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The International Magazine for the Wire & Cable Industries

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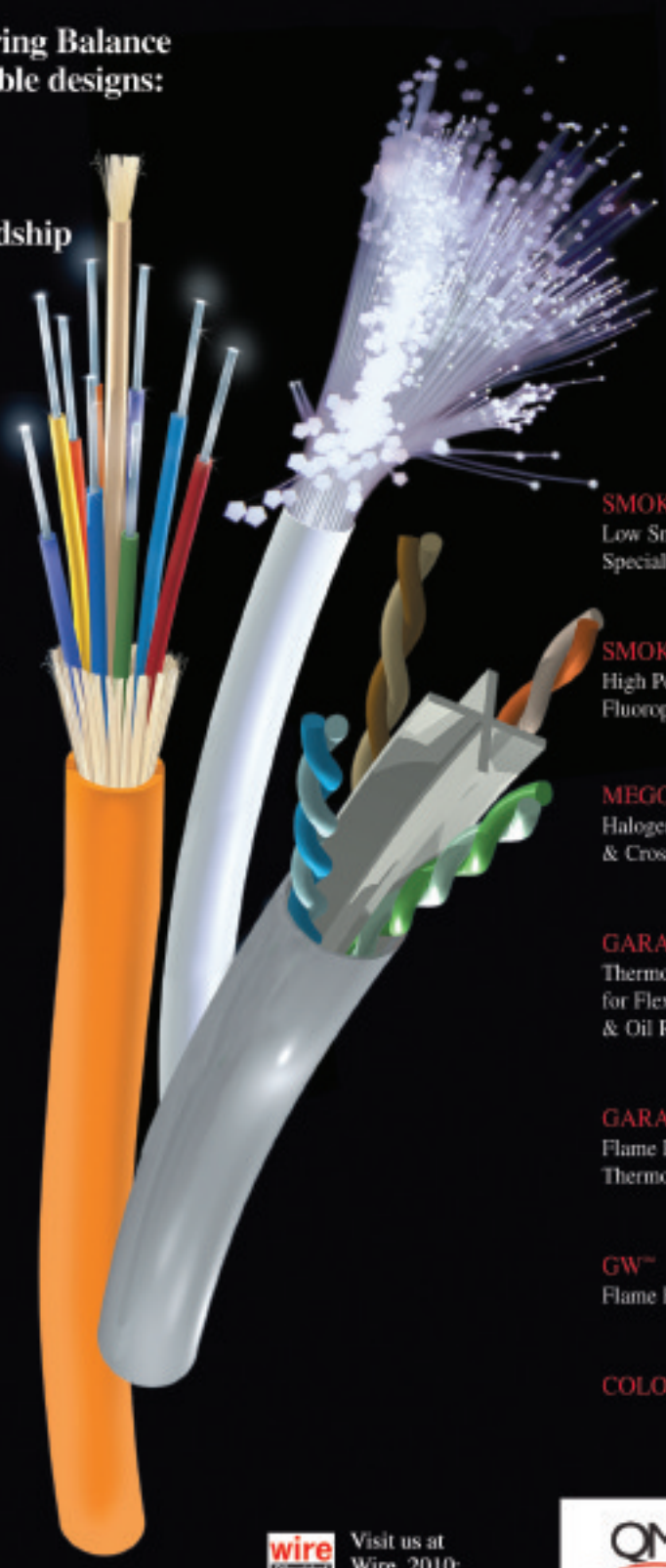

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When American physicist Richard Feynman won the 1965 Nobel Prize for Physics, he was asked to explain his research in a way the average person could understand. He famously answered, "If I could explain it to the average person, I wouldn't have been worth the Nobel Prize."

Part of me sympathises with his point of view. I don't hope or expect to comprehend the hypotheses behind Nobel prize-winning physics research so it was a surprise and a pleasure to read that Dr Charles Kuen Kao was to receive the lion's share of the 2009 Nobel Prize for Physics for something I can understand.

Dr Charles Kuen Kao is the inventor of the fibre optic cable, and if prizes were the reserve solely of individuals who have impacted on millions of lives, Dr Kao would be high on even such a rarefied list.

The fibre optic cable has transformed the way we communicate, creating a technology network estimated to exceed 3 million kilometres in the UK alone, 600 million miles across the globe, carrying voice and video, and high-speed Internet data. Using very little energy, information is reliably transmitted over long distances at very high rates. It's probably the first invention that carried its own news across the globe, to the average man, in a matter of seconds.

As with all the best ideas, the initial realisation was a simple one, to remove the impurities from glass would remove the opportunities for light (the signal) to be lost. At the time, in the mid-1960s, glass fibres were a reliable medium for only 20 metres at a stretch, and even then only 1% of transmitted light would make it to the other end. Compare that with the 100km fibres we take for granted today!

The earliest evidence of wire production of any type seems to date back to pre-3000BC Egypt. Five thousand years and 600 million miles – wire and cable has come a long way, but almost certainly has much further to go.

Gill Watson

The International Magazine for the Wire and Cable Industries

**** US$33 purchase only***
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See page 115 for further details

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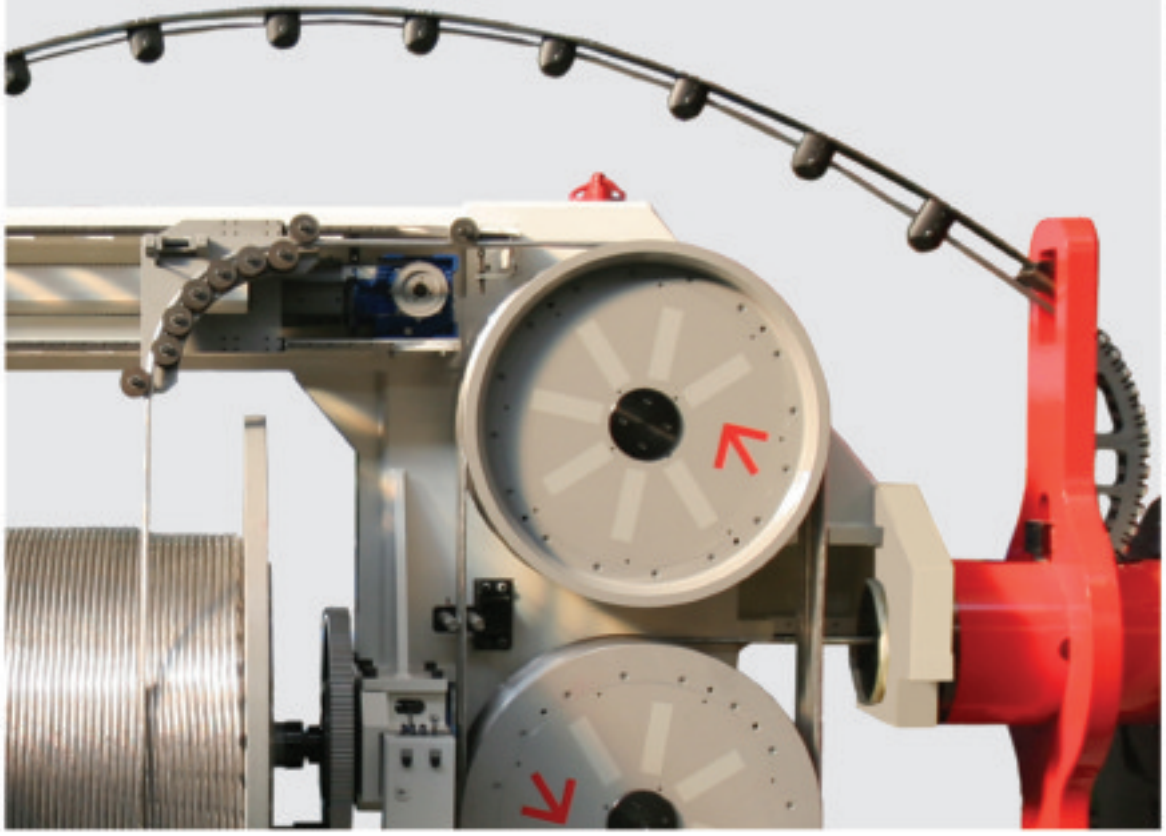

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- Springs

Getting Technical

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dates for your diary . . .

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wire Düsseldorf 2010

April 2010

12–16: **wire/Tube Düsseldorf** – trade exhibition – Düsseldorf, Germany
Organisers: Messe Düsseldorf
Fax: +49 211 45 6087 7793
Email: wire@messe-duesseldorf.de
Website: www.wire.de

2010

May 2010

11–12: **Wire Expo** – technical conference and trade exhibition – Milwaukee, Wisconsin, USA
Organisers: Wire Association International (WAI)
Fax: +1 203 453 8384
Website: www.wirenet.org

September 2010

21–24: **wire China 2010** – trade exhibition – Shanghai, China
Organisers:
Messe Düsseldorf China
Fax: +86 21 5027 8138
Email: wire@mdc.com.cn
Website: www.wirechina.net

November 2010

7–10: **59th IWCS** – technical conference – Providence, Rhode Island, USA
Organisers: IWCS Inc
Fax: +1 732 389 0991
Email: admin@iwcs.org
Website: www.iwcs.org

18–20: **Wire & Cable India** – trade exhibition – Mumbai, India
Organisers: CII
Fax: +91 22 2493 9463
Email: info@ciionline.org
Website: http://cii.in

2011

April 2011

2–5: **Interwire** – trade exhibition – Atlanta, Georgia, USA
Organisers: Wire Association International (WAI)
Fax: +1 203 453 8384
Email: info@wirenet.org
Website: www.wirenet.org

June 2011

19–23: **JICABLE** – technical conference and trade exhibition – Versailles, France
Organisers: SEE
Email: jicable@see.assoc.fr
Website: www.jicable.org

October 2011

4–6: **WiCAB**– trade exhibition – São Paulo, Brazil
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▲ *The new AEI Compounds facility in Kent, UK*

Investing in facilities

AEI Compounds Ltd, a subsidiary of TT electronics plc and specialist producer of cross-linkable and thermoplastic polymer compounds, is to move its operations from its current base in Gravesend to Sandwich, Kent.

The company will also be installing new production capacity for its range of environmentally friendly, low smoke, halogen free (LSFOH) cable compounds. The new line will be capable of producing up to 1,500kg per hour.

Mark Shaw, managing director, commented: "This investment in our business and technical capability is critical to our strategy of continuing to lead in the supply and development of high performance flame retardant solutions to the polymer industry. "

The new facility in Sandwich will allow the business to develop all of its current activities and will house the company's comprehensive R&D and technical centre.

The project is scheduled to be complete by the end of February 2010.

AEI Compounds Ltd – UK
Email: sales@aeicompounds.co.uk
Website: www.aeicompounds.com

Reel handling merger

Tulsa Power Holdings Corporation has announced the merger of Reel-O-Matic Inc and Tulsa Power Inc, both manufacturers of reel handling equipment for processing and distributing cable, wire and other flexible materials.

The companies will maintain manufacturing facilities in Oklahoma City and Tulsa, Oklahoma respectively. All key personnel will remain the same at each location, with Terry Simmons as president of Reel-O-Matic, and Mike Spence as CEO of Tulsa Power.

"The Reel-O-Matic merger combines two highly regarded manufacturers with brand-name recognition into one parent company, diversifying our existing product lines and expanding our end markets," said Mike Spence. "We are excited by the new opportunities this merger creates for our customers."

Terry Simmons added, "With almost a hundred years of combined experience and shared technology, both companies are in a greater position to enhance and improve their equipment for everyone's benefit."

The companies manufacture shafted and shaftless take-up and payout machinery, high speed spoolers, coiling equipment and caterpullers, and specialise in the design and development of customised handling equipment for manufacturers and distributors of wire, cable and wire rope, amongst other products.

Reel-O-Matic Inc – USA
Website: www.reelomatic.com

Tulsa Power Inc – USA
Website: www.tulsapower.com

News from Eder

Eder Engineering has made three announcements recently; the first is that Matthias Bruegger, active within the wire drawing industry in his region for many years, is to represent Eder-Austria in Colombia and Ecuador. Matthias Bruegger already represents a range of companies, including Koch, Wafios and Schlatter.

Eder-Austria has received considerable orders for complete die-tool workshop equipment lines, from Azenco in Azerbaijan and from Gulf Cable Co of Jordan. Smaller orders for single machines are also pending from Malaysia, Vietnam and Saudi Arabia, following the wire Southeast ASIA exhibition in Bangkok.

Eder-Austria also reports that its new catalogues are now available, for die-tool processing and repairing equipment, die-workshop ancillary devices and die-tools.

Eder Engineering GmbH – Germany
Fax: +43 1367 494949
Email: office@eder-eng.com
Website: www.eder-eng.com

Gauder opens Bahrain office

Gauder Group has opened a new service centre in Bahrain, dedicated to serving the needs of Pourtier and Setic customers in the Middle East and supporting the sustained development of the cable industry in the area.

Bahrain has been chosen due to its central location in the area, within a short distance of main hubs such as United Arab Emirates, Saudi Arabia, Oman, Kuwait and the entire Arabic peninsula.

Gauder Group Middle East – Kingdom of Bahrain
Email: suk@gaudergroup.com
Website: www.gaudergroup.com

Power & Trends from Niehoff

Power & Trends 2/09, the latest issue of the Maschinenfabrik Niehoff customer newspaper, contains articles dealing with the rising demand for energy in East and Southeast Asia caused by large infrastructure and economic development projects, the consequences for the wire and cable industry and latest manufacturing solutions from Niehoff.

This edition also includes an interview with Mr Weidong Luo, managing director of Jiangsu Jiangrun Copper Co Ltd, company profiles and news articles.

Printed in English, German and Chinese Power & Trends is the successor to Niehoff-News. It can be obtained from Niehoff headquarters in Germany, any Niehoff subsidiary or service office across the world or from the website.

Maschinenfabrik Niehoff GmbH & Co KG – Germany
Fax: +49 9122 977 155
Email: info@niehoff.de
Website: www.niehoff.de

AWPA annual meeting in conjunction with Wire Expo 2010

Working alongside WAI, the American Wire Producers Association (AWPA) has planned to host its annual meeting and a new symposium from 9th to 11th May 2010, in Milwaukee, just prior to the opening of WAI's 80th Annual Convention, which begins on 11th May. In addition, WAI's Wire Expo exhibits will run 12th to 13th May in a first-time co-location with the National Electrical Wire Processing Technology Expo.

Sitting between these complementary events, Wire Expo 2010 exhibits will be shortened to a two-day format. WAI anticipates 225 exhibiting companies – suppliers to, or manufacturers in, the international wire and cable industry.

Other Wire Expo convention activities will include a complete technical programme, production solution sessions, networking exchanges and social functions.

Wire Expo 2010 has educational alliances with the Australasian Wire Industry Association and the Asociación Nacional de Transformadores de Acero, AC, (ANTAAC), which represents ferrous wire manufacturing operations in Mexico.

Wire Association International – USA
Fax: +1 203 453 8384
Website: www.wirenet.org

Nexans facility to close

In September 2009, Nexans SA announced it was to shed 400 jobs in France and completely close a production unit.

The group aims to reduce the activities of Nexans France and Nexans Copper France to cap costs. "This project aims to restore their competitiveness and ensure their future in a market...hard hit by the economic crisis," the company said in a statement.

As part of the project, 387 layoffs will take place in the production units of Clichy (Paris), Fumay (eastern France), Jeumont (northern France), Lyon (southeast France), Mehun (central France) and the Chauny production unit in northern France, which will be closed. However, around 50 jobs will be created in Nexans France and Nexans Copper France.

Nexans France, which makes half of its revenue from exports, has seen its sales directly hit by difficulties in traditional buying countries. This was made worse by the emergence of powerful local competitors in export markets and increased competition in the French market from Italian and Spanish cable makers.

"In this context, Nexans France has seen its activity level slump by 20 per cent in the first half of 2009, compared with 2008," the company said.

