprises with the platform for a presentation of their products and innovations in a joint pavilion.

As organisers of the world's leading trade fairs GIFA, METEC, THERMPROCESS and NEWCAST, Messe Düsseldorf is now contributing its expertise in this field to the Gulf region by organising its own trade fair.

### Longest HVDC link at record capacity

ABB will supply on-shore HVDC converter stations and the cable system to facilitate the first ever interconnection between the Norwegian and German power grids. The link will be 623km long, thought to make it the longest HVDC connection in Europe. Commercial operation is scheduled to begin in 2020.

The contract has been awarded by a consortium that includes the utilities TenneT and Statnett. NordLink will be key in connecting Norway with Germany and has been designated as one of the European Commission's projects of common interest to help create an integrated European Union energy market.

It will increase energy security in both countries and support the integration of renewable energy into the countries' grids by allowing surplus wind and solar power produced in Germany to be transmitted to Norway, and hydroelectric power to be transmitted in the opposite direction. The link will transmit power at a record capacity of 1,400MW.

ABB will design, engineer, supply and commission two 525kV 1,400MW converter stations, using its voltage sourced converter (VSC) technology, HVDC Light®. One station will be situated near Tonstad in southern Norway and the other near Wilster in northern Germany.

As part of the project, ABB will also design, manufacture and install a 525kV mass impregnated cable system in the German sector, to include 154km of subsea and 54km of underground cable.

**ABB – Switzerland**

**Website:** [www.abb.com](http://www.abb.com)

**Messe Düsseldorf GmbH – Germany**  
**Website:** [www.messe-duesseldorf.com](http://www.messe-duesseldorf.com)

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... and Shielding Lines, Taping & Rewinding Lines



**Booth #  
FOB16**

## Customised solutions from Flymca and Flyro

FLYMCA is offering its customers all types of customised solutions to their stranding and cabling requirements, since the standard machinery for special equipment is adapted to the customer's requirements.

The company has many years' experience and the necessary facilities to study such projects with 3D designs and finite element analysis of parts and frames, as well as modern machinery for parts fabrication and testing equipment.

Each year investment is growing in order to deliver higher quality at competitive prices.

Many things have happened in the last three years since the inauguration of its new manufacturing facilities, including growth in the production capacity and turnover, which have both reached an additional 30 per cent each year.

The company has been able to manage 90 per cent of its own production by itself, investing in new machinery, designing through new procedures as well as educating its own specialists in new and modern techniques.

This means that the company controls every step of the production process with minimum sub-contracting.

There has been a growth of 15 per cent in the traditional cabling and stranding machines while special machines suppose a growth over 55 per cent.

During the last year, the power field has been the most important area where Flymca machines are delivered, and this



▲ Investment at Flymca and Flyro is growing each year

has accounted for up to 70 per cent of the company's production.

This year has seen a strong increase in the manufacturing of machinery for steel ropes.

Flyro also deals with all types of used machinery for the production of electric wires and cables, as well as steel wires and ropes, thus also giving its customers

possible solutions to their requirements or projects. Machines can be sold 'as is', checked or reconditioned.

Combinations of used and new machines can be arranged when required by customers.

**Flymca and Flyro – Spain**

**Website:** [www.flymca.com](http://www.flymca.com)

**Website:** [www.flyro.es](http://www.flyro.es)

## Marine centre and Crown Estate performance report on subsea cabling

The European marine energy centre (EMEC) and the Crown Estate have published a report on the performance of subsea cabling in high energy environments to support the development of commercial wave and tidal energy sites.

The key aim of the subsea cable lifecycle study is to improve the industry's understanding of how best to specify and manage subsea cables for wave and tidal energy projects, by investigating how the cables installed at the EMEC test sites in Orkney have performed since installation.

With its first cables installed over ten years ago, EMEC has collected considerable data from numerous routine ROV and inshore dive surveys undertaken to examine structural integrity, as well as electrical cable testing.

During the study, this data was reviewed in relation to installation methods, faults and operational life of the cables.

Matthew Finn, senior business development manager, explains: "EMEC has built up a colossal amount of data since we set up the test centre 12 years ago.

"We're delighted to see our data put to use across other projects that will support the development of the nascent marine renewables industry."

The report concludes that in sites with high tidal flow the greatest risk to subsea cables is the effect of cable strumming (vibration) caused by the flow of water past the cable.

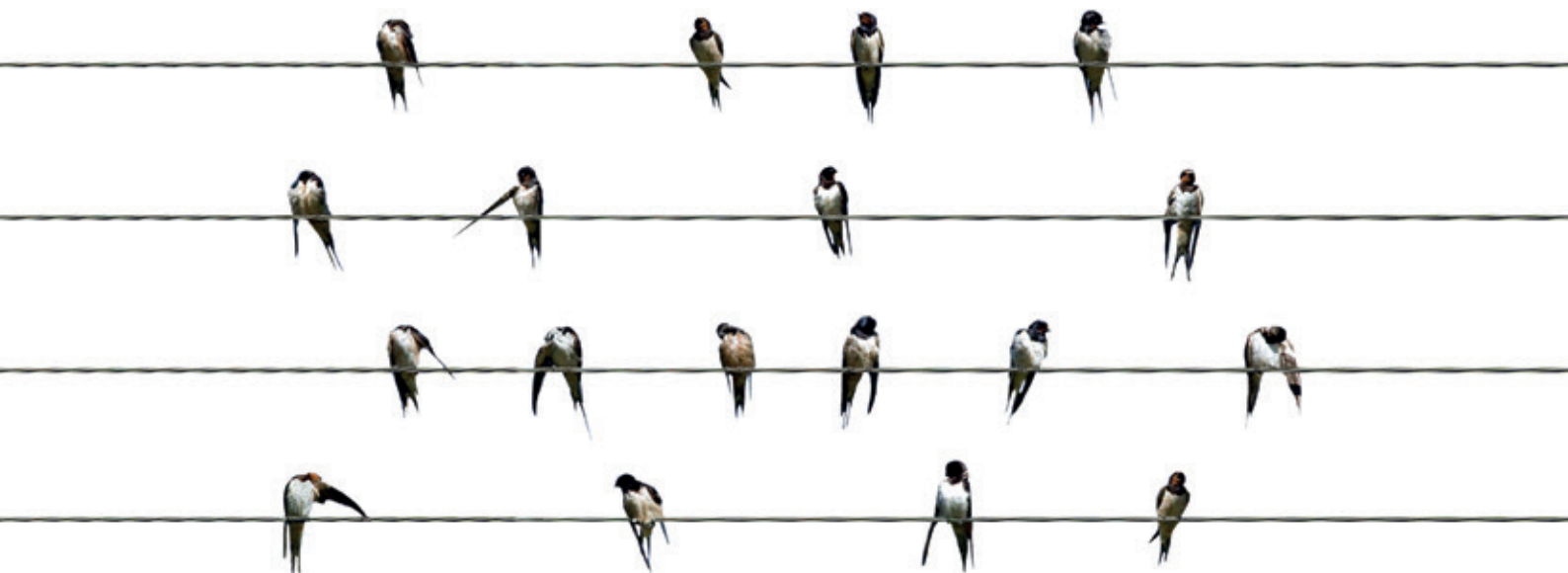
Key recommendations include calculations to assess the risk of strumming at an early stage; detailed site surveys and optimising the cable route to avoid key risks; and protecting the cables with armouring in high energy environments.

**European Marine Energy Centre – UK**

**Website:** [www.emec.org.uk](http://www.emec.org.uk)

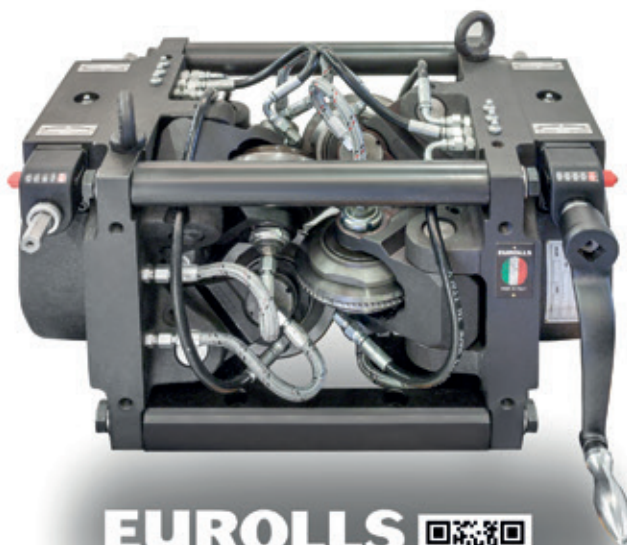


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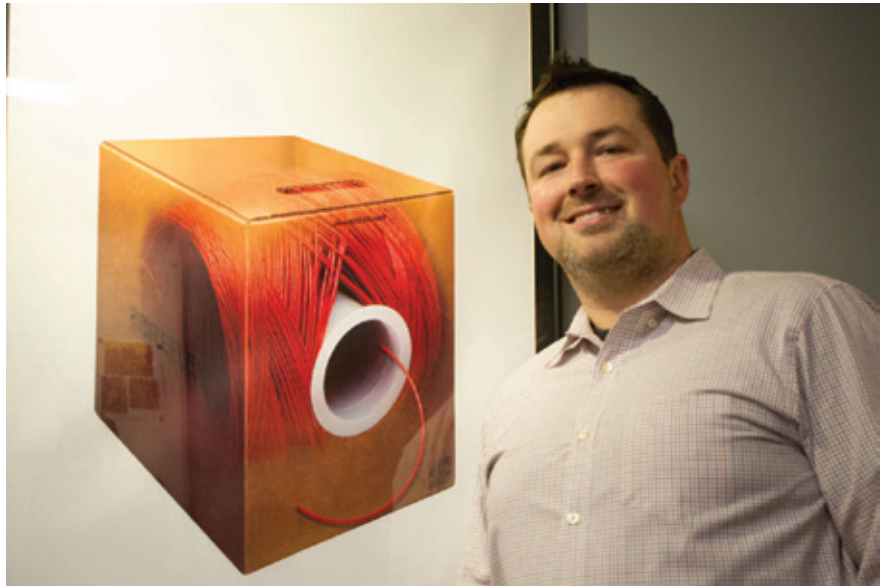
## Anti-counterfeit campaign

REELEX Packaging Solutions – inventor of the Reelex Packaging System which incorporates a specialised cable coil wind-pattern and payout dispenser – is embarking on an anti-counterfeiting campaign aimed at educating installers of the perils of using fake Reelex packaging systems and non-compliant cables.

The company has also vowed to continue to pursue measures against wire and cable brands that violate its patents and trademarks.

Reelex is a patented, trademarked method of winding cable into a figure-eight coil that, in turn, does not rotate during payout. This approach dates back to the Second World War as a method for US soldiers on the front lines to more efficiently run wire from their backpacks. Today, the Reelex coil hugely benefits bulk cartons of LAN and low-voltage cables across AV, security and electrical channels, most especially for installers conducting one-man wire-pulls.

In optimising each Reelex coil, factors such as gain, payout hole control and the density of the wind, along with progressive coil tension, are all instrumental in producing tangle-free packages. Void of any moving parts, the Reelex coil dispenses from the inside-out with a clear path, thus avoiding the twists, tangles and snags that plague fake



▲ Timothy Copp, of Reelex

bulk wire cartons. This unique coil can only be produced via unique, licensed software on a specialised Reelex machine purchased by a wire/cable manufacturer.

“Counterfeit boxes do not use the same technology as our licensees use,” said Timothy Copp, vice president of business development at Reelex. “It is important that the installer understands there are genuine Reelex boxes and there are knock-off boxes, and when the package

isn't genuine, it's very likely the cable isn't either. This leads to problematic wire-pulls; additionally inferior cable leads to the installer potentially having to re-wire the job in the future.”

“The best way for an installer to know they are using genuine Reelex technology is to look for the Reelex trademark printed on the box. The contract with our licensees says that the Reelex mark is required to be printed on all boxes utilising our technology,” Mr Copp added. This is to clearly identify to the installer that they are unquestionably getting a genuine product that will work as intended. It also assists Reelex in legally bringing potential infringement cases to court.”

The company has created a video that depicts their patented packaging systems and how to identify genuine Reelex-enabled cartons. It can be found on the Reelex website.

“Counterfeit and substandard LAN and other low-voltage cables are an ongoing issue in the industry, evidenced by educational initiatives and other actions being pushed by the Communications Cable and Connectivity Association (CCCA) and UL,” added Mr Copp.

“Reelex is wholly committed to protecting its licensees' investments in genuine patented and trademarked Reelex® packaging technology. These measures include legal action against patent offenders, restrictions on importation of patent or trademark-infringing products, and more.”

**Reelex Packaging Solutions – USA**  
Website: [www.reelex.com](http://www.reelex.com)

### Madem comes out on top

Madem Gulf Industries ended the 2014 customer satisfaction survey with 38 wire and cable manufacturing customers in Middle East, Asia and African countries.

The company received 23 (60 per cent) response polled in three categories: bad, good and very good, with 100 per cent of responses falling into good and very good categories. Madem Gulf polled the following services: claim response, quantities shipped and received, documentation, deliveries, quality inspections, performance and packing.

“In the fourth anniversary of our IMS certification we can realise the solidification and maturity of our process through the results achieved from our customer survey for the year 2014 which has once again given us a 100 per cent customer satisfaction feedback as achieved in the past three years,” said Cristian Outeiral, operations manager.

“At Madem Gulf Industries, we set a high quality standard at all levels of our operations so as to meet our customers' quality requirements and expectations which is reflected in the results of the survey. We wouldn't have been able to achieve this sustainable and consistent customer satisfaction level without the dedication and efforts of our highly efficient and trained team here who are the real driving force behind our success.”

Adel Abdullah Mohammed, general manager, said: “It is indeed a testament of our efforts and dedication towards the effective and active sustenance of our quality policies that has resulted in achieving 100 per cent customer satisfaction for the third consecutive year running.”

**Madem Gulf Industries – Bahrain** Website: [www.mademreels.com](http://www.mademreels.com)

## Farmers lobby for undersea cables

NATIONAL Farmers Union of Wales (NFU Cymru) is calling for transmission cables from Wylfa to be laid under the sea bed to Deeside, rather than using overhead and underground cables across the Welsh island of Anglesey as detailed in a recent meeting with National Grid.

Anglesey NFU Cymru county chairman Christine Jones said: "It was extremely disappointing to learn that even though undersea cable is technologically possible, National Grid is not going to pursue this option due to costs.

"We have now asked National Grid for figures to show the difference in capital to whole life costs and subsequent cost impacts on electricity bills of the various options considered in the original consultation.

"In the meantime National Grid is intent on pressing ahead and may be in contact with farmers and landowners as they carry out land referencing and baseline surveys and this is an ideal opportunity for those affected to once again question their choice. Also, with a general election looming, it is an ideal opportunity for farmers to raise any concerns with local parliamentary candidates."

A consultation on alignment options is



▲ The Wylfa plant in Wales

due later this year, followed by a statutory consultation in 2016.

"Our policy always has been and remains that the increased capacity requirement should be via an undersea cable from Wylfa to Deeside directly to a part of the

country with high electricity demand. We will continue to lobby for this on behalf of our members," Ms Jones concluded.

**National Farmers Union of Wales (NFU Cymru) – UK**

**Website:** [www.nfu-cymru.org.uk](http://www.nfu-cymru.org.uk)

### The Italian job for Interoute

Interoute has added a third route to access its pan-European fibre network. The new 1,300km stretch of fibre is part of Interoute's 7,000km Italian network, and part of its 67,000km pan-European platform.

The new route will provide high-capacity connectivity from Interoute's landing stations in Mazara del Vallo (Sicily) and Bari (Puglia), for submarine cables connecting to Europe. Cables from Greece, Malta, Tunisia and Israel have already come ashore at Interoute's southern Italian landing stations.

Interoute's new route is designed to support 8 Terabit/s of traffic, offering wavelength service up to 100Gbit/s. By offering three completely diverse routes from both Mazara del Vallo and Bari, to the major cities connected on its pan-European network, Interoute is reducing the vulnerability and risks associated with a single point of failure.

It also enables significantly shortened submarine cable routes by offering an alternative landing point in the south of Italy to those further afield, such as Marseille.

Renzo Ravaglia, Interoute EVP, service provider, said: "With this further expansion of its network Interoute is making southern Italy the most attractive landing point for all the submarine cables wanting to reach Europe, that come from the Far East, Middle East and Africa.

"With Cisco estimating that the Middle Eastern and African regions will continue to have the highest growth of IP traffic until 2018, predicting a fivefold growth with a compound annual growth rate of 38 per cent, the demand for broadband services looks set to keep rising."

**Interoute – Italy**

**Website:** [www.interoute.com](http://www.interoute.com)

### Cable fault research

Glasgow Caledonian University (GCU) is a partner in a new research project to design a system to detect and prevent high voltage insulation faults in subsea power cables.

Funded by the department of energy and climate change (DECC) offshore wind component technologies development and demonstration scheme, GCU lecturer and researcher Dr Alistair Reid will work on the nine-month project with High Voltage Partial Discharge Ltd (HVPD), Alstom Grid, and the University of Strathclyde.

Using its high voltage laboratories, used for testing and analysis of partial discharge data, GCU is receiving £56,000 of grant funding to propose new diagnostic solutions to online HVDC cable monitoring.

The research will be used by Manchester-based HVPD to develop a condition monitoring system for HVDC networks.

**Glasgow Caledonian University – UK**

**Website:** [www.gcu.ac.uk](http://www.gcu.ac.uk)



# Transatlantic Cable

## Steel

▶ The US Steel workforce is feeling the company's pain, aggravated by the inexpensive Chinese steel on offer worldwide

In an article filed from Hong Kong and generated there and in Pittsburgh and Beijing, the *Wall Street Journal* took notice of calls in the USA and Europe for tariffs on the excess products – sold abroad – of China's steel mills. Here are the main takeaways from the *WSJ* piece ("Why Chinese Steel Exports Are Stirring Protests," 15<sup>th</sup> March):

- ▶ "China's massive steelmaking engine, determined to keep humming as growth cools at home, is flooding the world with exports, spurring steel producers around the globe to seek government protection from falling prices.
- ▶ "From the European Union to Korea and India, China's excess metal supply is upending trade patterns and heating up turf battles among local steelmakers.
- ▶ "In the US, the world's second-biggest steel consumer, a fresh wave of layoffs is fuelling appeals for tariffs. US steel producers such as US Steel Corp and Nucor Corp are starting to seek political support for trade action."

So China's steel mills have stayed in high gear even as its economy is cooling. In her review of the *WSJ* piece, Lydia DePillis, a labour and business reporter for the *Washington Post*, suggested that it contains a lesson in how the global economy works in sometimes unexpected ways.

The example she chose is the effect the inexpensive Chinese steel flooding the world is having on one group of American workers – those employed by US Steel Corp of Pittsburgh. ("US Steel Plants Are on a Layoff Spree," 16<sup>th</sup> March)

## US Steel's 'pink-slip spree'

▶ Imports of steel into the USA have been on the rise for years now, going up 68 per cent in 2014 alone and contributing to a long decline in industry employment. A surging dollar and plunging energy prices have worsened the situation. Now, wrote Ms DePillis, "With consumption slowing in China, real downsizing has begun."

The 13<sup>th</sup>-largest steel producer in the world, US Steel has been on what the *Washington Post* reporter calls a pink-slip spree,

idling plants and cutting staff as part of an "ongoing adjustment" to accommodate for lower demand. Up to mid-March the company had laid off workers in Alabama, Texas, Ohio, Indiana, Minnesota and Illinois – cutting a few thousand from its 23,000-strong workforce in North America.

- ▶ In January, the steel giant announced it was closing its coke production operations in Granite City, Illinois, entailing a loss of 176 jobs. The largest business enterprise in the world when it launched in 1901 also temporarily idled one of the blast furnaces at Granite City.
- ▶ The company said as well that it would idle its pipe manufacturing plant in Lorain, Ohio, and send home 614 workers – casualties, at least for an interval, of weak demand from the oil industry.
- ▶ US Steel's Keetac iron ore plant in Keewatin, Minnesota, was set for an open-ended closedown as of 13<sup>th</sup> May, with the layoff of as many as 412 workers who mined the ore burned in the blast furnaces of Northwest Indiana's steel mills. A company spokeswoman told the *Minneapolis/St Paul Business Journal* (12<sup>th</sup> March), "We can't speculate on the duration of the temporary idling."
- ▶ While US Steel said it would continue to produce iron ore pellets at its Minntac plant in Mountain Iron, Minnesota, a planned expansion of the Keetac plant was put on hold.
- ▶ In its latest round of layoffs in Northwest Indiana, US Steel on 12<sup>th</sup> March let go 83 more workers at the Gary Works. All had worked at the sprawling mill, the company's largest, for under six months. The layoffs are permanent, a spokeswoman said of the probationary hires. With those cuts, US Steel had eliminated more than 780 jobs in Northwest Indiana to date.
- ▶ An editorial ("Show More Spine to Fight Steel Dumping," 15<sup>th</sup> March) in the *Northwest Indiana Times* noted that more steel is produced in Indiana than anywhere else in the USA – a distinction that the state has held for 34 straight years. But over that period, nearly 50,000 steel jobs have disappeared from Northwest Indiana.

In 2000 there were 26,700 steel jobs in the area, 39,900 fewer than in 1979; as of 2014, there were only 17,900 steel jobs. Through mid-March of 2015, another 1,000 steel jobs had been shed.

Like the policy agenda of the American Iron and Steel Institute, the *Times* editorial makes the case for laws that strengthen tariff enforcement and trade agreements that recognise the needs of the home-grown industry.

# Transatlantic cable

But Ms DePillis, the labour reporter, observed that these processes take a long time. "In the meantime," she wrote, "laid-off workers will have to figure out something else."

## Elsewhere in steel . . .

- In other news of US Steel, the company said on 19<sup>th</sup> March that it would invest \$277.5 million at its Fairfield mill in Alabama. A new \$230 million electric furnace that melts steel scrap will replace an ageing blast furnace that uses iron ore and coke. The furnace is expected to be operational by the third quarter of 2016.

As reported by Len Boselovic in the *Pittsburgh Post-Gazette*, a concurrent project is a plant to produce tube couplings for the energy industry. Between them, the company said, the new facilities will create 650 temporary construction jobs.

Work on both projects was scheduled to begin by midyear. Jefferson County, where the mill is located, provided economic incentives to US Steel.

- India overtook the USA to become the third-largest steel producer in the world with a production of 14.56 million metric tons (mt) in the first two months of the year. Data compiled by the World Steel Association (WSA) shows that the USA, third-largest global steel producer since 2010, produced 13.52 million mt for the January-February period, yielding its position to India.

India was the producer in fourth place for five years, behind China, Japan and the USA. *The Economic Times* (New Delhi) noted on 22<sup>nd</sup> March that, "interestingly, the USA snatched the third-place slot" from India in 2009.

While the gap in steel production between the two countries was just five million mt last year, the *Economic Times* observed that India may well retain its position vis-à-vis the USA for a while. Its present installed capacity of a little over 100 million mt of steel is set to be raised by new production facilities coming online in 2015.

## Energy

### A protracted drought in California costs money, imperils environmental advances, and prompts thoughts of climate change

"This unprecedented drought continues with no signs yet of letting up," Governor Jerry Brown of California said in a 17<sup>th</sup> March statement announcing a \$1 billion drought relief package and tighter restrictions on the use of water.

The drought, now in its fourth year, has had far-reaching effects – not least a reversal of progress in curbing emissions from power plants. As reported by *FierceEnergy*, the environmental non-profit Pacific Institute found that, between October 2011 and October 2014, a drought-related shift from hydropower to natural gas caused an eight per cent rise in such emissions. Over the same period it also made California's ratepayers spend \$1.4 billion more for electricity than they would have in normal conditions. ("California Drought Impacting Hydroelectric Output in a Big Way," 20<sup>th</sup> March)

The trend away from hydroelectric power in California dates to before the drought. According to Jaclyn Brandt of *FierceEnergy*,

Pacific Institute researchers found that, over the period 2007-2014, a reduction of 62,000 Gigawatt Hours (GWh) of hydroelectricity imposed around \$2.4 billion in extra energy costs on California residents.

In 2013, around 12 per cent of electricity in the state was powered by hydroelectric. Between the years 1983 and 2013, hydroelectric accounted for an average 18 per cent of power generation.

As noted by Ms Brandt, not much is being done to expand California's hydroelectric capacity. In the view of Pacific Institute president Peter Gleick there may be nothing that can be done. He pointed out that the state has few undammed rivers and little unallocated water.

What it does have are growing environmental, economic, and political constraints on the addition of hydropower capacity.

Even so, Mr Gleick believes that the hydroelectric information from the Pacific Institute usefully spotlights a significant consequence of the drought: the fundamental change in the way electricity is produced in California. In a statement accompanying publication he wrote: "We hope this report prompts a lively debate on how to factor in a changing climate when we plan for electricity generation."

### Even as hydroelectricity recedes in California, the state leads the USA in solar installations

With more than 60 per cent of electricity in California powered by natural gas, and hydroelectric providing around 12 per cent, the remaining energy production in the state comes from solar, wind, biomass, geothermal and nuclear. Even as hydroelectricity wanes (see "Drought," above), California was No 1 in the USA in new solar capacity installations in 2014.

The Solar Industry Energy Association (SEIA) ranks the states on the number of megawatts (MW) installed each, and the number of houses powered per megawatt of solar added.

Last year, California installed 4,316MW of solar power in more than a million homes. According to SEIA, California installed more solar in 2014 than the entire USA did between 1970 and 2011.

North Carolina, in second place nationally last year, installed 396.6MW of new solar in 43,000 homes: less than 10 per cent of California's showing. The leader in the Southeast, North Carolina accounts for more solar capacity than all other Southeastern states combined.

As reported in *FierceEnergy* by the same Jaclyn Brandt who supplied the drought/hydroelectric item, just behind North Carolina was Nevada with 339.3MW of solar installations last year.

According to SEIA, Nevada has more solar jobs per capita than any other American state, including California. ("Top Ten States for Solar Installation in 2014," 12<sup>th</sup> March)

Massachusetts and Arizona rounded out the top five with 308.2MW and 246.6MW, respectively, of new solar installed in 2014. From 2013 to 2016, more than 900MW of fossil fuel plants will come offline in Massachusetts, due in part to solar installations in the state.

In Arizona, all new utility-scale electric generating capacity in 2014 came from solar. Arizona is one of only four states with that distinction, along with Nevada, Tennessee and Vermont.

# Transatlantic cable

The other states that made it into the Top Ten for 2014 – with new solar installations ranging from 239.8MW down to 88.2MW – are New Jersey, New York, Texas, Hawaii and New Mexico.

## Technology

### ▶ Transparent solar panels hold promise for display screens and windows that could power mobile phones and buildings

“Solar energy is the future. The problem is, it’s been the future for a long time. And while progress has been made, using the sun as a primary source of power hasn’t really broken through.”

Sam Grobart of *BloombergBusiness* (22<sup>nd</sup> March) then went on to report a possible breakthrough in the form of see-through panels made up of solar cells that absorb only ultraviolet and infrared radiation – the invisible parts of the solar spectrum.

The totally transparent solar panels, thin as a laminate, are the brainchild of Miles Barr who, as a PhD student in chemical engineering at the Massachusetts Institute of Technology (MIT), developed invisible solar cells that could generate electricity. He was able to engineer the cells so that visible light could pass through while transmitting the solar energy.

Mr Grobart noted that the technology still has a way to go because the cells must become more efficient to prove cost-effective. But the prospect is intriguing: solar cells that could become a part of any glass or plastic surface.

They could invisibly cover the display of a smartphone, enabling the phone to charge itself under natural or artificial light. If the process were incorporated into window manufacturing, homes and skyscrapers could draw power from the sun without the spatial and aesthetic limits of the opaque solar panels in current use. (“See-Through Solar Is Tomorrow’s Threat to Oil,” 23<sup>rd</sup> March)

The inventive Dr Barr, now the CEO of Ubiquitous Energy, a Silicon Valley company he founded, hopes eventually to bring the see-through panels to market. Mr Grobart, for one, will be watching and waiting.

“If solar is the future,” he wrote in *BloombergBusiness*, “transparent solar may be the future that actually works.”

## Automotive

### ▶ Disillusioned with the Russian car market, General Motors is pulling out its Chevrolet and Opel brands

General Motors will stop production at its factory in St Petersburg, Russia, by midyear and will have halted production of Chevrolet cars through its joint venture with GAZ by the end of 2015. Also as reported by Greg Gardner and Alisa Priddle of the *Detroit Free Press*, GM will reel in its German-based Opel brand, which by the end of 2015 will no longer be sold in Russia.

The moves drastically reduce GM’s presence in Russia and will result in about \$600 million in special charges against

first-quarter earnings, the company said on 18<sup>th</sup> March. (“GM to Shut Russian factory, Opel Will Stop Selling There,” 19<sup>th</sup> March)

The *Free Press* reporters wrote that the moves show GM “has run out of patience” with a car market that not long ago was expected to be one of the fastest-growing in the world. They recalled the groundbreaking for an expansion of the St Petersburg plant, in 2012, at which the then-head of GM international operations bracketed Russia with China in terms of growth prospects.

“We had to take to take decisive action to protect our business,” said Karl-Thomas Neumann, Opel Group CEO, referencing Russia’s annexation of the Ukrainian territory of Crimea and the ongoing military conflict with Ukraine.

The company assured owners of Chevrolet and Opel vehicles that it that it would continue to provide parts and services, and GM’s joint venture with Autovaz will go on building the Chevrolet Niva.

Erik Gordon, a professor at the University of Michigan Ross School of Business, told Mr Gardner and Ms Priddle that he gives GM CEO Mary Barra credit for her willingness to acknowledge that Russia has not worked out for her company. He said: “In the past GM used to dither for years before making a decision like this.”

▶ Ford Motor Co, another of the Detroit Big Three, will stay the course in Russia although it has stopped making the current Ford Edge mid-size utility vehicle there and has not said when it will start producing the new model. Ford of Europe president Jim Farley told media at the Geneva auto show in March that, while Russia is volatile now, it has a strong middle class and Ford is committed to the region for the long term.

In 2012 Ford forecast auto sales in Russia of more than four million a year industry-wide. Sales were only around 2.5 million in 2014 and Mr Farley said he expected similar results this year.

### ▶ A star at home in the USA, the Tesla Model S electric sedan encounters a speed bump in China

“In 2014 Tesla Motors Inc sent 4,800 Model S sedans to China. Of those, 2,499 were sold and 2,301 were not.”

Paul Ausick, of the financial newsletter *24/7 Wall St*, was supplying background to reports from China, dated 16<sup>th</sup> March, concerning Tesla. These indicated that the Palo Alto, California-based maker of electric cars and electric vehicle powertrain components had fired 30 per cent of its Chinese staff.

The layoffs reportedly began before the Chinese New Year holidays in January and February and reduced the sales staff by half. The Chinese website *CarNewsChina.com*, cited by Mr Ausick, also said that layoffs had occurred in administration, tech support and procurement as well as in the marketing, public relations and legal departments. Before the firings, Tesla is believed to have had 600 employees in China.

Tesla CEO Elon Musk acknowledged weak sales in China in a letter to shareholders when the company reported fourth-quarter 2014 results. In January of this year, Tesla China sold just 120 cars, according to *CarNewsChina.com*. (“Tesla Fires China Staff as Sales Falter,” 17<sup>th</sup> March)

# Transatlantic cable

Mr Ausick wrote: "The issue is not so much that there are no buyers, but that Tesla has managed to step on its own toes as well as those of its potential customers. When the company introduced the P85D version of the Model S sedan last October, previous orders for the Model S were cancelled and new orders placed for the new version."

According to Mr Ausick, to offset the order cancellations Tesla raised its ordering fee of about \$2,400 to \$8,000. A requirement for a deposit of \$40,000 when the car was ready for shipment to China was imposed. The Model S costs about \$103,400 in China.

Chinese buyers balked at the payment changes "as the company's China office had predicted they would," wrote Mr Ausick – and orders began to dry up. Other reasons advanced for the poor showing include overly optimistic sales forecasts and the arrival of cars from the USA for Tesla stores in China that were never opened.

Chinese management suggested selling those cars at 20 per cent discount and using third-party sellers to help unpack the inventory. But, Mr Ausick wrote on *247wallst.com*, "Tesla headquarters apparently rejected both suggestions out of hand."

## Telecom

### Washington follows through on its pledge to make affordable high-speed broadband available to communities in rural areas

In its 23<sup>rd</sup> March announcement of the creation of the Broadband Opportunity Council, the White House noted that, with significant private investment, President Barack Obama's goal of providing 98 per cent of Americans with high-speed fourth Generation (4G) mobile broadband had been reached. The Council includes over 25 government agencies and components.

A particular concern for rural America was apparent in the concurrent announcement of \$35 million in broadband infrastructure loans by the US Department of Agriculture (USDA). This spotlighted three projects that will improve broadband service in portions of rural Arkansas, Iowa and New Mexico.

Southwest Arkansas Telephone will receive a \$25 million loan to upgrade portions of a fibre network and convert the remaining portions of a copper system to fibre.

In New Mexico, Mescalero Apache Telecom will receive a \$5.4 million loan to upgrade portions of its system and provide fibre service to approximately 50 per cent of its territory.

The New Mexico loan has historical roots. It is the first that USDA's Rural Utilities Service (RUS) will have made under the Substantially Underserved Trust Area provisions of the Farm Bill of 2008. Those provisions amended the Rural Electrification Act of 1936 to make funding available to areas that historically have had difficulty receiving federal assistance.

Over the past year RUS has held a series of outreach workshops around the country to help tribal (Native American/American Indian) communities access RUS broadband programmes.

Iowa's Minburn Communications is to receive a \$4.7 million loan to upgrade its copper network to fibre, and to provide subscribers with voice, broadband and video service.

According to Federal Communications Commission (FCC) data, in 2014 RUS awarded \$228 million to improve telecommunications service for 83,000 rural customers.

## Business

### A White House initiative to curb corporate tax avoidance has prompted a surge in foreign acquisitions of American firms

The law of unintended consequences seems to be operating in the matter of an action taken by the USA to prevent domestic companies from exploiting a loophole in the tax code that enabled them to sharply cut their federal tax bills.

In September the US Treasury all but eradicated the tax-inversion deals whereby an American company could gain the benefit of a corporate tax rate lower than the current 35 per cent by acquiring a rival from a lower-rate jurisdiction and moving the combined group to that country. But this has had the perverse effect of leaving many American groups vulnerable to foreign takeovers.

In fact, there already has been a steep rise in takeovers. Citing data from Thomson Reuters, the *Financial Times* (London, UK) reported that, since the crackdown on tax inversions, some \$156 billion in inbound cross-border US deals has been announced. This compares with \$106bn in the same period bridging 2013-2014 and \$81bn in that period a year earlier.

Through the first quarter of this year, foreign buyers announced \$61bn worth of USA acquisitions, an increase of 31 per cent on 2014 to that point and the strongest start to a year for inbound cross-border deals since 2007, according to Thomson Reuters. ("Tax Inversion Curb Turns Tables on US," 15<sup>th</sup> March)

Parsing the data on *ft.com/intl*, David Crow and James Fontanella-Khan in New York and Megan Murphy in Washington noted that "by far the biggest acquirers" have come from countries with lower tax rates, such as Canada and Ireland, which have announced \$26bn and \$22bn in M&A [mergers and acquisitions], respectively.

This highlights the competitive advantage now enjoyed by their companies. Before, Germany and Japan accounted for the biggest buyers of US companies.