Nexans – France
Fax: +33 15669 8484
Email: nexans.web@nexans.com
Website: www.nexans.com

Increased circulation a boost at wire Düsseldorf 2010

At this year's wire Düsseldorf exhibition, leading trade magazines EuroWire and Wire & Cable ASIA will be distributed to incoming visitors from a purpose-built stand in the main North Entrance to the exhibition halls (EN03).

Paul Browne, group advertising manager explains: "We have been able to secure this excellent distribution point in addition to our regular stand in Hall 11 (11D28). The additional location will ensure that all visitors to the exhibition are given an opportunity to pick up a magazine on entry to the show grounds.

"Our aim is to provide our clients and advertisers with the maximum possible coverage for their businesses during one of the most important shows in our industry's calendar. Times have been tough over the last year and we want to make sure our advertisers get maximum benefit from their investment in our magazines."

EuroWire Magazine already has a circulation of in excess of 18,000 copies to 89 countries worldwide, whilst Wire & Cable ASIA magazine has a circulation of over 12,000 copies to China and Southeast Asia. The boosted circulation for the wire Düsseldorf 2010 exhibition will increase the overall circulation of the magazine by 20% to over 36,000 copies worldwide (joint circulation).

Paul Browne added: "Now we are offering a heightened service to our clients at the biggest show in our industry. We're giving our advertisers better publicity and exposure, while providing readers with a free magazine full of show highlights and the latest industry news at the world's number one wire and cable trade show."

If you wish to publicise your company in the March issues of EuroWire and Wire & Cable ASIA magazines, please contact our sales team below. The closing date for advertising orders is 18th January 2010.

EuroWire magazine – Intras Ltd – UK
Fax: +44 1926 314755
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Website: www.read-eurowire.com

New premises and capacity for Kiswire

▼ *Kiswire is to open a new production facility for wire rope*

Kiswire is building a new plant for the production of very large wire ropes for offshore and mining applications. The Neptune 2 plant is located in Tanjung Langsat, on the east coast of Johor, Malaysia and will be operational in the summer of 2011.

The equipment installed is capable of manufacturing wire rope units up to 600 metric tonnes in non-rotating, multi-strand constructions. The output capacity of Neptune 2 will be 25,000 metric tonnes per annum, in addition to the existing Neptune 1 plant output of 25,000 metric tonnes each year.

With this investment Kiswire plans to service even the most extreme wire rope needs of the offshore and mining market.

Kiswire Ltd – Korea
Fax: +82 2753 5323
Website: www.kiswire.com

UK wire products industry review 2009

Plimsoll has published a review of the UK wire products industry, reflecting on the last twelve months and looking forward to the challenges and opportunities of 2010.

The report claims that some 49 companies in the market are finishing the year in financial difficulty. However, among the gloom there have been some outstanding performers.

David Pattison, author of the review, says, "A number of companies have managed to improve their performance in the last year. They are part of a band of 101 companies that prove success can still be achieved in the wire products industry despite difficult trading conditions."

Summing up, the new 2010 edition of the Plimsoll Industry Analysis shows a buffeted market emerging from recession with a third of companies making a loss and one in three companies in financial difficulty. Pattison adds, "If you are going to make a success of 2010, you need to learn the lesson of 2009."

Plimsoll Publishing Ltd – UK
Fax: +44 1642 626410
Email: enquiries@plimsoll.co.uk
Website: www.plimsoll.co.uk

LS Cable aims to top subsea cable sales

In September 2009 a chief executive of LS Cable announced that the company is looking to achieve upwards of 1 trillion won in sales of subsea cables in 2015, topping the global market now dominated by three European companies.

"We are targeting 700 billion won to 1 trillion won in revenue from subsea cable sales in 2015, and to become the global number one firm in the market that year," said CEO Son Jong-ho at the company's plant in Donghae City, Gangwon Province.

The company has already started production of submarine cables at the 180 billion won ($148.8 million) plant, the first of its kind in Korea and the fourth in the world. "A revenue of 700 billion won would give the company about a 35% share in the global subsea cable market," Son said.

The global subsea cable market, which amounted to 1.5 trillion won last year, is expected to grow 24% to 25% annually. Son expects the increasing renewable energy market to boost demand for power cables linking offshore wind farms with mainland. Demand is also rising for submarine cables, he added.

LS is currently working on a 105-kilometre subsea power and communications cable system to connect Jeju and Jin Islands.

LS Cable – Korea
Website: www.lscable.com

Show a success, despite the gloom

wire Southeast Asia 2009 ended on a high note, having attracted around 5,000 highly relevant trade visitors and buyers from 57 countries. Approximately 30 per cent of visitors came from outside Thailand, with a significant number of visitors travelling from China, India, Japan, South Korea and the Middle East.

A total of 305 companies from thirty countries exhibited at the three-day show, with national pavilions for exhibitors from Austria, China, France, Germany, Italy, Singapore and the USA.

Joachim Schaefer, managing director of Messe Düsseldorf GmbH, commented: "Despite the global economic downturn, many companies have not lost sight of their intention to penetrate the regional markets of Asia, in particular the southeast Asian region."

Following the success of the 2009 event, wire Southeast Asia will return to Bangkok in autumn 2011.

Messe Düsseldorf Asia Pte Ltd – Singapore
Fax: +65 6332 9655
Email: wire@mda.com.sg
Website: www.wire-southeastasia.com

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Success in Bangkok

wire Southeast Asia proved to be a very successful event for British manufacturer PWM, which designs and manufactures high performance cold welding equipment and dies for the world market.

Steve Mepsted, managing director of PWM, said:

"We were surprised by the high turnout. Visitor traffic was excellent and our stand was busy every day, right up to the last day – in fact, people were still coming on to the stand as we were packing up the exhibits!

"Visitor quantity and quality were both good, with a large number of prospective buyers from Vietnam, India, Pakistan and Jordan. We received numerous sales leads, and the larger machines in our range, such as the EP500, P1000 and P1500 rod welders, proved particularly popular with manufacturers looking for a fast, cost-efficient method of welding large non-ferrous rod sections."

▲ *Left to right: Peter Rachatasumrit, interpreter; June Goh, PWM's agent for South East Asia; Carole Cole, PWM's export manager, and Steve Mepsted, managing director*

PWM Ltd – UK
Fax: +44 1233 820591
Email: pwm@btinternet.com
Website: www.pwmltd.co.uk

Sikora to expand in Bremen

Sikora AG is to expand its headquarters in Bremen. By the extension of one of the existing three buildings by three stories, the company will provide more space for future developments.

Construction is scheduled to begin in the spring of 2010.

Sikora AG – Germany
Fax: +49 421 48900 90
Email: sales@sikora.net
Website: www.sikora.net

New office in Japan

In autumn 2009, Sikora AG opened up a new office in the Japanese capital Tokyo. With the establishment of Sikora Japan, Sikora's internal distribution network is increased to ten offices.

▲ *Ms Yumi Ito is the manager of Sikora Japan*

The sales manager of Sikora Japan is Ms Yumi Ito. A native-born Japanese from Tokyo, she speaks English and German fluently, in addition to her native Japanese. Ms Ito has completed six months of technical training at Sikora's headquarters in Bremen.

With the establishment of Sikora France and Sikora Türkiye at the beginning of 2009, Sikora Japan is the third new office within a year.

Sikora AG – Germany
Fax: +49 421 48900 90
Email: sales@sikora.net
Website: www.sikora.net

AWCMA board elected until 2012

During the 2009 annual general meeting of the Austrian Wire and Cable Machinery Manufacturers' Association (AWCMA/VOEDKM), the following members of the board were elected into office until the end of 2012: Dr Kurt G Eder, president; Mag Robert Ebner, vice-president; Mag Werner Lichtscheidl, secretary; and Ing Siegfried Altmann to be co-ordinator and advisor.

Since its founding in 1988, twenty-one specialist companies within the wire and cable sector in Austria have joined. The members have an average export rate of 95 per cent.

AWCMA/VOEDKM – Austria
Fax: +43 1367 494949
Website: www.awcma.com

Name change for Philatron

Philatron Wire and Cable (formerly Philatron International Inc), a custom electrical wire and cable manufacturer, has launched a new corporate name and logo.

Philatron's new name, Philatron Wire and Cable, is thought to better reflect the company's core competencies.

Philatron Wire and Cable – USA
Website: www.philatron.com

Better outlook prediction from worldsteel

▲ *Furnace worker at the Edgar Thompson plant, Pennsylvania (photograph courtesy of World Steel Association)*

The World Steel Association (worldsteel) is predicting that apparent steel use will have contracted, worldwide, by –8.6% to 1,104mmt in 2009 after declining by –1.4% in 2008. This is an improved figure over the spring forecast issued in April 2009 when a decrease of –14.1% was predicted. The improvement is largely due to exceptionally strong growth in steel demand in China. With signs of a recovery slowly becoming apparent, global steel demand in 2010 is forecast to grow by 9.2% to 1,206mmt, a recovery to the level of 2008.

Commenting in October 2009, Daniel Novegil, chairman of the worldsteel economics committee, said: "The global recovery is stronger than we predicted in April. According to our current forecast, China will rebound 19% in 2009 and 5% in 2010. Emerging economies will slow down 17% in 2009, to grow 12% in 2010. Apparent steel use in developed economies, that contracted 34% in 2009, will rebound 15% in 2010. Therefore, worldsteel forecasts moderate growth in global steel demand in 2010. As before the financial crisis, the emerging economies, especially China, will be the critical factor in driving world steel demand in the near future."

World Steel Association – Belgium
Website: www.worldsteel.org

Takeover talks halted

Cable maker Prysmian has called off talks to take over the Dutch company Draka Holding NV. In brief, separate statements on 10th September 2009, Prysmian and Draka said they could not reach agreement on the main terms and conditions.

When talks were first announced, Prysmian was worth about €1.77 billion, dwarfing its nearest rival Nexans of France, and Draka around €325 million, according to data from Reuters.

By 10th September, Prysmian was estimated to be worth around €2.5 billion and Draka about €548 million.

Prysmian – Italy
Website: www.prysmian.com

Draka Holding – The Netherlands
Website: www.draka.com

Transatlantic Cable

Telecom

Showing modest gains, third-quarter results hearten badly battered equipment makers

The most recent earnings report from Tellabs (Naperville, Illinois) is one of several signs that the worst of the slump in spending for telecom gear may be ending in the US. The designer and maker of telecom equipment for service providers said its revenue went up 1% in the third quarter from the previous quarter, a small but significant rise and the second straight uptick.

As noted by Olga Kharif, a senior writer covering technology for BusinessWeek.com, Tellabs has some way to go: third-quarter revenue was 8.3% lower than in IIIQ 2008. Even so, she took its latest report as indicating that the telecom gear market may be in tentative recovery. The industry was badly jolted in 2008 when enterprises slashed spending on networks, and phone providers curtailed investment in systems that deliver communications services. ("Piecing Together a Telecom Gear Rebound," 26th October)

Ms Kharif cited other third-quarter results supporting a turnaround. Juniper Networks (Sunnyvale, California), a maker of networking equipment, said its sales rose 5% from the previous quarter. And Infinera, another Sunnyvale-based company, reported a 21% sequential sales increase and a 3% gain from a year earlier.

"It looks like the first half of this year was the bottom," Infinera CEO Jagdeep Singh told Ms Kharif. "It looks like we are in the early stages of a recovery."

Infinera makes equipment used in fibre optic networks in metropolitan areas. The view of the broader market for wireless and wireline equipment is even more encouraging. The market research and consulting firm IDC (Framingham, Massachusetts) thinks carriers trying to improve their networks after delaying some upgrades may push second-half spending as much as 8% higher than that in the first six months of 2009.

❉ Moreover, Ms Kharif pointed out, demand for telecom equipment may also be spurred by the government stimulus package aimed at improving broadband access in the US. Washington has earmarked about $7 billion in broadband spending so far, and Federal Communications Commission chairman Julius Genachowski said the agency is also looking at ways to boost non-government spending, too. In a discussion of regulations for an open Internet as well as other telecom and technology topics, he said, "There is no question that it will take a lot of private investment to do what's necessary."

Many industry insiders note the obvious: that spending on telecom equipment could recede again if the larger economic recovery falters. Customers "will be conservative at the beginning of the year, just to make sure we don't hit the double dip," Kim Perdikou, an executive vice-president at Juniper, told BusinessWeek.com. "Now they are very strategically pinpointing where the revenue growth is and spending in those areas."

Landline giants AT&T and Verizon now see their future in mobile networks and devices

For their part, the US telecom titans AT&T and Verizon Communications – which might have been expected to trim their sails during the recession – are likely to register a combined total as high as $35 billion in capital investment last year, about what they spent in 2008. According to their chief executives, hopes of a return on that investment rest squarely on the companies' mobile networks.

The loss of interest in their landline businesses is absolute, if Ivan Seidenberg can be taken at his word. The Verizon CEO told a Goldman Sachs investors conference in New York in the fall, "I don't care about that any more" – that being the traditional area in which Verizon made its name and its fortune. Equally emphatic about his company's commitment to wireless, AT&T chief Randall Stephenson said he expects new electronic devices geared to mobile access to open up additional revenue streams. "We're investing very, very hard in this area," Mr Stephenson said. "The next wave of growth in the industry is centered around the concept of mobility." Indeed, in the very week of the Goldman conference AT&T announced a deal to include mobile-Internet access in a new GPS navigation device produced by Garmin Ltd.

Incorporated in the Cayman Islands and based in Kansas, Garmin has its largest operating subsidiary and primary production facility in Taiwan. Jeffry Bartash, who follows telecommunications from Washington, DC, wrote in the Wall Street Journal (21st September), "The way [Messrs Seidenberg and Stephenson] see it, consumers and businesses are increasingly willing to spend more on wireless data and Internet service as long as the carriers can meet their need for greater speed and reliability."

❉ Mr Bartash saw few signs that the AT&T and Verizon executives feel threatened by smaller rivals offering lower prices but less attractive handsets and more limited networks. AT&T has exclusive US rights to sell the Apple iPhone – a tremendous asset even if the phone's popularity has the company straining to ease network congestion. Verizon benefits from its reputation for running the network widely considered to be the best in the country. To maintain that commanding lead, the two companies plan to spend billions of dollars over the next few years to migrate to LTE (long term evolution) wireless technology, which promises to handle more Internet traffic at much faster speeds. "The whole idea here is for us to not take our foot off the gas," Verizon's Ivan Seidenberg told the investors gathered in New York. "And we will not take our foot off the gas."

Automotive

GM moves to shed more than one-third of US Saab dealers as the brand is sold, unsold, and goes back on offer – pro tem

In mid-November, Saab was waiting out the preliminaries of its sale by General Motors to the Swedish supercar maker

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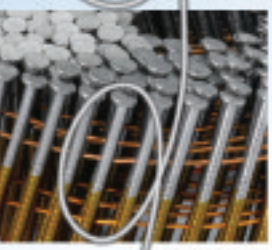
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Transatlantic Cable

Koenigsegg Group AB under a deal backed by China's state-run Beijing Automotive Industry Holdings (BAIC). An uneasy period for Saab, to be sure; but preferable to the situation of some 37% of its US dealers who were summarily told they must close their doors in chime with the closing of the sale.

On 14th November, GM spokeswoman Ryndee Carney said the company had sent letters to 81 of the 218 US Saab dealers instructing them to be prepared to terminate their businesses within the month. The remaining 137 dealers would continue operating under Saab Cars North America, a newly formed company that would run the brand under Koenigsegg's ownership.

The directive could not have come as a total surprise to dealers in either category, all of whom signed deferred termination agreements during GM's reorganisation under bankruptcy protection earlier in 2009. The Koenigsegg consortium – which includes Augie Fabela II, co-founder and former chairman of Russian telecom operator VimpelCom – agreed in August to buy Saab from GM. The culling process was conducted unabashedly on the principle of survival of the fittest. Mike Colleran, chief operating officer of Saab Cars North America, said the company chose the keeper-dealers based on their potential to make money. He told AP Pittsburgh correspondent Daniel Lovering, "We selected a network that gives us the best opportunity to achieve that." Then, on 24th November, Koenigsegg announced that it had decided not to buy Saab, after all. Sweden effectively ruled out a state bailout of the 60-year-old auto company that had begun there and seemed to be on its way home. From that point, things moved fast but went nowhere. On 25th November, BAIC, the Chinese presence on the scene, said it was reviewing its options.