► If the administration of President Barack Obama is feeling any chagrin over these results of the tax inversion initiative, it is not apparent. "The targeted anti-inversion action we took last year removed some of the economic benefits of inversions," a Treasury spokesperson told the *FT* reporters. "But the only way to completely close the door on inversions is with anti-inversion legislation, and we have consistently called on Congress to act."

But gridlock in Washington means that the call for a comprehensive overhaul of the tax code will almost certainly go unheeded. Meanwhile, several American companies – having stopped the repatriation of overseas revenues to avoid taxation at home – have built sizeable cash reserves outside the USA. It may occur to their managements that acquisition by a foreign company would give them ready access to their stashes.

Dorothy Fabian – USA Editor



▲ The BM 1250 from SAMP

## Precision and quality

FOR over 70 years SAMP has been developing and producing wire and cable manufacturing machines, which are synonymous with precision and quality of the final product all around the world.

Extensive research and the continuous improvement of existing technology recently led to the development of the new SAMP double-twist bunching machine platform, which is designed for reels with a flange diameter in the range of 250-1,250mm and up to a total weight of 4,500kg when filled (in case of copper strand).

In developing the new platform, the targets were:

- Energy consumption reduction due to the implementation of low energy consumption bows
- Ability to run the machine without human intervention thanks to the SAMP automatic traversing system, including:
- Automatic detection of the reel dimensions
- Automatic traversing adjust
- Programmable strand tension by load cell dancer
- Low preventive maintenance
- Pay-off system integration with wire break detection
- Energy efficiency architecture for high power factor ( $\cos\varphi$ )
- Unique drive and system control platform for all machine types
- Integrated motor power unit installed inside the cradle for electronic machines
- Communication based on safety integrated industrial wireless technology

In the electronic series the drive system is based on an integrated motor power unit (IPU), installed inside the cradle. The drive system is supplied from the outside through a bus whereas all communications between the external control cabinet and the motors is based on safety integrated industrial wireless technology.

The models BM 630 E, BM 800 E and BM 800 C have the IPU fully integrated

in one unit (motor and drive), while the BM 1250 adopts standard motors with drives installed in a cabinet on the cradle. Due to the compact structure of the slip-ring and brush-holder system, maintenance operations are reduced to a minimum.

For all bunching machines, SAMP designs its own bows which are aimed at:

- Reducing energy consumption thanks to the aerodynamic shape
- Minimising the wear of eyelet and wire path
- Diminishing the damage of wire surface, important for stranding electroplated wires (ie tinned, nickel plated copper, etc)
- Decreasing the damage of insulated cores surface
- Open bows are available with carbide or ceramic eyelets or rollers for bare and coated wire, aluminium wire, bare strands and insulated cores

**SAMP – Italy**

**Website:** [www.sampsistemi.it](http://www.sampsistemi.it)



# COMPETENCE AND INNOVATION

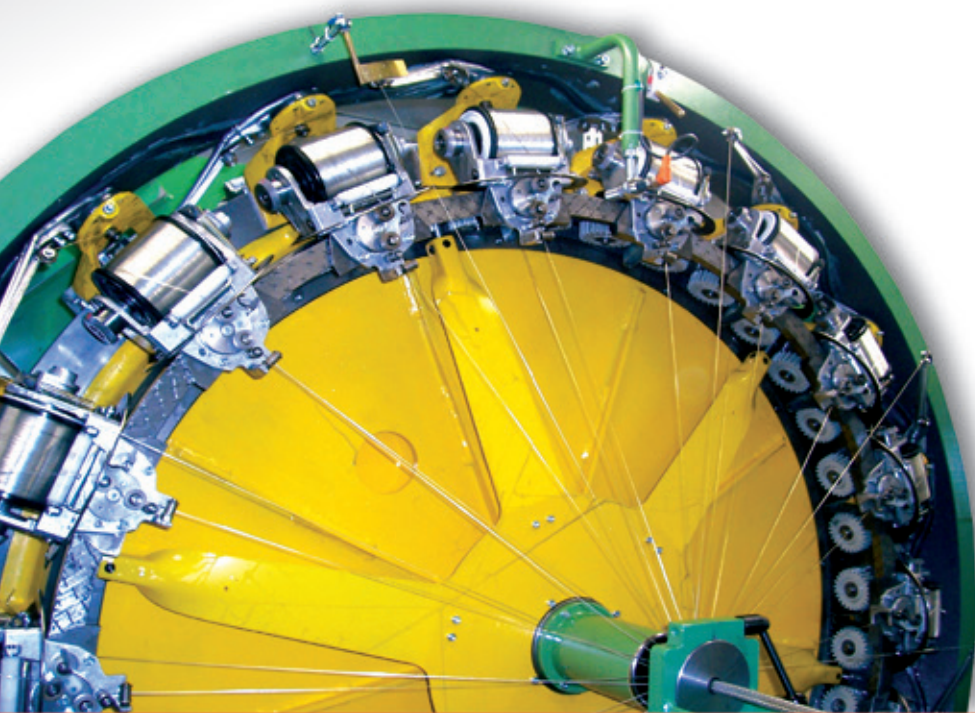
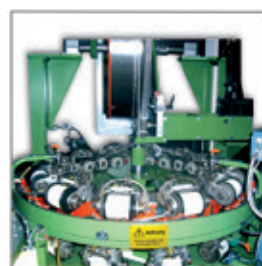
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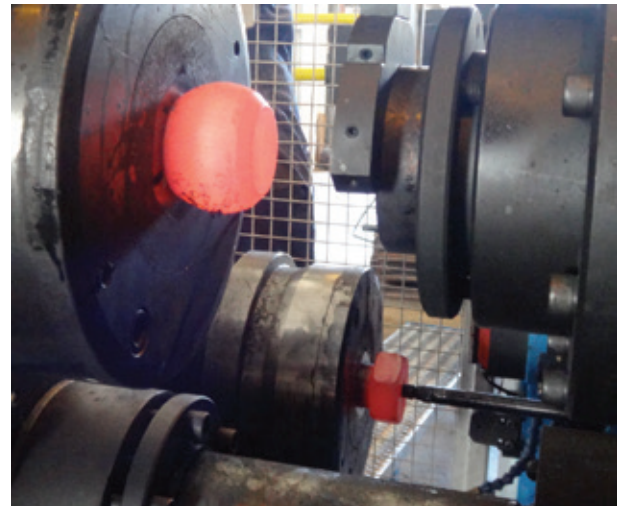
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## Fasteners return for owner

DAVID Wiesenfeld, founder and owner of Videx Machine Engineering, started his way in the fastener industry 50 years ago, as a plant engineer in an Israeli fastener plant. He gained his experience in hot forging at that time and had always dreamed of returning to this business.

His dream was fulfilled last year and Videx has added hot forging lines to its portfolio. The Videx hot forging lines are the first fully automatic lines for long and large bolts.

The forging machines are available in 300, 400 and 500 metric tons, covering the thread range of M-20 to M-48 (¾" to 2") in the smallest machine and up to M-80 (3") in the largest machine. The length range is 200-1,000mm (8"-36") under the head. The hex is formed in a closed die and it does not need trimming. The production rate is four to six parts per minute.



▲ Videx hot forging lines are a dream return to his original business for Videx owner David Wiesenfeld

The complete line consists of the following machines:

- Impact cutter, cutting long bars to length
- Chamfer machine, accepting cut-to-length bars from the impact cutter or from a one-row magazine
- Extrusion machine, extruding the chamfered side
- Induction heating machine (not made by Videx)
- Forging machine with solid die, double blow, with 300/400/500 metric tons capacity

The forging machine has five stations – one feed station, two forging stations and two ejecting stations. The chamfered and extruded bars are fed into the die by a pneumatic piston. Then, the dial indexes the parts to the first forging station, which upsets the parts and breaks the scale. In the next station, the hex is formed in a slide-closed die.

After heading, the parts are indexed to the ejection position, where they are ejected to a conveyor which takes them out of the machine area.

The machine is supplied with a spray system for cooling and lubricating the die and punch. Additionally, Videx offers the machines as self-standing independent units.

**Videx Ltd – Israel**

**Website:** [www.videx.co.il](http://www.videx.co.il)

# Wire cleaning – the dilemma that GEO is solving for the industry

WHEN looking for a cleaning system for wires and cables, etc, you can often be faced with a dilemma.

Which method, in general mechanical or wet-chemically, is suitable for the desired surface quality?

Budget or available space is limited, and the range of manufacturers of in-line cleaning systems as well as the current market solutions is manageable. The appropriate method is difficult to determine at first glance.

As a result there is often an attempt to construct and implement your own solutions only to find that the outcome is, despite intense input of time and material, inadequate.

Basically, the definition of the cleaning target and the analysis of the surface texture should be at the beginning of the search. Only when these points are defined can the choice of the suitable method and, if necessary, a suitable cleaning agent, be carried out.

As mentioned, usually a subdivision in 'mechanical cleaning' and 'chemical cleaning' is made, whereby nearly all mechanical cleaning methods can be combined with the chemical cleaning.

In 'mechanical cleaning' the contamination is removed by the mechanical frictional force of normally solid cleaning materials such as brushes, textiles and microfibres. To remove gross contamination from the wire surface, cleaning with brushes or textile materials is very effective.

Since the surface characteristics of the wire are far from ideal due to, for example, fine cracks and defects, these methods quickly reach their limits.



▲ Many factors should be considered when choosing the appropriate cleaning method

'Chemical cleaning' means, in most cases, that a fluid exposure performs the cleaning. The performance of these methods is considerably improved by increasing the velocity of the liquid by means of high pressure, ultrasonic or steam relaxation.

Cleaning processes with liquids, supported by ultrasonic, high pressure or steam, can substantially meet the challenging task of removing dirt even from the smallest surface defects.

Finally, the effectiveness of the cleaning process depends on how targeted the cleaning power (force or impulse) can be applied to the contamination for a certain time.

Since the choice of the appropriate

cleaning method is determined by many other factors, a comprehensive analysis of all parameters should be undertaken. This is precisely the approach that GEO-Reinigungstechnik GmbH has selected.

For the last two decades GEO has explicitly dealt with the cleaning of continuous profiles such as wires, ribbons, strands and cables.

The procedures can be tested under near-production conditions at GEO's test laboratory, and from the knowledge gained, suitable solutions can be selected and implemented.

**GEO-Reinigungstechnik GmbH – Germany**  
**Website:** [www.geo-reinigungstechnik.de](http://www.geo-reinigungstechnik.de)



## 850°F gas-heated oven

NO. 791 is a gas-heated, two-zone belt conveyor oven from Grieve, currently used to stress relieve heavy-duty steel springs. This unit has a maximum operating temperature of 850°F and workspace dimensions of 48" W x 360" L x 15" H.

The conveyor includes a 4ft-long open belt loading zone, 2ft-long insulated unheated entrance vestibule, two 15ft-long insulated heating zones with independent re-circulated airflow and temperature controls, 2ft-long insulated unheated exit vestibule and 3½ft-long open unloading zone.

Heat is provided by 1,600,000 BTU/HR installed in two modulating natural gas burners. Two 10,000 CFM, 7½ HP recirculating blowers provide vertical downward airflow over the workload.

All safety devices required by IRI, FM and NFPA Standard 86 for gas-heated equipment are included on this Grieve



▲ The unit has a maximum operating temperature of 850°F

oven, which also features a two-pen, 10" diameter circular chart recorder.

Other construction features on No. 791 comprise a 42"-wide, 1" x 1/2" flatwire conveyor belt with 1/3 HP motor drive, variable speed from 5.8 to 16.1" per

minute, 7" insulated walls throughout, a Type 304, 2B finish stainless steel interior and an exhaust hood over each end of the oven, equipped with a 12" diameter fan.

**Grieve Corporation – USA**  
Website: [www.grievcorp.com](http://www.grievcorp.com)

### Flexible compounds from Sylvin

Sylvin Technologies manufactures flexible vinyl compounds for the wire and cable and electrical markets that satisfy customers' performance, sustainability and regulatory goals.

Product features include the new 7844 series of electrical moulding compounds, which are approved to UL-94 with an HB flame rating and are compliant with California Proposition 65.

The 5409-92 compound is 125°C rated and suitable for SAEJ1127 and 1128 automotive wires. This material provides oil and grease resistance and increased low temperature flexibility.

Sylvin also has innovative bio-based compounds including the 6240-80 compound, which is non-phthalate and environmentally focused.

Bio-based products offer the same performance advantages

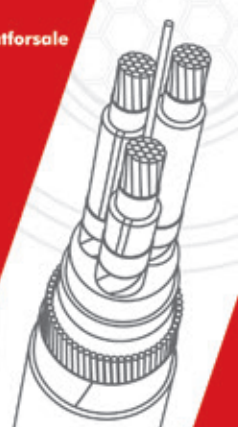
of general purpose flexible vinyl compounds. Sylvin's diverse product portfolio for the wire and cable and electrical markets includes RoHS, REACH and Prop 65 compliant compounds.

Several grades are UL and CSA recognised and numerous speciality grades have been developed for enhanced conductive properties, flame and oil resistance and improved low temperature flexibility.

Sylvin's on-site technical experts have developed custom formulations for a variety of wire and cable and electrical applications including automotive wire, speaker wire, battery terminal covers, blasting wire, booster cable, moulded cable assemblies and electrical connectors.

**Sylvin Technologies Inc – USA**  
Website: [www.sylvin.com](http://www.sylvin.com)

[www.bacuri.pila.pl/cableplantforsale](http://www.bacuri.pila.pl/cableplantforsale)



### FOR SALE

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  - DRUM-TWISTER
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- high voltage 110 kV laboratory
- approvals and certificates
- prepared infrastructure for catenary CV line

**Production capacity:** 2000 tons of copper, 2000 tons of aluminium and 2000 tons of compounds.

## New cables from Helukabel

HELUKABEL has added two new motor connection cables to its Topflex product family – the Topflex-EMV-UV-3 PLUS 2XSLCYK-J and the Topflex-EMV-UV-2XSLCYK-J – which have conductor temperature resistances of 90°C.

A higher current load rating is possible due to the improved conductor temperature resistance of 90°C.

This enables a smaller cross section compared to standard cables to be used when designing electrical networks in machines or systems.

In addition to the resulting lower costs and use of copper, the much smaller outer diameter offers advantages for installation in tight spaces due to an increase in the cable's maximum bending radius.

The Topflex-EMV-UV-3 PLUS 2XSLCYK-J is constructed using a three conductor plus three symmetrical ground configuration for improved concentricity and creating an electrically 'balanced' cable.

It is available in sizes 16 AWG to 500kcmil. The Topflex-EMV-UV-2XSLCYK-J uses a traditional three conductor plus full-size



▲ The new Topflex-EMV-UV-2XSLCYK-J

ground structure and comes in sizes 16 AWG to 350kcmil.

The latest Topflex cable products are jacketed using a special PVC compound, double shielded and use XLPE insulation on the inner conductors, which makes them suitable for applications that experience high voltage spikes and have long cable runs due to their low capacitance.

Both cables are suited for supplying power to frequency converters while ensuring electromagnetic compatibility (EMC) in systems, buildings and facilities from devices and operating equipment, which can emanate electromagnetic interference and cause impermissible malfunctions.

They are both designed for medium mechanical loads in both fixed and

occasional flexing installation in wet rooms or outdoors. They are suitable for use in the automotive, food and packaging industries, in environment technology, washing machines, handling devices, pumps, fans, conveyor belts and air conditioning devices. Their use in explosive environments is also possible.

Both Topflex products are UV resistant, self-extinguishing and flame retardant in compliance with DIN VDE 0482-332-1-2 and DIN EN 60332-1-2.

The low transfer impedance results in good electromagnetic compatibility. The materials used are free of silicone, cadmium and substances harmful to the wetting properties of lacquers.

**Helukabel – USA**  
**Website:** [www.helukabel.com](http://www.helukabel.com)

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## X-ray technology combined with high-resolution optics

THE purity of XLPE pellets, as they are used for the insulation of medium, high and extra-high voltages cables as well as for on- and offshore cables, is a decisive characteristic for the quality of the end product.

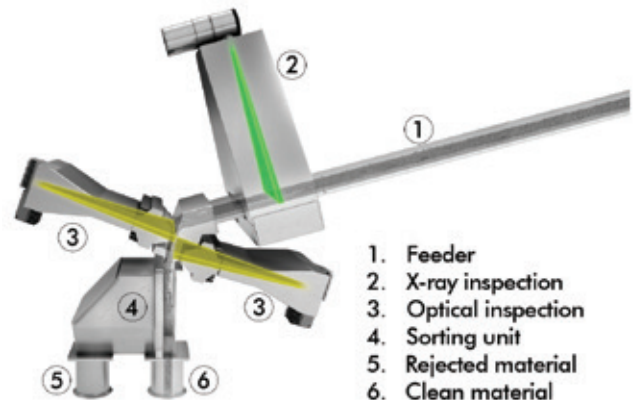
Damage caused by breakdowns due to contaminated material can quickly become expensive.

Therefore, the production of highly clean material as well as the continuous detection and sorting out of contaminated pellets before they get into the extrusion process is of essential importance.

With the Purity Scanner, Sikora provides a user-orientated system for a 100 per cent online inspection and automatic sorting of XLPE pellets.

The Purity Scanner intelligently combines X-ray technology with a dual-axis optical system. This allows the detection of metallic and organic impurities of 50µm in the pellet itself and on its surface. Contaminated pellets are separated and sorted out in order to prevent them from getting into the cable insulation.

Due to the specially developed X-ray technology, the Purity Scanner inspects coloured (eg black) pellets as well as semi-conductive XLPE material for impurities and sorts them out automatically.



▲ Functional principle of the Purity Scanner

The scanner not only features unique inspection technology, but also a novel transport system of the pellets. The feeding of the pellets is carried out via a vibrating ramp.

The material does not come into contact with the ambient air as the transport system is hermetically sealed. Absolute purity is guaranteed.

The system is designed for a throughput of 500, 1,000 or 2,000kg/h and can easily be integrated into existing feeding systems.

The system is typically installed between the hopper that is fed from the XLPE supply (octabin, bag or silo) and the hopper of the extruder, whereas the compound is fed by gravity.

The transport system of the scanner is hermetically sealed, ensuring that there is no risk that dust or other contaminants can get into the flow of XLPE pellets. In addition, the transport system can be operated with an overpressure.

The production process in the cable industry is also improved significantly and, thus, the safety and lifetime of the cable is increased.

When designing the Purity Scanner, it was the utmost priority to create a system that remains clean for a long period of time.

Accordingly, the transport system is integrated into an encapsulated housing with slight overpressure in order to prevent contamination entering the system from the outside. In the event that cleaning of the system is required, the system can be easily and quickly opened.

Furthermore, the cleaning concept was developed for customers who run different materials and want to clean the system when changing the material.

In addition to cleaning, there is the possibility to exchange the complete transport system with a cleaned, sealed system.

**Sikora AG – Germany**  
Website: [www.sikora.net](http://www.sikora.net)

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# Modular digital amplifier with Profinet interface

PROFINET is becoming the new standard interface for many applications because only one cable is necessary for most communication and switching functions.

In the field of force and web tension measurement, Profinet technology is gaining increasing acceptance.

With the new modular digital amplifier DCX, Haehne offers a Profinet interface for the conversion of up to eight measurement signals for high-speed transmission rates. The following are advantages of special significance in the industrial environment:

- Very fast cycling time for time critical applications
- Convenient set-up in Profinet networks
- Conversion of up to eight measurement signals and additional input signals

**Haehne Elektronische Messgeräte GmbH – Germany**  
Website: [www.haehne.de](http://www.haehne.de)



▲ The new DCX from Haehne

## OCG™ – extending the life of your overhead line conductors



OCG™ is a world-beating range of cold-applied greases for the protection of overhead line conductors. Fully compliant with all international specifications, the range delivers unrivalled protection against fretting, multi-metal corrosion and high temperature oxidation.

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## Braider and winders for medium heavy and heavy cables

THE increasing demand for cables with bigger diameters for infrastructure projects, shipyard cables, offshore cables, mining cables, etc, are also making greater demands for braiders suitable for bigger cable diameters and cross-sections.

Spirka Schnellflechter offers a comprehensive product portfolio of 24, 32 and 36 carrier braiding machines in vertical and horizontal applications as well as for combination machines like tapping units, payoff and take-up for reels up to 2,500mm flange diameter.

These braiding machines have an application range for cables up to 65mm and steel and copper wires up to 0.4mm diameter, and are also suitable for high tensile steel wires and thread tension up to 120 N.

One of most popular machines is the medium heavy braider type Dratex 2450 for cables up to 45mm diameter and copper and steel wires up to 0.4mm diameter.

The Dratex 2450 is suited to high-speed production in short and medium run lengths. It also provides the flexibility to move easily from wire applications to textile applications for both cables and hoses.

This braider can handle spools with a maximum flange diameter of 110mm with a capacity of 780cm<sup>3</sup>.

**Spirka Schnellflechter GmbH – Germany**  
Website: [www.spirka-schnellflechter.com](http://www.spirka-schnellflechter.com)



▲ The braiding head of the Dratex 2450



# Non-contact system for continuous measurement of conductor temperature

SIKORA has launched the Wire-Temp 6000, a system for precise online measurement of the wire temperature.

In cable production, it is often required to preheat the conductor prior to the extrusion process. Reasons might be to ensure optimum adhesion of the insulation on the wire, or especially in the insulation of wires for high-frequency and data transmission, in order to stabilise and control the foaming of the insulation.

The Wire-Temp 6000, which is also part of the Preheater 6000 TC, is now available as an independent online measuring device. The Wire-Temp 6000 measures the temperature of metallic conductors as well as the surface temperature of insulated conductors continuously on a non-contact base.

Designed for diameters from 0.3 to 5mm, or alternatively from 3 to 50mm, the system is laid-out for product temperatures up to 150°C, optionally up to 250°C. The measurement of the temperature is independent of the cross section, the material and the structure of the conductor surface.

The temperature measurement is made by means of a non-contact thermal image sensor in an infrared camera, which detects the conductor reliably and provides accurate measurements with no need for calibration.

Various communication interfaces are available for transmission of the measuring values to a Sikora processor system, the line control or a laptop.

The universal interface module for connections to RS485, RS232, Profibus-DP or industrial field buses such as CANopen, Ethernet/IP, DeviceNet, Profinet IO fulfils every demand. The interface module and all connection plugs are fully sealed for protection against water, dirt and mechanical damage.

**Sikora AG – Germany**  
**Website:** [www.sikora.net](http://www.sikora.net)



▲ The Wire-Temp 6000 from Sikora

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CABLES

## Wire cleaning for plating quality

THE PWC-S system performs wire cleaning and polishing in-line with a wire drawing machine at 6 to 12m/s (1,200 to 2,400ft/min).

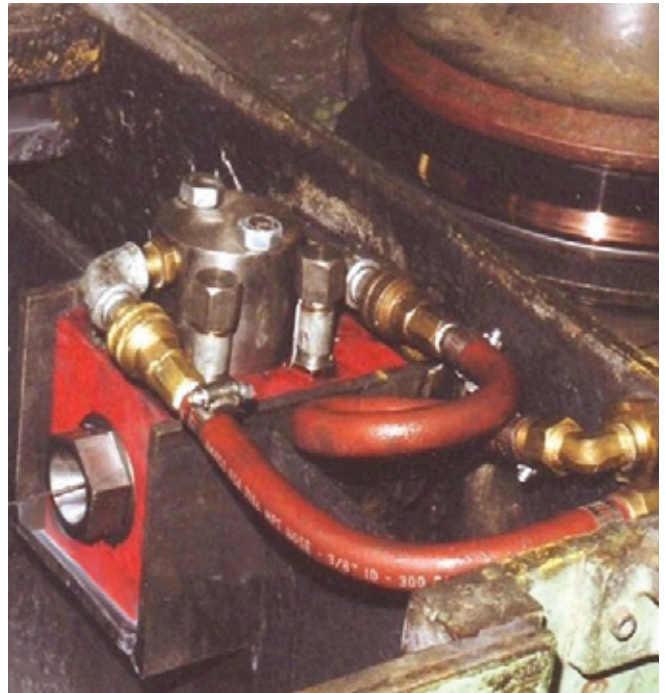
Exceptional cleanliness permits direct wire brass coating, copper coating, and wire cleaning prior to heat treatment and coating applications including patenting, annealing, painting, plastic coating, etc.

The system incorporates new technology which enables normal cold plant water to be converted into a unique multi-action high pressure wetting/displace/flush cleaning liquid used to clean drawn wire at high-speed, providing a smooth and glossy wire finish in plating quality.

The PWC-S system effectively removes lubricant residue from the base material and is particularly recommended for cleaning applications with wires drawn upon severe conditions resulting in increased heat and burned lubricant tightly bound to the wire surface and embedded in micro cavities.

The system can be used with an emulsion including a new rust preventive additive diluted at 3-5 per cent concentration. The PWC-S unit is compact and can be easily installed on the finishing/last block of a wire-drawing machine.

**Decalub – France**  
Website: [www.decalub.com](http://www.decalub.com)



▲ Wire cleaning by PWC-S system

**OUR COVERAGE OF WIRE RUSSIA STARTS ON PAGE 60**

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## Affordable, high-performance testing

MAGNETIC Analysis Corporation's new Minimac<sup>®</sup> 55 brings high-performance eddy current testing to a broad range of production applications for wire and cable, at an affordable price.

This is the first eddy current tester to offer the robust capabilities of MAC's Multimac<sup>®</sup>, in a powerful, compact design.

The Minimac 55 features MAC's proprietary Multimac performance, in a single channel instrument, with software controls for all functions including phasing, filtering and sensitivity, all while operating at speeds over 4,000fpm.

The test results are displayed in full-colour polar and linear mode showing real time, true wave form signals for easy review on a separate on-site monitor or at remote locations.

The track screen depicts the test product's length, with data on the line speed, end suppression, flaw tracking, piece count and alarm routing.

Linear strip charts and complete test data, as well as an unlimited number of settings,



▲ The new Minimac<sup>®</sup> 55 from Magnetic Analysis Corporation

can be stored, annotated and recalled from a library on the internal storage device or network.

When networked, multiple instruments can share the same library to ensure correct settings in multiple test lines. Setup and monitoring can be handled through a computer network, and reports with customer, product information, defect location, time, amplitude and phase, can be stored locally or on a network server for quick follow up and quality assurance.

The instrument is especially well suited for dedicated, continuous production line

testing where simple setup, without the need for constant operator adjustment, is desirable.

Once the optimum settings have been established, a lockout mode feature can be set to prevent unauthorised changes.

Defects and conditions that can be readily detected by the Minimac 55 include finding short surface and some subsurface defects such as laps, slivers and cracks in bar, wire and parts.

The Minimac 55 can also check continuity and locate welds in single and multi-conductor insulated wire and cable, and, using the MID model, detect magnetic inclusions.

MAC's broad range of encircling and sector test coils is available for use with the Minimac, which can also be configured for flaw or absolute mode, depending on the application. Coil platforms, including those with DC saturation for testing magnetic material are offered.

**Magnetic Analysis Corporation – USA**  
**Website:** [www.mac-ndt.com](http://www.mac-ndt.com)

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## Embracing a wide range of machines

Sket Verseilmaschinenbau's products embrace a wide range of machines and equipment for the manufacture of electric cable and steel wire rope. In addition to high-speed tubular stranding machines, cage-type stranding machines and central stranders, and drum twisters for the cable industry are also included.

In German, drum twisters are referred to as universal stranding machines, and this is a better description of the role for these machines – all-purpose machines which can be used universally. Drum twisters are usually to be found wherever cable is produced.

More specifically, the main areas of application for these machines are to be found in:

- the manufacture/production of energy cables out of round or sector shaped conductors (aluminium or copper)
- the manufacture/production of telephone cables, control cables and special cable
- the screening of medium and high voltage cables
- the armouring of energy cables with round or flat steel wires
- the production of Milliken conductors for high voltage and super high voltage cables
- the manufacture of offshore energy cables

Sket has been manufacturing and supplying drum twisters – a relatively recent machine addition – for over 50 years. The machines are tailored to the



▲ Sket has been manufacturing and supplying drum twisters for more than 50 years

product-specific requirements of the user.

Right from the planning stage the requirement priorities of the customer are taken on board and solutions are proposed which, after acceptance by the user, are developed through to fruition.

The equipment is in consequence tailored to the specific needs of the end product, resulting in a machine design which meets with all technical and technological requirements.

As with other systems, this machine system also follows the trend towards the

development of ever-bigger diameters and cable lengths.

Pay-off and take-up bobbin diameters are typically in the range 1,000 to 5,000mm. The throughput weights can be more than 50 tonnes.

In this way the tendency in the cable industry for ever-longer production lengths is taken into account and the suitability of the drum twister for the manufacture of offshore energy cables is facilitated.

**Sket Verseilmaschinenbau GmbH – Germany**  
**Website:** [www.sketvmb.de](http://www.sketvmb.de)

## Wire bender for complex 3D items

E-FLEX is BLM's completely electric single-head wire-bending machine.

The scope of wire is expanding globally. The BLM wire line includes both single-head and double-head solutions to meet all production needs.

E-FLEX is designed to process diameters up to 8mm. It has two bending turrets with clockwise/anticlockwise rotation and is suitable for 3D bending.

It also enables several bending technologies to be used simultaneously (flexure, blows, variable radius).

Supplying the wire from a coil ensures automatic operation. The workpiece is straightened in a single forward movement, at constant speed, without intermediate stops, ensuring precise straightening and bending repeatability.

The 3D visual graphic programming (VGP3D) and the continuous visual support of the processing zone make the machine extremely easy, comfortable and safe to use.



▲ The E-FLEX from BLM

The machine can correct the program automatically and safely by searching its database for previous bending experiences that ensure that the first product to be processed is correct.

**BLM Group SpA – Italy**  
**Website:** [www.blmgroup.com](http://www.blmgroup.com)

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# wire Russia 2015



The ZAO Expoctr, at Krasnaya Presnya in Moscow will be home to the wire and cable industry when wire Russia opens its doors from 12<sup>th</sup> to 15<sup>th</sup> May.

More than 10,500 trade and international visitors are expected to attend the three-day exhibition, which many companies visit as the place to view pioneering technologies and to strengthen relations already developed over previous years.

## Opening times:

12<sup>th</sup>-14<sup>th</sup> May: 10am – 6pm, 15<sup>th</sup> May: 10am – 4pm  
ZAO Expoctr, Krasnaya Presnya, Moscow



## Alphabetical list of Exhibitors

<b>Company</b> .....	<b>Country</b>	
ACIMAF Italian Wire Machinery Manufacturers Association .....		<b>FOC56</b>
Advantage Austria Wirtschaftskammer Österreich .....		<b>FOC26</b>
AESA SA AESA Cortailod .....		<b>FOB31</b>
Almazinstrument Ltd .....		<b>FOB08</b>
Anbao (Qinhuangdao) Wire & Mesh Co Ltd .....		<b>FOA36</b>
August Strecker GmbH & Co KG .....		<b>FOD41</b>
Aumann GmbH .....		<b>FOB29</b>
Balloffet SAS .....		<b>FOA15</b>
Bayka Color Farbkonzentrate GmbH .....		<b>FOD51</b>
Boockmann Engineering GmbH .....		<b>FOD35</b>
Borealis AG .....		<b>FOB24</b>
Bühler Würz Kaltwalztechnik GmbH .....		<b>FOD44</b>
BWE Ltd .....		<b>FOC17</b>
Caballé SA .....		<b>FOC16</b>
Cables and Wires .....		<b>TBC</b>
Carl Bechem GmbH.....		<b>FOD51</b>
Ceeco Bartell Products, Bartell Machinery Systems LLC .....		<b>FOA12A</b>
Cerrini Srl.....		<b>FOD57</b>
Changzhou Jiangxin Machinery Co Ltd .....		<b>FOA34</b>
Changzhou Winlong Import and Export Co Ltd .....		<b>FOB41</b>
China TJK Machinery Beijing Co Ltd .....		<b>FOD50</b>
Cometo Srl .....		<b>FOB42</b>
Compomec Oy Cable Machinery .....		<b>FOB18</b>
Condat Lubrifiants .....		<b>FOB29</b>
Condor Compounds GmbH.....		<b>FOD51</b>
Continuus-Properti SpA.....		<b>FOC60</b>
CSM Metalurji Imalat San ve Mühendislik Ltd Sti.....		<b>FOA12</b>
CZKSK .....		<b>FOB51</b>
Daloo Machinery Co Ltd.....		<b>FOA14</b>
Davis-Standard LLC .....		<b>FOC19</b>
DEM Costruzioni Speciali Srl.....		<b>FOD48</b>
Dunst GmbH.....		<b>FOC25</b>
Ebner Industrieofenbau GmbH .....		<b>FOD31</b>
Eder Engineering GmbH .....		<b>FOC21</b>
Ekstel doo.....		<b>FOC15</b>
Ernst Koch GmbH & Co KG.....		<b>FOC42</b>
Esteves-DWD Polska Sp zoo.....		<b>FOA25</b>
Euroalpha Srl.....		<b>FOC43</b>
Eurobend GmbH .....		<b>FOD53</b>
Eurolls SpA .....		<b>FOB40</b>
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FSP-one SAS .....		<b>FOA13</b>
Gauder & Co SA.....		<b>FOA14</b>
GEO Reinigungstechnik GmbH.....		<b>FOD42</b>
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## AWCMA Stand FOC21

With 20 member companies and under the leadership of Dr Kurt Eder, the AWCMA will be exhibiting in the Austrian pavilion, jointly organised by the AWCMA and the Austrian Federal Economic Chamber.

The following AWCMA enterprises will display their products and technologies for the Russian wire and cable industry:

Dunst, Ebner, Eder, EVG, Isovolta, MAG, Mali, Medek & Shörner, Rosendahl and Nextrom, VOEST Alpine, AWCMA/VOEDKM and Pengg.



▲ The association's stand at a previous show

The stand has been combined with Eder Engineering, and all catalogues and information from member companies will be on the stand.

Member companies will also be able to take guests to the association's Café Vienna at the stand.

**VOEDKM/AWCMA – Austria**  
**Website:** [www.awcma.com](http://www.awcma.com)



## Borealis and Borouge Stand FOB24

For nearly 50 years, Borealis has been a supplier of advanced energy and infrastructure plastics solutions for the pipe, wire and cable and capacitor film industries. Together with Borouge, its joint venture with the Abu Dhabi National Oil Company (ADNOC), Borealis provides services and products to customers around the world.

Recently the companies announced a true step-change HVDC innovation based on the Borlink™ technology platform.

This new grade, Borlink™ LS4258DCE, supported by a unique track record of 15 years' proven operational excellence and industry leadership in extruded HVDC materials, will support the further integration of renewable energies into the grid and the establishment of more

interconnections among countries in major infrastructure projects around the world.

At this year's conference, both companies will be highlighting their low voltage and medium voltage cables in the Borlink™, Visico™ and Ambicat™ portfolios as well as their jacketing and communication insulation solutions under the Borstar® brand umbrella.

The unique Borstar technology supports several innovative polyethylene (PE) compound applications in communication cable jacketing, as well as very low shrinkage high density polyethylene compounds (HDPE) designed especially for fibre optic cables.

**Borealis AG – Austria**  
**Website:** [www.borealisgroup.com](http://www.borealisgroup.com)

**Borouge – Abu Dhabi**  
**Website:** [www.borouge.com](http://www.borouge.com)



## BWE Ltd Stand FOC17

BWE Ltd specialises in continuous extrusion machines and cold pressure welders for many different applications.



▲ BWE – specialist in continuous extrusion machines

Conform™ and Conklad™ are well-established continuous extrusion technologies in the non-ferrous, cable and tube industries. Typical applications include copper and aluminium rectangular wire (magnet wire for transformers), solid aluminium conductor (SAC for cables) copper bus bar, trolley wire and other shaped conductors, AS wire, OPGW, CATV, round refrigeration tube, multiport or PFC tubes in different alloys.