On 27th November, GM said it was talking to possible buyers of Saab in advance of a board meeting that would consider whether to revive the sale process or eliminate the brand. On 30th November, BAIC said it might still be interested in buying Saab. On 1st December, the GM board said it would consider offers on the brand until the end of the month. If a credible buyer did not emerge by the New Year, Saab was to be closed down.

Two days before its dealerships in the US were selected in or out of its network, Saab provided a news item. After an interview with Saab's director of global operations Knut Simonsson, the online car magazine InsideLine.com reported that Saab within the next year planned to show a new "concept car" that will define the brand's future identity. But it also noted that sales of the stylish new 9-5 sport sedan had been delayed by the sale of the brand by General Motors.

Auto critic Mark Phelan of the Detroit Free Press wrote that Saab developed the sleek 9-5 to elevate the style and performance of its midsize model to compete with cars like the Audi A6 and BMW 5-series. But production was held up by about six months as Saab moves factory equipment from an Opel plant in Germany to the Swedish auto maker's headquarters in Trollhattan. ("Saab to Show Concept Car That Will Define Brand," 12th November)

Noting that Saab had planned to build the 9-5 alongside the Opel Insignia in Ruesselsheim, Germany, Mr Phelan said, "That plan was scuttled when GM, which owns Opel, decided to sell Saab." It would appear that, whatever the future holds for Saab, as 2009 drew to a close the company's US dealers had plenty of companionship in limbo.

Metals

- Harsco Corp (Harrisburg, Pennsylvania) said on 15th October that, under agreements valued at up to $100 million over ten years, its minerals subsidiary will treat and recycle the metalmaking by-products of the two Austrian steel mills Bohler Edelstahl and Breitenfeld Edelstahl.

  Employing environmentally sound methods, and in collaboration with Scholz Recycling AG, of Germany, the US industrial services company will recover the slag's high-value metallic content for commercial resale. The new treatment facility that Harsco will build in Austria is slated to go into operation toward the end of this year.

- Alcoa Inc in the third quarter of 2009 returned to profitability after three straight quarterly losses. The largest US aluminium producer earned $77 million for the three months ended 30th September, for a 9% gain from the second quarter. The improved showing was attributed to rising demand, especially from auto makers, and rigorous cost-cutting.

Pittsburgh-based Alcoa on 7th October predicted an 11% increase in worldwide aluminium demand over the rest of the year.

"We do clearly see growth, substantial growth, in China," Alcoa CEO Klaus Kleinfeld told analysts and reporters after the company reported results. "The second half of the year is clearly better than the first half in many industries and many regions."

Dorothy Fabian –
USA Editor

▲ *The PS 200/6/B double-head spool winding line*

Double-head winding

PS Costruzioni Meccaniche Srl has launched an improved double-head fully automatic spool winding line with faster restart time between the wound and the next spool. While the second spooling head is winding, the first head has completed the winding cycle and the spool is moved to the palletising area.

This machine can accommodate 200 cardboard, aluminium, plastic or wooden spools in two stores. The spools range from a flange outer diameter of 100mm (3.94") up to 200mm (7.88") and flange width from 50mm (1.97") up to 190mm (7.49").

The PS 200/6/B process specifications are as follows:

- Bore centring to start the winding operation
- Cable layer on layer winding
- Cable measuring accuracy ±0.1%
- Spark tester cable insulation tests
- Fast, pneumatic cable cutting
- End product packaging by polyethylene film
- Division between faulty and correct products
- Labelling
- Cartesian axis palletiser
- Pallet wrapping

The machine can produce 4 x 100m spools of 100 metres per minute. The cable sections can vary from 0.65 up to 6.53mm^2 (AWG from 19 up to 9).

The wire guide comes with CNC digital technology, and special CNC software helps to obtain perfect winding results. On request, an in-line cable diameter detector can be included. It can correct any cable diameter modification in real time.

PS Costruzioni Meccaniche Srl – Italy
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Email: ps@pscostruzioni.com
Website: www.pscostruzioni.com

Adaptive die match technology

Precision, stable processes and early and effective failure detection are key factors for productivity. With this in mind, EW Menn, in partnership with Brankamp, has combined EW Menn's push button die match with Brankamp's process monitoring expertise to create ADM. ADM stands for adaptive die match and describes a system that electronically measures and evaluates die match and corrects it automatically while the machine is running, without interrupting production and without requiring the assistance of an operator. Standard process monitoring takes place simultaneously.

ADM is only available on EW Menn machines in combination with Brankamp process control systems.

EW Menn is also active in the field of special applications, such as the warm rolling system that allows heating of the blanks just before feeding them into the rolling dies.

Originally developed for aerospace applications involving titanium and highly special alloys this system allows a higher degree of material displacement, thereby enabling forming processes that cannot be achieved without heating and greatly extending the possibilities of the flat die rolling process.

EW Menn GmbH – Germany
Fax: +49 2733 7781
Email: mail@ewmenn.de
Website: www.ewmenn.de

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Measuring shapes or profiles

Zumbach Electronic has introduced a new profile measuring system. Profilemaster® PMM 80 is the latest model available from the Zumbach Profilemaster family, enabling measurement systems using light section principle and machine vision. The design was focused to achieve the best price-to-performance ratio for all profiles, tubes and cables made of plastic, rubber, metal, steel or other materials. In addition, the Profilemaster PMM 80, fulfils the demands of the market for a compact, industrial-proof and cost effective system to increase the accuracy of the end product.

Profilemaster PMM 80 can be easily integrated into an existing production line and any PC-based network.

Main technical specifications include:
- Measuring field: within 80mm (3.15") cross-section
- Repeatability: up to ± 0.002mm (± .00008")
- Measurement rate: up to 5/s (option: 20/s)
- Light source: VLD (visible laser diode) red, class 3R
- Cameras: CCD megapixel gigabit ethernet
- Line speed: unlimited
- Type of protection: IP 65
- Dimensions (w x h x d): 440 x 520 x 280mm (17.3 x 20.4 x 11")
- Operating system: Windows™ XP embedded
- Display: high resolution 17" TFT
- Network interfaces: 2 x ethernet
- Communication interfaces: digital I/Os, relay outputs

Zumbach Electronic AG – Switzerland
Email: sales@zumbach.ch
Fax: +41 32 356 0430
Website: www.zumbach.com

Software partnership

Cimteq, the supplier of the cable design software CableBuilder©, has signed a partnership agreement with SAP to enhance its software's ability to generate professional reports, manufacturing instructions and online catalogues.

CableBuilder, used by wire and cable manufacturers worldwide for design, quotations, costing and datasheets, will now feature an integrated reporting engine in the form of Crystal Reports.

Crystal Reports software enables CableBuilder users to design interactive reports and use them as a template to format CableBuilder data. These reports can be static or interactive, and can cover a variety of purposes from manufacturing instructions to datasheets to quotation performance analysis.

The chief benefit of Crystal Reports is thought to be the familiar and convenient drag-and-drop user interface, similar to the majority of word processing applications. A secondary, but important, feature is the ability to generate PDF, Microsoft Office, and HTML documents from the same user defined report format, hence reducing the time and cost of reporting.

Cimteq – UK
Fax: +44 1978 667 005
Email: ali.shehab@cimteq.com
Website: www.cimteq.com

Smoother winding

The Luxembourg facility of tyre manufacturer Goodyear Dunlop is using AVS automatic winding width control, developed by Joachim Uhing KG GmbH & Co, to prevent the formation of bulges and dents in wires wound on the flange area of spools.

The metal spools on which Goodyear Dunlop winds the 1mm–2mm thick steel tyre cord are used in several locations of the Colmar-Berg plant. During their service life, some of the spools change their initial geometry considerably, bent flanges being the central issue.

Warped metal spools require frequent adjustment of the traversing width if such spools are to be reused. This negatively affects the cost efficiency of the production process.

Uhing developed the automatic winding width control, AVS, to provide a smooth winding pattern in the reversing area of the traversing system, known to be particularly critical in the process.

The Uhing AVS is extremely unsusceptible to soiling, since it lacks optical sensors, and can be integrated into existing traversing systems as a complete system or in parts.

Joachim Uhing KG GmbH – Germany
Fax: +49 4347 90640
Email: info@uhing.com
Website: www.uhing.com

The continuing development of dry lubrication

The Condat group allocates significant resources to its research and development laboratories, for:

- Strategic and prospective research to find new lubricating solutions and develop lubricant technology
- Applied research to characterise and develop new products
- Analysis and SAV to review and maintain current lubricants in use

During the last two years, over €500,000 has been invested in a Laboratory of Analysis, to gather information from the group's production units in Brazil, China and USA.

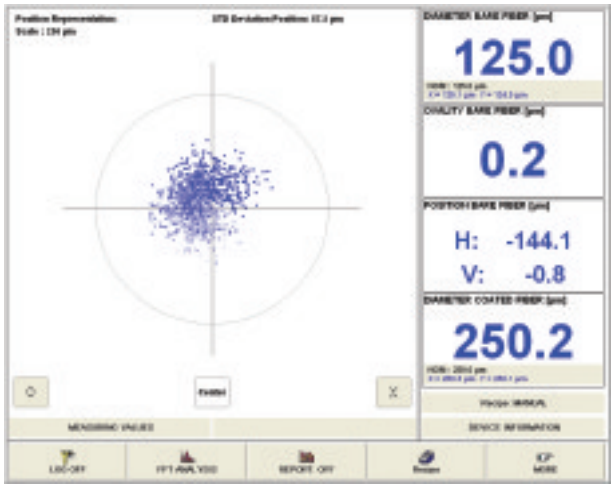
Its role is to analyse the finished goods manufactured in Condat factories, and to control the raw materials used in their composition. It also follows the evolution of products currently in use.

The Condat Laboratory of Analysis controls and measures the powders and pellets of the Vicafil and Steelskin ranges:

- Size and shape of powder granules (calcium and sodium) is analysed in 3D by granulometers with double cameras, from 64 different angles
- Hardness of the particles: if the grain is too crumbly it breaks down too quickly, creating dust and excessive consumption. If it is too hard, it will not circulate in the die, increasing die wear and wire breakage
- Quality and quantity of fat content, is measured using infrared spectrometers and chromatography of phase gases. Quality of the fat content influences product resistance to high temperature and regulates the lubricant film. Fat quantity influences the cleanness of the wire after drawing: the higher the fat content, the cleaner the wire
- Thermal decomposition: the temperature at which changes of product behaviour (solid, crystalline, liquid phases) are observed, to establish melting points, fusion points, and decomposition of the different elements to optimise soap consumption or residue left on the drawn wire.

Condat AS – France
Fax: +33 47807 3885
Email: info@condat.fr
Website: www.condat.fr

Measuring optical fibres more precisely



▲ *The position of the fibre is visualised within the measuring field*

After seven years of intensive research, Sikora AG has further developed its Fiber Laser 6003 for the diameter measurement of bare fibres. Using the new measuring principle the diameter of optical fibres with a diameter of 50 micrometers or more can be measured with an accuracy of ±0.05 micrometers. This is said to be ten times more precise than conventional measuring systems.

Speeds of 2,500 measurements per second allow extremely precise single values, and highest accuracy, even at high draw speeds. Statistical analyses are directly taken in the gauge head. By using an FFT-analysis the spin, vibration frequency and position of the fibre in the measuring field can be accurately defined. In addition, other randomly occurring non-conformities during production and/or during coating (caused by variations of line speed or vibrating fibres) are discovered at an early stage. The statistical distribution of short-term variations of the product parameters is graphically displayed during production on the processor system of the Ecocontrol series in the form of a cloud diagram.

The devices are factory-calibrated and maintain their accuracy for the life of the gauge. The gauge head technology ensures the quality of the fibre and thus assists in producing a product that provides reliable data transfer over long distances without data loss. The diameter sizing quality provided by the gauge guarantees a good connection of optical fibres. The measuring principle is based on Sikora's patented laser-shadow projection principle.

Sikora also offers the Fiber Lump 6003 T for lump detection in the drawing tower.

Sikora AG – Germany
Fax: +49 421 48900 90
Email: sales@sikora.net
Website: www.sikora.net

New coiling solution

Windak has announced that the first of its new generation of automatic coilers, the FC5, has been successfully installed in Finland.

According to Urban Bollo, managing director of Windak Sweden, the FC5 automatic flex coiler is the first machine Windak has introduced as part of a new generation of affordable automated packaging solutions. "We understand that the market today demands cost-effective solutions that have a short pay-back time with maximum flexibility and output."

FC5 is compact and accommodates a wide range of cable diameters and coil sizes. It features fully automatic coiling with or without a strapper or binder. Without a strapper or binder the coil is stretch-wrapped before it exits the coiling head.

▲ *Windak's new FC5 coiler*

Windak – Sweden
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Zero slip rod breakdown

▲ *Frigeco's TA rod breakdown machine*

To tackle the demands of lower costs and improved machine performance and finished wire quality, Frigeco (a division of Mario Frigerio) has further developed its TA copper and aluminium rod breakdown machine with zero slip.

Conventional slip breakdown machines can cause longitudinal friction – by the wire sliding on the capstan – and axial friction as the wire moves from wrap to wrap on the capstan itself. Frigeco's TA zero slip rod breakdown machine avoids friction between wire laps and between wire and the capstan. An independent AC motor for each drawing block, with dancer synchronisation of the wire/capstan speed, eliminates the longitudinal slipping problem and avoids longitudinal wire scratches.

In each drawing block the wire is wound to a double capstan. The first pulling capstan is motor driven while the second idle capstan is slightly out of centre with respect to the first. The idle capstan prevents side sliding and drafting and so avoids any axial wire scratches.

To prevent dangerous wire yielding, the machine is also supplied with large diameter pulling and idle capstans while a high-pressure lubricant die holder and efficient wire cooling help to achieve high production speeds.

The advantages of the TA are said to include:

- Wire breaks are reduced when produced wire is re-drawn
- The machine is adaptable to most drawing ranges and wire elongations, with inlet diameter from 8mm to 10mm and outlet diameter of 0.8mm to 9mm
- Reduced energy consumption
- The absence of slippage minimises pulling capstan wear, resulting in low maintenance costs and reduced downtime
- Low noise, less than 80dBA
- Unused motors are switched off

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Finishing lines contract

Dong Bei Special Steel has given an order to Mair Research for the supply of four bar inspection and conditioning lines to process bars of engineering steels and stainless steel. Two lines will process bars from 13mm up to 40mm diameter and the other two lines will be up to 60mm diameter; the bar lengths will be from 4m up to 12m.

The main supply will consist in four 2-rolls straightening machines, Mair RMS2-40 and RMS2-60, four chamfering stations and three shot blasting machines.

The contract includes the engineering for the handling system and full automation of the complete line. The delivery of the machine is expected to be in spring 2010 and the lines will come into full operation during summer 2010.

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Cable specific enterprise software

Successful wire and cable manufacturers and distributors use enterprise software to make their business processes across the company more efficient. However, the promises of these systems do not always materialise because standard ERP systems do not fulfil the unique requirements of wire and cable companies.

By definition, generic ERP systems do not understand the world of wire and cables. These standard ERP systems are built to support either discrete industries or process industries but the wire and cable industry does not fit either one. As a result, the typical business processes and best practices in the wire and cable industry are not supported.

Companies who try to force the generic software into the reality of cable manufacturing and distribution have to accept many compromises. The result is said to often be an expensive, heavily customised and rigid ERP system that cannot provide the flexibility needed to compete in the current competitive environment.

InnoVites understands the specific requirements of the wire and cable industry, and specialises in providing solutions for the industry. Based on extensive experience within the industry the company has developed ERP software that addresses the needs of wire and cable manufacturers and distributors.

This industry solution is based on the popular and mature Microsoft Dynamics AX software and InnoVites complements this rich solution with features that are specific for the wire and cable industry, including:

- Cable length management throughout the logistics (sales, production, purchasing, master planning)
- Optimisation algorithm, developed in association with scientists, to reduce scrap in production and cutting operations
- Precious material management, to manage the volatile prices of materials such as copper, aluminium and XLPE
- Easy cable cutting procedure
- Standard integration to the popular cable design software CableBuilder

InnoVites BV – The Netherlands
Website: www.innovites.com

Turkish order

Rautomead Ltd has secured a firm order from Elsan Elektrik Gerecieri SA of Denizli, Turkey to supply an RS 3000/6 copper rod-casting machine for use in the manufacture of enamelled wires. Elsan will be building its own operating platform and cathode feed, but in accordance with Rautomead's designs. Proprietary components of Rautomead's standard coilers will be supplied as kits for local manufacture.

Rautomead's expertise in graphite crucible and electrical resistance heating technology is well suited to copper wire rod production. The all-carbon containment system acts as a strongly reducing environment and avoids risk of ceramic refractory contamination of the molten copper. These factors ensure the highest quality oxygen-free copper rod.

Rautomead Ltd – UK
Fax: +44 1382 622941
Email: sales@rautomead.com
Website: www.rautomead.com

Wire cutting

The Delisi company manufactures and sells automatic wire straightening and cutting machines for smooth and ribbed wire in diameters between 1mm and 20mm.

Model HS6H, with hydraulic and flying shear cut for wires from 1.5mm to 6mm, is suitable for smooth wires and for short pieces. It has four pairs of feeding rolls and rapid change of diameter.

Feed speed is from 30m up to 150m per minute. The system produces less wire twist, increased production and reduced noise.

Delisi Srl – Italy
Fax: +39 0882 333236
Email: delisi@delisisrl.com
Website: www.delisisrl.com

Complex shape forming

Robust and reliable, Pave's space-saving Cyber-Form Selekta 2000 wire forming centre offers a full 360 degree, three-dimensional wire bending capability for complex shapes at a competitive price.

The machine's integrated multi-head wire forming facility provides a wide range of 'in cycle' wire bending and end finishing options, while the fully automatic CNC system allows a number of normally separate processing operations to be performed at the same time on the same machine. This cuts handling and production times considerably and substantially reduces the cost per product.

▲ *Selekta 2000 wire forming centre*

Equipped with automatic user-friendly technology to minimise operator training, the Selekta also incorporates Pave's patented 'Trueline' wire straightening system, which provides accuracy similar to hard tooling and provides twist-free finished form products. Other special features include a double end chamfering unit, moving guillotines for back and front cuts, a double pressing station, roll threading unit and manipulation unit for double eye end forming.

The compact Selekta can be customised to suit specific user requirements, such as profile cutting and welding.

Pave Automation Ltd – UK
Fax: +44 1733 563500
Email: pave@enterprise.net
Website: www.pave-wire.com

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wire Düsseldorf
12 – 16 April 2010
Düsseldorf, Germany
www.wire.de

Lämneå Bruk AB
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Sweden

www.lamnea.se

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Wire drawing machinery

Dongguan Guanbiao Electrical Machinery Co Ltd specialises in manufacturing and cable machinery. From its 6,000m² facility the company produces a wide range of wire drawing machines including continuous intermediate wire drawing and annealing machines, small, fine and super-fine wire drawing machines.

All wire drawing machinery produced by Dongguan Guanbiao Electrical Machinery is provided with modern technology such as frequency conversion speed regulation, PLC, DC speed regulation and an opto-electrical transducer to improve working accuracy and productivity and assist energy-saving and environmental protection.

▲ *Wire drawing equipment from Dongguan Guanbiao Electrical*

Dongguan Guanbiao Electrical equipment is in use for producing copper wire, copper-clad aluminium wire, copper-clad steel wire, aluminium wire and ALMG alloy wires.

Dongguan Guanbiao Electrical Machinery – China
Fax: +86 769 8892 0895
Email: info@guanbiao.com **Website**: www.guanbiao.com

Tension sensor

Haehne has developed a sensor specifically for the direct measurement of small and medium web tension forces, ranging from 25 to 1,000 Newtons, acting in cables, wires, ropes and tapes. They can be used in cable making and stranding machines that already require deflection rolls or pulleys.

The sensors have been optimised with finite element analysis methods (FMA) and have a series of special features:

- The total nominal force range from 25 to 1,000 Newtons is covered by one mechanical size
- Both clamping block and flange mounting versions, several cable connections and quick disconnects are available
- Mechanical stops provide six-fold overload protection
- Adaptation to various mounting elements using different axle adapters
- Zero adjust by an externally accessible potentiometer

Strain gauges applied to the active surface of the cantilever bending beam measure the acting forces. The integrated strain gauge amplifier converts the bridge signals into a standardised current output signal of 4 to 20 milliamps.

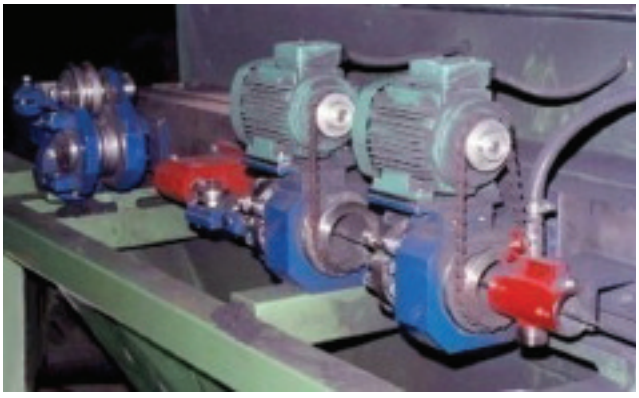
The signal can be used, for instance, for displaying the force or as actual value in closed loop controls.

The power supply is 24 volts DC.

Haehne Elektronische Messgeräte GmbH – Germany
Fax: +49 211 92591 20
Email: info@haehne.de
Website: www.haehne.de

Lubricant viscosity control to optimise wire drawing

Advertorial on behalf of Decalub



▲ *Rod cleaning and wire drawing by DCCD process*

The acid-free DCCD (dry cleaning, coating and drawing) process incorporates lubricant viscosity control that enables demanding wire qualities to be drawn in an economical way, at the highest speed. The system replaces conventional rod preparation (chemical cleaning, rinsing, wet pre-coating and drying) in all direct drawing applications from rod to wire, including 0.85 - 0.88%C mechanically descaled bare rod, without pre-coating chemicals. The result is lower cost, improved wire quality and environmental benefits.

The critical aspects of lubrication, friction and wear, part of the complex wire drawing mechanism, are greatly simplified and some problems, such as wire breaks, surface damage and excessive generation of metallic fines, are virtually eliminated. Instantaneous rod dry coating, operating with no speed limit and at zero energy consumption (self-generated by the LVC/PDH unit), enables an automatic control of crucial variables, including liquefied lubricant thermal stability, a vital parameter that prevents metal-to-metal contact at the wire-die interface. This allows high drawing speed and wear performance of 0.1–0.3 micron per ton of wire drawn.

Full film consistent coatings are achieved in a range from a strongly adherent hard multi-coat layer for high-tensile spring wire or PC strand wire, to an ultra thin nano-coat water-soluble film for plating wire.

Benefiting from the recent development in rod dry preparation and wire lubrication mode, the DCCD process provides reliability and potential for improved steel wire production.

Decalub – France
Fax: +33 1 6020 2021
Email: info@decalub.com
Website: www.decalub.com

Cable machinery manufacturer

Chinese manufacturer, Wai Tak Lung Machinery Ltd (WTL) is a developer, designer and producer of wire and cable machinery, including cable extrusion lines, single-twist cabling, bunching machines, cable coiling and wire braiding machines.

Wai Tak Lung Machinery Ltd – China
Fax: +86 769 8555 1407
Email: wtldongn@pub.dgnet.gd.cn
Website: www.chinacablemachine.com

Ice-resistant cable contract for the Barents Sea

Nexans has been awarded a €6 million contract by Sevmash, Russia's largest shipbuilding company, to develop, manufacture and supply low-temperature and ice-resistant control, instrumentation and power cables for the marine ice-protected Prirazlomnaya stationary oil production platform in the Barents Sea.

The Prirazlomnaya platform has been specially constructed for the development of the Prirazlomnoye oil field and is the first oil production project on the Russian Arctic shelf. The area is characterised by extremely low temperatures and high ice loads. Ice-free for only 110 days a year, the annual average temperature is –4˚C while winter temperatures can fall to –50˚C.

The severe operating conditions require a unique combination of marine cable technologies to provide low-temperature resistance with fire-resistant, low-smoke and halogen-free properties.

Around 850km of the special cables for Sevmash will be produced in the specialised facilities of Nexans Kukdong Electric Wire Co, Korea. Production has already started, and deliveries will continue until the end of 2011.

Nexans – France
Fax: +33 15669 8484
Email: nexans.web@nexans.com
Website: www.nexans.com

Double–winding spooling line

German cable system specialist KFM Kabelmaschinenfabrik Müller has developed a fully automatic, double-spooling line for winding, packing and palletting cable reels. The double-winding system is said to significantly increase the rate of output of coiled reels.

The installation is designed in modules that can be adapted to each customer's particular requirements. These include a new TW 800 payoff – suitable for drums with a flange diameter of 300mm to 500mm – programmed to automatically pick up and deliver each drum. The system operator has only to connect the ends of the cables.

The heart of the installation is a TS 500/300 2-reel winder. The system is designed to deal with different sizes of reels quickly and easily. Changing the setup of the complete line takes about ten minutes.

Up to twelve empty reels are manually placed on a special chain on a table; from there they are collected individually and set onto the winding axis by a pick-and-place unit.

A PTB-certified gaugeable measuring system for cable length, a variety of monitoring instruments, an accumulator and a laying unit supervise the winding.

The cable is fixed automatically onto the core of the reel.

Defective cable, detected by the monitoring instruments, will be automatically cut and taken out of the system.

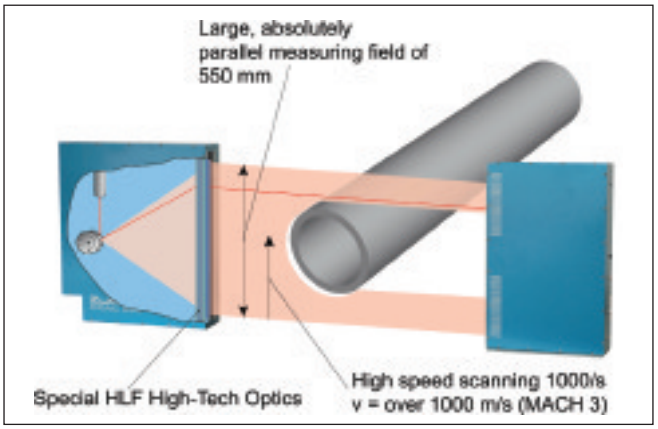
▲ *Double spooling line from KFM*

The cable is wound according to the programmed length, fixed and packed in stretch foil.

Packing is done at a separate stage in the system to maximise production capacity, then the reel is labelled – either with standard information or individual inline result information. The last position of the line is the fully automatic programmable palletiser, designed to cope with any combination of spool and pallet size.

KFM Kabelmaschinenfabrik Müller GmbH – Germany
Fax: +49 4498 9233 60
Email: info@kfm-mueller.de
Website: www.kfm-mueller.de

Large-field diameter scanner with HLF technology



▲ *Zumbach's ODAC 550 HLF scanner*

A new measuring head is available from Zumbach, offering highly accurate outside diameter measurements up to 500mm. Systems in static or oscillating configuration are available, for hot or cold processes, with up to six axes.

Zumbach has developed the ODAC® 550 HLF for large diameters, widths, heights and diagonals. This technology is said to eliminate previous problems and disadvantages of large product systems. At the heart of the development is a new optical system for collimation and scanning, generating an absolutely parallel (telecentric) measuring field and supplying 1,000 calibrated measurements per second. Accurate measurements are generated, regardless of product position in the measuring field. It also makes possible large emitter-receiver separations of 2m or more.

ODAC® 550 HLF features include:

- Large 550mm measuring field without dead zone
- Absolute parallel scanning
- Accuracy and stability, typically within 0.01mm
- No position error
- Very large emitter-receiver separation possible
- 1,000 calibrated measurements (CSS) without averaging
- High scanning speed, over 1,020m/s

These features open many new possibilities and allow for tighter product specifications for hot rolling, cold rolling, forming and welding applications as well as for other processes in difficult environments.

Zumbach Electronic AG – Switzerland
Fax: +41 32 356 0430
Email: sales@zumbach.ch
Website: www.zumbach.com

▲ *Wire lines from GCR Eurodraw*

Range for wire production

GCR Eurodraw's wide range of equipment includes wire preparation and treatment lines, electrolytic and electroless cleaning, pickling and plating lines and special multi-function cleaning, drawing and/or plating lines; cold rolling lines, multi-block dry drawing machines, mono- and multi-wire wet drawing machines; coil and spool payoffs, take-ups and rewinding systems; double twist stranders, bunchers and cabling machines; skip stranders and tubular stranders and a choice of accessories such as mechanical descalers, motorised soap mixers and rotating die boxes.

The company is also a supplier of plant and machinery for the production of bare and plated steel wire and cord, in particular the steel cord used for radial tyres, and specialises in the design and construction of machinery and complete plants for the production of PC and PHC wire and PC strand, hose wire, bead wire, wire ropes, welding wire, staple wire and stainless steel wire.

GCR Eurodraw SpA – Italy
Fax: +39 029354 0452
Email: gcr@gcrgroup.com
Website: www.gcrgroup.com

Flexible compounds

Evonik Industries has extended its product range of flame-retardant polyamide 12 compounds for cable conduits and cable protection hoses.

Vestamid® EX9203 black, a highly flexible moulding compound, is a response to the increasingly tough requirements in the electrical and cable industries. The new compound is designed for excellent fire-retardant properties and a high oxygen index and, with an elastic modulus of 770 MPa, is highly flexible. This impact–resistant material will work even at temperatures as cold as –50°C.

Halogen-free flame-retardant cable conduits and cable protection hoses are in particular demand for dynamically highly stressed components, as in rail vehicles, industrial plants, and mechanical engineering.

Evonik Degussa GmbH – Germany
Fax: +49 2365 49 5992
Website: www.evonik.com

Cable to carry solar power

Leoni will equip the Brandenburg Lieberose solar farm with installation cables capable of carrying electricity, generated by the approximately 700,000 solar modules, to the system's inverters.

More than 1,000 kilometres of this sophisticated cable will be installed for the purpose.

"It meets the heavy demands to which the solar modules themselves are also subjected," explains Marc Ziegler, purchasing coordinator of the project developer, juwi solar GmbH.

Leoni's cable is extremely weather resistant and has an expected useful life of at least 150,000 operating hours, which allows it to be used for more than thirty years.

The world's second largest photovoltaic plant, Lieberose will provide an annual output of around 53 million kWh, which covers the demand of 15,000 households. juwi solar GmbH, a leading project developer of solar, wind and bioenergy plants, is building the solar farm across an area of 162 hectares, the equivalent size of more than 210 football fields.

Leoni AG – Germany
Fax: +49 911 2023 231
Email: info@leoni.com
Website: www.leoni.com

Saving heat and energy

ILES Srl works to develop energy-efficient heat treatment plants.

The company has recently completed a conveyor belt furnace with forced air circulation, the model 2.72 R1, said to save over 35 per cent of energy costs compared with a conventional furnace with the same technical characteristics.

The results of customer tests suggest that it is possible to treat the material effectively at lower temperatures.

The new plant also has the safety advantage for operators of no hot external components.