With seven lines currently in production, BWE's SheathEx™ technology is fast becoming the new alternative to seamless aluminium sheathing of high voltage cables.

The SheathEx process provides a continuous (no stop marks), reliable (no weld) and cost effective (cheap materials, low energy, etc) method of sheathing high voltage power cables.

A new Conform machine has been specifically designed to extrude solid aluminium conductor (round or sector shaped) from 2 x 9.5mm diameter rods, providing a cost-effective process to a product in demand.

A new Conklad machine has been added to the range, enabling small and delicate cores to be sheathed from one aluminium feedstock rod instead of two. The machine will reduce capital and running costs for applications such as AS wire, OPGW, sheathed composite cores, reinforced aluminium wire and solid aluminium conductor (SAC).

BWE continues to manufacture and supply a complete range of cold welders and dies for a fast and reliable solution to welding non-ferrous materials from fine wire to round rod.

SheathEx, Conform and Conklad are registered trade marks of BWE Ltd.

**BWE Ltd – UK**  
**Website:** [www.bwe.co.uk](http://www.bwe.co.uk)



## C M Caballé Stand FOC16

With over 70 years' experience in the design and manufacture of rotating machinery for the production of power and telecommunication cables as well as steel ropes, Spanish company C M Caballé provides the cable industry with a wide array of stranding, twinning, bunching and cabling machinery.

The firm is constantly developing new, high quality equipment to meet the ever-changing needs of the wire and cable industry.

The company's portfolio includes the following equipment for:

**Power cables:** double twist stranders, rigid stranders, drum twisters, single twist stranders, bow skip stranders, tubular stranders, planetary stranders and SZ stranders.

**Telecom and LAN cables:** double twist pairing-quadding machines, single twist cabling lines, group twinners, drum twisters, shielding-jelly filling-sheathing lines and SZ stranders.

**Steel ropes:** double twist stranders, tubular stranders, planetary stranders and bow skip stranders.

**Ancillary equipment:** pay-offs, take-ups, capstans, caterpillars, taping machines and binders.



▲ Caballé's Capstan for large steel ropes or copper conductors

Caballé will show the new developments, highlighting the following products:

- Upgraded rigid stranders and drum twisters for HV energy cables (Milliken conductors, overhead conductors with trapezoidal wires)
- Complete range of double twist stranders to manufacture compacted conductors of Cu and Al up to 630mm<sup>2</sup>
- Complete range of stranders and closers for steel ropes
- Latest improvements in the existing stranders for all types of cables

**Construcciones Mecánicas Caballé SA – Spain**  
**Website:** [www.cmcaballe.com](http://www.cmcaballe.com)

## Ceeco Bartell Products Stand FOA12A

In 2015, Ceeco-Bartell celebrates its 75<sup>th</sup> year of success and innovation. From advanced fibre optic and LAN cable production to high-speed manufacture of energy cables, Ceeco-Bartell's range of wire and cable products have been at the forefront of technologies that cut costs, expand data signal rates and allow higher transmission frequencies to speed communications and power to all corners of the globe.



▲ 1,800mm roll form strander

At wire Russia, Ceeco Bartell will introduce the most recent innovations that it has made to its product range:

- High-speed side-loading roll form strander, up to 300mm<sup>2</sup>

- High-speed single twist roll form strander, up to 500mm<sup>2</sup>
- Modularised roll form units, producing 500mm<sup>2</sup> compact aluminium at 200m/min
- High-speed Orbistrand rigid strander machine
- Backtwist high-speed data cable twinning
- High performance planetary stranders
- New high-speed strip armouring lines, with 300mm<sup>2</sup> wide coil width
- High-speed tubular stranders

**Ceeco Bartell Products – USA**  
**Website:** [www.bartellmachinery.com](http://www.bartellmachinery.com)

## Cerrini Srl Stand FOD57

Cerrini will be displaying the new efficient heavy-duty equipment for the sheathing of very big steel wire ropes up to a diameter of 250mm, heavy-duty caterpillars up to 10 tons and take-ups up to 125 tons.

Visitors can familiarise themselves with the high performing SZ stranding machine for rigid and flexible conductors



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**Stand: FO/A12A**



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# wire Russia 2015

to be run in tandem with the extrusion line for the most demanding production.

The company will also present the advantages of its improved safety silicone cable extrusion line with infrared vulcanisation system for the production of silicone fire-resistant cables.



▲ Take-up for up to 125 tons from Cerrini

The fire-resistant silicone cable properties are achieved through the new generation of IR vulcanisation tunnels, equipped with high power radiators.

Compared to the salt bath curing process, the infrared radiation has the main advantage of flexibility: the start-up/shut-down of the system is very fast, allowing the production of short cable batches.

Low energy consumption, cleanness of the process and of the product and no need for disposing of the salts make of the IR curing a green process.

Cerrini, which has been operating since 1946, has a long tradition and know-how with a portfolio that includes cable extrusion lines for energy cables, building wires, THHN cables, automotive cables, LAN cables, data cables, coaxial cables, safety silicone cables and fibre optics.

**Cerrini Srl – Italy**  
**Website:** [www.cerrini.it](http://www.cerrini.it)



## DEM Wire Rolling Technology Stand FOD48

The Russian market has proved to present big opportunities for DEM Wire Rolling Technology, the Italian company that is a reliable supplier of steel mills to the country.



▲ DEM – a reliable supplier to companies in Russia

The combination of the latest technology and machine reliability is making DEM a long-term partner to industrial giants like Severstal-Metiz, MMK-Metiz and Mechel.

DEM supplies flat and profile wire rolling lines; high-speed rolling lines for reinforcing wire; cassettes for rolling and compacting; and micro-cassettes used in drawing lines. Its range of products also includes flux cored wire forming technology (welding wire production).

**DEM Wire Rolling Technology – Italy**  
**Website:** [www.demgroup.com](http://www.demgroup.com)



## Eder Engineering Stand FOC21

Eder Engineering will be displaying two machines at wire Russia. Russia and the CIS have always been good markets for both Eder's advanced drawing die tools and, particularly, for leading die tool working machines.

The Russian wire and cable industry is increasingly aware of the fact that only perfectly produced and perfectly repaired drawing dies will draw good wire.

Eder-Austria is supporting them with the right high-degree automatic equipment to compensate for reducing human skills available in the die workshops.



▲ The machines on display from Eder Engineering

Single machines for upgrading of an existing infrastructure, completely equipped die reconditioning workshops, and also complete die-tool production lines in state-of-the-art technology and all kinds of die-tools are supplied to customers from Moscow to Siberia.

The company will display two of its best-selling die working machines, one Ultrasonic USP-115F and one wire-type HGM-21 unit.

The stand of Eder Engineering and its representation in Russia, Trade House of VNIIPK – Moscow (TDVNIIPK), will be located within the Austrian pavilion.

**Eder Engineering – Austria**  
**Website:** [www.eder-eng.com](http://www.eder-eng.com)



## FIB Stand FOA31

With 27 lines delivered and successfully commissioned in Russia and CIS countries, FIB has all necessary TRCU and Rostekhnadzor certification and an experienced Russian-speaking staff.

Its production line includes:

- Annealing, patenting furnaces for steel wires, rods and narrow strips. FIB has a large reference and exclusive experience in steel wire continuous process from 0.5mm (saw wire, steel cord) to 26mm (rope industry and special application)
- Phosphating, galvanising and ZnAl coating lines, including first class ancillary equipment and automatic control system
- Oil tempering lines for spring wire
- Muffle tube annealers for stainless steel wire
- Batch annealing solutions with bell and pit furnaces with nitrogen, hydrogen or air are possible in a batch range of 2 to 75 tons

Combustion equipment is another reason for the company's success. Its premix burners system has made the reputation of its furnaces and is widely used in the glass industry as well.

Batch galvanising is FIB's newest business segment, in which it offers turnkey customised solutions.

**FIB Belgium SA – Belgium**  
**Website:** [www.fib.be](http://www.fib.be)



## FSP-one Stand FOA13

FSP-one is well-known worldwide as a specialised and innovative company in the production and sale of speciality conductors.

Green6® is still developing strongly and is already used in high technology markets such as geophysics and IT, and it is now qualified by the aircraft industry.



NPCCA (nickel plated copper clad aluminium) and SPCCA (silver plated copper clad aluminium) have been especially developed for the aircraft industry by FSP-one.

This new generation of conductors are now available as standard industrial products and are already being used by Airbus in different programmes on the A350 and A380.

The CCA conductor offers a competitive advantage over to the classic copper conductors.

This allows the reduction of more than half the weight of cable while keeping optimum performance. These excellent performances are now moving to other applications.

FSP-one has had a presence in Russia for about 20 years and is a recognised partner on the Russian markets. It has proven to be a dynamic and innovative company and is ready to move forward with its customers and the markets to provide the best service, quality and efficiency.

**FSP-one SAS – France**  
**Website:** [www.fsp-one.com](http://www.fsp-one.com)



## H&R Chem Pharm Stand FOC15

The cables market has made great strides in terms of technology since the first mass impregnated medium voltage cables became commercially available in 1895.

Today the global cables market is estimated to have a value of \$98.2 billion, with the Asia Pacific region accounting for 62.5 per cent of this.

Market trends indicate that there is a move towards better transmission with lesser resources, requiring improvements in both core conductor and assembly technologies.

Additionally the global push towards the development of alternative energy sources has acted as a catalyst for the diversification of the cable and wire market meaning further challenges for both manufacturers and suppliers.

These trends have meant that cable manufacturers are now looking to suppliers who can offer a full portfolio of materials developed with the market needs moving forward.

At the forefront of the market, when it comes to the development and manufacture of cable fluids and compounds for the energy (and telecommunications) sector, is the H&R Group which has worked for over half a century with some of the industry's key energy cable manufacturers.

The range of cable fluids and compounds has been developed around the specific needs and requirements of manufacturers reacting to these market trends and include dielectric fluids for high voltage AC paper insulated cables; impregnating compounds for medium voltage AC paper insulated cables; bitumen-based flooding compounds for bonding and corrosion protection of cable armouring wires; super-absorbent polymers for water blocking applications; and conductor sealing products for XLPE cables.

These compounds have the added benefit of offering excellent adhesive properties and superior flexibility at low temperatures.

In addition, the H&R Group offers cable manufacturers a range of plasticisers and waxes with different viscosities and compositions to suit a wide variety of applications.



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See you at:

Developed for stranding and bunching applications up to 77 mm (3.03"). Diamond coated stranding dies provide your process with improved wire & cable surface quality, higher production efficiency, and lower manufacturing cost.

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Continued investment in product development in this key area will ensure that the organisation is ideally placed to continue to meet the diverse requirements of an ever-evolving marketplace.

**H&R Chem Pharm Ltd – UK**  
Website: [www.hur.com](http://www.hur.com)



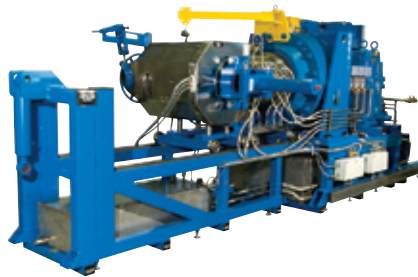
**HFSAB**  
**Stand FOD44**

H Folke Sandelin AB (HFSAB) from Motala, Sweden, will be a co-exhibitor with Niehoff of Russia.

HFSAB has had a leading role worldwide in the following areas for over 50 years supplying:

Continuous lead extrusion equipment and know-how for trouble free lead sheathing of cables thus providing a perfect moisture barrier.

Today the latest design lead extruder from HFSAB is horizontal, floor standing, easy to install and maintain, fully automatic, and extremely reliable with its control system enabling continuous



▲ Just one of the machines on display from HFSAB

operation for weeks with little or no variation in temperatures and wall thickness/concentricity. The lead wall thickness can be kept to a minimum with corresponding savings in lead.

A range of die blocks are available to cover an extensive diameter range of 6mm-225mm (over lead), and a range of melting pots are available for 10, 18, 35 and 60 tonne capacities.

Additional equipment includes the cable repair and recovery system CRRS, which has the possibility of removing individual layers, such as the outer jacket, lead sheath or triple layer XLPE insulation, without causing any damage to the subsequent layer below.

This enables the outer jacket, lead sheath or triple layer XLPE to be re-applied and the cable repaired. Even if the cable is just going to be scrapped, the metal price differences for insulated or un-insulated cables are very large and the equipment would have a very short pay-back period, if the metals are scrapped in their 'bright' form.

HFSAB is able to provide a full and extensive after sales service, know how, fully trained and experienced technician support and spare parts.

**H Folke Sandelin AB – Sweden**  
Website: [www.hfsab.com](http://www.hfsab.com)



**Lämneå Bruk AB**  
**Stand FOD11**

Lämneå Bruk AB specialises in the design and manufacture of machines for the wire drawing industry.

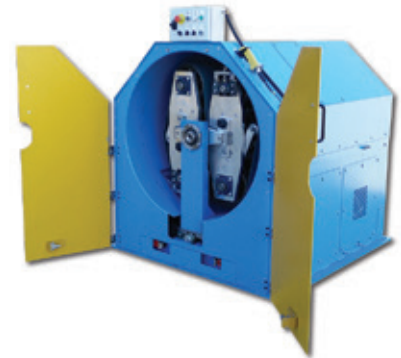
Its journey in this industry started more than 100 years ago, which has given it a tremendous amount of experience that is incorporated in the design of its machines and equipment.

On display in Russia will be its newest innovation: An advanced 'sandpaper descaling machine', best suited for cleaning low and high carbon as well as stainless steel wires.

The machine provides great innovative advantages and is equipped with two sanding belts as well as a counter bearing. These improved features lead to much lower flyer speeds and a perfect support for the bearings. There is no wire-guiding bar required and the wire is self-levelling.

Additionally, the sandpaper descaling machine comes with fan-cooled standard AC motors and a round housing design, avoiding dust deposits and providing a clean grinding zone.

Sandpapers of any grade may be used and in combination with Lämneå's wet coating unit, it provides a perfect combination for preparation of wire surfaces, suitable for drawing with up to 16 drafts at a drawing speed up to 50m/s.



▲ The new sandpaper descaling machine from Lämneå Bruk

The improved features of the sandpaper descaling machine result in much less wear and tear of the major machine components, such as bearings, rubber coated rollers, etc, for an extended lifespan of the equipment.

**Lämneå Bruk AB – Sweden**  
Website: [www.lamnea.se](http://www.lamnea.se)



**Lukas Anlagenbau**  
**GmbH**  
**Stand FOB29**

Lukas is a global supplier of machinery for the wire and cable industry. Its vertical taping line with vertical sinter oven is suitable for many different types of tapes and fibres, such as PTFE, polyimide, mica, polyester, fleece, laminated tapes, metal tapes and paper.

The high speed and high precision are enabled by a closed loop tape tension control and a very precise speed synchronisation between the capstan (or caterpillar) and the taping heads. Depending on the application, the line may be equipped with a cooling unit for the taping area, devices for quality control or an inline sintering oven.

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Add: Fangxiang Industrial Zone, Yangzhou City, China



▲ Lukas Anlagenbau – global supplier

The company will be exhibiting with its area representatives, Permanent K & M, Moscow.

**Lukas Anlagenbau GmbH – Germany**  
Website: [www.lukas-anlagenbau.de](http://www.lukas-anlagenbau.de)



## Maillefer Extrusion Stand FOB31

Maillefer offers more than 50 technologies and a wide services portfolio in the wire, cable, pipe and tube production industries to cover nearly 20 applications.

Clients can choose between three different levels of production lines varying in capacity, cost, automation, flexibility, product range and space, and maintenance requirements. The production solution levels are /Enter, //Extend, and ///Explore.

Maillefer delivers versatile maintenance, performance and upgrade solutions, as well as continuous service level agreements and 24/7 support to clients.

To serve customers better in the CIS market, service personnel have recently been trained to check the wearing

▼ *The world's sole vertical pilot line for medium and high voltage cable production in Maillefer's R&D centre at its headquarters in Finland*



of extruder screws and barrels. The company has also acquired special equipment for measuring screw and barrel dimensions.

Maillefer's wire and cable production solutions are available for building and automotive wires, dry or jelly-filled fibre optic cables, low, medium, high and extra high voltage cables, rubber cables, telecom, LAN and coaxial cables.

On the stand will be the compression caterpillar, CCA 1000, which is part of

the fibre optic cable secondary coating line OEL 40///Explore; the high voltage semiconductive XLPE screw Q15; and the physical foaming PE screw Gisele FD. All three components will be on live display.

For energy applications Maillefer has introduced new technology and innovations for material savings and perfect cable roundness.

Its new aviation cable production line, HFFR extrusion and medium voltage sector cables will also be on display.




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The company also has a new 1,500m<sup>2</sup> R&D centre at its headquarters in Finland. The centre aims to provide a solid platform for strengthened customer partnerships, where visiting customers develop customised solutions and receive training on full-scale equipment.

**Maillefer Extrusion Oy – Finland**  
**Website:** www.maillefer.net



**Medek & Schörner**  
**Stand FOB22**

Medek & Schörner will be presenting the following:

Cable marking machines

- High quality gravure printers (LAN cables, control cables, etc) for speeds up to 1,200m/min
- Water misting unit for the application of fine water dust for pre-cooling of the hot wire immediately after the extruder
- Embossing metre markers/hot foil sequential metre markers for high accuracy of length measurement (power cables, telecommunication cables, optical fibre cables, etc)
- High performance ring markers for marking telephone wires, switchboard wires, automotive cables and LAN cables
- Video system for monitoring the print quality of fast-running cable printing machines, eg allowing real-time inspection for bad quality and/or missing prints
- Laser marking system for cables

Optical fibre coating systems

- Optical fibre colour coding up to 3,000m/min
- Ring marking of optical fibres
- Tight buffering up to 1,300m/min

▼ Hot foil marker from Medek & Schörner



- Fibre ribbon production with excellent ribbon planarity and for speeds up to 1,000m/min
- CFU production of compact fibre units

Thanks to the modularity and flexibility of its systems, Medek & Schörner has been able to implement other applications, including some outside the field of optical fibres:

- Copper wire insulation with UV varnishes (enamelled wire)
- Manufacture of dimension-sensitive precision micro flexible flat cables (FFC) using UV resins

**Medek & Schörner GmbH – Austria**  
**Website:** www.medek.at



**MFL Group**  
**Stand FOB30**

MFL Group provides customers with complete solutions with products represented by two historic brands: Mario Frigerio steel wire and rope machinery and Frigeco machinery for the non-ferrous wire and cable industry.



▲ Complete solutions from MFL Group

MFL Group is not just a machine supplier. It continues to diversify with the goal of enhancing its knowledge base in order to assist customers pertaining to products: Machinery for wire drawing, stranding and insulation; technology: ferrous and non-ferrous materials; and customer service: specific product requirements and total customer satisfaction.

**MFL Group – Italy**  
**Website:** www.mflgroup.com



**Mikronmakina**  
**Electrostatic Powder**  
**Machines**  
**Stand FOD13**

Mikronmakina Electrostatic Powder Machines Co in Istanbul, Turkey, sells Mikronix electrostatic powder coating machines and plants to the worldwide cable, rubber and plastic industry.





▲ Electrostatic powder application from Mikronmakina

Mikronix uses a developed powder coating technology. By developing new techniques in the field of electrostatic and filter systems it has succeeded in simplifying the machine, reducing the consumption considerably, reducing costs, but maintaining the powdering quality.

#### Mikronmakina Electrostatic Powder Machines Co – Turkey

Website: [www.mikronixcable.com](http://www.mikronixcable.com)



#### Maschinenfabrik Niehoff Stand FOD44

At this year's wire Russia, Maschinenfabrik Niehoff and Niehoff of Russia are showing the following exhibits:

- an MSM 224 type wire-drawing machine for intermediate wire range with RI 250 type continuous inductive inline annealer
- a D 632 double-twist bunching machine with ARP 630.1 pay-off



▲ The MSM 224 type wire-drawing machine from Niehoff

The electronically driven MSM 224 wire-drawing machine for the intermediate wire range with continuous inductive inline annealer type RI 250 is preferably used for wires made of copper alloys such as brass, bronze and German silver.

Nickel and nickel alloy wires as well as other non-ferrous metals like platinum, rhodium and special materials can also be produced.

The machine is capable of drawing wires with a maximum inlet diameter of 3.7mm to a final diameter range of 0.2 to 1.8mm (depending on the material).

Other features include a completely submerged drawing process and die holders with high-pressure lubrication. The drawing capstans are made from a ceramic composite material and individually driven by water-cooled AC motors.

This drive principle enables a minimised slip operation resulting in wire with a very high surface quality and minimised energy consumption.

With help of the single drives the wire elongation between the different drawing capstans can be varied over a wide range. In this way, for different alloys, in each case the optimum wire elongation can be adjusted.

The continuous inductive inline annealer type RI 250 is, like the other models of the RI series, built in several sizes designed for wires with low electric and thermal conductivity.

RI type annealers work on the principle of an excitation voltage transformer. This principle and the fast cooling of the wire enable a fine-grained structure, giving the wire excellent processing and forming properties while ensuring a high wire surface quality.

The D 632 type double-twist bunching machine is designed for strands with 0.09 to 6mm<sup>2</sup> cross section and a steplessly variable lay length of 6 to 100mm. The maximum number of twists is 6,500 twists/min, the maximum speed 300m/min.

Other features of the machine include the service proven energy-saving single bow (ECO-Bow) design, the contactless transmission of machine data within the machine and a sophisticated drive concept. Compared to conventional bunching machines, energy consumption and noise emission are significantly reduced due to the one-bow design.

The relatively small rotor driving motor of energy efficiency class IE3 is characterised by a high degree of efficiency, and reduces power consumption. The 230V voltage supply in the spool carrier leads to an increased transmission security at the slip rings, and three-channel telemetry enables an absolutely secure signal feedback and a greater control accuracy of the lay length. The drive concept results in robust operation, free of dancer or spooler vibrations.

Operation is carried out via a panel with a 10" touch-screen display with with a new colour user interface: the NMI (Niehoff Machine Interface) with a clear navigation structure according to a unified concept. >>>



#### Taping Equipment



#### Single Twist Lines



#### Production range:

- Taping, binding, screening machines with concentric heads having dynamic dancer, for spools and pads;
- High performance single twist lines with high speed back-twist feeders;
- Rewinding lines with in-line measuring and quality control systems;
- Take-up and pay-off units for reels up to DIN 1600, also in traversing version with horizontal axis for precision flat wires laying;
- Caterpillars and capstans for any wire shape, for small and medium section;
- Cable peeling machines for large diameters;
- Ancillary, testing, special and customized equipment.

#### W.T.M. s.r.l.

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Tel. (+39) 049 8705566 - Fax (+39) 049 8705599  
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◀◀◀ A further special feature is the patented opto-electronic NBAT system (Niehoff Bunching Automatic Traverse), which allows spools to be perfectly spooled.

Spooled wire can then be paid-off tangle-free at extremely high speeds with no damage.

Users of the machine benefit from tested technology and future security concerning the supply of spare parts and service.

The D632 is part of a series of seven differently sized models which cover the cross sections from 0.013mm<sup>2</sup> to 95mm<sup>2</sup> (copper wire strands) or 120mm<sup>2</sup> (aluminium wire strands).

The ARP 630 type pay-off completes the portfolio for the production of strands. By clamping the spool with the help of pintles, spool loading becomes fast and easy.

Spools with various bore diameters can be used, and as an option particular spool lifting tables are available.

**Maschinenfabrik Niehoff GmbH – Germany**  
**Website:** [www.niehoff-gmbh.info](http://www.niehoff-gmbh.info)

## Pan Chemicals Stand FOC64

Pan Chemicals, a manufacturer and supplier of high tech drawing lubricants and coating to the wire industry, will be exhibiting its production programme, which includes:

- Dry drawing lubricants – Panlube S series: A full range of calcium, sodium and combined products for low and high carbon steel, non-ferrous and stainless steel
- Wet drawing lubricants – Panlube L series: A complete range of oils, greases and pastes for wet drawing of low and high carbon, welding wire, stainless steel and non-ferrous wire
- Lubricant carriers – Pancover series: Phosphates and non-reactive coatings
- Flux for galvanising – Panflux series: Especially developed to improve the efficiency of the galvanising process by a more uniform control of the reaction between the two metals, reducing operation costs and improving the quality of the zinc coating
- Auxiliary products – Panchem series: Degreasing agents, pickling inhibitors, protective products, activated charcoal, wiping pads and more



▲ Range of lubricants from Pan Chemicals

Pan Chemicals has a strong emphasis on a profound technical collaboration with its customers, and are deeply focused on the research and development of new products and solutions for specific applications.

Particular attention is dedicated to the development of ecological products



## It's Seamless and It's SheathEx™

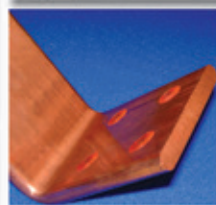
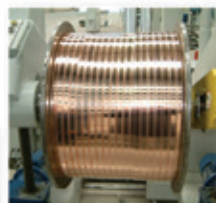
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#### Main Features Include:

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- In-line Corrugation

#### Other Benefits Include:

- Low capital cost
- Low running costs
- Low energy requirement
- Low manpower
- Low maintenance
- High reliability



## Conform™ - Conklad™ Original Machines at Affordable Prices

### Continuous Extrusion from Copper or Aluminium Rod

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- Solid Aluminium Conductor (SAC)
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- Aluminium Round & Multivoid Tubes

#### New 'S' Range Built in China:

- Low capital cost
- Low running costs
- Low energy requirement
- Low manpower
- Low maintenance
- High reliability



Visit BWE at Wire Russia 2015 – Stand No. C17



For more information visit: [www.bwe.co.uk](http://www.bwe.co.uk)  
Contact: +44 1233 627736 or [kevinbennett@bwe.co.uk](mailto:kevinbennett@bwe.co.uk)



according to the new international regulations (borax-free lubricants and coatings).

In addition to the chemical and auxiliary products, the engineering department can offer different solutions for mechanical descaling, coating and drying units, rotating die holders and die reconditioning equipment.

**Pan Chemicals SpA – Italy**  
Website: [www.panchemical.com](http://www.panchemical.com)



## Roblon Stand FOA29

Roblon will introduce its latest developments of both industrial fibres and machinery used for fibre optic cable production.

▼ *Water swellable yarns from Roblon*



Roblon will show, among others, its new developments within water-swellable yarns and fibres for longitudinal, binding and dry buffer tube applications, as well as its latest development within water-blocking glass yarns.

Furthermore, it will display its latest equipment for OFC manufacturing, further enhancing the range of cable-making machinery.

Roblon is a total solution provider to the cable industry, focusing on cable-making machinery and industrial yarns for cables. Its extensive knowledge of industrial fibres and related machinery ensures a unique position in the OFC industry. The company also offers strong technical support and reassurance of a smooth production.

Roblon Industry is both ISO 9001 and 14001 certified and develops high-tech industrial fibres such as glass and aramid strength members, binder yarns and ripcords. Furthermore, it develops and manufactures serving, binding, take-up and pay-off equipment. Its high quality servers and binding machines are popular, with more than 400 pieces of each operational worldwide.

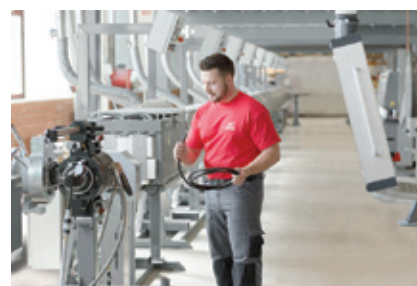
**Roblon AS – Denmark**  
Website: [www.roblon.com](http://www.roblon.com)



## Rosendahl Nextrom Stand FOC20

Rosendahl and Nextrom have extended their technological solutions and focused strongly on the extrusion of silicone and high temperature materials. The results are ready to be presented at wire Russia 2015.

Visitors will also learn about high performance secondary coating line and fibre optic cable manufacturing solutions,



▲ *A. The silicone line from Rosendahl*



▲ *B. Nextrom's secondary coating line*

as well as extrusion and crosshead technology.

The company has two offices in Moscow to assist both brands. Rosendahl and Nextrom are represented by their local sales representative office in Moscow. This office serves the majority of the Russian and CIS market. The service office, OOO Rosendahl Nextrom, fully supports Rosendahl's and Nextrom's customers in every aspect of project execution and post-project support.

OOO Rosendahl Nextrom fulfils spare parts orders locally. Its close contact with partners and the strategically positioned office ensures the shortest-possible response time.

Rosendahl and Nextrom are global suppliers of production technologies for cable, wire and optical fibre.

**Rosendahl Nextrom – Austria**  
Website: [www.rosendahlnextrom.com](http://www.rosendahlnextrom.com)



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## Samp SpA Stand FOC33

Samp will present the enhanced BM 630 E double-twist bunching machine, a compact, reliable and energy-efficient machine.

One of the most distinctive features of the BM 630 E is the ability to run the machine without human intervention, thanks to the automatic traversing system, which includes:

- Automatic detection of the reel dimensions
- Automatic traversing adjust
- Programmable strand tension by load cell dancer

Energy consumption and noise emission are reduced compared to conventional bunching machines due to the implementation of low energy consumption bows, and an energy efficiency architecture ensures high power factor (cosφ).

The main production parameters are fully adjustable at the control panel (number of twists, lay length, reel type, speed, production receipt, pay-off control, etc) and maintenance operations are reduced to a minimum.

Further relevant characteristics are the fully integrated IPU in one unit (motor and drive) and the pay-off system integration with wire break detection.

Users of the machine will benefit from Samp's 70-year long experience in the development and production of wire manufacturing machines and to the possibility to also add pre-twisters, equalisers, taping units and a wide range of static and dynamic pay-offs with pneumatic dancer for synchronisation.

**Samp SpA – Italy**  
Website: www.sampsistemi.com



## Sikora AG Stand FOD39

Sikora will showcase its measuring, control, inspection and sorting technology for continuous online quality control in the wire, cable and plastics industries.

One highlight is the Purity Scanner. This is a system for the online inspection and sorting of plastic pellets used for the insulation of medium, high and extra-high voltage cables where 100 per cent purity is required. Contaminated pellets are detected and sorted out, assuring that only pure pellets get



▲ The X-Ray 8000 NXT – quality control during production of MV, HV and EHV cables

into the extrusion process. The pellet inspection allows for the detection of organic and metallic contamination inside the pellet as well as on the pellet surface, using a special combination of X-ray technology and an optical system. The smallest detectable particle size is 50µm.

The Fiber Series 6000 is sophisticated equipment for continuous online quality control of optical fibres in the drawing tower.

The Fiber Laser 6003 measures the diameter of uncoated and coated fibres. Depending on its point of installation, it provides information on the position, vibration frequency, tension and spinning. The measuring principle ensures an accuracy of ±0.05µm.

For the detection of airlines there is the Fiber Laser 6003 Airline. In addition, further gauge heads provide information on concentricity and temperature of the optical fibre.

The newly developed Fiber Lump 6003 Micro detects lumps and neckdowns on the optical fibre surface to 100 per cent.

This is the result of the integration of six measuring axes. Shadow areas are eliminated and even the smallest faults from 5µm height and 50µm length are reliably detected.

For online quality control, optimisation of material usage and increased productivity during wire and cable production, Sikora offers the X-Ray 6000.

There are two X-Ray models available, the X-Ray 6000 for quality assurance of single layer products and the X-Ray 6000 Pro for the measurement of single and multi-layer products.



The systems are designed for continuous measurement of the outer diameter, wall thickness, eccentricity and ovality of cables.

In combination with the processor system EcoControl 600/1000/6000 an automatic control of the line speed and extruder rpm under consideration of the minimum values is possible.

Sikora will also present its Laser Series 2000, for classic diameter measurement in two or three planes, covering product diameters from 0.05 to 500mm. Furthermore, the high-end Laser Series 6000 will be displayed at the show.

These diameter-measuring devices meet the current high-end requirements in the wire and cable industry. The gauges fulfil all needs regarding high accuracy, a variety of interface connection options and utmost reliability for quality control during wire and cable production.

The high accuracy allows in addition for the detection of lumps and neckdowns. Three high-end gauges are available for product diameters from 0.2 to 78mm.

Also on display will be the Centerview 8000, which measures eccentricity, diameter and ovality of coaxial cables, LAN cables as well as automotive and installation cables.

Optionally integrated in the Centerview 8000e is a 7" TFT monitor, which displays production data. A special feature is the so-called scatter plot, which shows the distribution of short-term variations of the eccentricity.

The scatter plot is an alternative style visual view of the measurements being made at the EcoControl processor system or the integrated TFT monitor. The operation is intuitive and menu-driven via touch screen.

For quality control during the production of MV, HV and EHV-cables in CCV, VCV and MDCV-lines Sikora provides the X-Ray 8000 NXT. This has been delivered more than 1,000 times worldwide, and is recognised as an industrial standard.

It is used for precise measurement of the wall thickness of all three layers (concentricity, diameter and ovality).

Measuring values for centring and control are therefore available immediately after starting up the line.

In addition to innovative measuring devices, the company will display the two- or three-axis lump detectors Lump 2000 XY/T.

The heart of the Lump 2000 devices is the advanced double sensor technology, which detects punctual non-conformities on the cable surface even at high line speeds.

**Sikora AG – Germany**  
Website: [www.sikora.net](http://www.sikora.net)

## August Strecker Stand FOD41

In the production of cables, the consistent and process-reliable joining of cables is an important topic. Customers would like a fast working procedure which is reliable, economical and ensures an uninterrupted manufacturing process.

The trend here continues to move towards increasingly larger cable cross sections:

In order to satisfy the desire of many of customers for reliable welding machines for cable cross sections of 1,600 to 2,000mm<sup>2</sup> or even 2,500mm<sup>2</sup>, August Strecker has the new double-upset butt welding machine Type MK 1200.

The machine welds copper or aluminium stranded conductors from 185mm<sup>2</sup> even up to a maximum cross section of 2,500mm<sup>2</sup> (5,000kcmil/Ø 65.5mm).



▲ The MK1200 for welding copper or aluminium stranded conductors up to a maximum of 2,500mm<sup>2</sup>

As is the case with all the machines of the MS and MK series, these cables are also deflashed fully automatically after welding.

Especially when welding cables with large cross sections, the current requirement, or the short-term peak load is a concern, as the customer must ensure an adequate supply of power. >>>

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### Wire Cleaning

( for plating and high glossy finish )



### Wire Rod Lubrication

( for frictionless drawing )



### Rod Dry Preparation

( with no speed limit )



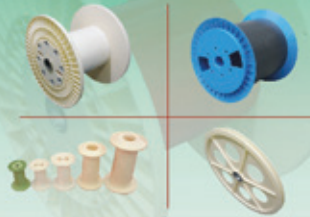
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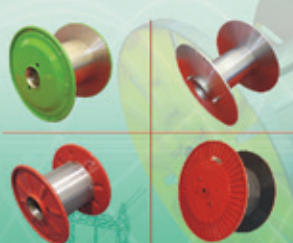
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### STEEL REELS



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Providing a separate transformer just for the supply of the welding machine is not only expensive, but also approaches the limits of what is physically possible.

Type MK 1200 has a nominal capacity of 1200 KVA - with a 3-phase direct current transformer. This drastically reduces the current required, nearly cutting it in half.

In a conventional transformer, the mains voltage is reduced (eg from 460V to 15V). Two phases of a three-phase mains network are loaded (both phases AC = alternating current). In a three-phase transformer, the input voltage is also reduced to 15V, but at the same time, the alternating current is converted to direct current. The transformer is connected to all three phases of the mains supply.