ILES Srl – Italy
Fax: +39 0373 750110
Email: info@iles.it
Website: www.iles.it

▲ *Solar farm Lieberose is the world's second largest photovoltaic plant*

Düsseldorf preview

Image credit – Messe Düsseldorf : Peruvian artist Nani Cardenas

wire 2010

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The 11th CHINA(GUANGZHOU) INT'L METAL & METALLURGY EXHIBITION

INVITATION

THE 11th CHINA (GUANGZHOU) INT'L EXHIBITION ON PLATEMETAL, BAR, WIRE, METAL PROCESSING AND SETTING EQUIPMENT

Date: June 23–26, 2010

Venue: China Import and Export Fair Pazhou Complex
(380,Yue Jiang Zhong Road, Guangzhou,China)

GUANGZHOU JULANG EXHIBITION DESIGN CO., LTD.
Tel: 86-20-38821287, 800-838-1658
Add: Room 3A04-3A06,Building A1, Galaxy City,
Huaming Road 29,Pearl River New City,
Guangzhou, 510623, China
E-mail:melven@julang.com.cn

Countdown to Düsseldorf

The wire, cable, spring and fastener sectors are getting ready for the 2010 staging of wire Düsseldorf – arguably the most important trade show in the industry's calendar. With space bookings at an all time high, visitors can expect to find seven dedicated halls packed with machinery, products and expertise relevant to their business.

New products for both traditional and new applications will reflect the challenges, changes and developments within this essential industry, with ample space and opportunity to see, touch and discuss the exhibits.

While technology will, understandably, be taking centre stage at Düsseldorf, the art of wire will also be on show. At time of going to press Peruvian artist Nani Cardenas (www.nanicardenas.com) and the contemporary German sculptor, Günter Scholz (www.hinz-kunst.de) were among the confirmed exhibitors in this section, which has proved to be a popular diversion for show visitors.

Admission tickets will be available on arrival on-site throughout the exhibition, but intending visitors are recommended to take advantage of the savings available to online buyers. Tickets will become available for online purchase during January 2010 (actual date to be announced).

Show dates: Monday 12th April to Friday 16th April 2010

Show opening hours: Daily from 9am to 6pm
Friday from 9am to 5pm

Organisers: Messe Düsseldorf GmbH – Germany
Fax: +49 211 45 6087 7793
Email: wire@messe-duesseldorf.de
Website: www.wire.de

For travel and accommodation information and bookings:
Düsseldorf Marketing & Tourismus GmbH
Fax: +49 211 161071
Website: www.duesseldorf-tourismus.de

Alphabetical list of Exhibitors

Please visit www.wire.de or email info@wire.de
(Exhibitors list correct at time of going to press – December 2009)

Company	Country	Stand
A-1 Fence Products Company	India	16D44
Aachener Maschinenbau GmbH	Germany	15H36
Aartal Service Isheim	Germany	12A77
Acciai Speciali Zorzetto Srl	Italy	12D16
Acerinox SA	Spain	12C53
ACM AB	Sweden	9E40
ADC Sarl Fabricant de Filières	France	9C02
Advaris Informationssysteme GmbH	Germany	10B22
AEI Compounds Ltd	UK	11D78
Aeroel Srl	Italy	9B55
AESA SA	Switzerland	10B38
AFH-Antriebstechnik GmbH	Germany	11A43
Agibi Progetti srl	Italy	16C22
Agir Technologies (Mouton-Rivom)	France	10A08-05
AGST Draht- & Biegetechnik GmbH	Germany	10A32
AIM Inc.	USA	11A25
Ajex & Turner Wire Dies Co	India	11F02
Alcan Aviatube	France	10E68
Alecosa Aleados del Cobre SA	Spain	9A13
Jacques Allemann SA	Switzerland	12E53
Alloy Wire International	UK	11E28
Almetha GmbH	Germany	11J72
Alok Ingots (Mumbai) Pvt Ltd	India	16H44
Wilhelm Alte GmbH,	Germany	12B76
Altec Srl	Italy	11A34
Altrimex Packaging Equipment BV	The Netherlands	15A19
Aluminium Pechiney Alcan Group	France	17A16
Alumoclad de Mexico SA de CV	Mexico	17D54
Amic	France	10H22
Anand Arc Ltd	India	16E05
Anbao (Qinhuangdao) Wire & Mesh Co Ltd	China	16K40
Anceschi Srl	Italy	15G30
An Chen Fa	Taiwan	11C57
Angeli Srl	Italy	11H32
Anhui Changjiang Jinggong Wire & Cable Machinery Co Ltd	China	16J44-03
Anu Extrusions Pvt Ltd	India	15D33
Apaydin Metal Urunleri Sanayi Ticaret As	Turkey	12D13
Appiani	Italy	11G32
Ara Makina Imalat Sanayi ve Ticaret Limited Sirketi	Turkey	16G07
ArcelorMittal Bettembourg	Luxembourg	12D51
Arcelormittal Commercial	Luxembourg	12D51
Arcelormittal Stainless and Nickel Alloys SA	France	12D51
Area Sistemi Srl	Italy	12B57
Arkema France	France	16F09
Arktel ve Makina Sanayi Ltd Sti	Turkey	17C31
Arma Plus S A	France	11B22
Asahi Sunac Corporation	Japan	15D26
ASA RT	Italy	9F74
AseA Wire & Cable Machineries Spare Parts Pvt Ltd	Turkey	9F48
ASEL – Spring Machine Production	Croatia	16F20
Aslanli Tel Sanayi	Turkey	17C41
Assomac Machines Ltd	India	17C07
Asteq Srl	Italy	16G10
AstroPlast Kunststofftechnik GmbH & Co KG	Germany	11A78
AT Wire	Germany	9F54
ATC Metal Industrial Sdn Bhd	Malaysia	16K64
ATE Applicazioni Termoelectroniche Srl	Italy	11C77
Atmos Folyo Plastik San Tic Ltd	Turkey	12D11
ATR SpA	Italy	17C20
ATS SA	Poland	16F27
Aumann GmbH	Germany	10G56
Aurubis AG	Germany	12C51
Auserpolimeri Srl	Italy	16F04
Automat Industrial SL	Spain	9C25
AW Machinery LLC	USA	9F09-03
AWM	Italy	11A22
Axjo Plastic AB	Sweden	12A23
B & S Quijano	Spain	17C16
B und B Eisen	Germany	12C77
B2K Co Ltd	Korea	16D59
J Adolf Bäuerle GmbH & Co KG	Germany	12D70
Bakker Springs bv	The Netherlands	16D24
Balloffet	France	10A18
Carlo Banfi SpA	Italy	11D61
BAR Products & Services Ltd	UK	11F07
Baremo GmbH	Switzerland	11J08
Carl Bechem GmbH	Germany	9F42
Carl Bechem GmbH	Germany	15E07
Bedmutha Wire Com Ltd	India	16B53
Begra Granulate GmbH & Co	Germany	12A57
Beijing Holland Tech Co Ltd	China	16G29
Bekaert NV/SA	Belgium	10E62
BEMA Ing Josef Bein Maschinenbau und Fertigungsautomation	Austria	10A40
Bender Werkzeugbau GmbH & Co KG	Germany	12B76
Beneke Wire Company	USA	9A75
Bennett Mahler Ltd	UK	16D16
Berkenhoff und Drebe	Germany	12A67
Besel Basim San Tic Ltd Sti	Turkey	12E61
Beta Lasermike Limited, Niederlassung Deutschland	Germany	11H58
BGH Edelstahlwerke GmbH	Germany	11H19
Bhansali Stainless	India	16D60
Otto Bihler Maschinenfabrik GmbH & Co KG	Germany	10F18
Bilwinco A/S	Denmark	15A41
Blachford Corporation	USA	9F05-05
BLM SpA (BLM Group)	Italy	10H56
BMS	France	16E19
Bobbio Srl	Italy	16C39
Maschinenfabrik Bock GmbH	Germany	10B31
Boehlerit GmbH + Co KG	Austria	10A40
Michael Böhm Ziehsteintechnik	Germany	9F76
Böllinghaus GmbH & Co KG Remscheider Walz- und Hammerwerke	Germany	12A16
Boffi SPA	Italy	10H67
Bogdany Petrol Kft	Hungary	12E60
Bogimac Engineering nv-sa	Belgium	9A44
Bongard Trading GmbH & Co KG	Germany	11A44
Boockmann GmbH	Germany	9C32
Borealis AG	Austria	10D72
Borkener Kistenfabrik GmbH	Germany	9A59
Bottaro Srl	Italy	17E37
Boxholm Stål AB	Sweden	12E14
Boxy SpA	Italy	10F55
Brambilla	Italy	12C05
Brankamp	Germany	15B42
Willi Bremer GmbH	Germany	10A63
Bright Steels Limited	UK	12A41
Britexco SAS	France	11J27
Friedr Brüninghaus & Söhne GmbH & Co KG	Germany	12C34
Bruker-Spaleck GmbH	Germany	10B66
Brune GmbH	Germany	15H12
Buch Comercial Breda SL	Spain	11D17
Bühler Würz Kaltwalztechnik GmbH	Germany	12A26
Burk Ziehwerkzeuge – Poliermaschinen	Germany	12C60
Burster Präzisionsmesstechnik GmbH & Co KG	Germany	11E02
Buss AG	Switzerland	9C48
BWE Ltd	UK	11F26
Byelorussian Steel Works	Belarus	17C15
Caballé, sa	Spain	11G65
Câbleries Namuroises (Belgium) SA	Belgium	16E52
Cabmach – MFL Group	Italy	11J65
Camfart Mole Abrasive Srl	Italy	16A16
Candor Sweden A/B	Sweden	10B72
Cape Gate (Pty) Ltd - Group	UK	9A14
Carbodies SRL	Italy	15E42
Nani Cardenas	Peru	16K27
Catic Mesh & Wire	China	16K44-06
CB Trafilati Acciai SpA -Steelgroup-	Italy	11D62
CCPIT Machinery Sub-Council	China	17E36
CEA Costruzioni Elettro-Meccaniche Annettoni SpA	Italy	11A31
Ceeco Bartell Products, Bartell Machinery Systems LLC	USA	9F64
Celik Halat Ve Tel Sanayii AS	Turkey	16F16
Cemsa SPA	Italy	16G23
CeramTec AG, Mechanical Applications Division	Germany	10F72
Cerrini srl	Italy	10F39

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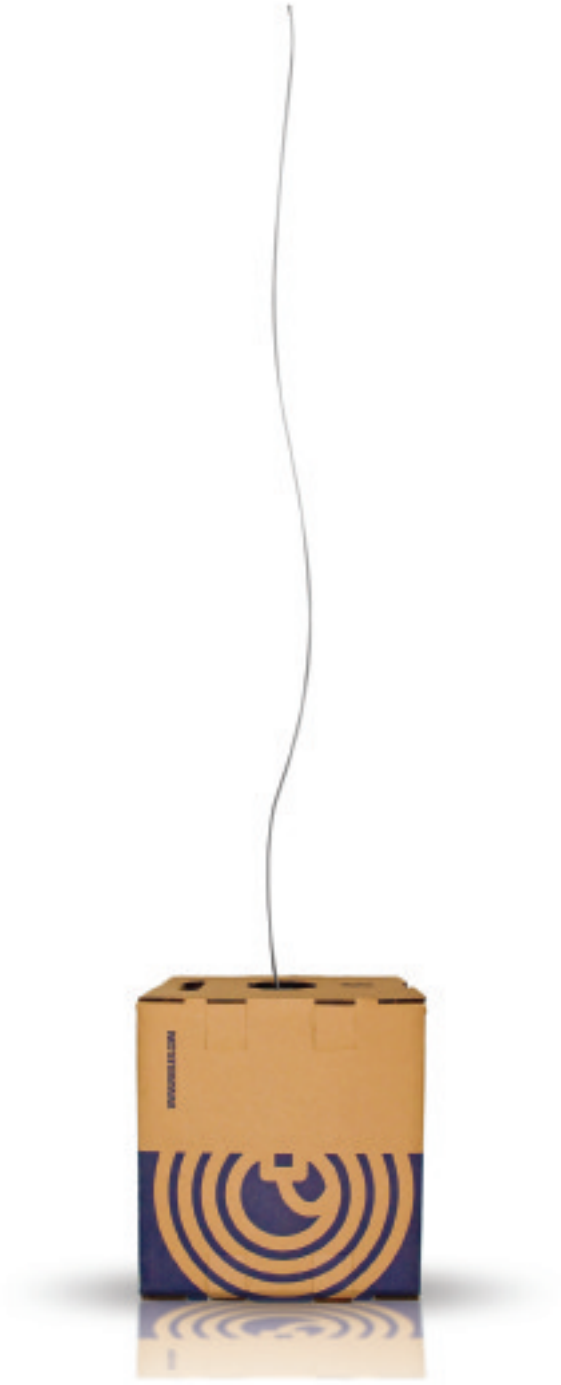

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Cersa-MCI Sarl	France	10D56-02
Champs Int & Services Srl	Italy	15F42
Chengdu Centran Industrial Co Ltd	China	9F75
Chhaperia International Company	India	16D44
Chief Technology Co Ltd	China	16J44-05
China Foreign Trade Guangzhou Exhibition Corp	China	17B41
China Jiangsu Provincial	Germany	17E48
Chi Ning Co Ltd	Taiwan	15F11
Chin Pu Jir Enterprise Co Ltd	Taiwan	17D57
Chircu Prod-Impex Company	Romania	16E09
Chun Zu Machinery Industry Co Ltd	Taiwan	15F41
Cimteq Ltd	UK	11D21
CITMA Minmetals Co Ltd	China	16F03
Claas GmbH & Co KG	Germany	12A79
Clifford Welding Systems	South Africa	11H06
Clinton Instrument Company	USA	9E38
CMC Sisak doo	Croatia	17E43
CMC Stahlhandel GmbH	Germany	12D67
CMC Zawiercie SA	Poland	17E43
CMEC Intl Exhibition Co Ltd	China	17A31/A35
Coding Products	USA	9F05-02
Cogebi	Belgium	12E37
Cogne Acciai Speciali SpA	Italy	11J25
Coia GmbH	Germany	9F51
Collari Edore	Italy	11J31
Carlo Colombo SpA	Italy	12B52
Colorant Chromatics AG	Switzerland	11J12
Comapac Wire Machinery Srl	Italy	11A66
Cometo di Tocchetti Enrico & C snc	Italy	10D38
CommScope	USA	10G71
Compomec Cable Machinery	Finland	10C23
Condat Lubrifiants	France	10D56-01
Condor Compounds GmbH	Germany	10F10
Condoroil Impianti Srl	Italy	10E46
Conductix-Delachaux	France	10A08-03
Conoptica as	Norway	10A72
Continuus-Properzi SpA	Italy	11G40
Coperion GmbH	Germany	9B21
Coprotec Systeme GmbH	Germany	17D16
Coro Solutions BV	The Netherlands	12C13
Cortinovis Machinery SpA, Eurolls Group	Italy	11G39
Corus Construction and Industrial	UK	12B51
Costa Machinery GmbH	Germany	11A27
Cousin Composites	France	9B13
CPA Srl	Italy	15F35
CPA Wire Technologies GmbH	Austria	11J26
CPM Gesellschaft für Computeranwendung	Germany	15E34
Crosspolimeri SpA	Italy	12D35
CSG Germany GmbH	Germany	9F60
CTR Carbide Dies (B´ham) Ltd	UK	15D25
CTS Cousin-Tessier	France	17D08
Cuprom SA	Romania	12E17
D & D Wire Industrial	Hungary	11A73
Dah-Lian Machine Co Ltd	Taiwan	15D08
Dahmen & Co GmbH & Co KG	Germany	11J28
Dalian Pro-Sun Metal Products Co Ltd	China	16F58
Dandong Decheng Plastics & Rubber Science & Technology Co Ltd	China	16G32
Danieli & C Officine Meccaniche SpA	Italy	9A26
Davis-Standard LLC	USA	9A21
Dayi Plastik	Turkey	10B24
DCM Industries Inc	USA	9F09-02
De Angeli Prodotti SRL	Italy	12E76
Decalub	France	10E72
Deco Neon Cables Co Ltd	China	16C60
Delisi SRL	Italy	10H24
Delta Tecnic SA	Spain	12E67
DEM Costruzioni Speciali Srl	Italy	11H27
Demgen Werkzeugbau GmbH	Germany	16B44
Demirci Makina San Tic Ltd Sti	Turkey	17E13
Deuk-Young Co Ltd	Korea	16H60
Deutsche Edelstahlwerke GmbH	Germany	17E20
Deutsche Nickel GmbH	Germany	12B36
Dexsen SA	Belgium	12A12
Deyang Dedong Electrotechnical Machinery Manufacture Co Ltd	China	16K44-05
Deyang Jiechuang Wire & Cable Machinery Co Ltd	China	16K44-04
DH Exports Pvt Ltd	India	17B20
Federico Dick SAS	Italy	10F67
Die Quip Corporation	USA	9D06-01
Dimac Srl	Italy	15E29
Disa Industrie AG	Switzerland	9C41
Dogan Tel Orgu Demir Dekorasyon Imalat at Montaj Tic Taah Ihr Sanayi Ltd Sti	Turkey	16H28
Domeks Makine Ltd Sti	Turkey	10B32
Dominion GmbH	Germany	12D23

12-16 April

A short history of wire Düsseldorf

by Terry D Robinson, treasurer of the IWMA

In 1968, after the first International Wire & Cable exhibition in London, several exhibitors suggested that it should move to a new venue, with an international and neutral status, where large wire and cable machines could be exhibited.

To satisfy these requirements Basel was selected for the next exhibition, scheduled for 1972. The show was a tremendous success and the exhibition halls at Basel were re-booked, with additional space, for 1974 and for every two years following. The show rapidly grew beyond all expectations, which brought some problems. Space availability was at a premium and some large exhibitors were denied the extra space they needed for their stands.

In 1982, through the secretariat offices of the International Wire & Machinery Association (IWMA), the executive secretary Mr John Hogg was approached by several members, all major exhibitors, who were dissatisfied with the situation in Basel.

They asked that the association find another site for the exhibition, one with ample exhibition space and plentiful hotel accommodation at acceptable prices.

Several European venues were considered and finally Düsseldorf was chosen. Meetings were immediately arranged with NOWEA (now called Messe Düsseldorf).

After much discussion the organisation confirmed that it would be pleased to receive the show, with the IWMA as its industry partner. No suitable dates could be offered in 1984, so it was agreed that the show would move to Düsseldorf with effect from 1986.

Since 1986 the Wire and Cable Exhibition (now wire Düsseldorf) has grown year on year. In 2010 exhibitors from across the world, from all sectors of wire and cable manufacturing, are confirmed to occupy over 50,000m² of hall floor space.

Dongguan Minxing Cables Co Ltd	China	16J44-04
G + M Dorn GmbH	Germany	16C03
Dornieden GmbH, Anlagentechnik	Germany	11J76
Dorstener Drahtwerke H W Brune & Co GmbH	Germany	11J27
Dow Wire & Cable	Switzerland	9A38
Drahtwerk Altena GmbH & Co KG	Germany	10G55
Drahtwerk Elisental W Erdmann GmbH & Co	Germany	12C23
Draht Wire Meisenbach	Germany	9C01
Drawing Technology Inc	USA	15A45
Drumet Liny i Druty Sp z oo	Poland	16K21
DSE Test Solutions A/S	Denmark	9F31
DSM Desotech BV	The Netherlands	12C61
DSR Wire Corp	Korea	16D43
DTN AB Dorstener Trad Norden AB	Sweden	11J27
Duferco La Louviere SA Trebos	Belgium	12E77
Dunst GmbH	Austria	10A40
DuPont de Nemours International SA	Switzerland	11C66
Durit Hartmetall GmbH	Germany	9C31
DWK Drahtwerk Köln GmbH	Germany	11E74
Easydur Italiana di Renato Affri	Italy	10E10
Ebner Industrieofenbau GmbH	Austria	10A40
EB Tech	Korea	16D55
Ecoform Umformtechnik GmbH	Germany	9C69
Econom-Servis	Ukraine	17B23
Eder Engineering GmbH	Austria	10A40
EEI Equipaggiamenti	Italy	11C77
EFAF	Italy	12A51
Effegidi International SpA	Italy	10F65
Egyplast	Egypt	11G05
Eisen- und Stahldraht-Vereinigung eV	Germany	10G55
EJP Maschinen GmbH	Germany	9C21
Ekomor sro	Czech Republic	16A60
Elantas GmbH	Germany	10A62
Elaskon Sachsen GmbH & Co KG für Spezialschmierstoffe	Germany	16G43
Elastogran GmbH	Germany	9C22
ELOF AB	Sweden	16J04
EME Elettromeccanica Erbese Srl	Italy	11C54
Emuco	Germany	12E51
EMUGE-Werk Richard Glimpel GmbH & Co KG	Germany	15H35
Enkotec A/S	Denmark	15F26
EOT Eibach Oberflächentechnik GmbH	Germany	15F34
Er-Bakir Elektrolitik Bakir Mamulleri AS	Turkey	10C61
Erocarb SA	Switzerland	10D61
Essebi SRL	Italy	15G26
Esteves Group	Spain	10C72
EurAsia Corporation Limited	Hong Kong	16E54
Euroalpha Srl	Italy	12C67
Eurobend SA	Greece	11J62
Euro Extrusion	Italy	11E07
Eurolls SpA	Italy	11D40
European Spring Federation ESF	Germany	16C06
Eurotek Srl	Italy	11B77
Eurotekne Industriale Srl	Italy	9B74
Eurowire magazine	UK	11D28
EVG Entwicklungs- und Verwertungs-GmbH	Austria	10G04
EVG Entwicklungs- und Verwertungs-GmbH	Austria	10H18
Exel Fil SA	Spain	11H33
Extrudex Kunststoffmaschinen GmbH	Germany	11C72
EZM	Germany	12A67
Fagersta Stainless AB	Sweden	11G31
Fainplast – Farotti Industrie Plastiche Srl	Italy	12B34
Falci SRL	Italy	12C75
FAR	Italy	11D62
Fastener + Fixing Magazine Fastener Fairs Ltd	UK	15B12
Fastener Technology International	USA	15D11
Fastener World Inc	Taiwan	15C15
Festec International Co Ltd	Korea	16F05
FIAV L Mazzacchera SpA	Italy	12C75
FIB Belgium SA	Belgium	11B62
Fil-Tec Inc	USA	9E52
Filzmoser Maschinenbau GmbH	Austria	10G04
Fine International Corp	USA	9F22
Fritz Finkernagel Drahtwerk GmbH & Co KG	Germany	12A50
Fisk Alloy Conductors Inc	USA	9F13-04
Flymca SL	Spain	10H64
Flyro Used Cable Equipment	Spain	10H64
FMD Carbide	Spain	15C22
FMS Force Measuring Systems AG	Switzerland	11G20
Dr Foerster GmbH & Co KG, Institut	Germany	9C26
Forever Cable Materials Suzhou Corp	China	16H63
Forplan AG	Switzerland	15E36
Fortek GmbH	Germany	12A52
Fortuna-Federn GmbH	Austria	16D19
Fort Wayne Wire Die Inc	USA	12A52
Foshan Chancheng District Jiashun Cable Material Factory	China	16F56
Fox Wire Limited	UK	11E18
Frekans Makina San Ve Tic AS	Turkey	16G51
Freudenberg Vliesstoffe KG	Germany	11E32
Frezpol PHU Sp z oo	Poland	17D42
Frigeco – MFL Group	Italy	11J65
Mario Frigerio	Italy	11J65
Frohn GmbH, Stahlmittel & Umformwerkzeuge	Germany	16A20
Froma SRL	Italy	10H38
FSPone SAS	France	12A66
Fuhr GmbH & Co KG	Germany	11A54
T Fukase & Company Ltd	Japan	11D60
Fushi Copperweld	USA	9A58
Gabarro SA	Spain	10D40
Galdabini SpA	Italy	9C51
Garg Inox Ltd	India	9B70
GarnTec GmbH	Germany	12E51
Gauder & Co SA	Belgium	10E38
Gavlick Machinery Corp	USA	12E56
GCR Eurodraw SPA	Italy	11A66
Gebauer & Griller Metallwerk GmbH	Austria	10A40
Geca-Tapes	France	10D76
Gefra GmbH	Germany	15A29
Geissler Heinrich	Germany	12D70
Gemit GmbH	Germany	17E04
Gem Srl	Italy	11C18
General Inspection LLC	USA	15C12
Geo Reinigungstechnik GmbH	Germany	11D71
Georgsmarienhütte GmbH	Germany	12D70
GER SA	Belgium	9F60
Gimax Srl	Italy	10B18
Global Steel Wire SA	Spain	12B22
Glory Mica Co Ltd	China	16K44-02
Gloser Marketing & Technology Srl	Italy	9B75
GMP Slovakia sro	Slovakia	10E66
Goizper S Coop	Spain	15E16
Gongyi Hengxing Hardware Co Ltd	China	TBA
Goodwin Machinery Ltd	UK	9C34
Gotex SA	Spain	9C56
GPP Chemnitz mbH	Germany	TBA
Rudolf Grauer AG	Switzerland	10F22
Grote-Apparatebau GmbH	Germany	12E16
Guarienti	Italy	16G39
Gühring oHG	Germany	9A52
Günes Tel Cekme ve Transmisyon	Turkey	17A23
Guney Celik Hasir ve Demir Mamulleri	Turkey	16G06
Gutmann Aluminium Draht GmbH	Germany	10B62
Gwo Lian Machinery Industry Co Ltd	Taiwan	9C73
Haefely Test AG	Switzerland	11D12
Häfner & Krullmann GmbH	Germany	9A25
Haehne Elektronische Meßgeräte GmbH	Germany	9E02
Hagener Feinstahl GmbH	Germany	11J44
Hagen und Funke	Germany	10E40
Hårnex Hårdmetallverktyg AB	Sweden	10F75
Hankuk Steel Wire Co Ltd	Korea	16B52
Hanwha Chemical Corp	Korea	16F39
Harditalia SRL	Italy	16H20
Hariton Machinery Co Inc	USA	15D38
Hartmann	Germany	16F24
Has Celik ve Halat San Tic AS	Turkey	17C32
Hascelik San Ve Tic AS	Turkey	16B64
Hasemann GmbH, Hasemann Maschinen	Germany	11A39
Hatebur Umformmaschinen AG	Switzerland	15F03
Hefei Smarter Import & Export Co Ltd	China	16J60
Heine + Beisswenger Stiftung + Co KG	Germany	12E05
Heinze & Streng GmbH	Germany	10F71
Hempel Wire Ltd	UK	11D18
Henkel AG & Co KGaA	Germany	11G74
Henrich	Germany	11G44
Herkula Farbwerke St Vith SA	Belgium	12E22
Stefan Hertweck GmbH & Co KG	Germany	15C26
August Herzog Maschinenfabrik GmbH & Co KG	Germany	9E76
Diedr Hesse GmbH & Co KG	Germany	10H26
Hetran Inc	USA	17D50
Hezel	Germany	9A56
Highvolt Prüftechnik Dresden GmbH	Germany	10C63
High Voltage Test Systems SA-HVTS	France	11C02
Hildebrandt GmbH	Germany	12E04
Hilker & Partner GmbH	Germany	15E04
Hindustan Stainless	India	17D36
Hinz & Kunst GmbH	Germany	16J63
Hivotec AG	Switzerland	11C02
HMP	Germany	9B33
Josef Hölscher GmbH & Co KG	Germany	12E51
Hoerle Trad	Sweden	12A36
Hofmann Ceramic GmbH	Germany	9E48
Holifa Fröhling GmbH & Co KG	Germany	11C40
Holton Crest Ltd	UK	11H39
HSW Zaklad Ciagarnia Sp zoo	Poland	17A53
HT Ceram Srl, HT Ceram Group	Italy	9C75
Huei Shang Industrial Co Ltd	Taiwan	16D03
Hüsecken & Comp	Germany	12E70
Huestis Industrial	USA	9F05-01
Hüttner Maschinenfabrik GmbH	Germany	10F43
Huntsman (Germany) GmbH	Germany	9A07
HyoDong Machine Co Ltd	Korea	15A03