The biggest advantages are:

- Lower current load for each individual phase
- Balanced load for all three phases
- Higher capacity/higher secondary voltage

### August Strecker GmbH & Co KG – Germany

Website: www.strecker-limburg.de



## Troester GmbH Stand FOD33

Troester GmbH & Co KG is a worldwide manufacturer of complete extrusion systems for the cable industry.

The company will present its technology and solutions in the field of:

- Rubber CV and CCV-lines up to 35kV
- XLPE CCV and VCV lines for power cables up to 500kV
- Sheathing lines for medium and high voltage cables
- Silane lines for LV and MV cables

▼ Extruder and kneader from the Troester Group



X-Compound, the new company of the Troester Group, will join the booth and present its kneader technology for the continuous compounding of HFFR (LSOH), PVC, XLPE, semiconductive materials and EPR/EPDM. X-Compound is specialised in the planning and construction of complete systems for the compounding of plastics with the process steps conveying, melting, dispersing, mixing and degassing.

### Troester GmbH & Co KG – Germany

Website: www.troester.de



## WiTechs GmbH Stand FOD45

WiTechs has developed over the last two years a new system for endless sanding of wire.

The priority was the development of a system which would be able to produce defect-free wire rod surfaces, for example for spring steel applications.



▲ Longitudinal sanding machine

Due to the special design the machine also allows high-speed sanding of up to 6m/s inlet speed, for example in front of single- or double-block drawing machines. The innovation lies in the sand belt guidance which is in the longitudinal direction. A sanding surface pattern is built in the wire direction.

This system complements the in-house developed flyer-grinding technology which has existed for several years. That technology works by means of three sand-belt rolls on a common flyer disc that is continuously rotating around the wire rod.

The new so-called longitudinal sanding machine SEZ 8-150 was presented during



wire 2014 in Düsseldorf for the first time to the public and was of particular interest for many visitors.

**WiTechs GmbH – Germany**  
**Website:** [www.witechs.de](http://www.witechs.de)

## **Zumbach Electronic Stand FOB12**

Zumbach's team will be able to provide information about its complete product range, among others:

New 'linear sensor technology' which allows cost effective, synchronous multi-axis measurement of diameter and ovality in any cable, tube and hose extrusion process.

This includes:

- Unique measurement technology for products up to 200mm outside diameter
- A new product line with two-coloured LED light sources allowing simultaneous scanning in each axis (XY\*) and trouble-free measurement even with product vibration
- Integrated extraneous light filters prevent occurrence of measurement errors that to date seemed unavoidable
- Perfect performance even with reflective surfaces thanks to the use of different colour lighting for each measurement axis

*\* This new concept allows even a four-axis measurement of products up to 54mm diameter.*

Also on display will be the versatile high-tech ultrasonic system Wallmaster, which offers application-specific solutions for measuring and monitoring wall thickness.

The measuring data processor with touch-screen display gathers data and QC fully automatically.

In combination with ultrasonic UMAC® scanners and various ODAC® diameter measuring gauges as well as with error detectors, the measuring and monitoring scale can be expanded to outside and inside diameter, statistics, SPC and processor communication.

Using Zumbach's Wallmaster measurement and control systems, manufacturers can economise their expenditure of raw materials.

The ROI is achieved within a few months. The use of these systems also allows reducing considerably the start-up time.



▲ *MSD – One of the new series of diameter and ovality measuring heads based on linear sensor technology*

One of the exhibition highlights will be the new ultrasonic scanners for flexible diameter adjustment. The transducers can be either individually or simultaneously adjusted to the best possible measuring position within seconds on this novel construction (patent pending).

The scanners cover an outside diameter up to 180mm and represent a smart and simple solution for full non-contact, in-line eccentricity and wall thickness measurement of cable jackets, tubes and hoses.

Complete lines of measurement and control equipment for any on-line and manufacturing process can be achieved with the new one-, two- and three-axis diameter gauges of the high precision ODAC® series for any wire and cable. The new models have special beam geometry, fault detection function and high scan rate.

Also on display will be:

- The advanced ODEX® concentricity and diameter gauge for wire extrusion. Fully non-contact, based on magnetic and laser technology
- New LSV length and speed gauges for down to zero speed measurement
- New and state-of-the-art spark tester AC and DST systems
- Advanced three-axis KW fault detectors with new local BAE control and display unit
- New economic, modular high performance USYS IPCe data acquisition, processing and display units
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# Measured and simulated DC powering of data cables for power over Ethernet

By Stephen W Simms, Brand-Rex Ltd

## Abstract

The increasing demand for higher power levels in Power over Ethernet (PoE) systems is evident, with a variety of non-standard products currently available on the market which provide power levels in excess of those stated in IEEE 802.3at.

Higher power levels will allow PoE to be used in a wider range of applications. However, they will also increase performance risk. With this increase in demand for more power, and the fact that installations using PoE technology differ greatly in terms of their configuration and environment, it is beneficial to mitigate risk by using numerical simulation.

The work presented here provides numerical simulation and experimental verification of the thermal properties of data cables under DC powering which is used in PoE applications.

## Introduction

The supply of DC power to end devices along the same electrical path used for AC signal communication has been successfully employed for many years, eg in telephones and audio equipment.

The technique used to provide this functionality is commonly known as 'phantom powering'. In relation to Ethernet, this technique allows power from the Power Sourcing Equipment (PSE) to be delivered to the Powered Device (PD) on the same pair that is used for data.

The DC power is applied to the centre tap of the signal coupling transformer and does not interfere with data transfer. This allows PoE to be deployed over 1000BASE-T systems, in which data is carried on all four pairs.

IEEE 802.3at standardisation in 2009 stated the system parameters required for Type 1 (PoE) and Type 2 (PoE+)<sup>[1]</sup>.

The standard classifies nominal highest DC current values of 0.35A and 0.60A per pair, for Type 1 and Type 2, respectively. Some of the most common applications which use PoE technology include wireless LAN access points, VoIP telephones and network cameras.

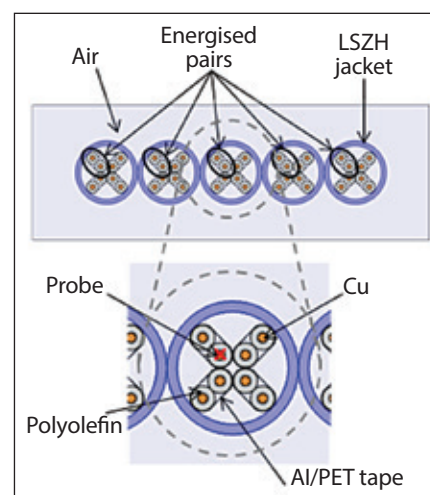
Applying electric current to a conductor releases heat energy, an effect known as Joule heating. In relation to Ethernet cables and components, this heating effect causes concern due to the rise in attenuation, which has a limiting effect on link length. This concern is heightened for cables with a higher resistance than standard cables, eg copper clad aluminium (CCA)<sup>[2]</sup>, and smaller diameter (26 AWG) solid copper conductor cables.

In 2009, IEC subcommittee 46C put forward a test method (46C/906/NP) entitled 'Proposal for measuring of heating of data cables by current'<sup>[3]</sup>.

In this paper, the aim is to achieve a strong correlation between simulation and the proposed measurement method regarding the DC powering of Ethernet cables for PoE applications. The paper also aims to compare temperature rise due to DC powering of CCA cable with cables which have solid copper conductors.

## Numerical modelling

A 2D model was set up using COMSOL Multiphysics 4.4, a software package which utilises the Finite Element method<sup>[4]</sup>. The model was set up to replicate the proposed measurement method<sup>[3]</sup>, which allowed for a comparison between theory and practice.



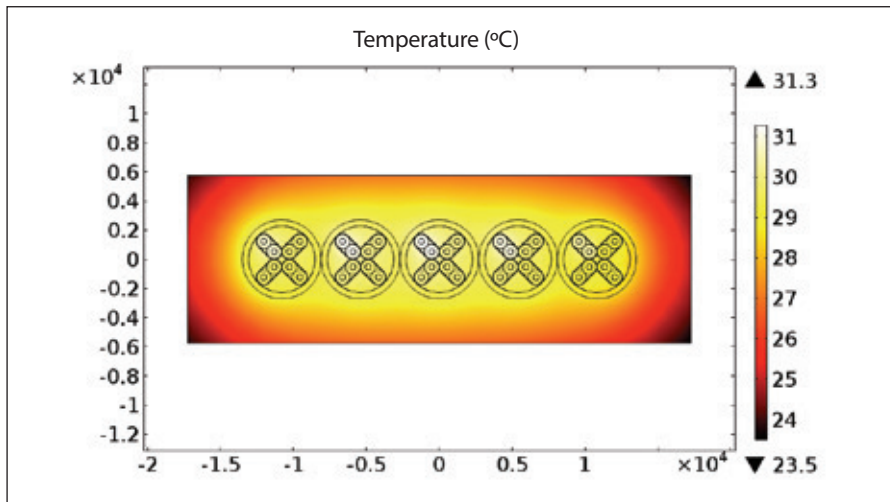
▲ Figure 1: Simulation setup in COMSOL Multiphysics

In order to achieve this, a five-cable linear configuration was set up with the intention of providing a good prediction of the thermal behaviour at the centre cable without the need for including additional cables in a model requiring higher computational resource.

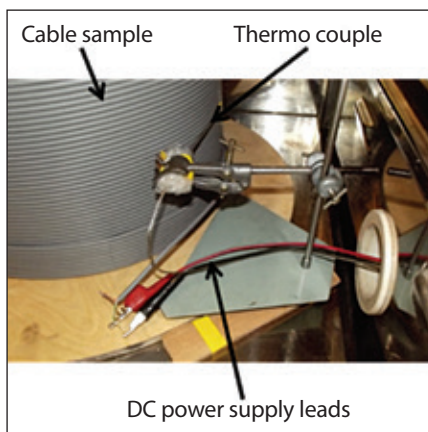
Heat capacity at constant pressure, density and thermal conductivity material properties were applied to represent the constituent parts of the Cat6A 26 AWG U/FTP cable. These properties were applied to the copper (Cu) conductor, aluminium/PET (Al/PET) tape, Low Smoke Zero Halogen (LSZH) jacket, and polyolefin insulation, see Figure 1. Conduction, convection and radiation heat transfer mechanisms<sup>[5]</sup> were accounted for in the model.

Simulated electric energy was applied to one pair of each cable in the model. A stationary solver was used to determine the thermal behaviour for (a), a point at the centre of one of the energised conductors (see probe position in Figure 1) and (b), a 2D temperature plot of the cross-section, Figure 2.





▲ **Figure 2:** Cross-sectional temperature plot



▲ **Figure 3:** Measurement setup

From the 2D plot, and as expected, the maximum temperature of the arrangement is evident in the proximity of the energised conductors.

## Test method and results

The test method proposed by IEC Subcommittee 46C<sup>[3]</sup> was followed in order to establish the rise in conductor temperature due to DC powering. This method involved measuring voltage supplied and jacket temperature using a 100-metre sample of cable wound onto a reel and positioned within an environmental chamber fixed at 20°C, see *Figure 3*. This method was followed using a sample of Cat6A U/FTP cable with solid copper 26 AWG conductors, as simulated in section 2.

The cable sample was conditioned at 20°C for at least 16 hours before testing. A thermocouple of J type was positioned along the jacket at the halfway point of the cable. Using a Keithley 2200-60-2 (60V, 2.5A) bench power supply operating in constant current mode, a current (I) of 0.6A was applied to the pair under test with the far end of the sample short circuited.

Temperature and voltage data was logged at 15 second intervals using National Instruments LabVIEW software<sup>[6]</sup>.

The temperature of the cable sample increased due to the Joule heating effect, and after a certain time, the temperature stabilised. At this point in time, the heating due to the DC power input became equal to the radiated power of the sample and the temperature was prevented from rising further.

Conductor resistance was calculated based on voltage immediately after the power was switched on ( $U_0$ ), equation (1), and after the temperature had stabilised ( $U_T$ ), equation (2). Change in (or delta) conductor temperature ( $\Delta t$ ) was then calculated using initial ( $R_{20}$ ) and stabilised ( $R_t$ ) resistance, equation (3).

$$R_{20} = \frac{U_0}{I} \quad (1)$$

$$R_t = \frac{U_T}{I} \quad (2)$$

$$\Delta t = \frac{1}{\alpha} \left( \frac{R_t}{R_{20}} - 1 \right) \quad (3)$$

$$\text{where } \alpha = 0.004 \frac{1}{K}$$

This methodology was repeated using four different current (I) values, ie 1.0A, 1.4A, 1.8A and 2.2A. *Figure 4* shows the change in conductor temperature versus DC current level simulated at the probe (see *Figure 1*) and calculated from the measurement.

Results show a linear relationship with both delta conductor temperature and current plotted on logarithmic scales. Based on this relationship, it was possible to apply an approximation, in the format  $\Delta t = \lambda I^\nu$ , which could be used to predict conductor temperature rise for current values outwith the range measured.

For the Cat6A 26 AWG U/FTP cable, this approximation was found to be:

$$\Delta t = 2.3 * I^{2.0}$$

Using the approximation, a current of 3A would provide a temperature rise of 20.7°C for a single cable within an environment fixed at 20°C.

The correlation between simulated and measured results was further investigated from a statistical point-of-view using a Paired t-test via Minitab software<sup>[7]</sup>. *Figure 5* shows an individual value plot of the temperature differences between simulation and measurement, which also shows the 95 per cent confidence interval based on these differences. The results shows that 95 per cent of additional simulated and measured values are expected to fall within the  $\pm 0.1$  difference range, confirming excellent correlation. As such, the null hypothesis of no difference in mean values between the two sets of data is not rejected.

## Copper clad aluminium

A sample of UTP CCA cable with 24 AWG conductor size was acquired and measured as per the Cat6A 26 AWG U/FTP cable sample in section 3. The DC loop resistance of the pairs under investigation for each cable type are given in *Table 1*. For comparison, a Cat5e UTP cable with 24 AWG solid copper conductors was included in the study.

	AWG	DC loop resistance ( $\Omega$ )
Cat6A	26	23.3
CCA	24	28.4
Cat5e	24	18.2

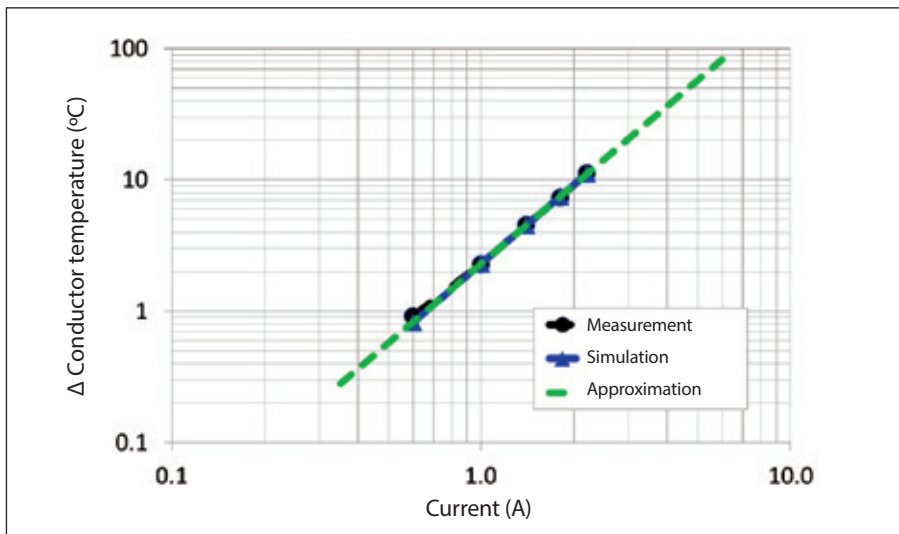
▲ **Table 1:** DC loop resistance of pair under investigation for each cable type

Due to the high resistance of the CCA cable under investigation, the high voltage required to provide a current of 2.2A was not possible using the bench power supply.

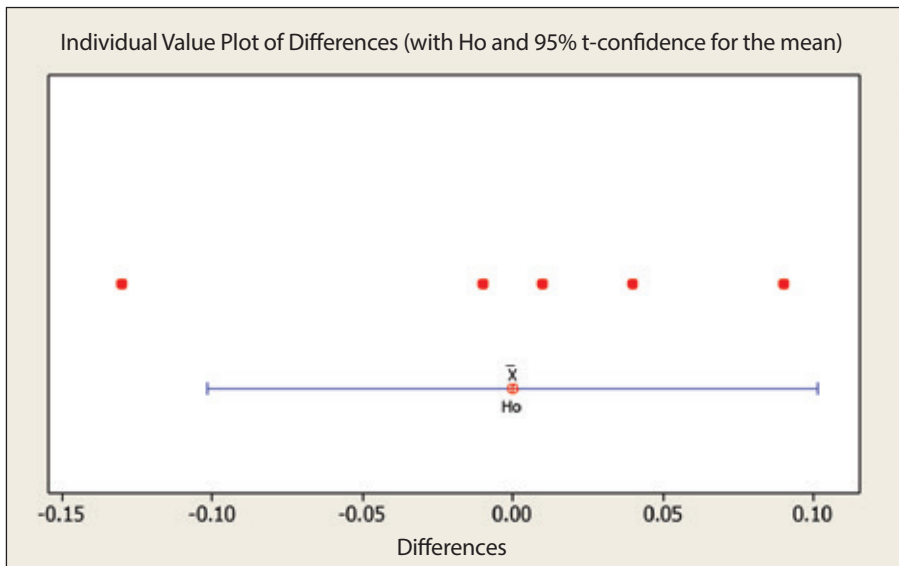
In other words, as the temperature and resistance increased, the voltage required (in order to meet Ohm's Law) was larger than the maximum voltage (60V) of the bench power supply. A current value of 1.95A was chosen in order to generate the fifth data point.

*Figure 6* shows the change in conductor temperature, versus DC current level, which was calculated from the measurement. For the CCA cable sample, approximated conductor temperature rise was found to be:

$$\Delta t = 3.1 * I^{2.0}$$



▲ **Figure 4:** Simulated, measured and approximated change in conductor temperature



▲ **Figure 5:** Individual value plot of temperature differences

Temperature rise due to the Joule heating effect is known to be proportional to  $I^2R$  losses<sup>[8]</sup> so, as current is fixed for each measurement point, the resistance of the cable pair under investigation will differentiate temperature rise from one cable to another.

Therefore, as expected, the cable with highest DC resistance will have the most temperature rise, and vice versa.

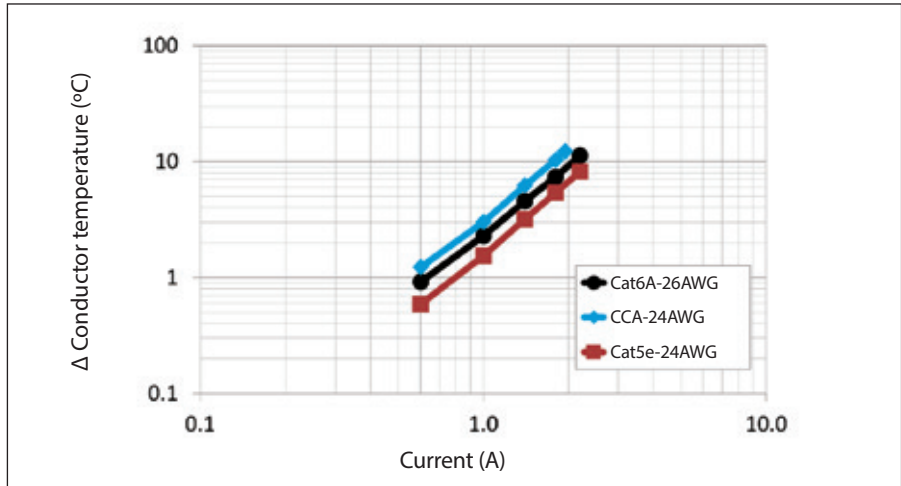
## Discussion

Heating cables is known to increase attenuation<sup>[9]</sup> which has a limiting effect on cable reach. In relation to PoE, the maximum temperature is likely to be in the proximity of the energised conductors which may be used for data transmission.

Therefore, the consequences of DC powering on attenuation of the same pair should be taken into consideration.

The results presented in this paper show the temperature rise of one pair energised with DC power using a cable located in a controlled 20°C environment. Realistically, the ambient temperature will vary from

▼ **Figure 6:** Measured change in conductor temperature



site-to-site, and therefore, caution should be taken when installing PoE systems into uncontrolled and/or warmer environments.

Further consideration should be given to the correlation of simulated data and that of the installation environment. On one hand, the simulation may be based on a worst case scenario. However, in reality, the duty cycle may dictate that the power is only supplied for a fraction of the time.

Good installation practices should be implemented wherever possible, such as minimising bundle sizes, accounting for temperature rise for maximum cable lengths, and keeping pathways and spaces free of thermally insulating materials.

It is important to note that, while excellent correlation was seen between simulated and measured results for a single cable setup, this work was not intended to replicate the behaviour of cables in bundles.

However, it is anticipated that good correlation between theory and practice will also apply to bundled configurations in free air and in a variety of cable containment systems, ie tray, trunking, conduit, etc.

A comparison between the CCA 24 AWG UTP and Cat6A 26 AWG U/FTP samples show that it is possible for cables with smaller conductors to radiate less heat than those of larger conductors when supplied with identical DC current values.

It is also known that the conductive foil in screened cables act as a heat sink which helps to reduce the amount of heat radiated from the cable<sup>[10]</sup>.

Therefore, it is important to take into account the construction of cable, and not only the conductor diameter for PoE system deployment.

The increasing demand for more power supplied from the Power PSE to the PD is obvious, with powering over all four pairs expected to be IEEE standardised<sup>[11]</sup> and a variety of non-standard products currently available on the market which provide power levels in excess of those stated in IEEE 802.3at.

Higher power levels will increase performance risk, but will also allow PoE to be used for a wider range of applications.

## Conclusions

A two-dimensional model was set up using COMSOL Multiphysics software in order to replicate measured results.

A test method proposed by IEC subcommittee 46C to assess cables for Power over Ethernet was followed, which outlined the measurement for heating data cables by DC current.

Excellent correlation between simulated and measured results for a single cable has been demonstrated. This correlation encourages use of the software for the thermal prediction of cables in densely populated networks. It is also expected to provide a strong indication of the temperature rise for varying bundle sizes, ambient temperatures, and containment systems, etc.

The thermal performance of a CCA cable subjected to DC powering has also been proven to radiate more heat than cables which use solid copper conductors using equal DC current values.

Installations using PoE technology differ greatly in terms of their configuration and environment.

With an increasing demand for more power, which is likely to require powering over all four pairs, further work is required to investigate cable and component performance in areas such as bundled cables, thermal behaviour in different ambient temperature environments, cable reach under PoE, and connector demating under load. ■

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▲ Die Geschäftsleitung: Johann Jäkel, Gerhard Jakopic, Ernst Altmann und Siegfried Altmann (von links nach rechts)

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Jessica Roberts hat die Position der Verkaufsleiterin im regionalen mittleren und südlichen Gebiet für Miltec UV übernommen. Als Jill bekannt, lebt sie in Grapevine - gleich außerhalb Dallas, Texas - mit ihren drei Kindern.

Als Absolventin der Texas A&M University, wo sie ihren Bachelor-of-Science-Abschluss im Industrievertrieb erhielt, war sie als Vertriebsingenieur und technische Verkaufsberaterin in mehreren Marktsegmenten der Technologie und Herstellung tätig.

Fred Beu, Global Director Verkauf und Marketing für Miltec, meinte dazu: "Jill verfügt über mehrere Jahre Industrieerfahrung im Bereich Elektronik, Halbleiter und zahlreichen technischen Anwendungen, wo sie erfolgreich komplexe Lösungen entwickelte und Großkunden sowohl technisch als auch aus Vertriebsicht unterstützte."

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# Gemessene und simulierte GS-Speisung von Datenkabeln für Power over Ethernet

Von Stephen W Simms, Brand-Rex Ltd

## Übersicht

Die steigende Nachfrage nach höheren Stromstärken in PoE-Systemen (*Power over Ethernet*) ist offensichtlich und zeigt sich durch eine Vielzahl von derzeit auf dem Markt erhältlichen, nichtstandardisierten Produkten, die höhere Stromstärken anbieten als durch den Standard IEEE 802.3at vorgegeben.

Höhere Stromstärken ermöglichen ein breiteres Anwendungsspektrum für PoE, allerdings erhöhen sie auch das Leistungsrisiko. Angesichts der steigenden Nachfrage nach höheren Stromstärken und der Tatsache, dass sich die Installationen, für die PoE-Technologie genutzt wird, in Konfiguration und Umgebung stark unterscheiden, ist eine Eingrenzung des Risikos durch die Verwendung der numerischen Simulation von Vorteil. Der vorliegende Artikel bietet eine numerische Simulation und experimentelle Überprüfung der thermischen Eigenschaften von Datenkabeln bei einer GS-Speisung, die für PoE-Anwendungen genutzt wird.

## Einleitung

Die Versorgung von Endgeräten mit GS über den gleichen Stromweg, der für die WS-Signalübertragung genutzt wird, kam viele Jahre lang erfolgreich zum Einsatz, so z. B. bei Telefonen und Audioanlagen.

Die für diese Funktionalität verwendete Technik wird allgemein als „Phantomspeisung“ bezeichnet. In Zusammenhang mit Ethernet ermöglicht diese Technik die Stromübertragung von den energiespeisenden Geräten (Power Sourcing Equipment - PSE) zu den energieaufnehmenden Endgeräten (Powered Device - PD) auf demselben Aderpaar, das auch für die Daten genutzt wird.

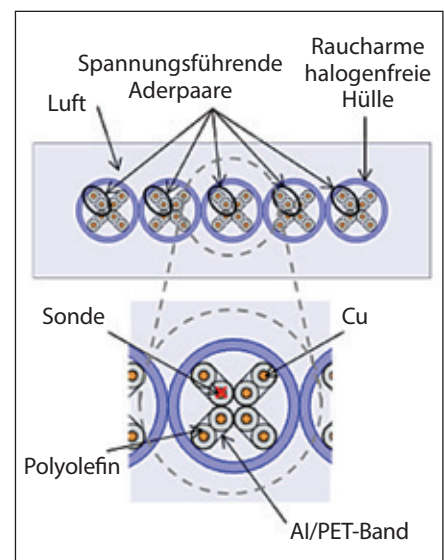
Der GS wird an den Mittelabgriff des Transformators zur Signaleinkopplung angelegt und interferiert nicht mit der Datenübertragung. Somit kann PoE in 1000BASE-T-Systemen verwendet werden, in denen alle vier Aderpaare der Datenübertragung dienen.

Die Standardisierung IEEE 802.3at-2009 legte die Systemparameter fest, die für die Installationen des Typs 1 (PoE) und Typs 2 (PoE+) erforderlich sind<sup>[1]</sup>. Der Standard klassifiziert die höchsten GS-Nennwerte bei 0,35A und 0,60A je Aderpaar, jeweils für Typ 1 und Typ 2. Zu den gängigsten Anwendungen der PoE-Technologie gehören schnurlose LAN-Zugangspunkte, VoIP-Telefone und Netzwerkkameras.

Das Anlegen von Strom an einen Leiter setzt Wärmeenergie frei. Dieser Effekt wird allgemein als Joule-Erwärmung bezeichnet. Im Hinblick auf Ethernet-Kabel und -Komponenten ist dieser Erwärmungseffekt problematisch aufgrund der höheren Dämpfung und der dadurch bedingten Begrenzung der Länge der Verbindungen. Dies gilt insbesondere für Kabel mit einem höheren Widerstand als Standardkabel, z. B. Kabel mit Leitern aus kupferkaschiertem Aluminium (CCA)<sup>[2]</sup> und aus massivem Kupfer mit niedrigem Durchmesser (26 AWG).

Im Jahre 2009 hat das IEC-Unterkomitee 46C eine Prüfmethode (46C/906/NP) mit dem Titel „Vorschlag für die Messung der Erwärmung von Datenkabeln durch Strom“ vorgelegt<sup>[3]</sup>. Dieser Aufsatz zielt auf eine starke Korrelation zwischen der Simulation und dem vorgeschlagenen Messverfahren mit Blick auf die GS-Speisung von Ethernet-Kabeln für PoE-Anwendungen.

Weiterhin vergleicht dieser Artikel den Temperaturanstieg durch GS-Speisung bei CCA-Kabeln mit Kabeln, deren Leiter aus massivem Kupfer bestehen.

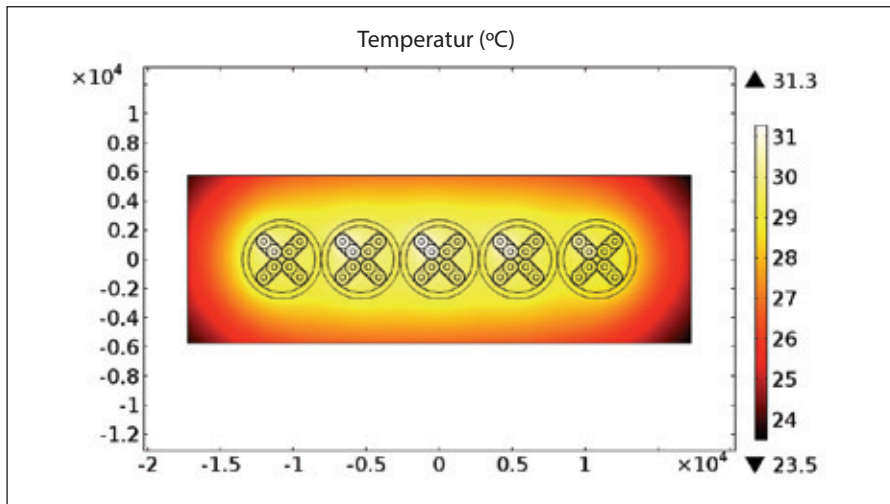


▲ Abb. 1: Gestaltung der Simulation in COMSOL Multiphysics

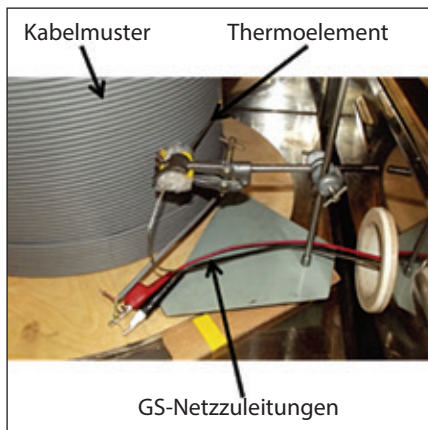
## Numerische Modellierung

Mit COMSOL Multiphysics 4.4, einem Softwarepaket, das FEM (Finite Element method)<sup>[4]</sup> verwendet, wurde ein 2-D-Modell erstellt. Das Modell diente der Nachbildung des vorgeschlagenen Messverfahrens<sup>[3]</sup> und der Möglichkeit einer Gegenüberstellung von Theorie und Praxis. Zu diesem Zweck wurde eine 5-kabelige lineare Konfiguration eingerichtet, um so eine aussagekräftige Vorhersage des Wärmeverhaltens in der Kabelmitte zu erhalten, ohne dafür zusätzliche Kabel in einem Modell zu verwenden, das höhere Rechenressourcen erfordert.

Um die Bestandteile des Cat6A 26 AWG U/FTP-Kabels darzustellen, wurden als Materialeigenschaften die Wärmekapazität bei konstantem Druck, die Dichte und die thermische Leitfähigkeit angelegt. Diese Eigenschaften wurden auf Kupfer



▲ Abb. 2: Graphische Darstellung der Temperatur des Querschnitts



▲ Abb. 3: Messaufbau

(Cu)-Leiter, auf Aluminium/PET (Al/PET)-Band, auf raucharme, halogenfreie (LSZH) Hülle und auf Polyolefinisolation angewendet (siehe Abb. 1). Leitungs-, Konvektions- und Strahlungs-Wärmeübertragungsmechanismen<sup>[5]</sup> wurden im Modell berücksichtigt.

An einem Aderpaar je Kabel im Modell wurde simulierte elektrische Energie angelegt. Ein starrer Auslöser wurde benutzt, um das Wärmeverhalten zu ermitteln für (a), einen Punkt in der Mitte einer der spannungsführenden Leiter (siehe Position der Sonde in Abb. 1), und (b), ein 2D-Diagramm der Temperatur des Querschnitts (Abb. 2). Aus dem 2-D-Diagramm geht, wie zu erwarten war, die Höchsttemperatur des Systems in der Nähe der spannungsführenden Leiter hervor.

## Prüfmethode und Ergebnisse

Die vom IEC-Unterkomitee 46C<sup>[3]</sup> vorgeschlagene Prüfmethode wurde angewendet, um den durch die GS-Speisung verursachten Anstieg

der Leitertemperatur festzustellen. Diese Methode umfasste die Messung der gelieferten Spannung und der Manteltemperatur bei Verwendung einer 100m langen Kabelprobe, die um eine Spule gewickelt in einer Klimakammer bei einer festgelegten Temperatur von 20°C platziert wurde (siehe Abb. 3). Bei diesem Verfahren kam einer Cat6A U/FTP-Kabelprobe mit 26AWG-Leitern aus massivem Kupfer zum Einsatz, wie im Abschnitt 2 simuliert.

Die Kabelprobe wurde vor dem Test bei 20°C über mindestens 16 Stunden konditioniert. Ein Thermoelement des J-Typs wurde entlang der Hülle auf halber Strecke des Kabels angebracht.

Mit einem Labornetzgerät Keithley 2200-60-2 (60V, 2,5A) im Konstantstrom-Betrieb wurde an das zu prüfende Aderpaar 0,6A Strom (I) angelegt, wobei das ferne Ende der Probe kurzgeschlossen wurde. Temperatur- und Spannungsdaten wurden in Abständen von 15 Sekunden über die LabVIEW Software<sup>[6]</sup> von National Instruments erfasst.

Die Temperatur der Kabelprobe stieg wegen des Joule-Erwärmungseffekts, und nach einer gewissen Zeit stabilisierte sie sich.

Die Erwärmung durch die GS-Speisung glich sich zu diesem Zeitpunkt der Strahlungsleistung der Probe an, und ein weiterer Temperaturanstieg wurde verhindert.

Der Leiterwiderstand wurde ausgehend von der Spannung unmittelbar nach dem Einschalten des Stroms ( $U_0$ ), Gleichung (1) und nach der Temperaturstabilisierung ( $U_T$ ), Gleichung (2) berechnet. Daraufhin wurde die Änderung (oder das Delta) der Leitertemperatur ( $\Delta t$ ) unter Verwendung des Anfangswiderstands ( $R_{20}$ ) und des stabilisierten Widerstands ( $R_T$ ), Gleichung (3) errechnet.

$$R_{20} = \frac{U_0}{I} \quad (1)$$

$$R_T = \frac{U_T}{I} \quad (2)$$

$$\Delta t = \frac{1}{\alpha} \left( \frac{R_T}{R_{20}} - 1 \right) \quad (3)$$

$$\text{wo: } \alpha = 0.004 \frac{1}{K}$$

Diese Vorgehensweise wurde unter Anwendung von vier unterschiedlichen Stromwerten (I) wiederholt, d. h. 1,0A, 1,4A, 1,8A und 2,2A.

Abb. 4 zeigt die Änderung der Leitertemperatur im Vergleich zum Gleichstromniveau, das bei der Probe simuliert (siehe Abb. 1) und anhand der Messung errechnet wurde.

Die Ergebnisse zeigen ein lineares Verhältnis sowohl mit der Delta-Leitertemperatur als auch mit dem Strom, das auf logarithmischen Skalen graphisch dargestellt wird.