wire **2010** exhibitors

12-16 April

IBA Industrial	Belgium	10E44
ICDAS Celik Enerji Tersane ve Ulasim San AS	Turkey	16G20
ICE Wire Line Equipment Inc	Canada	12E12
ICMI Srl	Italy	17D12
Ideal Werk	Germany	11H05
IFP srl Industria Filo Patentato	Italy	16E16
IIM AG	Germany	17E19
ILES Srl	Italy	10E18
IMAS Srl	Italy	15F45
Imess Optische Mess- und Prüfanlagen GmbH	Germany	16D09
IML Labels and Systems Ltd	UK	17C12
Impreglon AG	Germany	17D10
India Steel Works Ltd	India	16G64
Indore Composite Pvt Ltd	India	16C53
Induflex NV	Belgium	10B76
Industrial-Metalware Union Ltd	Ukraine	16D54
Ingramatic SpA	Italy	15F46
InHol bv / PTL	The Netherlands	12A15
InnoVites	The Netherlands	11C22
Inosym Ltd	New Zealand	11D58
Institute of Spring Technology	UK	16A22
Interkabel Internationale Seil- und Kabel-Handels-GmbH	Germany	12C05
Intras Publications	UK	11D28
Invimec Srl	Italy	17E32
IPEC Ltd	UK	11F05
Isabellenhütte Heusler GmbH & Co KG	Germany	12E71
Isis SAS	France	15B21
Isovolta AG	Austria	10A40
Isyko Filtersysteme	Germany	16F10
ITA SpA	Italy	11D62
Ital SPA	Italy	10A22
Itaya Europe GmbH	Germany	16A39
Itco Industries Ltd	India	9E55
Ito-Sin (Deyang) Wire & Cable Equipment Co Ltd	China	11D22
ITW Packaging Systems Group GmbH	Germany	9F25
IVA / Essex sas	France	10A08-02
IWCEA-France c/o Delachaux	France	10A08-01/D56-02
IWCEA-France c/o Delachaux	France	10A17-01
IWE Spulen und Handling GmbH	Germany	10E22
IWG High Performance Conductors	Belgium	9A73
IWIM	Iran	9C46
International Wire and Machinery Association IWMA	UK	11D26
J Fiber	Germany	11C58
Jankowski GmbH & Co KG	Germany	15B41
JCC Incorporated	Japan	15D12
Jern Yao Enterprises Co Ltd	Taiwan	15A33
Jiangyin Hengfeng Steel Rope Products Co Ltd	China	16F64
Jiangyin Kangrui Stainless Steel Products Co Ltd	China	16G53
Jian Hwa Enterprise Co Ltd	Taiwan	16E60
Jiashan Winsun Industrial Co Ltd	China	TBA
Jinyang Technology Co Ltd	Korea	16A54
Jinyoungtech Co Ltd	Korea	16H54
JLC Electromet	India	16G59
Joly	France	10A38
Jouhsen-Bündgens Maschinenbau GmbH	Germany	11G61
Jowitt	UK	16A23
Jun-En Enterprise Corp	Taiwan	16E23
JYD Tech & Industry Co Ltd	China	11E05
Jyoti Steel Industries	India	16F60
Kabeltrommel GmbH & Co KG	Germany	12A23
Kabmak Mühendislik Ve Makina Sanayi Ticaret Ltd Sti	Turkey	16K16
Kämpfer Würz Umformtechnik GmbH	Germany	10A55
Kaempfer Wuerz	Germany	12A34
KAIGO Co Ltd	Taiwan	11C06/C57
KAIGO Co Ltd	Taiwan	15D30/D34
KAIGO Co Ltd	Taiwan	16F44/F50
KAIGO Co Ltd	Taiwan	16E60
Kalpena Industries Limited	India	12D75
Kamatech Srl	Italy	16D10
Kamatics Corporation	USA	10F71
Kappa Steel GmbH	Austria	10A40
Kar-el Demir Tel San ve Tic Ltd	Turkey	17A38
KDM Kabel- und Drahtmaschinen GmbH	Germany	10E22
KEI Industries Ltd	India	11J06
Kennametal AMSG GmbH, General Industrial	Germany	9E47
KFM Kabelmaschinenfabrik Müller GmbH	Germany	9A20
KGHM Polska Miedz SA	Poland	12B37
Kieselstein International GmbH	Germany	10E17
Kingwin Precision Co Ltd	Taiwan	15D16
Kinrei Machinery Co Ltd	Japan	10F71
Kistner Anlagenbau GmbH	Germany	10A76
Kiswire Ltd	Korea	9B26
Kiveton Park Steel Ltd	UK	11G21
Kiwitz GmbH + Co KG	Germany	15B26
G Klawe GmbH, Holzwaren- und Spulenfabrik	Germany	9A48
Hermann Klincke JH Sohn GmbH & Co KG	Germany	12A79
Ernst Koch GmbH & Co KG	Germany	10F22
Ernst Koch GmbH & Co KG	Germany	10H39
Körting Nachfolger Wilhelm Steeger GmbH & Co KG	Germany	9B19
Kohnle Wärmebehandlungsanlagen GmbH	Germany	15H30
Kolon Industries Inc	Korea	17E08
Koner SPA	Italy	11A62
Kovohuty as	Slovakia	12E35
Albert Krenn Werkzeugfabrik	Germany	10G66
Friedr Krollmann GmbH & Co KG	Germany	10A29
Kuang Tai Metal Ind Co Ltd	Taiwan	17A54
Kühne + Vogel Prozessautomatisierung Antriebstechnik GmbH	Germany	10C75
Kuenne	Germany	10G55
Kurre	Germany	9C47
Kuwait Petroleum Int Lubricants	Belgium	11D25
Kyoeisha Chemical Co Ltd	Japan	16J54
Kyungwon New Materials Inc	Korea	16H52
Lämnea Bruk AB	Sweden	9A06
Lamiflex GmbH	Germany	11H28
Laminage de Precision NV	Belgium	17B39
Landgraf Srl	Italy	16A44
Lantor BV Lantor Cable Products	The Netherlands	10H55
LAW-NDT Mess- und Prüfsysteme GmbH	Germany	15B20
Lazpiur	Spain	15F08
Lead Extrusions Srl	Italy	17A43
Lech-Stahl Veredelung GmbH & Co KG	Germany	12C35
Lech-Stahlwerke GmbH	Germany	12C35
Leggett & Platt Wire Group	USA	9F21-02
Leibinger Ink-Jet Systems	Germany	9F55
Maschinenfabrik Johann Leimbach GmbH	Germany	11B34
Lennerts & Partner GmbH	Germany	16F19
Lenzen GmbH & Co KG	Germany	16K08
Lenzing Plastics GmbH	Austria	10A40
Leoni Draht GmbH	Germany	11A40
Leyer & Kiwus Ultraschall und Lasertechnik GmbH	Germany	10F25
LG Chem Ltd	Korea	16E27
Lichthart	Germany	15C04
Robert Lindemann KG	Germany	10E27
Lindemann & Störmer GmbH & Co KG	Germany	12B23
Lisciani Trafilerie Srl	Italy	11C74
LM Finishing Systems Srl	Italy	15E36
Locton Ltd	UK	11F17
Lötters GmbH & Co KG	Germany	10A75
Logopak Systeme	Germany	12C71
LOI Thermprocess GmbH	Germany	10A61
Longcombe Labels Ltd	UK	11D06
LongVision (Shanghai) Cable Materials Co Ltd	China	17A48
Lubrimetal SpA	Italy	10G62
Lucchini SpA	Italy	12C37
Lüling GmbH & Co KG	Germany	11H44
Lüttges GmbH	Germany	16B59
Lukas Anlagenbau GmbH	Germany	12B61
Lumpi Berndorf Draht- und Seilwerk GmbH	Austria	10A40
M und E Macchine	Italy	10H43
M und M Metal Wire	China	11G22
Macchine Speciali Srl	Italy	9B47
Macro Bars And Wires (I) Pvt Ltd	India	17A19
Madem SA	Brazil	12E66
Maillefer SA	Switzerland	10D21
Maleras Mekaniska AB	Sweden	9B76
Mali GmbH	Austria	10A40
Manassero & C Srl	Italy	15E33
Manentimacchine Srl	Italy	16D03
Manfisa Manufacturas Irular SA	Spain	10H65
Marldon Group Ltd	UK	9E34
Mathiasen Machinery Inc	USA	12A22
Mayes + Warwick Ltd	UK	15E30
Mazzoleni Trafilerie Bergamasche SpA	Italy	10C62
MDM	Italy	15E46
MDS Engineering Hardware Co Ltd China	China	15E14
Messe Düsseldorf China Ltd	Hong Kong	16J44-01/K44-06
Messe Düsseldorf India Pvt Ltd	India	16C44/D44
Messe Düsseldorf North America	USA	9D06-01/F21-02
Mectron Inspection Systems	USA	15A45
Medek & Schörner GmbH	Austria	10A40
Medya Analiz Yayin Grubu San Ltd Sti	Turkey	16E11
Mega Metal San ve Tic Ltd Sti	Turkey	10F04
Mekosan Elektrik Elektronik Otomasyon Ltd Sti	Turkey	16H16
Meltech Engineering Ltd	UK	12B44
Mema-Maschinenbau GmbH	Germany	12A17
Menam Stainless Wire Public Co Ltd	Thailand	11F21
E W Menn GmbH & Co	Germany	15B45
MEP Macchine Elettroniche Piegatrici SpA	Italy	16K20
Klaus Merten GmbH	Germany	10H42
Metal Forming Systems Inc	USA	15F21
Metalle Schmidt GmbH	Germany	17E10
Metallurgica Alta Brianza SpA	Italy	11D62
Metalube Ltd	UK	11G25
Metavan Reels NV	Belgium	11B43
Metizy	Ukraine	17D29
MFL Group	Italy	11J65
Microdia SA	Switzerland	11D27
Micron Machine Electrostatic Powder Application Co	Turkey	9A63
Micro Products Company	USA	9D14-02

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Microstudio SAS di Calafà Giampaolo & C	Italy	16C20
Mikrotek Machines Ltd	India	11E06
Millennium Steel & Wire LLC	United Arab Emirates	16D51
Miltec UV	USA	9F05-06
MMK Metiz	Russia	17D46
Mobac GmbH	Germany	10D18
Mohindra Stainless Ltd	India	11D08
Montanwerke Brixlegg AG	Austria	12E35
Moravia Steel as	Czech Republic	12D67
MPI Machines Ltd	India	11J01
MPK Special Tools GmbH	Germany	15B15
MTB Meier Technische Beratungen GmbH	Germany	16B44
MTT Machinery Technology Trading GmbH	Austria	10A40
Mukand Ltd	India	17B49
MWO Gesellschaft zur Herstellung	Germany	11E27
Naber & Wissmann GmbH	Germany	10F56
Nakashimada Engineering Works Ltd	Japan	15E41
National Machinery LLC	Germany	15A45
Nedschroef Herentals NV	Belgium	15H26
Neptco Inc	USA	9E41
Neumann Drahtveredelungstechnik GmbH	Germany	9E56
Nevatia Steel & Alloys Pvt Ltd	India	11D65
New Spool Srl	Italy	16K39
New Tech Srl	Italy	9B75
Nexans Bramsche	Germany	9B42
Nexans Hannover	Germany	9B42
Nextrom Oy	Finland	9A74
NHV America	USA	9B17
Niagara	UK	12D37
Niagara Composites Industries Inc	Canada	9A22
Niehoff GmbH & Co KG	Germany	10C18
Nikol Weber KG	Germany	9A76
Ningbo East River Imp & Exp Co Ltd	China	16E03
Ningbo Powerway Group Co Ltd	China	16H08
Niwar Trommeln und Spulenbau GmbH	Germany	11E78
NNDI bv	The Netherlands	10A32
Notz group	Switzerland	12E53
Nova Srl	Italy	11A69
Nowofol Kunststoffprodukte GmbH & Co KG	Germany	12C56
Nucoil Industries Co Ltd	Taiwan	16E40
Numalliance	France	10A17-02
Nuova Sima Srl	Italy	16F04
Nuova Tecno Tau Srl	Italy	12B16
Nyrosten Korrosionsschutzmittel GmbH + Co	Germany	9A59
OCN	Italy	9C55
OMA High Tech System	Italy	10A39
OMAS Srl	Italy	12E34
OMCG	Italy	12D05
OMD	Italy	10E18
Omicron	Austria	16G40
OML Srl	Italy	11A35
OMLesmo SpA Eurodraw Energy	Italy	11A28
OMR Srl	Italy	10H76
OMSA Srl	Italy	11B21
ONISC	Germany	16H30
Oni Waermetrafo	Germany	9B31
Ori Martin SpA	Italy	12B66
Ort Italia SpA	Italy	15B26
Oscam SpA	Italy	16G28
Otomec Srl	Italy	11B28
Otto Vision Technology GmbH	Germany	15B20
Outokumpu Stainless Ltd ASR Rod Mill	UK	11G17
Ovako	Germany	12A37
Ozel Elektrolitik Bakir Mamulleri Sanayi Ve Dis Ticaret AS	Turkey	17A32
Ozyasar Tel ve Galvanizleme San AS	Turkey	17B35
PA GmbH	Germany	11J18
PAB Prüfanlagenbau GmbH	Germany	15B30
Paganoni	Italy	10C71
Panatex srl	Italy	12E09
Pan Chemicals SpA	Italy	9B05
Panchmahal Steel Ltd	India	16H04
PanoPack	France	10A43
Pan-Pioneer Co Ltd	Taiwan	17A15
Paramount Die Company	USA	10D37
Pave Automation Design & Development Ltd	UK	12D17
PEKUtech GmbH	Germany	9A35
Pengg AG	Austria	10A40
Penkert Metallbearbeitungs-GmbH	Germany	15H05
Pentre Engineering Ltd	UK	9E25
Friedrich Petig GmbH	Germany	11D57
Phenix Technologies	USA	12B05
Phillystran Europe BV	The Netherlands	17A11
Pioneer Machinery Co Ltd	Taiwan	11G62
PKS GmbH	Germany	12A41
Plan-E-Tech Industries Inc	USA	15D21
Plasmait GmbH	Austria	10A40
Platestahl Umformtechnik GmbH	Germany	11J57
Pleuger GmbH	Germany	12A43
Polifibra Folien GmbH	Germany	11A65
Polifibra SpA	Italy	11A65
PolyOne Belgium SA	Belgium	9B38
Polyplast Müller GmbH	Germany	10G68
Polyprofils SAS	France	15D35
Polystal Composites GmbH	Germany	11D69
Ponziani SpA	Italy	10C62
Pourtier SAS Gauder Group	France	10E38
Prasum Metals Pvt Ltd	India	16A63
Pratech Mühendislik ve Makine San Tic Ltd Pty	Turkey	9E32
Pratto SA	Greece	12B17
Pratto SA	Greece	11G64
Precision Metals	India	16F40
Pressure Welding Machines (PWM) Ltd	UK	9B41
Profiroll Technologies GmbH	Germany	15G36
Progress Maschinen & Automation AG	Italy	11B74
Promills Srl	Italy	16J03
Propagroup srl	Italy	17E16
Proteco sas di Ing Marino Ozino & C	Italy	9F74
Proton Products Europe NV	Belgium	11D77
PS Costruzioni Meccaniche Srl	Italy	10B21
PSV Professional Service für die Industrie	Germany	12A77
PTG Precision Tool Group	Ireland	15G03
Push-Up Thread Dies Pvt Ltd	India	15C11
PWT Limited	New Zealand	16A51
PX Précimet SA	Switzerland	17C40
QED Wire Lines Inc	Canada	12A53
Qingdao Xingle Electrical Machinery Co Ltd	China	16J44-01
Qinhuangdao Yanda-Guohai Stainless Steel Co Ltd	China	16J44-02
Queins & Co GmbH	Germany	9B06
Qunye Electrical	China	16H59
R und K Umformtechnik	Germany	12A77
Rad-Con Inc	USA	9D06-03
Radyne IHWT	UK	9B23
Ralc Italia Srl	Italy	16K04
Ransohoff	USA	15A45
Ratnesh Metal Industries Pvt Ltd	India	17B31
Rautomead Limited	UK	10E56
Ravni Technologies	France	10A08-04
Reber Systematic GmbH + Co KG	Germany	10H62
Redaelli Tecna SpA	Italy	12E36
Redex SA	France	11A26
Redies SRL	Italy	9B25
Redimo Gesellschaft für Handel mit Maschinen f die Umformtechnik mbH	Germany	15D50
Reelex Packaging Solutions Inc	USA	9F06-01
Reel-O-Matic	USA	9F05-04
Refractron Technologies Corp	USA	9F09-04
Regg Inspection Srl	Italy	15B26
Remer Srl	Italy	17D31
Rentrop & Rahmer	Germany	10A37
Repsol	Spain	12D53
Rex Máquinas e Equipamentos Ltda	Brazil	15D42
Reynolds Packaging Group	USA	16C54
RG Attachments Ltd	UK	11C26
Rhodia Novecare	France	10A08-01
RichardsApex Inc	USA	9F13-02
Ridgway Machines Ltd	UK	11C24
Rigon Instruments	Italy	9F74
Rimjhim Ispat Ltd	India	12C76
Ringspann GmbH	Germany	11H74
Rizzardi Srl	Italy	11J40
RLS Tooling	UK	15B26
RMM – Metallhandel GmbH	Germany	12E23
Roblon A/S	Denmark	9F41
Rodacciai SpA	Italy	10E37
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Photo courtesy of FIB Belgium sa

Cleaning and descaling machinery and chemicals

An Internet site posted this question: "How to make descaling solution for different types of scale?" The best answer, chosen by vote, was: "Generally by diluting a concentrated master standard solution of known content, using volumetric bottles. Usually the master solution is diluted 1:10 to 1:100." The question was declared "Resolved."

This is satisfyingly decisive. But those charged with the cleaning and descaling operation in a modern wire making facility would likely have withheld their vote until they had the answers to some questions of their own: as to materials (steel, stainless, copper, nickel, titanium); processes (plasma, anodic, electrolytic, magnetic, electronic, hydraulic); hybrid functions (descaling/annealing, deglassing, pickling, passivating, corrosion inhibition, sanitation, finishing); plus temperature, salts and acids, thickeners, surfactants, and a host of other descalant concerns.

Whether chemical or mechanical, the products and services presented in this section are offered by suppliers who take the comprehensive view of their exacting skill.

Environmentally friendly cleaning

ICMI is marketing a new and environmentally friendly phosphating system. ICMI has developed a line machine, which, among its most significant features, gives the opportunity to avoid outsourcing wire treatment and so halves cleaning costs without using acids.

▲ *Typical wire cleaning line from ICMI*

This single wire system will clean high-carbon wire rods from 6mm up to 12mm diameter, and low-carbon rods from 6mm up to 22mm diameter. The wire is driven by a horizontal uncoiler and by a compacter, which pushes forward the wire loaded on the trestle of the uncoiler.

The next stage is the scaling machine, completely enclosed within sheet panels and provided with a mobile dolly for the collection and removal of the slag produced. The machine also has a hydraulic exchanger, for rapid and effective wire input. Another cleaning stage is the orbital brush with two opposing heads, controlled by two independent motors supported by inverters. The wire is thoroughly cleaned by this stage, and no further operation is required. The wire passes through a pressure-washing tank that removes the calamine on the wire.

A feature of the line is the phosphating tank, containing a solution of water and phosphate. A fluid heating system keeps the temperature constant, thus ensuring the correct execution of the phosphating process.