Basierend auf diesem Verhältnis konnte anhand einer Approximation im Format  $\Delta t = x \cdot I^y$  eine Vorhersage des Temperaturanstiegs im Leiter für die Stromwerte außerhalb des gemessenen Spektrums erfolgen.

Für das Cat6A 26 AWG U/FTP-Kabel erwies sich folgende Approximation:

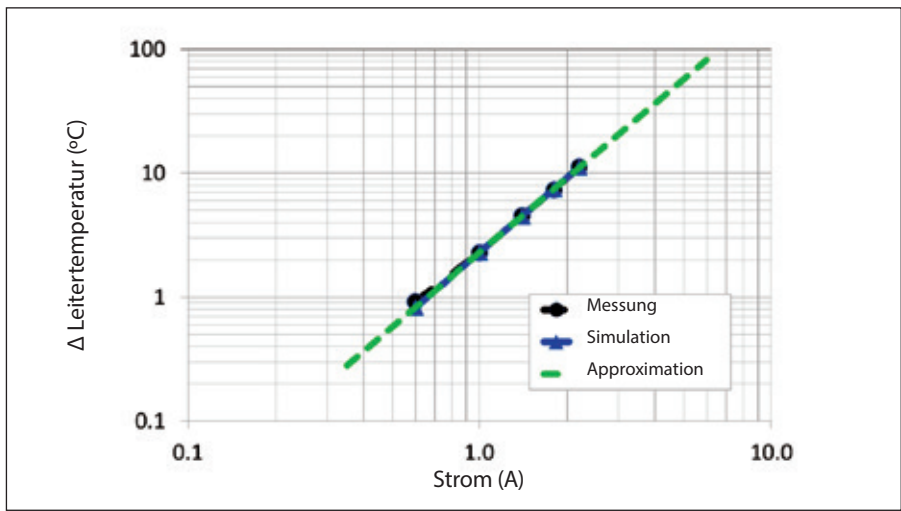
$$\Delta t = 2.3 * I^{2.0}$$

Gemäß der Approximation würde ein Strom von 3A in einem Einzelkabel bei einer festgelegten Umgebungstemperatur von 20°C einen Temperaturanstieg von 20,7°C erzeugen.

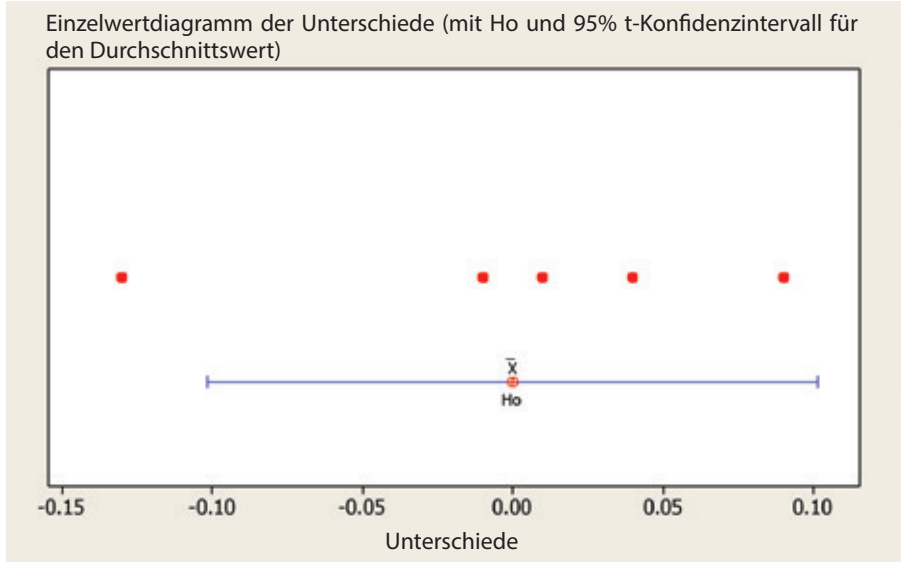
Die Korrelation zwischen den simulierten und den gemessenen Ergebnissen wurde unter statistischen Aspekten weiter erforscht, wobei ein Abhängiger t-Test (Paired t-test) über die Minitab-Software zum Einsatz kam<sup>[7]</sup> Abb. 5 zeigt ein Einzelwertdiagramm der Temperaturunterschiede zwischen Simulation und Messung, welches auch das auf diesen Schwankungen basierende, 95-prozentige Konfidenzintervall darstellt.

Die Ergebnisse zeigen, dass 95% der zusätzlichen simulierten und gemessenen Werte voraussichtlich in den  $\pm 0,1$  Unterschiedsbereich fallen und somit eine hervorragende Korrelation bestätigen.

Die Nullhypothese der nicht vorhandenen Unterschiede der Mittelwerte zwischen den zwei Datensätzen wurde per se nicht verworfen.



▲ **Abb. 4:** Simulierte, gemessene und genäherte Änderung der Leitertemperatur



▲ **Abb. 5:** Einzelwertdiagramm der Temperaturunterschiede

## Kupferkaschiertes Aluminium (CCA)

Eine Probe aus UTP-CCA-Kabeln mit 24 AWG-Leitern wurde analog der in Abschnitt 3 erwähnten U/FTP-Kabelprobe Cat6A 26 AWG erfasst und gemessen.

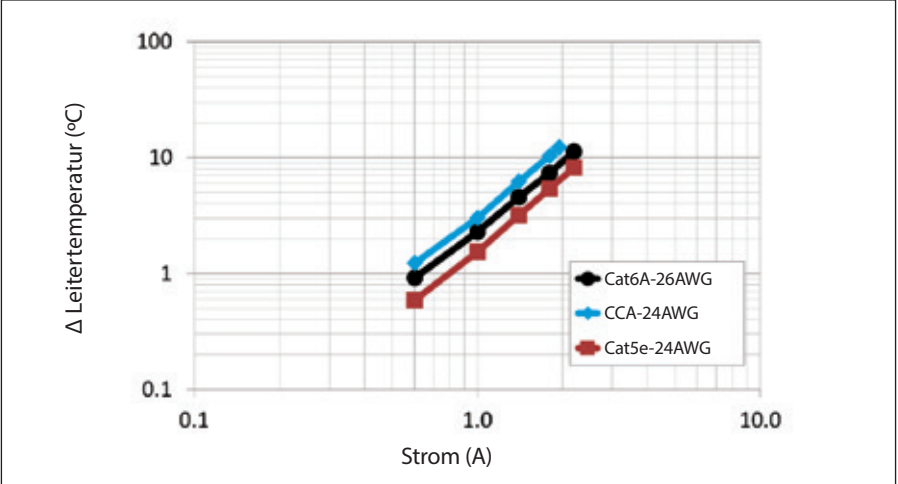
Der GS-Schleifenwiderstand der untersuchten Aderpaare je Kabeltyp ist in der *Tabelle 1* dargestellt. Zum Vergleich wurde ein Cat5e UTP-Kabel mit 24 AWG-Leitern aus massivem Kupfer in der Studie eingeschlossen. Wegen des hohen Widerstands des untersuchten CCA-Kabels

▼ **Tabelle 1:** GS-Schleifenwiderstand der untersuchten Aderpaare je Kabeltyp

	AWG	GS-Schleifenwiderstand (Ω)
Cat6A	26	23.3
CCA	24	28.4
Cat5e	24	18.2

konnte die zur Erzeugung eines Stroms von 2,2A erforderliche Hochspannung nicht mit der Laborstromversorgung erfolgen. Anders gesagt, war die beim Ansteigen von Temperatur und

▼ **Abb. 6:** Gemessene Änderung der Leitertemperatur



Widerstand geforderte Spannung (zur Erfüllung des Ohmschen Gesetzes) höher als die 60V-Höchstspannung der Laborstromversorgung.

Es wurde ein Stromwert von 1,95A gewählt, um den fünften Datenpunkt zu erzeugen. *Abb. 6* zeigt die Änderung der Leitertemperatur im Vergleich zum Gleichstromniveau, das anhand der Messung berechnet wurde. Für die CCA-Kabelprobe ergab sich eine Näherung des Temperaturanstiegs im Leiter von:

$$\Delta t = 3.1 * I^{2.0}$$

Es ist bekannt, dass der Temperaturanstieg wegen des Joule-Erwärmungseffekts im gleichen Verhältnis zu den  $I^2R$ -Verlusten<sup>[8]</sup> steht. Da der Strom für jeden einzelnen Messpunkt unveränderlich ist, wird der Temperaturanstieg von einem Kabel zum anderen durch den Widerstand des untersuchten Kabeladerpaars differenziert. Demzufolge weist erwartungsgemäß das Kabel mit dem höchsten GS-Widerstand den höchsten Temperaturanstieg auf, und das gleiche gilt umgekehrt.

## Debatte

Es ist bekannt, dass die Erwärmung der Kabel die Dämpfung<sup>[9]</sup> erhöht, was wiederum eine begrenzte Wirkung auf die Kabellänge hat. Für PoE heißt dies, dass die Höchsttemperatur wahrscheinlich in der Nähe spannungsführender Leiter lokalisiert ist, die für Datenübertragung eingesetzt werden könnten. Demzufolge sollten die Folgen der GS-Speisung auf die Dämpfung desselben Aderpaars berücksichtigt werden.

Die in diesem Artikel dargestellten Ergebnisse zeigen den Temperaturanstieg eines GS-führenden Aderpaars unter Einsatz eines Kabels bei einer kontrollierten Umgebungstemperatur



von 20°C. Unter realen Bedingungen variiert die Umgebungstemperatur von Ort zu Ort, und daher ist bei der Verlegung von PoE-Systemen in unkontrollierten und/oder wärmeren Umgebungen Vorsicht geboten. Weiterhin sollte die Korrelation der simulierten Daten mit der Installationsumgebung in Betracht gezogen werden.

Einerseits könnte die Simulation auf dem Schlimmstfall basieren, praktisch gesehen könnte der Betriebszyklus jedoch vorschreiben, dass der Strom nur für einen Bruchteil der Zeit geliefert wird.

Es sollten nach Möglichkeit gute Installationspraktiken Anwendung finden, wie z. B. das Minimieren der Bündelgrößen, das Berücksichtigen von Temperaturanstiegen bei den maximalen Kabellängen sowie das Freihalten von Wegen und Räumen von wärmeisolierenden Materialien.

Es sollte darauf hingewiesen werden, dass zwar eine hervorragende Korrelation zwischen den simulierten und den gemessenen Ergebnissen für den Aufbau eines Einzelkabels beobachtet wurde, dieser Artikel jedoch nicht das Verhalten der Kabel in Bündeln wiedergibt.

Dennoch ist auch für den gebündelten Aufbau an freier Luft eine gute Korrelation zwischen Theorie und Praxis in einer Vielzahl von Kabelbehältersystemen wie z. B. Pritschen, Kabelkanäle, Leitungen usw. zu erwarten.

Ein Vergleich zwischen den CCA 24 AWG UTP- und den Cat6A 26 AWG U/FTP-Proben zeigt, dass auch Kabel mit kleineren Leitern weniger Wärme als Kabel mit größeren Leitern abstrahlen können, wenn identische GS-Stromwerte eingespeist werden.

Darüber hinaus ist bekannt, dass die leitfähige Folie in abgeschirmten Kabeln als Kühlkörper wirkt, was dazu beiträgt, die vom Kabel abgestrahlte Wärme zu reduzieren<sup>[10]</sup>. Demzufolge ist es wichtig, bei der Verlegung von PoE-Systemen nicht nur den Leiterdurchmesser, sondern auch den Kabelaufbau zu berücksichtigen.

Die steigende Nachfrage nach einer höheren Stromversorgung von PSE auf PD ist unumstritten, wobei eine Speisung nach IEEE-Standard über alle vier Aderpaare erwartet wird<sup>[11]</sup> und derzeit eine Vielzahl von nichtstandardisierten Produkten auf dem Markt sind, die höhere Stromstärken anbieten, als durch IEEE 802.3at spezifiziert.

Höhere Stromstärken erhöhen das Leistungsrisiko, eröffnen aber auch ein breiteres Anwendungsspektrum für PoE.

## Schlussfolgerungen

Unter Verwendung einer COMSOL Multiphysics-Software wurde ein zweidimensionales Modell erstellt, um Messergebnisse nachzubilden. Eine durch das IEC-Unterkomitee 46C vorgeschlagene Prüfmethode zur Bewertung von Kabeln für den Einsatz für Power over Ethernet wurde umgesetzt, die sich mit der Messung der Erwärmung von Datenkabeln durch GS befasste. Bewiesen wurde eine hervorragende Korrelation zwischen den simulierten und den gemessenen Ergebnissen für ein Einzelkabel.

Diese Korrelation unterstützt den Einsatz der Software für die Vorhersage des Wärmeverhaltens von Kabeln in Netzwerken in dicht besiedelten Gebieten. Darüber hinaus wird davon ausgegangen, dass dies einen deutlichen Hinweis auf den Temperaturanstieg bei variierenden Bündelgrößen, Umgebungstemperaturen, Behältersystemen usw. liefert. Bewiesen wurde auch, dass die Wärmeleistung eines mit GS gespeisten CCA-Kabels bei gleichen GS-Stromwerten mehr Wärme abstrahlt als Kabel mit Leitern aus massivem Kupfer.

Die auf PoE-Technologie basierenden Installationen unterscheiden sich deutlich hinsichtlich ihrer Konfigurationen und Umgebungen. Bei einem steigenden Strombedarf, der wahrscheinlich die Speisung über alle vier Aderpaare erfordert, sind weitere Studien notwendig, um die Leistungsfähigkeit von Kabeln und Komponenten zu untersuchen. Dies betrifft u.a. die Bereiche Kabelbündelung, Wärmeverhalten bei unterschiedlichen Umgebungstemperaturen, Kabellängen bei PoE und Auslösung stromführender Leiter. ■

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# Открытие нового технологического центра

Самая быстрая в мире линия по нанесению вторичного покрытия появилась, когда Rosendahl and Nextrom запустили свои линии свободно лежащего кабеля нового поколения, которые не только являются небольшими по габаритам, но и первыми по превосходству показателя 1000 метров в минуту. Но они появились не без доли инвестиций.

Rosendahl and Nextrom вложили немало инвестиций для запуска на рынок высокоскоростной производственной линии, однако, сама линия - это не главная инвестиция Rosendahl и Nextrom. Компания также внесла инвестиции в собственный завод по производству в городе Пишельсдорф, Австрии.

Помимо трех уже основанных технологических центров: одной лаборатории производства кабеля, одной лаборатории производства батарей и одной производственной лаборатории оптического волокна в Вантаа, Финляндии, четвертая была основана для эксклюзивных демонстраций заказчику в высоко профессиональной среде.

Новый учрежденный технологический центр должен стать домом для вдохновения и идей для нестандартных специалистов и технологов, так как он включает возможность увидеть работающие линии на демонстрации.

Площадь объекта составляет 700 м<sup>2</sup> для установки и испытаний новых разработанных производственных линий, где также находится



▲ Руководство: Йохан Екель, Герхард Якопик, Эрнст Альтманн, Зигфрид Альтманн (слева направо)

переговорная для технических семинаров. Благодаря новому технологическому центру Rosendahl Nextrom разрабатывает все технологии, которые позволят превратить сверхсовременное производство кабеля в реальность. Сегодня Rosendahl Nextrom вытесняют ограничения стандартного производства кабеля и позволяют клиентам посетить и увидеть действующие линии своими глазами.

«Наш технологический центр позволит внести инновации для наших клиентов и продвигать эти инновации в мире», - заявил директор Зигфрид Альтманн и Герхард Якопик. «За последнее десятилетие мы

внести наши инвестиции в научно-исследовательские разработки и расширили нашу мировую сеть продаж и объектов обслуживания для соответствия растущим требованиям наших клиентов в революционной технологии, которую мы разработаем вместе с ними. Мы видим значительные возможности в функционировании, а наличие лучшей технологии обеспечит нам качественные решения».

**Rosendahl – Австрия**  
Вебсайт: [www.rosendahlaustria.com](http://www.rosendahlaustria.com)

**Nextrom OY – Финляндия**  
Вебсайт: [www.nextrom.com](http://www.nextrom.com)

## Новая роль Джилл в продажах

Джессика Робертс стала региональным директором по продажам в южном и центральном регионе компании Miltec UV. Известная под именем Джилл, она живет в городе Грейпвайн рядом с Далласом в штате Техас с тремя детьми.

Выпускница университета A & M в Техасе, где она получила степень бакалавра в отраслевом распределении, она работала инженером по продажам и техническим консультантом по продажам в многочисленных сегментах рынка по технологии и производству.

Фред Бью, директор по продажам и маркетингу в мире компании Miltec, заявил: «Джилл принесет многолетний

опыт в промышленности с электрооборудованием, полупроводниками и разнообразными технологическими применениями, где она успешно разрабатывала сложные решения и поддерживала большое количество заказчиков как с технической точки зрения, так и с точки зрения продаж.

«Мы с нетерпением ждем расширения нашего рынка во многих сферах промышленности на центрально-южной территории, и мы очень довольны тем, что Джилл будет представлять Miltec UV нашим ключевым заказчиком.»

**Miltec UV Corp – США**  
Вебсайт: [www.miltec.com](http://www.miltec.com)

## Гибкие компаунды

Компания Sylvin Technologies производит гибкие виниловые компаунды для проволоки и кабеля, и рынка электрооборудования, которые соответствуют требованиям заказчиков к эксплуатации, надежности и стандартам.

Характеристики продукции включают новую серию 7844 электрических прессованных компаундов, которые одобрены для UL-94 с расчетной стойкостью к воздействию пламени и соответствуют California Proposition 65. Компаунд 5409-92 рассчитан на 125°C и подходит для автомобильных проводов SAEJ1127 и 1128. Данный материал предусматривает устойчивость к действию масел и жира и повышает низкотемпературную эластичность.

Компания Sylvin также разработала инновационные компаунды на основе биологического сырья, включая компаунд 6240-80, который не содержит фталат и является экологически чистым. Компаунды на основе биологического сырья обладают теми же преимуществами при эксплуатации, что и пластичные виниловые компаунды

общего назначения, и продаются по конкурентным ценам. Широкий ассортимент продукции Sylvin для кабеля и проволоки, а также рынка электрооборудования включает компаунды, соответствующие RoHS, REACH и Prop 65. Некоторые марки признаны UL и CSA, а многочисленные специализированные марки разработаны для улучшения характеристик проводимости, устойчивости к маслу и пламени и увеличенной низкотемпературной эластичности.

Технические специалисты по эксплуатации Sylvin разработали специализированные технологии для большого числа проволоки и кабеля и электро применения, включая автомобильные провода, двухволоконные оптические кабели для шнуров с перемычкой, покрытия для выводов аккумуляторной батареи, провода для взрывных работ, кабели для питания от внешнего источника, прессованные кабельные узлы и электроразъемы.

**Sylvin Technologies Inc – США**  
**Вебсайт:** [www.sylvin.com](http://www.sylvin.com)

# Возврат к креплениям, о котором мечтал владелец

Давид Визенфельд, основатель и владелец Videx Machine Engineering, начал свою карьеру в сфере производства креплений 50 лет назад, работая инженером на заводе по изготовлению креплений в Израиле. В то время он получил опыт горячейковки и всегда мечтал вернуться в этот бизнес.

Его мечта осуществилась в прошлом году, и к ассортименту Videx прибавились линии горячейковки. Линии горячейковки Videx - это первые полностью автоматические линии для длинных и больших болтов.

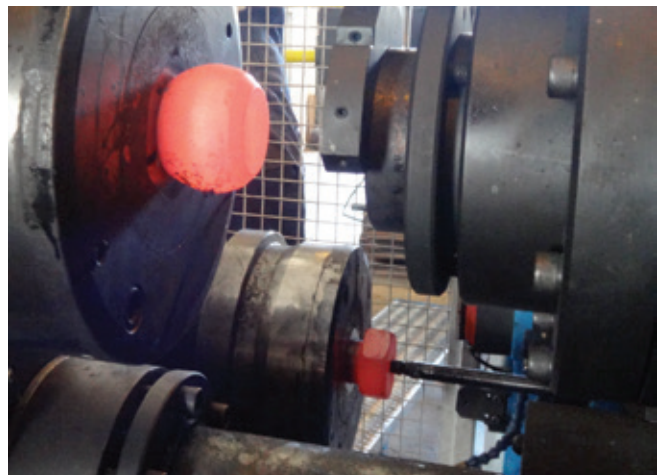
Ковочные машины имеются в ассортименте 300, 400 и 500 метрических тонн для диапазона резьбы от M-20 до M-48 (¾ до 2 дюймов) в самой маленькой машине и до M-80 (3") в самой большой машине. Диапазон длины составляет 200-1,000мм (8-36 дюймов) под головкой. Шестигранник формируется в закрытой штамповке и не требует обрезки. Скорость изготовления - 4-6 частей в минуту.

Полная линейка состоит из следующего оборудования:

- Устройство ударной резки, резка длинных прутков по длине
- Устройство для снятия фаски, принимающее разрезанные по длине прутки с устройства ударной резки или с однорядного укладчика
- Экструзионный станок, выполняющий экструзию на стороне снятой фаски
- Устройство индукционного нагрева (не производства Videx)
- Станок дляковки с жесткой матрицей прессования, двухударный с мощностью 300/400/500 метрических тонн

Станок дляковки имеет пять станций - одну станцию загрузки, две станцииковки и две станцииизвлечения.

Прутки со снятой фаской и экструдированные подаются в формирующую головку пневматическим стержнем. Затем шкала



▲ Линии горячейковки Videx - это возврат к первоначальному бизнесу, о котором мечтал владелец Videx Давид Визенфельд

направляет части на первую станциюковки, которая разводит части и нарушает шкалу. На следующейстанцииформируется шестигранник в скользящей закрытой формовке.

После загибания части нумеруются по позиции извлечения, где они извлекаются на конвейер и отправляются к местам сборки.

Станок поставляется с системой распыления для охлаждения и смазки формовки и пуансона. Кроме того, Videx предлагает автономные и не подключаемые к линии устройства.

**Videx Ltd – Израиль**  
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# Измеренное и смоделированное питание постоянным током кабелей передачи данных для питания по Ethernet

Стивен У. Симмс, «Brand-Rex Ltd»

## Аннотация

Растущая потребность в более высокой мощности систем Ethernet (питание по Ethernet – PoE) очевидна при наличии большого разнообразия нестандартной продукции, доступной сегодня на рынке, которая предусматривает мощности, намного превышающие те, что указаны в IEEE 802.3at.

Более высокие мощности позволят применять Ethernet для более широкого диапазона, однако, это также увеличит риск в надежности. С увеличением потребности в мощности и тем фактом, что установки с применением технологии Ethernet сильно отличаются с точки зрения их экологичности и конфигурации, снижение риска при использовании численного моделирования становится выгодным.

Предоставленная далее работа содержит численное моделирование и экспериментальную проверку термических характеристик кабелей для передачи данных при питании с постоянным током, которое используется в Ethernet.

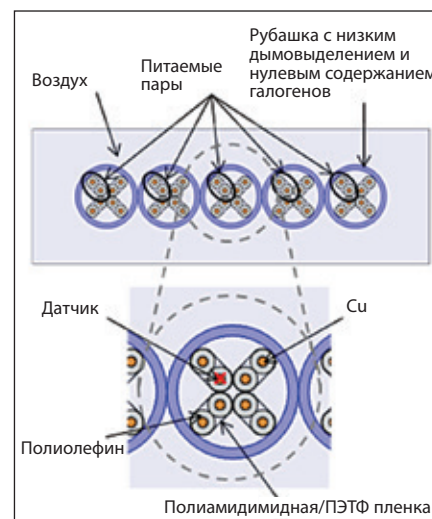
## Введение

Подача питания с постоянным током конечным устройствам вместе с одинаковой электрической цепью, используемой для передачи сигнала переменного тока применяется успешно много лет, например, в телефонах и аудио оборудовании. Технология, применяемая для

обеспечения данной функциональности, повсеместно именуема «искусственное электроснабжение». Применительно к Ethernet данная технология предусматривает доставку электроэнергии из оборудования источника электропитания в снабжаемое энергией устройство на той же паре, которая используется для данных. Постоянный ток применяется к отводу от середины сигнала трансформатора связи и не пересекается с передачей данных. Это позволяет использовать Ethernet в системах выше 1000BASE-T, где данные передаются на всех четырех парах.

В стандарте IEEE 802.3at от 2009 года указаны системные параметры, необходимые для Типа 1 (PoE) и Типа 2 (PoE+) [1]. По стандарту номинальные самые высокие показатели постоянного тока 0,35 А и 0,60 А на пару классифицированы как Тип 1 и Тип 2 соответственно. Некоторые самые распространенные способы применения, где используется технология PoE, включают беспроводные точки доступа локальной информационной сети, IP-телефония и сетевые камеры.

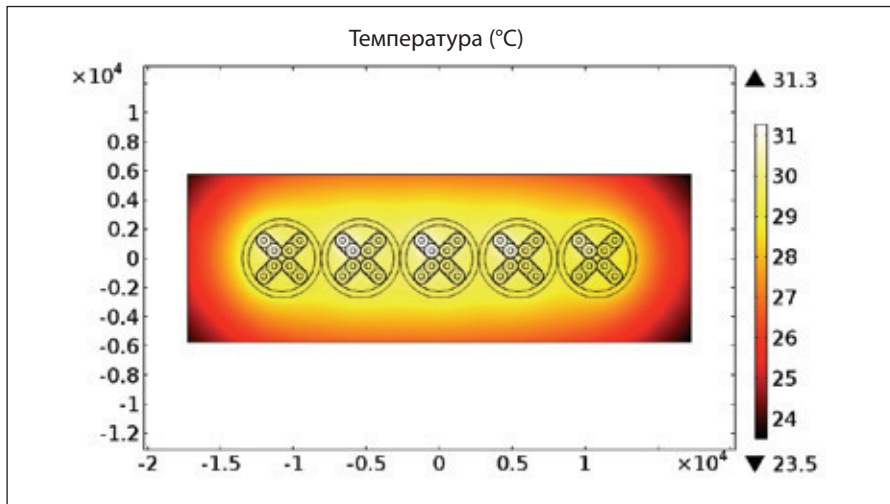
Применение электрического тока для проводника высвобождает тепловую энергию, действие, известное как джоулев нагрев. В отношении кабелей Ethernet и компонентов, данный эффект нагревания вызывает опасения из-за увеличения затухания, что имеет эффект ограничения длины линии связи. Данное опасение увеличивается для кабелей с более высоким сопротивлением, чем у стандартных кабелей, например, для алюминиевых кабелей с медным



▲ Рисунок 1: Настройка моделирования в COMSOL Multiphysics

покрытием [2] и для твердых кабелей с медными жилами с меньшим диаметром (26 AWG).

В 2009 подкомитет IEC 46C предложил метод испытаний (46C/906/NP), названный «Предложение по измерению нагревания кабелей для передачи данных током» [3]. Целью данной работы является получение сильной корреляции между моделированием и предложенным методом измерения для постоянного тока, поступающего в кабели Ethernet, применяемые для PoE. Кроме того, в работе поставлена задача сравнить подъем температуры при поступлении постоянного тока в алюминиевые кабели с медным покрытием и кабели с твердыми медными жилами.



▲ Рисунок 2: Температурная диаграмма в разрезе



▲ Рисунок 3: Настройка измерения

## Численное моделирование

2-D модель была установлена при использовании COMSOL Multiphysics 4.4, пакет программного обеспечения, который использует метод конечного элемента [4]. Модель была установлена для воспроизведения предложенного метода измерения, который предусматривает сравнение между теорией и практикой.

Для достижения данного, была установлена пятикабельная линейная конфигурация с целью получения хорошего прогнозирования температурного режима в центральном кабеле без необходимости включения дополнительных кабелей в модель, требующую более мощного вычислительного ресурса.

Характеристики материала, такие как теплоемкость при постоянном давлении, плотность и теплопроводность были

применены в качестве представления составляющих частей кабеля Cat6A 26 AWG U/FTP. Данные характеристики были применены для медных жил, алюминиевой/полиамидидной/ПЭТФ пленки, рубашки с низким дымовыделением и нулевым содержанием галогенов и для полиолефиновой изоляции, смотрите рисунок 1. Механизмы проводимости, конвекции и радиационного теплообмена [5] были учтены в модели.

Моделируемая электроэнергия была применена к одной паре каждого кабеля в модели. Стационарный инструмент использовался для определения температурного режима для (а), точки в центре одного из проводников, получающих питание (смотрите положение датчика на рисунке 1) и (б), температурной диаграммы поперечного размера, рисунок 2. На двухмерной диаграмме, как и ожидалось, максимальная температура конфигурации наглядно расположена в непосредственной близости от жил, получающих питание.

## Метод испытания и результаты

Метод испытания и результаты, предложенные подкомитетом IEC 46C [3] был соблюден для установления поднятия температуры в проводнике вследствие питания постоянным током. Данный метод состоит в измерении подаваемого напряжения и температуры рубашки при использовании 100-метрового образца кабеля, намотанного на катушку и расположенного в пределах камеры с искусственным микроклиматом при 20°C, смотрите рисунок 3. Данный метод был соблюден при использовании

образца кабеля Cat6A U/FTP с твердыми медными жилами 26 AWG (американский калибр проволоки), что смоделировано в Разделе 2.

Образец кабеля хранился при температуре 20°C минимум в течение 16 часов до проведения испытания. Байонетная термопара типа J была расположена в рубашке на средней точке кабеля. При использовании демонстрационного электроснабжения 2200-60-2 (60V, 2.5A), функционирующего в постоянном режиме, ток в 0,6 А был применен для пары при испытании с образцом, дальний конец которого был коротко замкнутый. Данные по температуре и напряжению были зарегистрированы с 15-секундными интервалами при использовании программного обеспечения National Instruments LabVIEW [6].

Температура образца кабеля выросла вследствие эффекта джоулева нагрева, а спустя определенное время температура стабилизировалась. В данный момент времени нагрев вследствие подачи постоянного тока сравнялся с излучаемой мощностью образца, и повышение температуры было предотвращено.

Сопротивление жил было рассчитано на основе напряжения сразу после включения питания ( $U_0$ ), уравнение (1), и после стабилизации температуры ( $U_T$ ), уравнение (2). Изменение (или дельта) температуры жил ( $\Delta T$ ) было затем рассчитано при использовании первоначального ( $R_{20}$ ) и стабилизированного ( $R_T$ ) сопротивления, уравнение (3).

$$R_{20} = \frac{U_0}{I} \quad (1)$$

$$R_T = \frac{U_T}{I} \quad (2)$$

$$\Delta T = \frac{1}{\alpha} \left( \frac{R_T}{R_{20}} - 1 \right) \quad (3)$$

$$\text{where } \alpha = 0.004 \frac{1}{K}$$

Данная методика была повторно использована при применении четырех различных показателей тока (I), т.е. 1,0A, 1,4A, 1,8A и 2,2A. На рисунке 4 показано изменение температуры жил по отношению к моделируемому уровню постоянного тока на датчике (смотрите рисунок 1) и рассчитанное из измерения.

Результаты демонстрируют линейное соотношение как дельты температуры жил, так и тока на диаграмме с логарифмическими координатами. На

основе данного соотношения возможно применить округление в формате  $\Delta t = \chi^2$ , которое может использоваться для прогнозирования подъема температуры для фактических показателей измеренного диапазона.

Для кабеля Cat6A 26 AWG U/FTP данное округление выглядит следующим образом:

$$\Delta t = 2.3 * I^{2.0}$$

При использовании округления ток 3А обуславливает подъем температуры в 20,7°C у одного кабеля в пределах условий с фиксированной температурой 20°C.

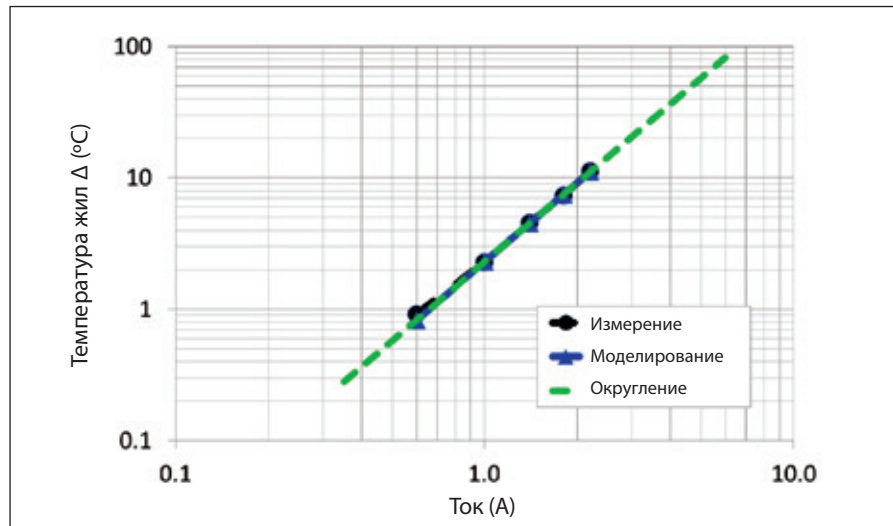
Соотношение между смоделированными и измеренными результатами было рассмотрено далее со статистической точки зрения при использовании двустороннего критерия Стьюдента в программном обеспечении Minitab [7]. На рисунке 5 показана отдельная диаграмма со значениями разницы температуры между моделированием и измерением, где также показан доверительный интервал на основе данных различий. Результаты демонстрируют, что 95% дополнительно смоделированных и измеренных показателей вероятно упадут в пределах разницы диапазона  $\pm 0,1$ , подтверждая отличительное соответствие. Как таковая, нулевая гипотеза отсутствия различия в средних показателях между двумя блоками данных не отклоняется.

## Алюминий с медным покрытием

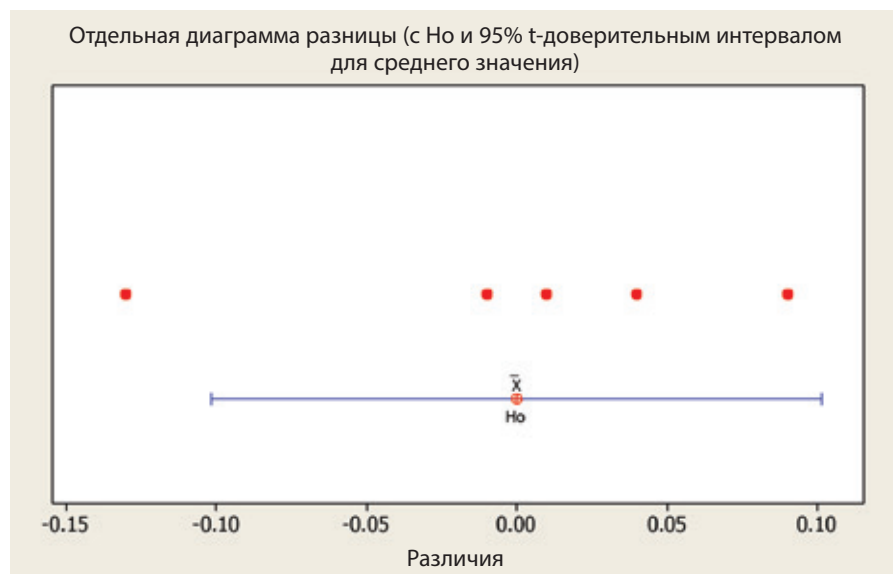
Образец кабеля UTP CCA с размером жил 24 AWG был приобретен и измерен в соответствии с образцом кабеля Cat6A 26 AWG U/FTP в разделе 3. Сопротивление контура постоянного тока пар при рассмотрении каждого типа кабеля показано в таблице 1. Для сравнения кабель Cat5e UTP с твердыми медными жилами 24 AWG был включен в исследование.

	AWG (американский проволочный калибр)	Сопротивление в контуре постоянного тока ( $\Omega$ )
Cat6A	26	23.3
CCA	24	28.4
Cat5e	24	18.2

▲ Таблица 1: Сопротивление в контуре постоянного тока рассматриваемой пары для каждого типа кабеля



▲ Рисунок 4: Смоделированное, измеренное и округленное изменение температуры жил



▲ Рисунок 5: Отдельная диаграмма значения разницы температур

Из-за высокого напряжения рассматриваемого алюминиевого кабеля с медным покрытием, высокое напряжение, необходимое для подачи тока в 2,2А было невозможно при использовании демонстрационного электроснабжения. Другими словами, так как температура и сопротивление увеличились, необходимое напряжение (для соблюдения закона Ома) было больше максимального напряжения 60В) демонстрационного электроснабжения. Показатель тока в 1,95А был выбран для создания пятой точки замера.

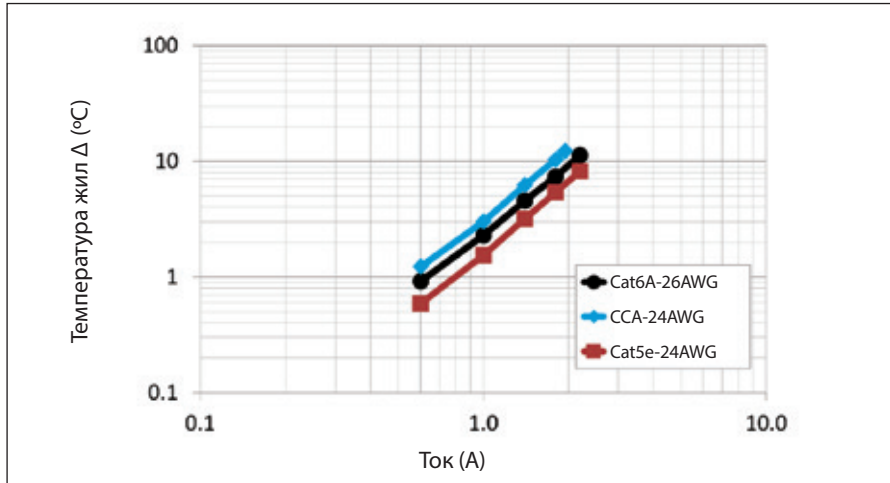
На рисунке 6 показано изменение температуры жил по отношению к уровню постоянного тока, который был рассчитан из измерения. По образцу алюминиевого кабеля с медным покрытием, округленный подъем температуры жил рассчитан следующим образом:

$$\Delta t = 3.1 * I^{2.0}$$

Поднятие температуры вследствие джоулева нагрева является пропорциональными потерям  $I^2R$ , таким образом, так как ток фиксируется на каждой точке измерения, сопротивление рассматриваемой кабельной пары будет определять подъем температуры от одного кабеля к другому. Таким образом, как и ожидалось, кабель с самым высоким сопротивлением постоянного тока будет иметь самый высокий подъем температуры, и наоборот.

## Пояснение

Известно, что кабели подогрева увеличивают затухание [9], что имеет ограничивающее действие на растяжение кабеля. Касательно PoE,



▲ **Рисунок 6:** Измеренное изменение температуры жил

максимальная температура должна по всей вероятности приближаться к питаемым жилам, что может использоваться для передачи данных. Поэтому, необходимо учитывать последствия питания постоянным током для затухания той же пары.

Результаты, показанные в данной работе, демонстрируют подъем температуры питаемой постоянным током пары при использовании кабеля, находящегося в условиях окружающей среды при контролируемой температуре 20°C. Фактически, температура окружающей среды может варьироваться от объекта к объекту, а, следовательно, необходимо обращать особое внимание на неконтролируемые и/или более теплые условия окружающей среды при установке систем PoE.

Кроме того, необходимо учесть соотношение моделируемых данных и эксплуатационных условий установки. С одной стороны, моделирование может быть основано на самом плохом сценарии, однако, в реальности, коэффициент нагрузки может определять, какое питание подается в определенный отрезок времени. По возможности необходимо использовать опыт надлежащей установки, такой как минимизация размера пучков, учет подъема температуры для максимальных длин кабеля и отсутствие изоляции на трассах и участках.

Важно заметить, что в то время, как данное отличное соотношение наблюдалось между моделируемыми и измеренными результатами, целью данной работы не являлось воспроизведение характеристик кабелей в пучках. Однако, ожидается, что хорошее соотношение между теорией и практикой также будет применимо к конфигурациям с пучками на открытом воздухе и в различных кабелепроводных

системах, т.е. в коробах, кабель-несущих системах, кабельных вводах.

Сравнение между образцами CCA 24 AWG UTP и Cat6A 26 AWG U/FTP показывает, что есть возможность для данных кабелей с меньшими жилами излучать меньше тепла, чем те, у которых жилы больше при подаче постоянного тока с одинаковыми показателями. Также известно, что токопроводящая фольга в экранированных кабелях действует как поглотитель тепла, что помогает уменьшить количество тепла, излучаемого кабелем<sup>[10]</sup>. Следовательно, важно учитывать конструкцию кабеля, не только диаметр жил при использовании системы PoE.

Растущая потребность в увеличении подачи энергии от оборудования подачи электроэнергии до потребителей энергии очевидна, с подачей энергии всем четырем парам ожидается стандартизация IEEE<sup>[11]</sup> и различных нестандартных продуктов в настоящее время доступных на рынке, что предусматривает высокие уровни электроэнергии, выше, чем те, что указаны в IEEE 802.3at. Более высокие уровни электроэнергии увеличат эксплуатационные риски, что также позволит применять PoE в более широком спектре.

## Заключения

Двухмерная модель была создана при использовании программного обеспечения COMSOL Multiphysics, чтобы воссоздать измеряемые результаты. Метод испытаний, предложенный подкомитетом IEC 46C для кабелей доступа взамен Ethernet, был соблюден, что выявило измерение нагревания кабеля данных постоянным током. Было продемонстрировано отличное соотношение между

моделируемыми и измеренными результатами для одного кабеля. Данное соотношение способствует применению программного обеспечения для прогнозирования термических характеристик кабелей в крупных сетях. Также ожидается, что оно предусмотрит надежный показатель подъема температуры для различных размеров пучков, температур окружающей среды и кабелепроводных систем, и т.д. Термические характеристики кабеля CCA, зависящие от постоянного тока, излучают больше тепла, чем кабели, в которых используются твердые медные жилы с теми же показателями постоянного тока.

Установка при использовании технологии PoE намного отличается с точки зрения своей конфигурации и экологичности. Срастающей потребностью в электроэнергии, при которой вероятно потребуется подача энергии для всех четырех пар, необходима дальнейшая работа по изучению эксплуатации кабеля и составляющих в таких областях, как кабельные жгуты, температурные характеристики в различных средах, протяженность кабеля при PoE и распытка разъемов при нагрузке. ■

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# Ouverture d'un nouveau centre technologique

LA ligne de revêtement secondaire la plus rapide du monde fut créée lorsque Rosendahl et Nextrom lancèrent leur nouvelle génération de lignes "loose tube" qui non seulement sont de dimensions réduites mais également les premières à dépasser la limite des 1000m/min. Toutefois, la ligne n'est pas née sans une considérable part d'investissement.

Rosendahl et Nextrom ont effectué des importants investissements supplémentaires pour introduire sur le marché la ligne de production à haute vitesse, mais la ligne en soi ne constitue pas le seul investissement important effectué par Rosendahl Nextrom. La société a également investi dans son établissement de production de Pischelsdorf, en Autriche.

Outre les trois centres technologiques déjà ouverts, (un laboratoire pour la production de câbles, un pour la fabrication de machines pour la production de batteries et un laboratoire avec salle blanche pour la technologie à fibres optiques à Vantaa, en Finlande), un quatrième centre spécialement conçu pour les démonstrations aux clients dans un environnement hautement professionnel a été également ouvert.

Le nouveau centre technologique est un lieu d'inspiration et d'idées pour visionnaires et technologues et il offre l'opportunité aux clients d'assister à la démonstration des lignes durant leur



▲ La direction: Johann Jäkel, Gerhard Jakopic, Ernst Altmann et Siegfried Altmann (de gauche à droite)

fonctionnement. L'établissement occupe 700m<sup>2</sup> pour le montage et l'essai de ses nouvelles lignes de production et dispose d'une salle de réunion pour les séminaires techniques.

Grâce au nouveau centre technologique, Rosendahl Nextrom développe actuellement tous les processus qui traduiront en réalité la fabrication de câbles de pointe.

Actuellement, Rosendahl Nextrom repousse les limites de la production de câbles normale en permettant aux clients de visiter et de voir directement les lignes pendant leur fonctionnement.

"Notre nouveau centre technologique nous permettra de réaliser localement

des innovations pour nos clients et de les promouvoir dans le monde," ont déclaré les directeurs exécutifs Siegfried Altmann et Gerhard Jakopic.

"Pendant ces dix dernières années, nous avons augmenté notre investissement dans la recherche et dans le développement et nous avons étendu notre réseau de ventes et de services global pour répondre à la demande croissante de nos clients pour les technologies révolutionnaires que nous développons ensemble."

**Rosendahl – Autriche**  
**Website:** [www.rosendahlaustria.com](http://www.rosendahlaustria.com)

**Nextrom OY – Finlande**  
**Website:** [www.nextrom.com](http://www.nextrom.com)

## Composés flexibles

La société Sylvin Technologies est spécialisée dans la fabrication de composés vinyliques flexibles pour les marchés du secteur électrique, du câble et du fil satisfaisant ainsi les demandes de performance, de soutenabilité et les objectifs de réglementation.

Les produits comprennent la nouvelle série 7844 des composés pour moulage électrique, approuvés selon la norme UL-94 avec une cote d'inflammabilité HB et conformes à la loi californienne Proposition 65. Le composé 5409-92 est classé jusqu'à une température de 125°C et il est indiqué pour les câbles SAEJ1127 et 1128 du secteur automobile. Ce matériau est résistant aux huiles et aux graisses et permet une majeure flexibilité aux basses températures.

Sylvin offre également de nouveaux bio-composés tels que

le composé 6240-80, non-phtalate et éco-compatible. Les bio-produits offrent les mêmes avantages que les composés vinyliques flexibles pour un usage général et ils ont des prix compétitifs.

La vaste gamme de produits de Sylvin pour les marchés du secteur électrique, du câble et du fil comprend des composés conformes aux normes RoHS, REACH et Proposition 65.

Plusieurs types sont classés UL et CSA et de nombreux types spécifiques ont été développés pour améliorer les propriétés conductrices, la résistance à la flamme et aux huiles et la flexibilité aux basses températures.

**Sylvin Technologies Inc – États-Unis**  
**Website:** [www.sylvin.com](http://www.sylvin.com)



## Nouveau rôle commercial Jill

Jessica Roberts a assumé la charge de directeur des ventes régional dans la zone centre-sud pour Miltec UV. Connue comme Jill, Jessica vit à Grapevine, juste à l'extérieur de Dallas, au Texas, avec ses trois fils.

Licenciée auprès de la Texas A&M University où elle a obtenu un baccalauréat en distribution industrielle, elle a travaillé en tant qu'ingénieur des ventes et conseiller technico-commercial dans plusieurs segments du marché des technologies et de la fabrication.

Fred Beu, directeur global des ventes et du marketing de Miltec, a déclaré: "Jill apporte plusieurs années d'expérience

de l'industrie électronique, des semi-conducteurs et de différentes applications techniques où elle a développé avec succès des solutions complexes et a offert un support à d'importants clients du point de vue technique et commercial.

"Nous espérons accroître notre part de marché dans de nombreux secteurs industriels que nous desservons sur tout le territoire centre-sud et nous sommes très heureux d'avoir Jill comme représentante de Miltec UV parmi nos clients clés."

**Miltec UV Corp – États-Unis**  
**Website:** [www.miltec.com](http://www.miltec.com)

# Le rêve de revenir aux éléments de fixation devient réalité

DAVID Wiesenfeld, fondateur et propriétaire de Videx Machine Engineering, a débuté dans le secteur des éléments de fixation il y a 50 ans, comme ingénieur d'usine dans une usine spécialisée dans la production d'éléments de fixation israélienne. Durant cette période il a acquis son expérience dans le forgeage à chaud et il a toujours rêvé de faire retour à cette activité.

Son rêve s'est accompli l'année dernière, lorsque Videx a ajouté les lignes de forgeage à sa propre gamme de produits. Les lignes de forgeage à chaud de Videx sont les premières complètement automatiques pour fabriquer des boulons longs et larges.

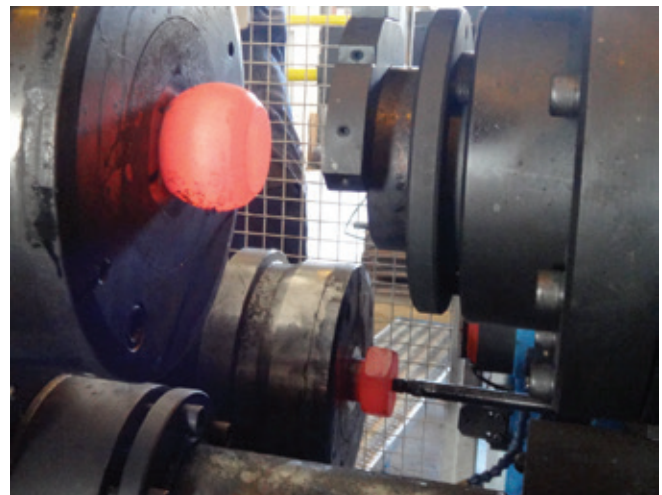
Les machines de forgeage sont disponibles avec des capacités de 300, 400 et 500 tonnes métriques, couvrant une gamme de filets de M-20 à M-48 (de ¾" à 2") avec la machine la plus petite et jusqu'à M-80 (3") avec la plus grande. La gamme de longueurs est de 200-1 000mm (8"-36") sous la tête. La tête hexagonale est formée dans une filière fermée et n'exige pas d'ébarbage. La vitesse de production est de 4-6 pièces par minute.

La ligne est composée des machines suivantes:

- Cisaille par percussion, conçue pour la coupe à longueur de barres longues
- Machine à biseauter, qui reçoit les barres coupées à longueur par la cisaille par percussion ou par un alimentateur à une rangée
- Extrudeuse, qui extrude le côté biseauté
- Réchauffeuse par induction (non fabriquée par Videx)
- Machine de forgeage avec filière solide, à double coup de 300/400/500 tonnes métriques de capacité

La machine de forgeage est équipée de 5 stations (une station d'alimentation, deux stations de forgeage et deux stations d'expulsion).

Les barres biseautées et extrudées sont acheminées à la filière au



▲ Pour David Wiesenfeld, propriétaire de Videx, les lignes de forgeage à chaud Videx représentent le rêve de retourner à son activité d'origine

moyen d'un piston automatique. Ensuite, le disque diviseur sépare les pièces et les envoie à la première station de forgeage qui les refoule et casse l'écaïlle. À la station successive, la tête hexagonale est formée dans une filière avec fermeture à glissement.

Après le refoulement, les pièces sont séparées et acheminées vers la position d'expulsion où elles sont éjectées sur un convoyeur qui les transporte en dehors de la zone de la machine.

La machine est équipée d'un système d'arrosage pour refroidir et lubrifier la filière et le poinçon. En outre, Videx offre les machines comme équipements individuels et autonomes et non connectés en ligne.

**Videx Ltd – Israël**

**Website:** [www.videx.co.il](http://www.videx.co.il)

# Alimentation en CC mesuré et simulé de câbles de transmission de données pour systèmes PoE

Par Stephen W Simms, Brand-Rex Ltd

## Résumé

La demande croissante de niveaux de puissance plus élevés dans les systèmes d'alimentation par Ethernet PoE (*Power over Ethernet*) est mise en évidence par la variété de produits non standardisés actuellement disponibles sur le marché qui fournissent des niveaux de puissance supérieurs à ceux indiqués dans la norme IEEE 802.3at.

Si d'un côté des niveaux de puissance plus élevés permettent d'utiliser les systèmes PoE dans un champ d'application plus étendu, de l'autre, ils augmentent également le risque de performance.

Compte tenu de la croissance de la demande de majeure puissance et du fait que les installations utilisant la technologie PoE diffèrent considérablement en termes de configuration et d'environnement, il est préférable d'atténuer le risque en utilisant la simulation numérique.

Cette étude présente la simulation numérique et la vérification expérimentale des propriétés thermiques des câbles de transmission des données avec l'alimentation en CC utilisés dans les applications PoE.

## Introduction

La fourniture de CC à des terminaux le long du même circuit électrique pour la transmission de signaux de CA a été utilisée avec succès pendant plusieurs années, par exemple pour les téléphones et pour le matériel audio.

La technique employée pour permettre cette fonctionnalité est généralement connue comme "alimentation fantôme".

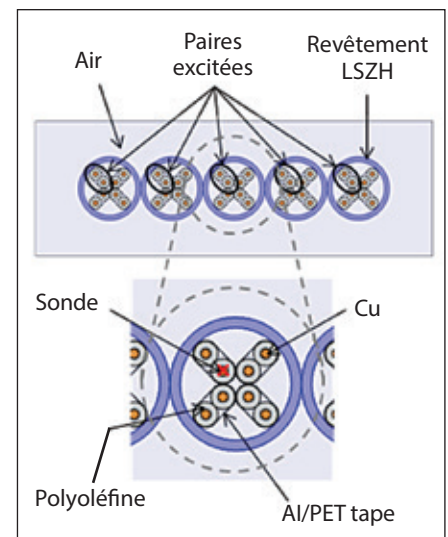
En ce qui concerne Ethernet, cette technique permet de transmettre de l'énergie électrique de l'équipement de source d'alimentation PSE (*Power Sourcing Equipment*) au dispositif alimenté PD (*Powered Device*) sur la même paire de conducteurs utilisée pour les données. L'alimentation en CC s'applique à la prise centrale du transformateur de couplage de signaux sans empêcher la transmission de données. Cela permet d'employer la technologie PoE dans des systèmes 100BASE-T, qui utilisent les quatre paires pour la transmission des données.

La norme IEEE 802.3at, approuvée en 2009, établissait les paramètres de système requis pour les installations du Type 1 (PoE) et du Type 2 (PoE+)<sup>[1]</sup>. La norme établit les valeurs maximales nominales de courant en CC à 0,35A et 0,60A par paire, respectivement pour le Type 1 et le Type 2. Un certain nombre des applications les plus communes qui utilisent la technologie PoE comprennent des points d'accès LAN sans fil, des téléphones VoIP et des caméras réseau.

En appliquant le courant électrique à un conducteur, ce dernier produit de l'énergie thermique, un effet connu comme chauffage par effet Joule. En ce qui concerne les câbles et les composants Ethernet, cet effet de chauffage est inquiétant du fait de l'augmentation de l'atténuation qui a un effet limitatif sur la longueur de la connexion.

Cette préoccupation est majeure dans le cas de câbles ayant une résistance supérieure par rapport aux câbles traditionnels, comme par exemple les câbles conducteurs revêtus de cuivre (CCA)<sup>[2]</sup> et ceux de cuivre plein d'un diamètre inférieur (26AWG).

En 2009, le sous-comité 46C de l'IEC a proposé une méthode d'essai (46C/906/



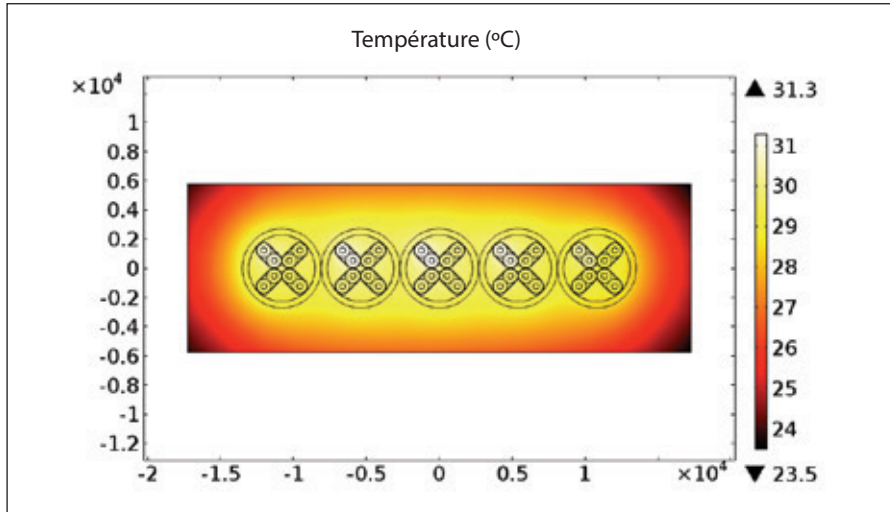
▲ Figure 1: Configuration de la simulation avec COMSOL Multiphysics

NP) appelée "Proposition pour la mesure du réchauffage de câbles de transmission de données au moyen de courant"<sup>[3]</sup>.

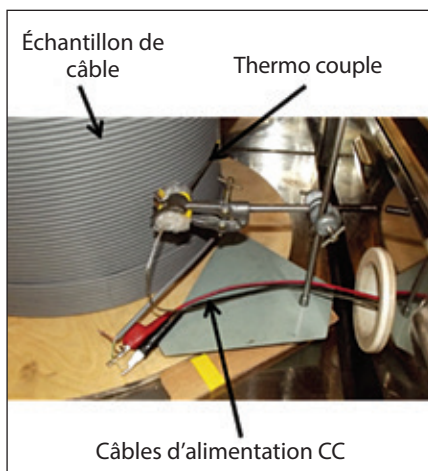
Le but de cette étude consiste à obtenir une forte corrélation entre la simulation et la méthode proposée en ce qui concerne l'alimentation en CC de câbles Ethernet pour les applications PoE. L'article a également pour but d'effectuer une comparaison entre l'augmentation de température causée par l'alimentation en CC du câble CCA et les câbles qui présentent des conducteurs de cuivre plein.

## Modélisation numérique

Un modèle 2-D a été réalisé en utilisant COMSOL Multiphysics 4.4, un paquet de programmes employant la méthode des éléments finis (FEM)<sup>[4]</sup>.



▲ **Figure 2:** Graphique de la température de la section transversale



▲ **Figure 3:** Configuration de la mesure

Le modèle a été mis au point pour reproduire la méthode de mesure proposée<sup>[3]</sup>, et pour consentir la comparaison entre la théorie et la pratique. C'est dans ce but qu'une configuration de cinq câbles linéaires, permettant d'effectuer une prévision satisfaisante du comportement thermique au centre du câble sans avoir besoin d'inclure d'autres câbles dans un modèle exigeant une majeure ressource computationnelle, a été réalisée.

Pour représenter les différentes composantes du câble U/FTP 26AWG Cat6A, on a appliqué des propriétés du matériau telles que la capacité thermique à pression constante, la densité et la conductivité thermique.

Ces propriétés ont été appliquées au conducteur de cuivre (Cu), à la bande d'aluminium/PET (Al/PET), au revêtement à faible émission de fumées et sans alogènes (LSZH) et à l'isolation polyoléfine (voir la Figure 1). Pour ce modèle on a considéré des mécanismes de conduction, de convection et de transfert de la chaleur par irradiation<sup>[5]</sup>.

On a appliqué l'énergie électrique simulée à une paire de chaque câble du modèle. Un solveur stationnaire a été utilisé pour déterminer le comportement thermique pour (a), un point situé au centre d'un des conducteurs excités (voir la position de la sonde à la Figure 1), et (b), un graphique 2-D de la température de la section transversale (Figure 2). Comme prévu, sur le graphique 2-D, la température maximale du système prédisposé est évidente à proximité des conducteurs excités.

## Méthode d'essai et résultats

La méthode d'essai proposée par le Sous-comité 46C de l'IEC<sup>[3]</sup> a été appliquée pour établir l'augmentation de la température dans le conducteur causée par l'alimentation de CC. Cette méthode prévoyait la mesure de la tension fournie et la température du revêtement en utilisant un échantillon de 100 mètres de câble enroulé sur un dévidoir et positionné à l'intérieur d'une chambre climatique à une température fixe de 20°C (voir la Figure 3).

Cette méthode a été suivie en utilisant un échantillon de câble U/FTP Cat6A avec des conducteurs en cuivre de 26AWG, comme simulé dans la section 2.

L'échantillon de câble a été conditionné à 20°C durant au moins 16 heures avant l'essai. Un thermocouple du type J a été placé le long du revêtement, à un point situé à moitié du câble. En utilisant un alimentateur de laboratoire Keithley 2200-60-2 (60V, 2,5A) avec un fonctionnement à courant constant, un courant (I) de 0,6 A a été appliqué à la paire soumise à l'essai en plaçant en court-circuit l'autre extrémité de l'échantillon.

Les données de la température et de la tension ont été enregistrées à des intervalles de 15 secondes en utilisant le logiciel LabVIEW de National Instruments.

La température de l'échantillon a augmenté à cause de l'échauffement par effet Joule et, après un certain temps, elle est devenue stable.

À ce point, le réchauffage dû à l'alimentation de CC a atteint la même valeur que l'énergie rayonnée de l'échantillon en évitant ainsi une augmentation supplémentaire de la température.

La résistance du conducteur a été calculée en fonction de la tension mesurée immédiatement après l'allumage de l'alimentation ( $U_0$ ), équation (1), et après la stabilisation de la température ( $U_T$ ), équation (2). Ensuite, la variation (ou Delta) de la température du conducteur ( $\Delta t$ ) a été calculée en utilisant la résistance initiale ( $R_{20}$ ) et stabilisée ( $R_T$ ), équation (3).

$$R_{20} = \frac{U_0}{I} \quad (1)$$

$$R_T = \frac{U_T}{I} \quad (2)$$

$$\Delta t = \frac{1}{\alpha} \left( \frac{R_T}{R_{20}} - 1 \right) \quad (3)$$

$$\text{où } \alpha = 0.004 \frac{1}{K}$$

Cette méthodologie a été répétée en utilisant quatre valeurs de courant (I) différentes, ou bien 1,0A, 1,4A, 1,8A et 2,2A.

La Figure 4 montre la variation de température dans le conducteur par rapport au niveau de courant CC simulé dans la sonde (voir la Figure 1) et calculée à partir de la mesure.

Les résultats montrent une corrélation linéaire dans le cas de la variation de température (Delta) du conducteur, et dans le cas du courant représenté sur des échelles logarithmiques. Sur la base de cette relation, il a été possible d'appliquer une approximation, dans le format  $\Delta t = x \cdot I^2$ , pouvant être utilisée pour prévoir l'augmentation de température du conducteur pour des valeurs de courant hors de la gamme mesurée.

Pour le câble U/FTP 26AWG Cat6A, l'approximation a été la suivante:

$$\Delta t = 2.3 * I^{2.0}$$

En utilisant l'approximation, un courant de 3A entraînerait une augmentation de température de 20,7°C dans un seul câble avec une température environnementale fixe de 20°C.

La corrélation entre les résultats simulés et ceux mesurés a été étudiée plus en détail d'un point de vue statistique en utilisant un test t pour échantillons appariés (*Paired t-test*) au moyen du logiciel Minitab<sup>®</sup>.

La *Figure 5* montre un graphique de valeurs individuelles des différences de température entre la simulation et la mesure qui montre également un intervalle de confiance de 95% sur ces différences.

Les résultats montrent que l'on prévoit que 95% des valeurs additionnelles simulées et mesurées rentre dans la gamme de différence  $\pm 0,1$ , en confirmant ainsi une excellente corrélation. En tant que telle, on ne peut pas exclure l'hypothèse nulle de différence zéro entre les valeurs moyennes des deux groupes de données.

## Aluminium revêtu de cuivre

Un échantillon de câble UTP CCA avec des conducteurs de 24AWG a été pris et mesuré comme échantillon de câble U/FTP de 26AWG Cat6A dans la section 3. La résistance du circuit de CC des paires étudiées pour chaque type de câble, est illustrée dans le *Tableau 1*. À titre comparatif, l'étude comprend également un câble UTP de Cat5 avec des conducteurs en cuivre plein de 24AWG.

	AWG	Résistance du circuit CC ( $\Omega$ )
Cat6A	26	23.3
CCA	24	28.4
Cat5e	24	18.2

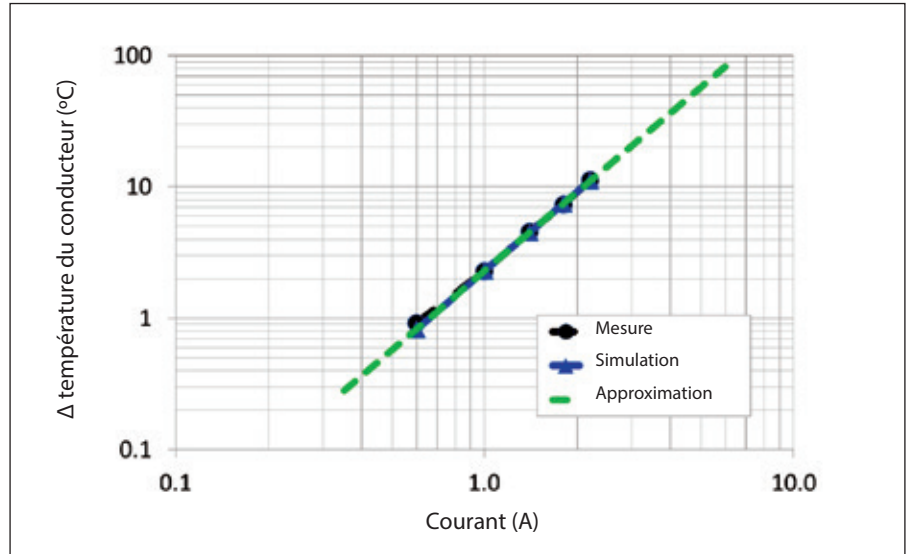
▲ **Tableau 1:** Résistance dans le circuit CC de la paire examinée en relation à chaque type de câble

Étant donné la résistance élevée du câble CCA examiné, il n'était pas possible d'obtenir la haute tension requise pour fournir un courant de 2,2A en utilisant l'alimentateur de laboratoire. En d'autres termes, avec l'augmentation de la température et de la résistance, la tension requise (pour satisfaire la loi d'Ohm) était supérieure à la tension maximale de 60V de l'alimentateur de laboratoire.

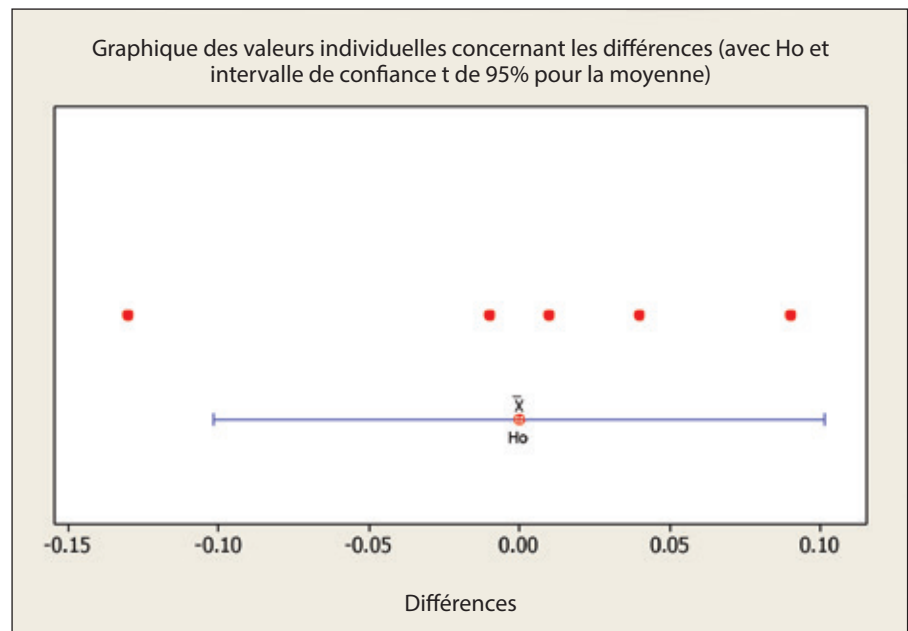
Pour générer le cinquième point de données on a utilisé une valeur de courant de 1,95A.

La *Figure 6* montre la variation de température dans les conducteurs par rapport au niveau de CC calculé à partir de la mesure. En ce qui concerne l'échantillon de câble CCA, l'augmentation de température approximée du conducteur a été la suivante:

$$\Delta t = 3.1 * I^{2.0}$$

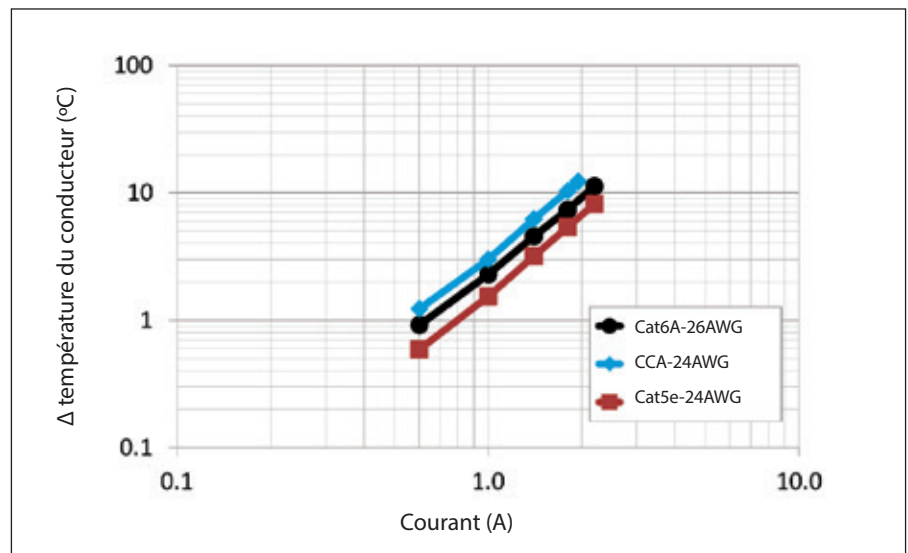


▲ **Figure 4:** Simulation, mesure et approximation de la variation de température dans le conducteur



▲ **Figure 5:** Graphique des valeurs individuelles des différences de température

▼ **Figure 6:** Mesure de la variation de température dans le conducteur



Il est notoire que l'augmentation de température due à l'échauffement par effet Joule est proportionnelle aux pertes  $I^2R$ <sup>[8]</sup>; par conséquent, le courant étant fixe pour chaque point de mesure, la résistance de la paire du câble en question entraînera une différence dans l'augmentation de température entre un câble et l'autre. Il s'ensuit que, comme prévu, le câble ayant une résistance CC majeure présentera l'augmentation de température majeure et vice versa.

## Discussion

Il est connu que l'échauffement des câbles augmente l'atténuation<sup>[9]</sup>, ce qui a pour effet de limiter la longueur du câble. En ce qui concerne la technologie PoE, il est probable que la température maximale sera localisée à proximité des conducteurs excités qui pourraient être utilisés pour la transmission des données. Par conséquent, il faudrait prendre en considération les conséquences de l'alimentation en CC sur l'atténuation de la même paire.

Les résultats illustrés dans le présent article montrent une augmentation de température d'une paire excitée avec CC en utilisant un câble placé dans un environnement contrôlé à 20°C. En réalité, la température ambiante variera en fonction du lieu d'installation, et il faudrait donc faire attention lors de l'installation de systèmes PoE dans des environnements non contrôlés et/ou plus chauds.

Il faudrait également accorder une attention particulière à la corrélation entre les données simulées et celles de l'environnement d'installation. D'un côté, la simulation peut être basée sur le scénario le plus pessimiste ; toutefois, en réalité, le cycle de fonctionnement peut exiger que l'alimentation ne soit fournie que pendant une fraction de temps. Dans la mesure du possible, il faudrait adopter des pratiques d'installation appropriées telles que réduire les dimensions du faisceau, considérer l'augmentation de température pour des longueurs de câble maximales et éliminer les matériaux thermostolants dans les circuits et dans les espaces libres.

Il importe de relever que bien que l'on ait observé une excellente corrélation entre les résultats simulés et ceux mesurés dans le cas d'une configuration avec un seul câble, cette étude n'avait pas le but de reproduire le comportement des câbles en faisceaux.

Toutefois, on prévoit qu'une corrélation satisfaisante entre la théorie et la pratique pourra être valable également pour les configurations des câbles en faisceaux,

à l'air libre et dans différents systèmes de confinement de câbles, comme par exemple les chemins, les gaines, les conduits, etc..

Une comparaison entre les échantillons UTP 24AWG CCA et U/FTP 26AWG Cat6A montre que les câbles avec des conducteurs plus petits peuvent diffuser moins de chaleur que ceux ayant des conducteurs plus grands lorsqu'ils sont alimentés avec des valeurs de courant CC identiques. Il est également connu que la feuille conductrice des câbles blindés fait fonction de dissipateur de chaleur, en contribuant ainsi à réduire la quantité de chaleur irradiée par le câble<sup>[10]</sup>. Par conséquent, dans l'installation des systèmes PoE, il est essentiel de considérer la structure du câble et non seulement le diamètre du conducteur.

La demande croissante d'une quantité supérieure d'énergie électrique des dispositifs d'alimentation PSE aux dispositifs alimentés PD est évidente, et on attend de la part de l'IEEE<sup>[11]</sup> la normalisation de l'alimentation de toutes les quatre paires et d'une série de produit non standardisés actuellement disponibles sur le marché fournissant des niveaux de puissance supérieurs à ceux indiqués par la norme IEEE 802.3at. Des niveaux de puissance majeurs entraîneront l'augmentation des risques de performance, mais permettront également d'utiliser les systèmes PoE dans une gamme d'applications plus ample.

## Conclusions

On a réalisé un modèle en deux dimensions en utilisant le logiciel COMSOL Multiphysics pour reproduire les résultats mesurés. On a adopté une méthode d'essai proposée par le Sous-comité 46C de l'IEC pour tester les câbles pour les systèmes d'alimentation par Ethernet PoE (*Power over Ethernet*), qui illustre comment effectuer la mesure des câbles de transmission de données pour l'échauffement au moyen de courant CC.

Une corrélation excellente entre les résultats simulés et ceux mesurés a été démontrée dans le cas d'un câble individuel.

Cette corrélation encourage l'emploi du logiciel pour la prévision du comportement thermique des câbles installés dans les réseaux densément peuplés. On s'attend également à ce qu'une indication importante soit fournie en ce qui concerne l'augmentation de température en fonction de différentes dimensions de faisceau, de températures environnementales, des systèmes de confinement, etc..

En outre, il a été démontré que le rendement thermique d'un câble CCA alimenté en courant CC, avec les mêmes valeurs de courant CC, rayonne plus de chaleur par rapport aux câbles utilisant des conducteurs de cuivre plein.

Les installations basées sur la technologie PoE diffèrent considérablement en termes de configuration et environnement.

Étant donné la demande croissante de majeure puissance, ce qui probablement exigera une alimentation sur toutes les quatre paires, il est nécessaire d'étudier plus en détail les performances des câbles et les composants arrangés en faisceaux, le comportement thermique dans des environnements ayant différentes températures ambiantes, des longueurs de câble dans des systèmes PoE et le désaccouplement des conducteurs sous charge. ■

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# Apertura di un nuovo centro tecnologico

LA linea di rivestimento secondario più rapida del mondo fu creata quando Rosendahl e Nextrom lanciarono la loro nuova generazione di linee "loose tube" che non solo sono di dimensioni ridotte, ma anche le prime a superare il limite dei 1000m/min. Tuttavia, la linea non è nata senza una buona quota di investimento.

Rosendahl e Nextrom hanno fatto ulteriori importanti investimenti per introdurre nel mercato la linea di produzione ad alta velocità, ma la linea di per sé non costituisce l'unico investimento consistente effettuato da Rosendahl Nextrom. La società ha realizzato investimenti anche nel proprio stabilimento di produzione di Pischelsdorf, in Austria.

Oltre ai tre centri tecnologici già aperti (un laboratorio per la produzione di cavi, uno per la fabbricazione di macchine per la produzione di batterie e un laboratorio con camera controllata per tecnologia a fibre ottiche a Vantaa, in Finlandia), è stato aperto un quarto centro dedicato esclusivamente alle dimostrazioni per i clienti in un ambiente altamente professionale.

Il nuovo centro tecnologico è un luogo di ispirazione e di idee per visionari e tecnologi e offre l'opportunità ai clienti di assistere alla dimostrazione delle linee durante il loro funzionamento. Lo stabilimento occupa 700m<sup>2</sup> per il montaggio e il collaudo delle sue nuove



▲ La direzione: Johann Jäkel, Gerhard Jakopic, Ernst Altmann e Siegfried Altmann (da sinistra a destra)

linee di produzione e dispone di una sala di riunioni per i seminari tecnici.

Attraverso il nuovo centro tecnologico, Rosendahl Nextrom sta sviluppando tutti i processi che trasformeranno in realtà la fabbricazione di cavi di avanguardia. Attualmente, Rosendahl Nextrom sta forzando i limiti della normale produzione di cavi consentendo ai clienti di visitare e vedere direttamente le linee in funzione.

"Il nostro nuovo centro tecnologico ci permetterà di realizzare innovazioni localmente per i nostri clienti e di promuoverle nel mondo," hanno dichiarato i direttori esecutivi Siegfried Altmann e Gerhard Jakopic.

"Negli ultimi dieci anni, abbiamo incrementato il nostro investimento nella ricerca e nello sviluppo e abbiamo esteso la nostra rete globale di vendite e servizi per rispondere alle crescenti esigenze dei nostri clienti per le tecnologie rivoluzionarie che sviluppiamo congiuntamente.

"Intravediamo importanti opportunità di prestazioni e il fatto di possedere la migliore tecnologia ci consentirà di mantenere il nostro livello di qualità nelle nostre soluzioni."

**Rosendahl – Austria**  
Website: [www.rosendahlaustria.com](http://www.rosendahlaustria.com)

**Nextrom OY – Finlandia**  
Website: [www.nextrom.com](http://www.nextrom.com)

## Composti flessibili

Sylvin Technologies fabbrica composti vinilici flessibili per i settori del cavo e del filo ed elettrico che soddisfano le richieste di prestazione, di sostenibilità e gli obiettivi normativi dei clienti.

I prodotti comprendono la nuova serie 7844 dei composti per stampaggio elettrici, approvati secondo la norma UL-94 con una classe di combustibilità HB e conformi alla legge californiana Proposition 65.

Il composto 5409-92 è classificato fino ad una temperatura di 125°C ed è indicato per i cavi SAEJ1127 e 1128 del settore automobilistico. Questo materiale è resistente agli olii e ai grassi e consente una maggiore flessibilità alle basse temperature.

Sylvin offre inoltre biocomposti innovativi propri quali il composto 6240-80, privo di ftalati ed ecocompatibile. I bioprodotto offrono i medesimi vantaggi di prestazione dei

composti vinilici flessibili per uso generale e hanno prezzi competitivi.

La vasta gamma di prodotti di Sylvin per i settori del cavo e del filo e il settore elettrico comprende composti conformi alle norme RoHS, REACH e Proposition 65. Diversi tipi sono classificati UL e CSA e numerosi tipi specifici sono stati sviluppati per migliorare le proprietà conduttive, la resistenza alla fiamma e agli olii e la flessibilità alle basse temperature.

Gli esperti tecnici dello stabilimento di Sylvin hanno messo a punto delle formulazioni personalizzate per una serie di applicazioni per cavi e filo ed applicazioni elettriche fra cui il filo per l'industria automobilistica, filo per altoparlanti, protezioni per morsetti di batterie, filo di brillamento, cavo di continuità, cavi stampati e connettori elettrici.

**Sylvin Technologies Inc – Stati Uniti**  
Website: [www.sylvin.com](http://www.sylvin.com)

## Nuovo incarico di venditore per Jill

Jessica Roberts ha assunto il suo nuovo incarico di responsabile vendite regionale nell'area centro meridionale per Miltec UV. Conosciuta con il nome di Jill, Jessica vive a Grapevine, appena fuori Dallas, in Texas, con i suoi tre figli.

Laureatasi presso la Texas A&M University dove ha conseguito una laurea in distribuzione industriale, ha lavorato come addetto alle vendite e consulente tecnico di vendita in numerosi segmenti del mercato delle tecnologie e della fabbricazione.

Fred Beu, direttore generale delle vendite e del marketing di Miltec, ha dichiarato: "Jill vanta molti anni di esperienza

dall'industria elettronica, dei semi-conduttori e diverse applicazioni tecniche in cui ha sviluppato con successo soluzioni complesse e offerto supporto a importanti clienti sia dal punto di vista tecnico che commerciale.

"Ci auguriamo di accrescere la nostra quota di mercato in numerosi settori industriali che serviamo in tutto il territorio centro meridionale e siamo molto lieti di avere Jill come rappresentante di Miltec UV fra i nostri clienti chiave."

**Miltec UV Corp – Stati Uniti**  
**Website:** [www.miltec.com](http://www.miltec.com)

# Il sogno di ritornare agli elementi di fissaggio diventa realtà

DAVID Wiesenfeld, fondatore e proprietario di Videx Machine Engineering, ha iniziato la sua avventura nel settore degli elementi di fissaggio 50 anni fa, come ingegnere di impianto in una fabbrica di elementi di fissaggio israeliana. Aveva acquisito allora la sua esperienza nella forgiatura a caldo ed aveva sempre sognato di ritornare a questa attività.

Il suo sogno si è avverato lo scorso anno, quando Videx ha aggiunto le linee di forgiatura alla propria gamma di prodotti. Le linee di forgiatura a caldo di Videx sono le prime linee completamente automatiche per fabbricare bulloni lunghi e grandi.

Le macchine per forgiatura sono disponibili con capacità di 300, 400 e 500 tonnellate metriche, coprendo una gamma di filetti da M-20 a M-48 (da ¾" a 2") con la macchina più piccola e fino a M-80 (3") con la più grande.

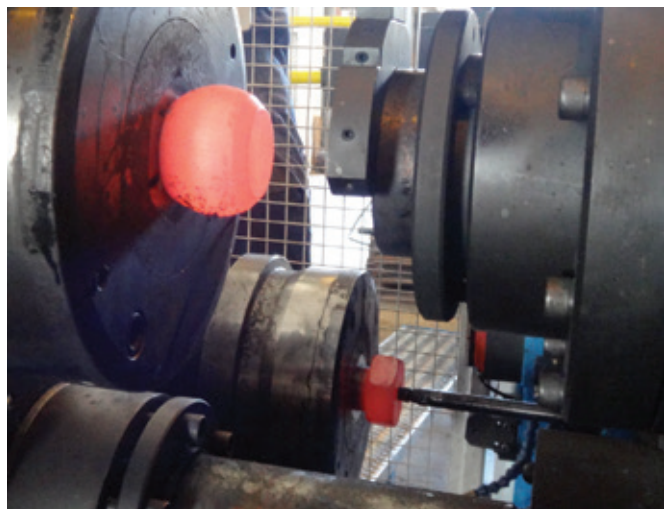
La gamma di lunghezze è di 200-1000mm (8"-36") sotto la testa. La testa esagonale è formata in una filiera chiusa e non richiede rifilatura. La velocità di produzione è di 4-6 pezzi il minuto.

L'intera linea è composta dalle seguenti macchine:

- Cesovia a percussione, progettata per il taglio a misura di barre lunghe
- Smussatrice, che riceve le barre tagliate a misura dalla cesovia a percussione o da un alimentatore a una fila
- Estrusore, che estrude il lato smussato
- Macchina riscaldatrice a induzione (non fabbricata da Videx)
- Fucinatrice con filiera massiccia, a doppio colpo da 300/400/500 tonnellate metriche di capacità

La fucinatrice è dotata di 5 stazioni (una stazione di alimentazione, due stazioni di fucinatura e due stazioni di espulsione).

Le barre smussate ed estruse vengono inviate alla filiera mediante un pistone automatico. Quindi, il disco divisore separa



▲ Per David Wiesenfeld, proprietario di Videx, le linee di forgiatura a caldo Videx rappresentano il sogno di ritornare alla sua attività originaria

i pezzi e li invia alla prima stazione di forgiatura che li riscalda e rompe la scaglia. Alla stazione successiva, la testa esagonale viene formata in una filiera chiusa.

Dopo la riscalatura i pezzi vengono separati e inviati in posizione di espulsione, dove sono espulsi verso un trasportatore che li porta fuori dall'area della macchina.

La macchina è fornita equipaggiata con un sistema di spruzzatura per raffreddare e lubrificare la filiera e il punzone. Inoltre, Videx sta offrendo le macchine come equipaggiamenti singoli e autonomi e non collegati in linea.

**Videx Ltd – Israele**  
**Website:** [www.videx.co.il](http://www.videx.co.il)

# Alimentazione di CC misurata e simulata di cavi di trasmissione dati per sistemi PoE

A cura di Stephen W Simms, Brand-Rex Ltd

## Riassunto

La domanda crescente di livelli di potenza più alti nei sistemi PoE (*Power over Ethernet*) è resa evidente dalla varietà di prodotti non standardizzati attualmente disponibili sul mercato che forniscono livelli di potenza superiori rispetto a quelli indicati nella norma IEEE 802.3at.

Se da un lato livelli di potenza più elevati consentiranno di utilizzare i sistemi PoE in un campo di applicazioni più vasto, dall'altro aumenteranno anche il rischio di rendimento. Considerato l'aumento della domanda di maggiore potenza e il fatto che le installazioni che utilizzano la tecnologia PoE differiscono notevolmente in termini di configurazione e ambiente, è preferibile attenuare il rischio utilizzando la simulazione numerica.

Questo studio presenta la simulazione numerica e la verifica sperimentale delle proprietà termiche dei cavi di trasmissione dati con alimentazione di CC utilizzati in applicazioni PoE.

## Introduzione

La fornitura di CC a dispositivi remoti lungo il medesimo circuito elettrico per la trasmissione di segnali di CA è stata utilizzata con successo per molti anni, ad esempio per i telefoni e per le apparecchiature audio. La tecnica impiegata per consentire questa funzionalità è comunemente nota come "alimentazione phantom".

Per quanto riguarda Ethernet, questa tecnica permette di trasmettere energia elettrica dall'apparecchiatura di alimentazione PSE (*Power Sourcing Equipment*) al dispositivo alimentato PD (*Powered Device*) sulla stessa

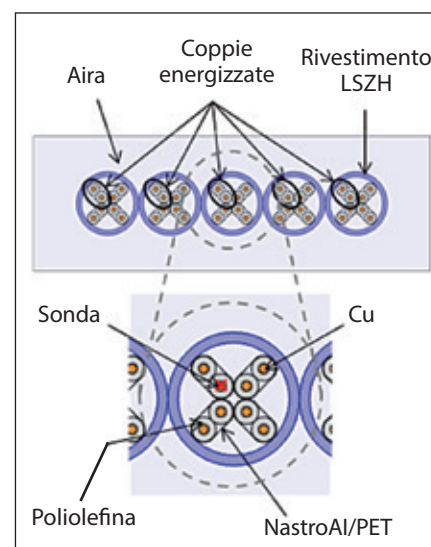
coppia di conduttori che viene utilizzata per i dati. L'alimentazione di CC si applica alla presa centrale del trasformatore di accoppiamento dei segnali e non interferisce con la trasmissione dei dati. Ciò consente di impiegare la tecnologia PoE in sistemi 100BASE-T, che utilizzano le quattro coppie per la trasmissione di dati.

La normativa IEEE 802.3at, approvata nel 2009, stabiliva i parametri di sistema richiesti per installazioni del Tipo 1 (PoE) e Tipo 2 (PoE+)<sup>[1]</sup>. La norma stabilisce i valori massimi nominali di CC a 0,35A e 0,60A per coppia, rispettivamente per il Tipo 1 e il Tipo 2. Alcune delle applicazioni più comuni che utilizzano la tecnologia PoE comprendono punti di accesso LAN senza filo, telefoni VoIP e telecamere di rete.

Applicando corrente elettrica ad un conduttore, questo produce energia termica, effetto conosciuto come riscaldamento Joule.

Per quanto riguarda i cavi e i componenti Ethernet, questo effetto di riscaldamento è fonte di preoccupazione dato l'aumento dell'attenuazione che ha un effetto limitante sulla lunghezza del collegamento. Questa preoccupazione è maggiore nel caso di cavi con resistenza maggiore rispetto ai cavi tradizionali, come ad esempio i cavi con conduttori in alluminio rivestiti di rame (CCA)<sup>[2]</sup> e quelli di rame pieno di diametro inferiore (26 AWG).

Nel 2009, il sottocomitato 46C dell'IEC ha proposto un metodo di prova (46C/906/NP) chiamato "Proposta per la misurazione del riscaldamento di cavi di trasmissione dati mediante corrente"<sup>[3]</sup>. L'obiettivo del presente articolo è di ottenere una forte correlazione fra la simulazione e il metodo di misurazione proposto riguardo l'alimentazione di CC di cavi Ethernet per applicazioni PoE.



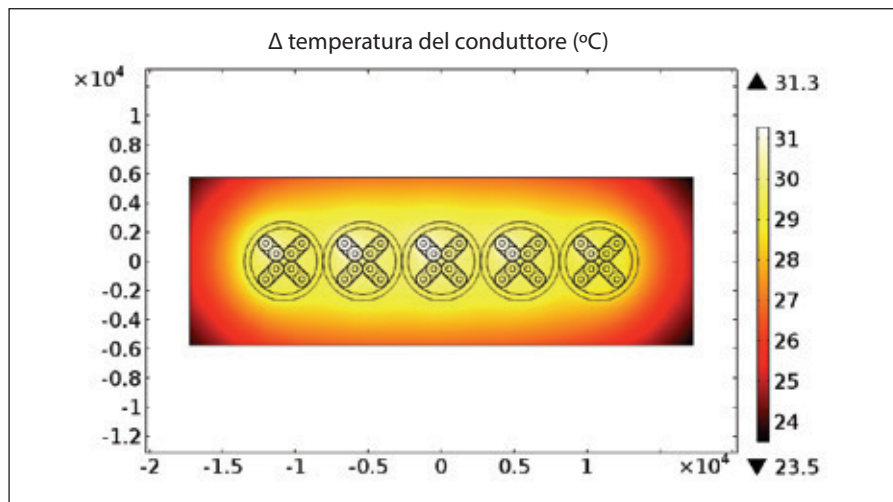
▲ Figura 1: Configurazione della simulazione con COMSOL Multiphysics

L'articolo ha inoltre lo scopo di effettuare una comparazione fra l'aumento di temperatura causato dall'alimentazione di CC del cavo CCA e i cavi che presentano conduttori di rame pieno.

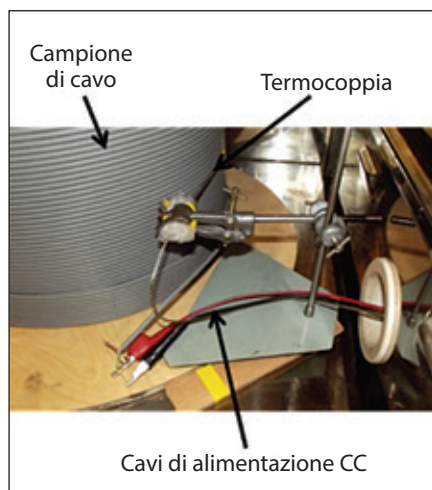
## Modellazione numerica

È stato realizzato un modello 2-D utilizzando COMSOL Multiphysics 4.4, un pacchetto di programmi che utilizza il metodo degli elementi finiti (FEM)<sup>[4]</sup>. Il modello è stato messo a punto per riprodurre il metodo di misurazione proposto<sup>[3]</sup> e consentire la comparazione fra la teoria e la pratica. A tale scopo, è stata predisposta una configurazione di cinque cavi lineari che consentisse di effettuare una buona previsione del comportamento termico al centro del cavo senza la necessità di includere altri cavi in un modello che richiedeva una maggiore risorsa computazionale.





▲ **Figura 2:** Grafico della temperatura della sezione trasversale



▲ **Figura 3:** Impostazione della misurazione

Per rappresentare le parti costituenti del cavo U/FTP 26AWG Cat6A, sono state applicate proprietà del materiale quali la capacità termica a pressione costante, la densità e la conduttività termica. Queste proprietà sono state applicate al conduttore di rame (Cu), al nastro di alluminio/PET (Al/PET), al rivestimento a bassa emissione di fumo e privo di alogeni (LSZH) e all'isolamento poliolefinico (cfr. Fig. 1). Per questo modello sono stati considerati i meccanismi di conduzione, convezione e trasferimento di calore per irraggiamento<sup>[5]</sup>.

È stata applicata l'energia elettrica simulata ad una coppia di ciascun cavo del modello. È stato utilizzato un risolutore fisso per determinare il comportamento termico per (a), un punto al centro di uno dei conduttori energizzati (si veda la posizione della sonda nella Figura 1), e (b), un grafico 2-D della temperatura della sezione trasversale (cfr. Fig. 2).

Come previsto, nel grafico 2-D la temperatura massima del sistema predisposto è evidente in prossimità dei conduttori energizzati.

## Metodo di prova e risultati

È stato applicato il metodo di prova proposto dal Sottocomitato 46C dell'IEC<sup>[3]</sup> per stabilire l'aumento della temperatura nel conduttore causato dall'alimentazione di CC. Questo metodo prevedeva la misurazione della tensione fornita e la temperatura del rivestimento utilizzando un campione di 100 metri di cavo avvolto su un aspo e posizionato all'interno di una camera climatica ad una temperatura fissa di 20°C (cfr. Fig. 3). Questo metodo è stato seguito utilizzando un campione di cavo U/FTP Cat6A con conduttori di rame di 26AWG, come simulato nella sezione 2.

Il campione di cavo è stato condizionato a 20°C per almeno 16 ore prima della prova. Lungo il rivestimento, a metà del cavo, è stata collocata una termocoppia del tipo J. Utilizzando un alimentatore da banco Keithley 2200-60-2 (60V, 2,5A) con funzionamento a corrente costante, è stata applicata una corrente (I) di 0,6A alla coppia sottoposta alla prova ponendo in cortocircuito l'altro estremo del campione. I dati della temperatura e della tensione sono stati registrati a intervalli di 15 secondi utilizzando il software LabVIEW di National Instruments.

La temperatura del campione di cavo è aumentata per effetto del riscaldamento Joule e, dopo un certo tempo, si è stabilizzata. A questo punto, il riscaldamento dovuto all'alimentazione di CC ha raggiunto lo stesso valore dell'energia irradiata del campione evitando un ulteriore aumento della temperatura.

La resistenza del conduttore è stata calcolata in base alla tensione misurata immediatamente dopo l'accensione dell'alimentazione ( $U_t$ ), equazione (1), e dopo la stabilizzazione della temperatura

( $U_r$ ), equazione (2). Quindi, è stata calcolata la variazione (o Delta) della temperatura del conduttore ( $\Delta t$ ) utilizzando la resistenza iniziale ( $R_{20}$ ) e stabilizzata ( $R_r$ ), equazione (3).

$$R_{20} = \frac{U_0}{I} \quad (1)$$

$$R_r = \frac{U_r}{I} \quad (2)$$

$$\Delta t = \frac{1}{\alpha} \left( \frac{R_r}{R_{20}} - 1 \right) \quad (3)$$

dove  $\alpha = 0.004 \frac{1}{K}$

Questa metodologia è stata ripetuta utilizzando quattro valori di corrente (I) distinti, ovvero 1,0A, 1,4A, 1,8A e 2,2A. La Figura 4 mostra la variazione di temperatura nel conduttore rispetto al livello di corrente CC simulata nella sonda (cfr. Fig. 1) e calcolata a partire dalla misurazione.

I risultati mostrano una correlazione lineare sia nel caso della variazione di temperatura (Delta) del conduttore, sia nel caso della corrente rappresentata in scale logaritmiche. Sulla base di questa relazione, è stato possibile applicare un'approssimazione, nel formato  $\Delta t = x \cdot I^y$ , che si poteva utilizzare per prevedere l'aumento di temperatura del conduttore per valori di corrente fuori dalla gamma misurata.

Per il cavo U/FTP 26AWG Cat6A l'approssimazione è stata la seguente:

$$\Delta t = 2.3 * I^{2.0}$$

Utilizzando l'approssimazione, una corrente di 3A determinerebbe un aumento di temperatura di 20,7°C in un singolo cavo con una temperatura ambientale fissa di 20°C. La correlazione fra i risultati simulati e misurati è stata studiata più a fondo da un punto di vista statistico utilizzando un test t per dati appaiati (Paired t-test) mediante software Minitab<sup>[7]</sup>.

La Figura 5 mostra un grafico di valori individuali delle differenze di temperatura fra la simulazione e la misurazione, che evidenzia inoltre un intervallo di confidenza del 95% basato su queste differenze. I risultati indicano che si prevede che il 95% dei valori aggiuntivi simulati e misurati rientri nel campo di variazione  $\pm 0,1$ , confermando un'eccellente correlazione.

Come tale, non si può escludere l'ipotesi nulla di differenza zero fra i valori medi dei due gruppi di dati.

## Alluminio rivestito di rame

Un campione di cavo UTP CCA con conduttori da 24AWG è stato acquisito e misurato come campione di cavo U/FTP da 26AWG Cat6A nella sezione 3. La resistenza del circuito di CC delle coppie studiate per ciascun tipo di cavo è illustrata nella *Tabella 1*. A fini comparativi, è stato incluso nello studio un cavo UTP di Cat5 con conduttori di rame pieno da 24AWG.

	AWG	Resistenza del circuito CC ( $\Omega$ )
Cat6A	26	23.3
CCA	24	28.4
Cat5e	24	18.2

▲ **Tabella 1:** Resistenza del circuito CC della coppia in esame in relazione a ciascun tipo di cavo

Data l'elevata resistenza del cavo CCA studiato, non era possibile ottenere l'alta tensione richiesta per fornire una corrente di 2,2A utilizzando l'alimentatore da banco. In altri termini, all'aumentare della temperatura e della resistenza, la tensione richiesta (per soddisfare la Legge di Ohm) era superiore alla tensione massima di 60V dell'alimentatore da banco. Per generare il quinto punto di dati è stato utilizzato un valore di corrente di 1,95A.

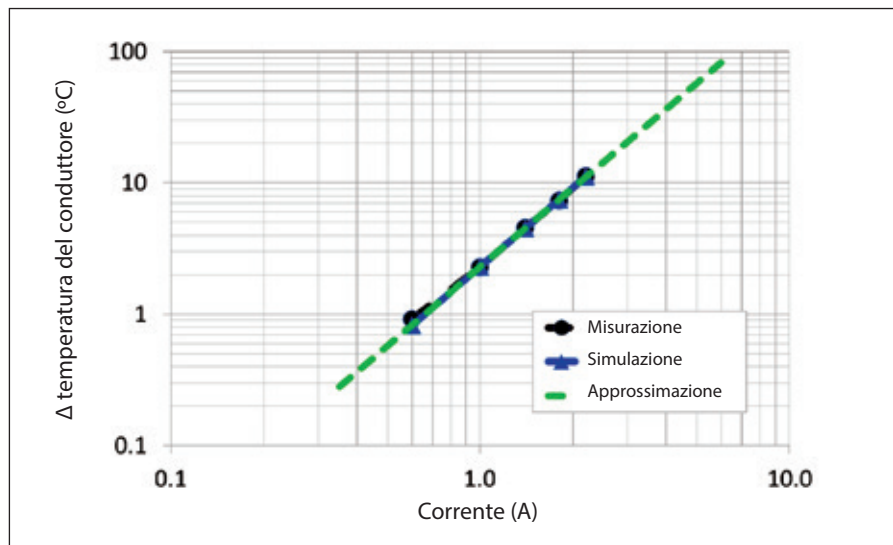
La *Figura 6* mostra il cambio di temperatura nei conduttori rispetto al livello di CC calcolato a partire dalla misurazione. Per il campione di cavo CCA, l'aumento di temperatura approssimato del conduttore è stato il seguente:

$$\Delta t = 3.1 * I^{2.0}$$

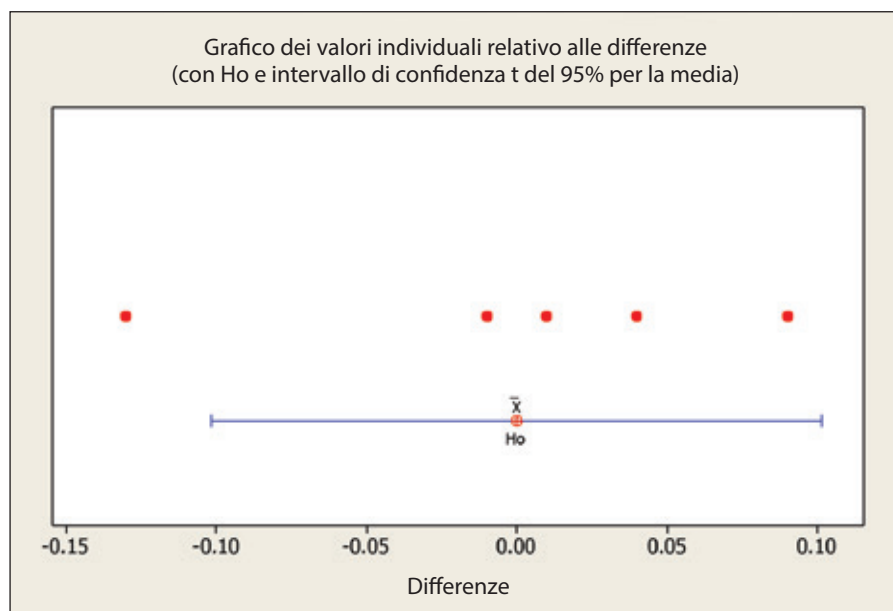
È noto che l'aumento della temperatura dovuto all'effetto di riscaldamento Joule è proporzionale alle perdite  $I^2R^{(8)}$ ; di conseguenza, essendo la corrente fissa per ciascun punto di misurazione, la resistenza della coppia del cavo in esame differenzierà l'aumento di temperatura da un cavo all'altro. Pertanto, come previsto, il cavo con maggiore resistenza CC presenterà il maggiore aumento di temperatura e viceversa.

## Discussione

È noto che il riscaldamento dei cavi aumenta l'attenuazione<sup>(9)</sup>, il che ha un effetto limitante sulla lunghezza del cavo. Per quanto riguarda la tecnologia PoE, è probabile che la temperatura massima sia localizzata in prossimità dei conduttori energizzati che potrebbero essere utilizzati per la trasmissione dei dati. Pertanto, si dovrebbero considerare le conseguenze dell'alimentazione CC sull'attenuazione della stessa coppia.

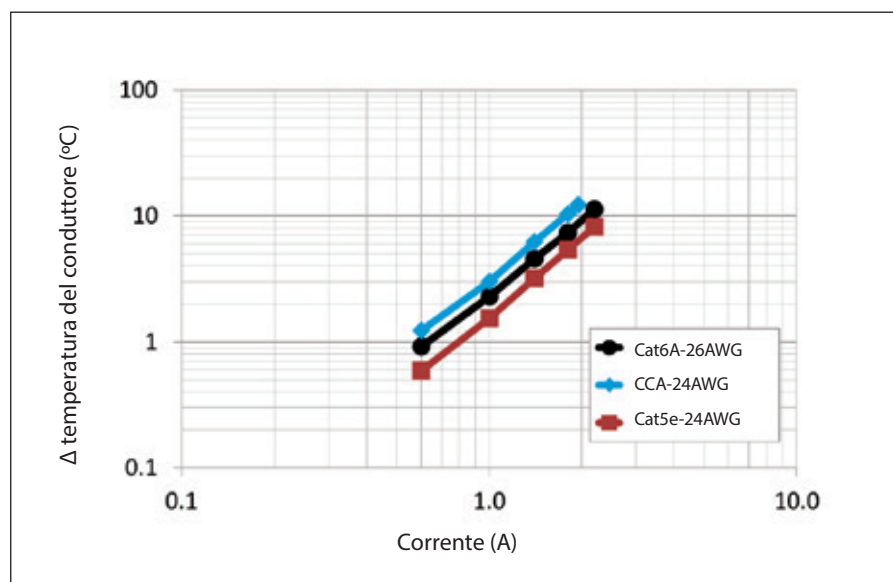


▲ **Figura 4:** Simulazione, misurazione e approssimazione della variazione di temperatura nel conduttore



▲ **Figura 5:** Grafico dei valori individuali delle differenze di temperatura

▼ **Figura 6:** Misurazione della variazione di temperatura nel conduttore



I risultati illustrati nel presente articolo mostrano un aumento di temperatura di una coppia energizzata con CC, utilizzando un cavo posto in un ambiente controllato a 20°C.

In realtà, la temperatura ambiente varierà a seconda del luogo d'installazione e, pertanto, si dovrebbe prestare attenzione quando si installano sistemi PoE in ambienti non controllati e/o più caldi.

Ulteriore attenzione va prestata alla correlazione fra i dati simulati e quelli dell'ambiente di installazione. Da un lato, la simulazione può basarsi sul peggiore dei casi; tuttavia, in realtà, il ciclo di funzionamento può richiedere che l'alimentazione venga fornita solo durante una frazione di tempo.

Si dovrebbero adottare, ove possibile, adeguati metodi di installazione come ridurre le dimensioni del fascio, considerare l'aumento di temperatura per lunghezze di cavo massime ed eliminare materiali termoisolanti nei circuiti e negli spazi liberi.

È importante sottolineare che sebbene sia stata osservata un'eccellente correlazione fra i risultati simulati e quelli misurati nel caso di una configurazione a cavo singolo, con questo studio non si intendeva riprodurre il comportamento dei cavi in fascio.

Tuttavia, si prevede che una buona correlazione fra la teoria e la pratica possa essere valida anche per le configurazioni di cavi in fascio, in aria libera e in vari sistemi di contenimento per cavi, come ad esempio passerelle, canalizzazioni, condotti, ecc.

Una comparazione fra i campioni UTP 24AWG CCA e U/FTP 26AWG Cat6A mostra che i cavi con conduttori più piccoli possono irradiare meno calore rispetto a quelli con conduttori più grandi quando sono alimentati con valori di corrente CC identici. È inoltre noto che la lamina conduttrice dei cavi blindati funge da dissipatore di calore, contribuendo così a ridurre la quantità di calore irradiato dal cavo<sup>[10]</sup>.

Pertanto, nell'installazione di sistemi PoE è importante tenere conto della struttura del cavo e non solo del diametro del conduttore.

La crescente domanda di maggiore fornitura elettrica dai dispositivi di alimentazione PSE ai dispositivi alimentati PD è evidente, e si attende da parte dell'IEEE<sup>[11]</sup> la normalizzazione dell'alimentazione di tutte quattro le coppie e di una serie di prodotti non standardizzati attualmente disponibili sul mercato che forniscono livelli di potenza

superiori a quelli indicati dalla norma IEEE 802.3at. Livelli di potenza più elevati comporteranno l'aumento dei rischi di prestazione, ma consentirà altresì di utilizzare i sistemi PoE in una gamma di applicazione più ampia

## Conclusioni

È stato realizzato un modello in due dimensioni utilizzando il software COMSOL Multiphysics per riprodurre i risultati misurati. È stato adottato un metodo di prova proposto dal sottocomitato 46C dell'IEC per testare i cavi per sistemi di alimentazione via Ethernet PoE (*Power over Ethernet*), che descriveva a grandi linee come effettuare la misurazione dei cavi di trasmissione di dati per riscaldamento mediante corrente CC. È stata dimostrata un'ottima correlazione fra i risultati simulati e quelli misurati nel caso di un cavo singolo.

Questa correlazione incoraggia l'uso del software per la previsione del comportamento termico dei cavi installati in reti densamente popolate. Si auspica inoltre di fornire un'importante indicazione per quanto riguarda l'aumento di temperatura per varie dimensioni di fascio, temperature ambientali, sistemi di contenimento, ecc.. È stato anche dimostrato che il rendimento termico di un cavo CCA alimentato con CC, a parità di valori di corrente CC, irradia più calore rispetto ai cavi che utilizzano conduttori di rame pieno.

Le installazioni basate sulla tecnologia PoE differiscono notevolmente in termini di configurazione ed ambiente. Data la domanda crescente di maggiore potenza, che probabilmente richiederà un'alimentazione su tutte quattro le coppie, è necessario effettuare uno studio più approfondito delle prestazioni dei cavi e dei componenti disposti in fasci, il comportamento termico in luoghi con diverse temperature ambiente, le lunghezze di cavo in sistemi PoE e il disaccoppiamento dei connettori sotto carico. ■

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# Abre un nuevo centro tecnológico

LA línea de revestimiento secundario más rápida del mundo surgió cuando Rosendahl y Nextrom lanzaron su nueva generación de líneas de tubo holgado, que no sólo es pequeña de dimensiones sino que también es la primera que bate la marca de los 1000 m/min. Pero la línea no llegó sin una buena dosis de inversión.

Rosendahl y Nextrom han invertido una buena cantidad de dinero para llevar al mercado la línea de producción a alta velocidad, pero no es la única inversión importante que ha realizado Rosendahl Nextrom. La empresa también invirtió en su planta de producción de Pischelsdorf, en Austria.

Además de los tres centros tecnológicos ya abiertos (un laboratorio para producción de cables, uno para fabricación de máquinas para la producción de baterías y un laboratorio con sala blanca para tecnología de fibra óptica en Vantaa, en Finlandia), han inaugurado un cuarto centro sólo para hacer demostraciones a sus clientes en un ambiente de alta profesionalidad.

El nuevo centro tecnológico es lugar de inspiración e ideas para visionarios y tecnólogos y brinda la oportunidad a los clientes de asistir a la demostración de las líneas en marcha. La planta ocupa 700m<sup>2</sup> para el montaje y ensayo de sus líneas recién desarrolladas y dispone



▲ La dirección: Johann Jäkel, Gerhard Jakopic, Ernst Altmann y Siegfried Altmann (de izquierda a derecha)

de una sala de reuniones para los seminarios técnicos.

A través del nuevo centro tecnológico, Rosendahl y Nextrom están desarrollando todos los procesos que harán realidad la fabricación de cables de vanguardia. Actualmente, Rosendahl y Nextrom están forzando los límites de la producción normal de cables y permiten a los clientes visitar y ver directamente las líneas en función.

“Nuestro nuevo centro tecnológico nos permitirá implementar innovaciones localmente para nuestros clientes y promoverlas luego por el mundo,” comentaron los directores ejecutivos Siegfried Altmann y Gerhard Jakopic.

“En la última década, hemos incrementado nuestra inversión en I&D y extendido nuestra red global de ventas y servicios para atender las crecientes necesidades de los clientes de tecnología revolucionaria, algo que desarrollamos junto con ellos.

“Vislumbramos importantes oportunidades de rendimiento y el hecho de disponer de la mejor tecnología nos permitirá mantener nuestro nivel de calidad en nuestras soluciones.”

**Rosendahl – Österreich**  
Website: [www.rosendahlaustria.com](http://www.rosendahlaustria.com)

**Nextrom OY – Finlandia**  
Website: [www.nextrom.com](http://www.nextrom.com)

## Compuestos flexibles

Sylvin Technologies fabrica compuestos vinílicos flexibles para el sector del cable y alambre y el eléctrico que satisfacen la demanda de rendimiento, sostenibilidad y normativa de los clientes.

Los productos comprenden la nueva serie 7844 de compuestos de moldear eléctricos, aprobados según la norma UL-94 con clase de combustibilidad HB y conformes con la ley californiana Proposition 65. El compuesto 5409-92 está clasificado a 125°C y es indicado para los cables SAEJ1127 y 1128 del sector automotriz. Este material ofrece resistencia al aceite y a la grasa y aumenta la flexibilidad a baja temperatura.

Sylvin también ofrece biocompuestos innovadores, como el 6240-80, sin ftalatos y respetuoso con el ambiente. Los productos de origen biológico ofrecen las mismas ventajas de rendimiento que los compuestos vinílicos flexibles para uso general y resultan competitivos desde el punto de vista económico.

La variada gama de productos de Sylvin para los sectores del cable y alambre y el eléctrico comprende compuestos conformes con las normas RoHS, REACH y Proposition 65.

Varios grados están clasificados UL y CSA y se han desarrollado numerosos grados especiales para mejorar las propiedades de conducción, resistencia a la llama y al aceite, además de mejorar la flexibilidad a baja temperatura.

Los técnicos expertos de la planta Sylvin han desarrollado formulaciones personalizadas para una serie de aplicaciones para cable y alambre y eléctricas, entre las que se incluyen cables para automóviles, cables de altavoces, tapas de los bornes de las baterías, cables para voladuras, cables puente, ensamblajes de cables moldeados y conectores eléctricos.

**Sylvin Technologies Inc – EE.UU.**  
Website: [www.sylvin.com](http://www.sylvin.com)

## Nuevo cargo para Jill

Jessica Roberts ha tomado posesión de su nuevo cargo como jefe de ventas de la zona centro sur en Miltec UV. Jessica, conocida como Jill, vive en Grapevine, justo a las afueras de Dallas, en Texas, con sus tres hijos.

Jill está licenciada por la Universidad de Texas A&M en distribución industrial y ha trabajado como ingeniero de ventas y asesora de ventas técnicas en diversos segmentos de mercado de tecnología y fabricación.

Fred Beu, director global de ventas y marketing de Miltec, comentó: "Jill cuenta con muchos años de experiencia en

la industria electrónica, de los semi conductores y diversas aplicaciones técnicas donde desarrolló con éxito complejas soluciones y siguió a clientes importantes tanto desde el punto de vista técnico como de las ventas.

"Esperamos aumentar nuestra cuota de mercado en muchos sectores industriales a los que atendemos por toda la zona centro sur. Estamos encantados de tener a Jill como representante de Miltec UV ante nuestros clientes clave."

**Miltec UV Corp – EE.UU.**  
**Website:** [www.miltec.com](http://www.miltec.com)

# El sueño de volver a las piezas de sujeción se hace realidad

DAVID Wiesenfeld, fundador y propietario de Videx Machine Engineering, inició su camino en el sector de las piezas de sujeción hace 50 años, como ingeniero de planta en una fábrica de piezas de sujeción de Israel. Allí fue donde adquirió su experiencia en el forjado en caliente y siempre había soñado con volver a ese sector industrial.

Su sueño se hizo realidad el año pasado, cuando Videx añadió las líneas de forjado en caliente a su gama de productos. Las líneas de forjado en caliente de Videx son las primeras líneas totalmente automáticas para fabricar tornillos largos y de sección grande.

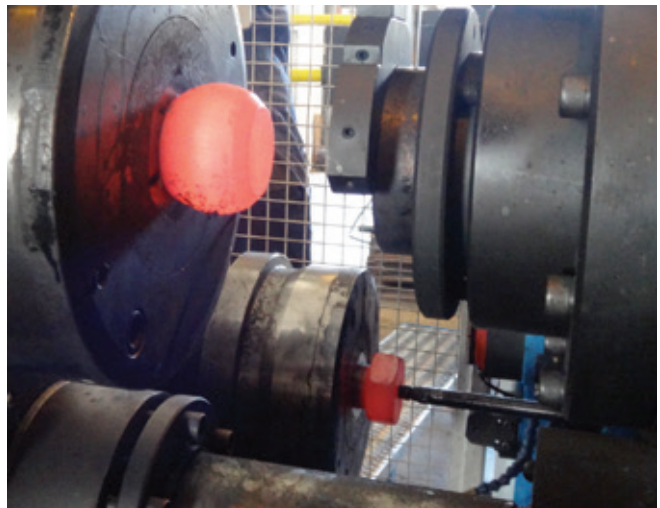
Las máquinas de forjado están disponibles con capacidades de 300, 400 y 500 toneladas métricas, cubriendo la gama de roscas de M-20 a M-48 (de ¾" a 2") con la máquina más pequeña y de hasta M-80 (3") con la más grande. La gama de longitudes es 200-1000mm (8"-36") debajo de la cabeza. La cabeza hexagonal es conformada en una hilera cerrada y no requiere recorte de rebabas. La velocidad de producción es 4-6 piezas por minuto.

La línea entera está formada por las máquinas siguientes:

- Cortadora de impacto, que corta a medida barras largas
- Biseladora, que recibe las barras cortadas a medida de la cortadora de impacto o de un alimentador de una fila
- Extrusora, que extruye el lado biselado
- Calentadora por inducción (no fabricada por Videx)
- Forjadora de hilera maciza, de dos golpes, de 300/400/500 toneladas métricas de capacidad

La forjadora tiene cinco estaciones (una estación de alimentación, dos estaciones de forjado y dos estaciones de expulsión).

Las barras biseladas y extruidas son enviadas a la hilera por un pistón neumático. Entonces, el plato divisor las dirige a la



▲ Para David Wiesenfeld, propietario de Videx, las líneas de forjado en caliente Videx representan el sueño de volver a su actividad original

primera estación de forjado, que recalca las piezas y rompe la cascarilla. En la estación siguiente, la cabeza hexagonal es conformada en una hilera cerrada.

Después de conformar las cabezas, las piezas son enviadas a la estación expulsora, donde son expulsadas hacia un transportador que las saca de la zona de la máquina.

La máquina es suministrada con un sistema de rociado para enfriar y lubricar la hilera y el punzón. Además, Videx está vendiendo las máquinas como autónomas y no conectadas como línea.

**Videx Ltd – Israel**

**Website:** [www.videx.co.il](http://www.videx.co.il)

# Alimentación de CC medida y simulada en cables de datos para instalaciones de suministro eléctrico sobre Ethernet

Por Stephen W Simms, Brand-Rex Ltd

## Resumen

La demanda creciente de niveles de potencia más altos en las instalaciones de suministro eléctrico sobre Ethernet (PoE - *Power over Ethernet*) resulta evidente por toda una variedad de productos no normalizados actualmente disponibles en el mercado que suministran niveles de potencia superiores a los indicados por la norma IEEE 802.3at.

Estos niveles de potencia más altos permitirán usar el suministro eléctrico sobre Ethernet (PoE) en un campo de aplicaciones más amplio, pero con el riesgo de afectar negativamente al rendimiento. Con el aumento de la demanda de mayor potencia, y el hecho de que las instalaciones que usan tecnología PoE difieren enormemente en términos de configuración y entorno, conviene atenuar el riesgo usando la simulación numérica.

En este trabajo se presenta la simulación numérica y la verificación experimental de las propiedades térmicas de cables de datos con alimentación de CC usados en aplicaciones PoE.

## Introducción

El suministro de CC a dispositivos finales a lo largo del mismo recorrido eléctrico que se usa para la transmisión de señales de CA ha sido usado con éxito durante años, por ejemplo para los teléfonos y los equipos de sonido.

La técnica usada para implementar esta función se conoce corrientemente como "alimentación fantasma".

Con relación a Ethernet, esta técnica permite mandar energía desde el equipo de suministro de energía PSE (*Power Sourcing Equipment*) hasta el dispositivo alimentado PD (*Powered Device*) con el mismo par que se usa para los datos.

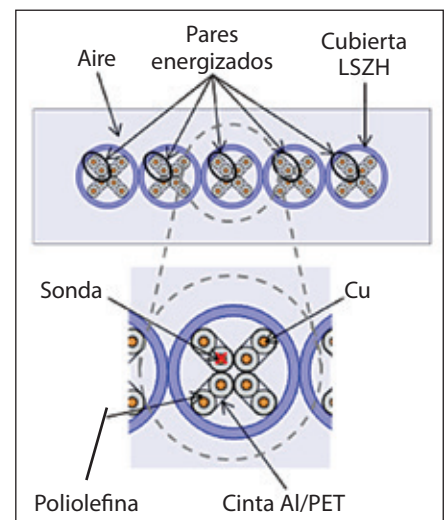
La alimentación de CC se aplica a la toma central del transformador de acoplamiento de las señales y no interfiere con la transmisión de datos. Esto permite usar la tecnología PoE en sistemas 1000BASE-T, que utilizan los cuatro pares para la transmisión de datos.

La norma IEEE 802.3at, ratificada en el 2009, determinaba los parámetros de sistema requeridos para instalaciones de Tipo 1 (PoE) y Tipo 2 (PoE+)<sup>[1]</sup>.

La norma establece que los valores de corriente de CC nominales máximos deben ser 0,35A y 0,60A por par para el Tipo 1 y el Tipo 2 respectivamente. Algunas de las aplicaciones más corrientes que usan la tecnología PoE incluyen puntos de acceso LAN inalámbricos, teléfonos VoIP y cámaras de seguridad de red.

Si se aplica corriente eléctrica a un conductor, éste produce energía térmica, un efecto conocido como calentamiento Joule. Con referencia a los cables y componentes Ethernet, este calentamiento es fuente de preocupación porque hace aumentar la atenuación, que limita la longitud del enlace.

Esta preocupación es mayor en caso de cables con resistencia más alta respecto a los cables convencionales, por ejemplo los cables conductores de aluminio revestidos de cobre (CCA)<sup>[2]</sup> y los de cobre macizo de diámetro más pequeño (26AWG).

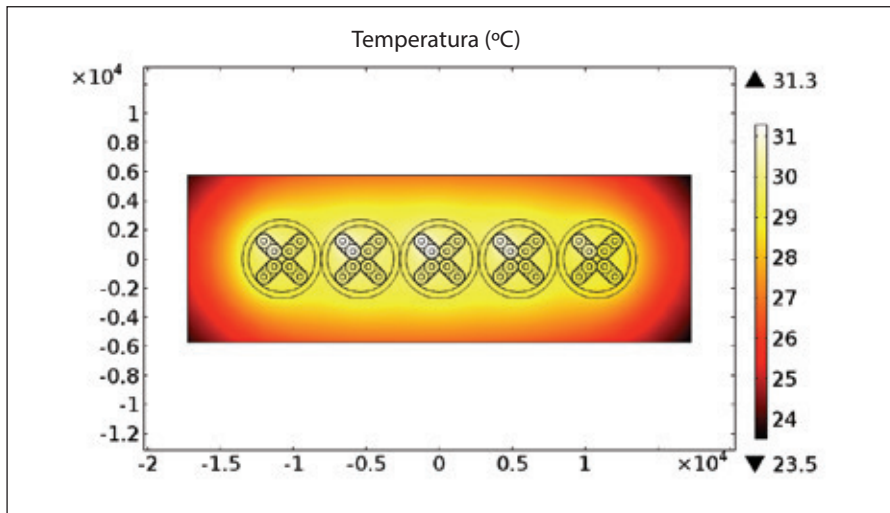


▲ Figura 1: Configuración de la simulación con COMSOL Multiphysics

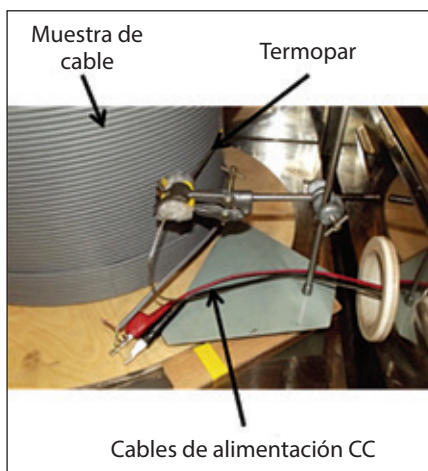
En el 2009, el subcomité 46C de la IEC propuso un método de prueba (46C/906/NP) llamado "Propuesta para medir el calentamiento de cables de datos causado por la corriente"<sup>[3]</sup>. En este artículo, el objetivo es alcanzar una fuerte correlación entre simulación y el método de medición propuesto con respecto a la alimentación de CC de cables Ethernet para aplicaciones PoE. Este artículo también intenta comparar el aumento de temperatura causado por la alimentación de CC de cable CCA con cables que tienen conductores de cobre macizo.

## Modelación numérica

Se realizó un modelo 2-D usando COMSOL Multiphysics 4.4, un paquete de programas que usa el método de elementos finitos<sup>[4]</sup>.



▲ **Figura 2:** Gráfico de la temperatura de la sección transversal



▲ **Figura 3:** Configuración de la medición

El modelo fue realizado para reproducir el método de medición propuesto<sup>[3]</sup>, y permitir la comparación entre teoría y práctica. Para ello, se dispusieron cinco cables linealmente para poder prever de manera fiable el comportamiento térmico en el centro del cable sin tener que incluir otros cables en un modelo que hubiera requerido recursos de cálculo más potentes.

Para representar las partes constituyentes del cable U/FTP 26AWG Cat6A se aplicaron propiedades del material como capacidad térmica a presión constante, densidad y conductividad térmica. Estas propiedades fueron aplicadas al conductor de cobre (Cu), a la cinta de aluminio/PET (Al/PET), a la cubierta de baja emisión de humo y sin alógenos (LSZH) y al aislamiento de poliolefina, véase la *Figura 1*. En el modelo se consideraron los mecanismos de conducción, convección y transferencia de calor por radiación<sup>[5]</sup>.

Se aplicó energía eléctrica simulada a un par de cada cable del modelo. Se utilizó un solucionador estacionario para determinar el comportamiento térmico para (a), punto

en el centro de uno de los conductores energizados (véase la posición de la sonda en la *Figura 1*), y (b), un gráfico 2-D de la temperatura de la sección transversal, *Figura 2*. Del gráfico 2-D, y como se esperaba, la temperatura máxima del sistema preparado es evidente cerca de los conductores energizados.

## Método de prueba y resultados

Se aplicó el método de prueba propuesto por el Subcomité 46C de la IEC<sup>[3]</sup> para establecer el aumento de la temperatura en el conductor causado por la alimentación de CC. Este método incluía la medición de la tensión suministrada y la temperatura de la cubierta usando una muestra de 100 metros de cable enrollada en un carrete y colocada dentro de una cámara ambiental a una temperatura fija de 20°C, véase la *Figura 3*.

Este método fue seguido usando una muestra de cable U/FTP Cat6A con conductores de cobre macizo de 26AWG, como se simula en la sección 2.

La muestra de cable fue mantenida a 20°C durante al menos 16 horas antes de la prueba. A lo largo de la cubierta, a la mitad del cable, se puso un termopar de tipo J.

Usando una fuente de alimentación de sobremesa Keithley 2200-60-2 (60V, 2,5A) con funcionamiento en modo de corriente constante, se aplicó una corriente (I) de 0,6A al par bajo prueba poniendo en cortocircuito el otro extremo de la muestra.

Los datos de temperatura y tensión fueron registrados a intervalos de 15 segundos usando el software LabVIEW de National Instruments.

La temperatura de la muestra de cable aumentó por efecto Joule, después de un cierto tiempo, la temperatura se estabilizó. Entonces, el calentamiento producido por la llegada de alimentación CC alcanzó un valor igual a la energía desprendida por la muestra y la temperatura no pudo aumentar más.

La resistencia del conductor fue calculada en base a la tensión medida justo después de dar corriente ( $U_0$ ), ecuación (1), y después de que la temperatura se estabilizara ( $U_T$ ), ecuación (2). Luego, se calculó el cambio (o variación) de temperatura del conductor ( $\Delta t$ ) usando la resistencia inicial ( $R_{20}$ ) y la estabilizada ( $R_T$ ), ecuación (3).

$$R_{20} = \frac{U_0}{I} \quad (1)$$

$$R_T = \frac{U_T}{I} \quad (2)$$

$$\Delta t = \frac{1}{\alpha} \left( \frac{R_T}{R_{20}} - 1 \right) \quad (3)$$

$$\text{donde } \alpha = 0.004 \frac{1}{K}$$

Esta metodología fue repetida usando cuatro valores de corriente (I) distintos, es decir 1,0A, 1,4A, 1,8A y 2,2A. La *Figura 4* muestra el cambio de temperatura en el conductor respecto al nivel de corriente CC simulada en la sonda (véase la *Figura 1*) y calculada a partir de la medición.

Los resultados muestran una relación lineal ya sea en el caso de la variación de temperatura del conductor, ya sea en el caso de la corriente representada en escalas logarítmicas. En base a esta relación, fue posible aplicar una aproximación, en el formato  $\Delta t = x \cdot I^y$ , que se podía usar para prever el aumento de temperatura del conductor para valores de corriente fuera de la gama medida.

Para el cable U/FTP 26AWG Cat6A la aproximación fue:

$$\Delta t = 2.3 * I^{2.0}$$

Usando la aproximación, una corriente de 3A causaría un aumento de temperatura de 20,7°C en un solo cable en un entorno con temperatura fija de 20°C.

La correlación entre resultados simulados y medidos fue estudiada más desde un punto de vista estadístico usando una prueba t por parejas (Paired t-test) mediante software Minitab<sup>[7]</sup>.

La *Figura 5* muestra un gráfico de valores individuales de las diferencias de temperatura entre simulación y medición,

que muestra también un intervalo de confianza basado en estas diferencias de un 95 por ciento.

Los resultados muestran que se espera que un 95 por ciento de los valores adicionales simulados y medidos esté dentro de un campo  $\pm 0,1$  de diferencia, confirmando una excelente correlación.

Como tal, no se puede rechazar la hipótesis nula de diferencia cero entre los valores medios de los dos grupos de datos.

## Aluminio revestido de cobre

Una muestra de cable UTP CCA con conductores de 24AWG fue adquirida y medida como muestra de cable U/FTP de 26AWG de Cat6A en la sección 3. La resistencia de bucle de CC del par estudiado para cada tipo de cable se ilustra en la *Tabla 1*. Para fines comparativos, un cable UTP de Cat5 con conductores de cobre macizo de 24AWG fue incluido en el estudio.

	AWG	Resistencia de bucle CC ( $\Omega$ )
Cat6A	26	23.3
CCA	24	28.4
Cat5e	24	18.2

▲ **Tabla 1:** Resistencia de bucle CC del par bajo prueba para cada tipo de cable

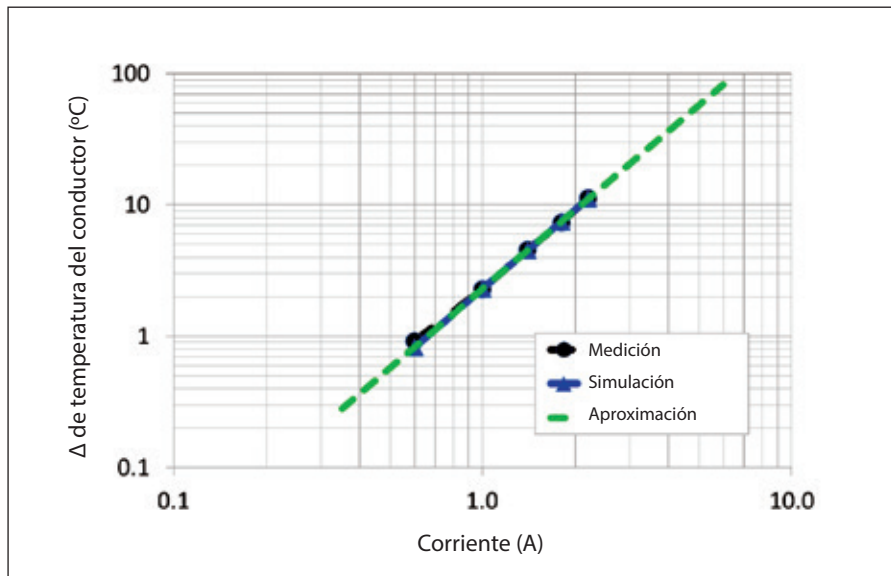
Debido a la alta resistencia del cable CCA estudiado, no se podía obtener la alta tensión requerida para suministrar una corriente de 2,2A usando la fuente de alimentación de sobremesa.

En otras palabras, al aumentar la temperatura y la resistencia, la tensión requerida (para cumplir la Ley de Ohm) era superior a la tensión máxima de 60V de la fuente de alimentación de sobremesa. Para generar el quinto punto de datos se utilizó un valor de corriente de 1,95A.

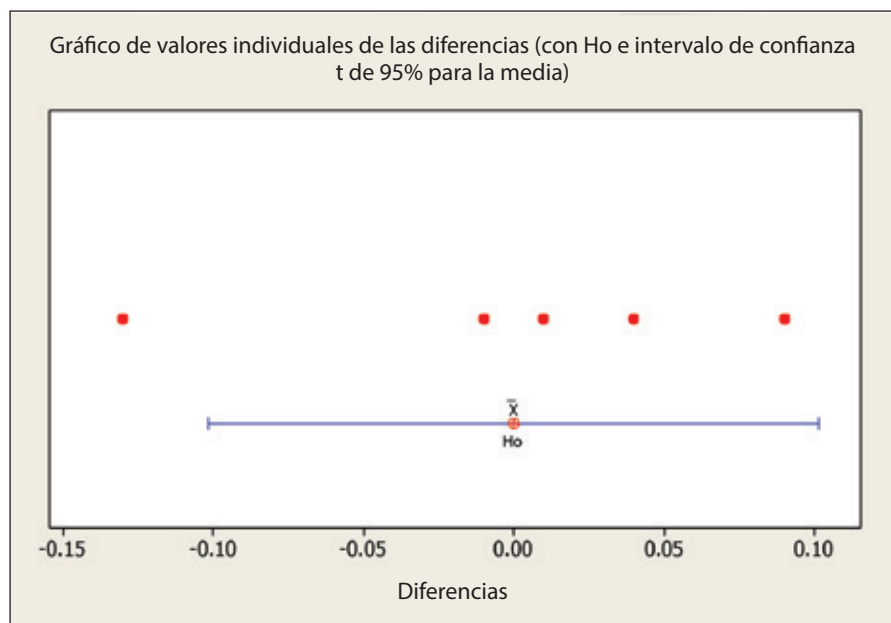
La *Figura 6* muestra el cambio de temperatura en los conductores respecto al nivel de corriente CC que fue calculado a partir de la medición. Para la muestra de cable CCA, el aumento de temperatura aproximado del conductor fue:

$$\Delta t = 3.1 * I^{2.0}$$

Se sabe que el aumento de temperatura debido al efecto de calentamiento Joule es proporcional a las pérdidas  $I^2R^{(8)}$ ; por lo tanto, dado que la corriente es fija en cada punto de medición, será la resistencia del par del cable estudiado la que determinará el diferente aumento de temperatura entre un cable y el otro.

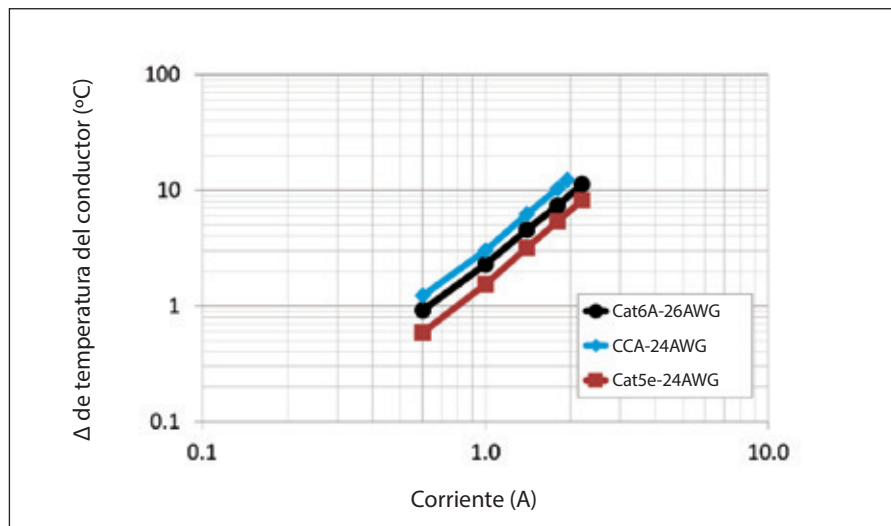


▲ **Figura 4:** Cambio de temperatura del conductor simulado, medido y aproximado



▲ **Figura 5:** Gráfico de valores individuales de las diferencias de temperatura

▼ **Figura 6:** Cambio de temperatura del conductor medido





Por lo tanto, como se esperaba, el cable con mayor resistencia CC tendrá el aumento de temperatura mayor, y viceversa.

## Argumentación

Se sabe que el calentamiento de los cables aumenta la atenuación<sup>[9]</sup>, que tiene un efecto limitante en el alcance del cable. Por lo que se refiere a la tecnología PoE, es probable que la temperatura máxima esté cerca de los conductores energizados que se podrían usar para la transmisión de datos. Por lo tanto, se deberían tomar en consideración las consecuencias que tiene la alimentación CC sobre la atenuación del mismo par.

Los resultados presentados en este artículo muestran el aumento de la temperatura de un par energizado con alimentación de CC usando un cable puesto en un entorno controlado a 20°C. En la práctica, la temperatura ambiente variará dependiendo del lugar de instalación y, por lo tanto, se debería prestar mucha atención cuando se instalan sistemas PoE en ambientes no controlados o más calientes.

También se debería tener en cuenta la correlación de los datos simulados con los del lugar de instalación. Por un lado, la simulación puede basarse en un escenario del caso peor; sin embargo, en la realidad, el ciclo de servicio puede imponer que se suministre electricidad sólo durante una fracción de tiempo.

Se debería aplicar buenas prácticas de instalación siempre que fuera posible, como reducir de las dimensiones del fajo, tomar en consideración el aumento de temperatura para longitudes de cable máximas, y eliminar materiales aislantes térmicamente en los recorridos y espacios libres.

Es importante notar que, aunque se haya observado una excelente correlación entre los resultados simulados y los medidos en el caso de un solo cable, con este trabajo no se pretende reproducir dicho resultado cuando los cables están instalados en fajos. Sin embargo, se espera que la buena correlación entre teoría y práctica también sea válida en instalaciones en fajos, al aire libre y en varios tipos de sistemas de contención de cables, como barandillas, conductos, tubos, etc.

Una comparación entre las muestras UTP 24AWG CCA y U/FTP 26AWG Cat6A muestra que los cables con conductores más pequeños pueden irradiar menos calor que los con conductores más grandes cuando son alimentados con valores de corriente CC idénticos. Se sabe también que la lámina conductora de los

cables blindados actúa como disipador térmico, lo que ayuda a reducir la cantidad de calor irradiado del cable<sup>[10]</sup>. Por lo tanto, es importante tomar en consideración la estructura del cable y no sólo el diámetro del conductor a la hora de instalar sistemas PoE.

La demanda creciente de mayor suministro eléctrico desde el equipo de alimentación (PSE) hasta el dispositivo alimentado (PD) resulta evidente, y se espera que la IEEE<sup>[11]</sup> normalice la alimentación de los cuatro pares y una serie de productos no normalizados actualmente disponibles en el mercado que proporcionan niveles de potencia mayores que los indicados por la norma IEEE 802.3at.

Un nivel de potencia más alto conlleva un aumento del riesgo funcional, pero también permitirá usar los sistemas PoE en un campo de aplicaciones más amplio.

## Conclusiones

Se realizó un modelo en dos dimensiones usando el software COMSOL Multiphysics para reproducir los resultados medidos. Se utilizó un método de prueba propuesto por el subcomité 46C de la IEC para probar los cables para sistemas de alimentación sobre Ethernet, que describía de forma general cómo tomar medidas en cables de datos calentados por corriente de CC.

Se ha demostrado la excelente correlación entre los resultados simulados y los medidos en el caso de un solo cable. Esta correlación fomenta el uso del software para prever el comportamiento térmico de los cables instalados en redes de alta densidad de población. Se espera también dar una importante indicación del aumento de temperatura para varios tamaños de fajos, temperaturas ambiente y sistemas de contención, etc. Se ha demostrado también el rendimiento térmico de un cable CCA alimentado con CC y se ha comprobado que, usando valores de corriente CC iguales, irradia más calor respecto a los cables con conductores de cobre macizo.

Las instalaciones que usan tecnología PoE difieren mucho en términos de configuración y entorno. Para la creciente demanda de mayor potencia, que probablemente requerirá un suministro de alimentación por los cuatro pares, es necesario realizar un estudio más detenido sobre las prestaciones de los cables y componentes cuando están dispuestos en fajos, el comportamiento térmico en entornos con distintas temperaturas ambientes, el alcance de los cables en sistemas PoE y el desacoplamiento de conectores bajo carga. ■

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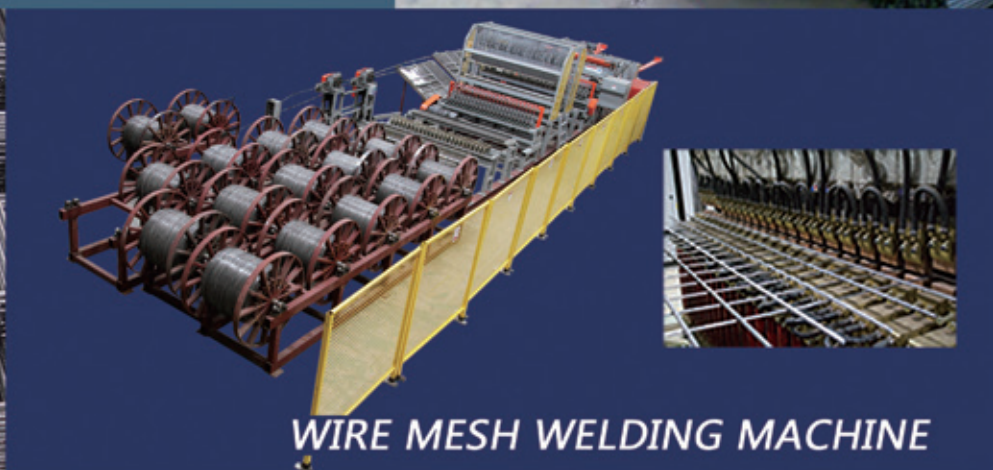
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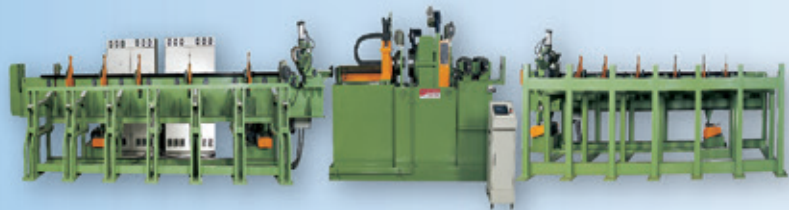
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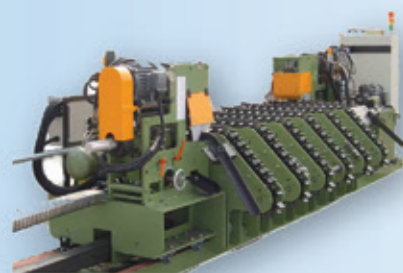
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