At this point the wire is ready for the last passage in the washing tank where it is cleaned and neutralised. At the outlet of the tank there is a hot air drying unit, and a hydraulic pushing system ensures that the dry wire can be easily inserted in the wiredrawing bench.

The phosphating tank can also be double-sized to house two coils and is therefore useful for treating wires of different diameters.

ICMI researches solutions to improve efficiency and reduce processing costs for furnaces and sophisticate systems, overseeing design and construction up to assembly, transport and final start-up. ICMI has recently expanded its market to cover the calcining of carbon steel and stainless steel wire.

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So if you're still wondering what happened to the letter—Here are three to remember: **W A I.** Stop by The Wire Association International stand in Hall 11 # B25 at wire Düsseldorf and stop the clock on outmoded business methods. Or join our network today at: www.wirenet.org.

We may not be ready to pass the torch but we're pleased to light the way.

Visit the Wire Association International stand in Hall 11 # B25 at wire Düsseldorf

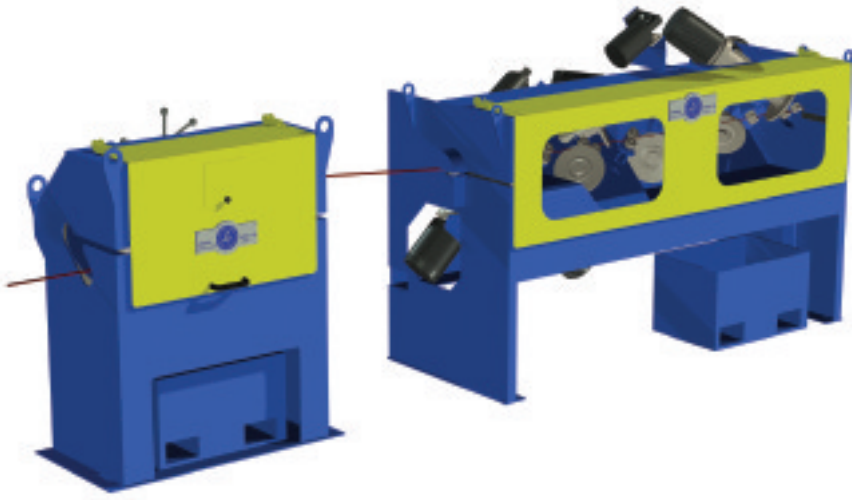
The Wire Association International, Inc.

1570 Boston Post Road | P.O. Box 578 | Guilford, CT 06437-0578 | Telephone: (001) 203-453-2777 | Fax: (001) 203-453-8384 | Web site: www.wirenet.org

Inline rod cleaning

The Lämneå inline rod cleaning system continuously performs in-line reverse bending of wire rod from 5mm to 15mm diameter. The system consists of a 4 or 6-sheave scale breaker, DU series, in combination with a BM 8, 4-pair brushing unit.

In operation the rod is bent in four planes and pulled through the scale breaker. About 80 to 90 per cent of scale removed from the wire falls into a collection box beneath the scale breaker. The remaining 10 to 20 per cent is loose, but clings to the rod due to electrostatic charge; this undesirable scale residue is removed by the brushing machine. The wire passes through four brush sections, each section containing two brushes. Each pair of brushes is oriented 45º to each other in order to cover the entire wire surface.



▲ *Mechanical descaling system DU4*

An integrated system for automatically adjusting the brushes has been implemented into the BM 8. This monitors and ensures that the preset pressure is maintained throughout the brush lifetime.

Under normal circumstances the brushes last for at least 120 tons of operation.

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Website: www.lamnea.se

Descaling and cleaning combinations

Electrorrec's mechanical descaling machine DECL cleans rod using a combined bending and polishing system. The modular design of the descaling machine offers a wide range of configurations to suit customer requirements. When heavy-duty cleaning is required, the heavy descaling unit DECL-G can be combined with the fine descaling unit, DECL-F, and a polishing unit, UP. Arranging the heavy descaling unit with a polishing unit can solve many applications, with a significant reduction in investment. There are three descaling models (DECL-16, DECL-20 and DECL-28) and two polishing units (UP-1 and UP-2).

The heavy descaling unit is a fabricated frame housing a double set of bending rollers in two planes 90° (model DECL-28 has only one set of bending rollers) with central, hydraulically driven, rollers. The bending rollers are equipped with tungsten carbide central rings. The fine descaling unit consists of two sets of wire brushes also allocated in two planes 90°. An independent pneumatic cylinder, which allows a permanent contact between the wire brushes and the wire rod surface independently of brush wear, tilt each set. The brushes' motors are placed outside, to avoid problems with scale powder.

The polishing units can be equipped with metallic wire brushes or abrasive wheels, depending on final product specifications.

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Wet blasting process

Vapormatt Ltd has developed a compact, dedicated machine for the in-line cleaning of continuous wire, rod and strip materials during manufacturing or post-production operations.

The new Vapormatt 1210 machine is said to remove heat treatment oxides, lacquers, oil and grease from the surface of the material more effectively than ultrasonic or mechanical methods based on ultrasonic or mechanical systems, and is safer and more environmentally acceptable than processes using harsh or potentially hazardous chemicals.

The machine removes deep-seated contamination without damaging the underlying substrate and eliminates the need for time-consuming pre-cleaning or preparation. It can be installed into existing wire, rod or strip production lines.

The machine operates on a continuous basis, providing a simultaneous surface preparation, degreasing and rinsing action, with the wire, rod or strip material passing through the processing enclosure on a roller support system, via sealed entry and exit apertures.

▲ *Vapormatt's 1210 machine*

The processing enclosure incorporates a specially designed manifold, fitted with preliminary wash, multiple wet blast and air blow-off nozzles to ensure all round, thorough surface cleaning as the material passes through. An aluminium oxide-based wet blast media is normally employed for the main cleaning action, although other types of media can be used, depending on the particular application.

Because the wet blast process uses water and compressed air as the carrier for the abrasive media it is less aggressive than dry blasting. With wet blasting, the water acts as a buffer and lubricates the particles on impact, enabling very fine and smooth finishes to be produced without surface damage.

The process is self-contained, with the machine working on a closed-loop basis; process water is continuously filtered and waste material and debris is directed to a container for regular removal.

Since no solvents or other potentially hazardous chemicals are used in the process, the machine is not subject to strict solvent emission, VOC or dust emission legislation.

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Cleaning and descaling system

QED Wire Lines supplies multi-wire cleaning systems including high turbulence pickling, electrolytic pre-cleaning, heat-treating and coating equipment.

QED's high turbulence pickling is an advanced cleaning system for the removal of scale from steel wire, incorporating a patented multi-stage high turbulence design for optimum cleaning in a compact system. This completely enclosed and fume-free system also reduces acid consumption and waste treatment costs. PLC-based controls are easy to use with a touch screen operator interface and onboard data logging. This can be connected to a SCADA network if required. All the liquid levels within the tanks are monitored with ultrasonic level sensors. These reliable units provide constant supervision to ensure the system is operating correctly.

▲ *QED Wire Lines' pre-clean system*

The company's advanced pre-cleaning system produces consistent quality finished wire and increases production flexibility. In many production environments there is a need to clean lubricants from the wire.

The QED system uses efficient solution scrubbing with a bipolar electrolytic boost to quickly dissolve lubricants on the wire surface. The tanks have multiple electric heaters to maintain the solution at optimum cleaning temperature, or a hot water or steam heat exchange can be supplied. Wires pass through a double freshwater rinse section at the end of the tank. The entire process is controlled with a PLC and touch screen interface complete with data logging.

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Descaling range

WILCO supplies a range of descalers for all applications, from basic low-cost mechanical descalers for the production of industrial quality wires, to automatic brush descaling systems for applications demanding the highest quality drawn wire.

▲ *The WILCO 1250 automatic brush descaling system*

Operator-friendly control systems are said to make WILCO descalers among the easiest to use. Even the advanced brush descaling system, incorporating PLC controls, does not require operator adjustment of the wire brush pressure. Simply select the brush pressure desired, based on wire rod condition, and the WILCO brusher automatically maintains the setting.

The WILCO controls constantly monitor brush condition and automatically adjust to account for wear, producing a consistently clean mechanically descaled rod.

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Modular acid baths

After commissioning over 80 fibreglass pickling baths, FIB has chosen a polypropylene construction to be used with a geyser-type cooling bath with high water turbulence. The combination of the geyser cooling bath and FIB's Tornado pickling achieves optimum continuous pickling for steel wires of 0.6mm to 16mm. Thirty units have already been installed.

▲ *The geyser cooling bath and FIB's Tornado pickling*

Tornado pickling (patent applied for) follows the latest environmental requirements of the EC including an easy system of cover lifting, an internal system for the control of acid and water pick-up by the wire, and four-stage rinsing. Due to its high turbulence, the system works at low acid temperatures.

The modularity of the acid bath allows upgrading in the future and a step-by-step investment. Special care has been applied to the comfort of the operators, with simple or double threading units and optimised access to the wire field, both at the entry and exit of the bath.

The entire construction conforms to the international stability welding norms for plastic DVS 2205.

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Lubrication and cleaning

The GPS/PDH wire re-coating system greatly improves the present state of both wire lubrication and in-line wire cleaning. The system enables high-speed smooth frictionless drawing, benefiting from the system wire dry re-coating in intermediate drafts with completely water-soluble sodium lubricants. Full film consistent coatings are achieved in a wide variety of selections from ultra thin coat for plating wire through a strongly adherent hard coat for high-tensile spring wire with no speed limitation. The GPS/PDH system allows immediate substantial cost savings in drawing applications, including spring and plating wire, completely eliminating conventional wet pre-coating chemicals, such as phosphate and borax, for all direct drawing applications from rod.

The system allows in-line wire cleaning in a wet application in last draft, operating with a specific paste in a continuous in and out motion, in closed circuit pressure lubrication self generated by the unit, performing wire cleaning and polishing to a reflective wire appearance, at high speed, in a single run. The system operates at zero energy consumption and zero lubricant consumption waste. It can be easily installed into the existing soapbox, and operational within 10 minutes.

Decalub – France **Fax**: +33 1 60 202021 **Email**: info@decalub.com **Website**: www.decalub.com

Evaluating batch process lines

CMI UVK Corp, a USA business unit of CMI Chemline Belgium, reports the development of simulation model software for complete evaluation of batch process lines for cleaning and descaling of carbon and stainless steel wire and rod in coil.

Carbon steel lines from 50,000 to 400,000 tons per year and stainless steel lines from 25,000 to 200,000 tons per year have been input to the model. Through evaluation of the model, the correct design capacity and treatment process for multiple batch treatment recipes can be decided in real time. The model has proved to be successful for plant design and installation.

▲ *Cleaning and descaling of carbon and stainless steel wire and rod*

CMI UVK Corp distributes closed vent batch cleaning and descaling plants according to installed capacity. CMI engineers are believed to have pioneered the closed vent plant in 1978, and the latest designs are based on 30 years of experience. Material handling equipment has been improved due to value engineering and 3D drawing methods. Design innovation technology is applied for treatment of carbon steel, stainless steel, with comprehensive systems for acid recovery, air treatment, and water treatment. CMI UVK Corp plants are designed to have low energy requirements and high flexibility for process and material handling solutions.

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Continuous shot-blasting installations for straightened wire rod descaling

The DS series of descaler from Carlo Banfi are designed to meet the production requirements of metallurgical products from straightened wire rod with SA3 finishing, and an A or B initial surface quality.

The DS machines can process the range of cross-sections (round, square, hexagonal or flat) at speeds over 180m per minute. The inlet and outlet guides are correlated to the required shape, but guide replacement is said to be quick and easy.

The output of the blasting operation directs the abrasive jets onto the work piece without leaks.

The materials used for the output liners are highly wear-resistant with differentiated composition according to the impact or friction strength of the abrasive in use.

Other products in the Carlo Banfi range include:
- Foundry-forging shot-blasting systems to descale both iron and non-iron metals
- Pickling of wire rods and bars in materials of various sizes and sections, either continuous or in coils
- Shot peening equipment specifically designed for helical, cylindrical, parabolic and diaphragm springs

Carlo Banfi SpA – Italy
Fax: +39 0331 578656
Email: banfi@carlobanfi.it
Website: www.carlobanfi.it

▲ *DS series descaler from Carlo Banfi*

New wire cleaning series

Ultrasonic cleaning is recognised as a highly efficient cleaning method for the surface treatment of wire- or band-shaped endless profiles, yielding excellent surface quality even at high processing speeds. GEO-Reinigungstechnik is among specialists in the use of ultrasonic cleaning technology. Whether the requirement is for a comprehensive turnkey system, an upgrade, or an addition to an existing process, GEO offers application specific solutions.

GEO's new wire cleaning series (WCS) comprises four basic systems, designed to clean, rinse, and dry continuous lengths of single-line wire- or band-shaped endless profiles from a couple of micrometres up to 30mm diameter. WCS lines can be installed in-line with a wiredrawing machine, in front of annealing operations, or can be used as a stand-alone unit where the wire is wound on spools. The purifying plant consists of several modules placed in a row according to the procedure.


▲ *Wire cleaning system, WCS from GEO*

The core of GEO's wire cleaning system is a high performance ultrasonic tube reactor, optimised for continuous industrial profile cleaning. Inside the tube, the cleaning fluid is exposed to a high-intensive ultrasonic field to create cavitation. The concentration across the entire tube cross-section and the distinctive focus zone inside the tube causes an intensive sonication that effectively removes soap, grease, oil, emulsions or particulate contaminants inline. The compact design includes cleaning and rinsing circuits with heated and insulated liquid tanks, bag filter systems and a touch screen-based user interface and fault display.

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Extruding – machinery & equipment

Is it possible to mass-produce custom work? If it were, extrusion would be the process for the job. So adaptable that it can be operated hot, warm, or cold, an extruder accepts a variety of materials and delivers high yields at top speeds. At the same time, it shapes a product perfectly conformed to the requirements of the most demanding customer – while imparting a surface finish reminiscent of the days of pumice and elbow-grease.

Extrusion acquires its accommodating ways from the suppliers of equipment – complete lines for insulation and sheathing down to cooling troughs and barrels – who know that responsible troubleshooting begins long before the trouble does. They also know that the choice between, say, gas injection and dry/liquid injection for XLPE insulation can have important consequences for the productivity of a wire and cable plant. A selection of the products and services of these professionals is found here.

Photo courtesy of Teknor Apex Company

Continuous extrusion of cable sheath

BWE's new SheathEx™ process is an extension of its well established Conform™ and Conklad™ continuous extrusion technologies. The SheathEx machine extrudes a continuous and seamless aluminium tube from two 12mm diameter rods around a high voltage cable core. BWE collaborated with high voltage power cable producers in China to develop the product and process specifications for this new technology. Three installations are in production and a fourth machine will be commissioned during the first half of 2010.

The SheathEx machine incorporates a large crosshead to accommodate the large diameter dies required for cable sheathing. The aluminium sheath is seamless, with no weld line or bead. The twin groove mode of operation ensures the aluminium sheath is concentric. BWE's patented induction heating system provides a very even temperature distribution around the tooling, leading to very stable running conditions, and consistent properties in the aluminium tube. The feedstock material is standard and readily available CCR aluminium rod.

The cable core passes continuously through the crosshead. A cooled insertion tube protects the cable core on entry to the crosshead, and rapid quench of the aluminium tube immediately after the die prevents thermal damage to the core.

▲ *BWE's SheathEx production line*

Downstream from the SheathEx machine the cable sheath is corrugated in-line and coiled onto large drums. The SheathEx process is described as a continuous, reliable and cost effective method of sheathing high voltage power cables.

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It is in the area of electronic and engineering materials that our two newest additions, Quadrant and Shimo, will reside. The unique technologies and applications provided by these acquisitions will enhance the ELANTAS leadership position around the globe. ELANTAS intends to leverage the new resins systems acquired in these acquisitions to service all of our customers with a broad range of products to meet their electrical insulation needs.

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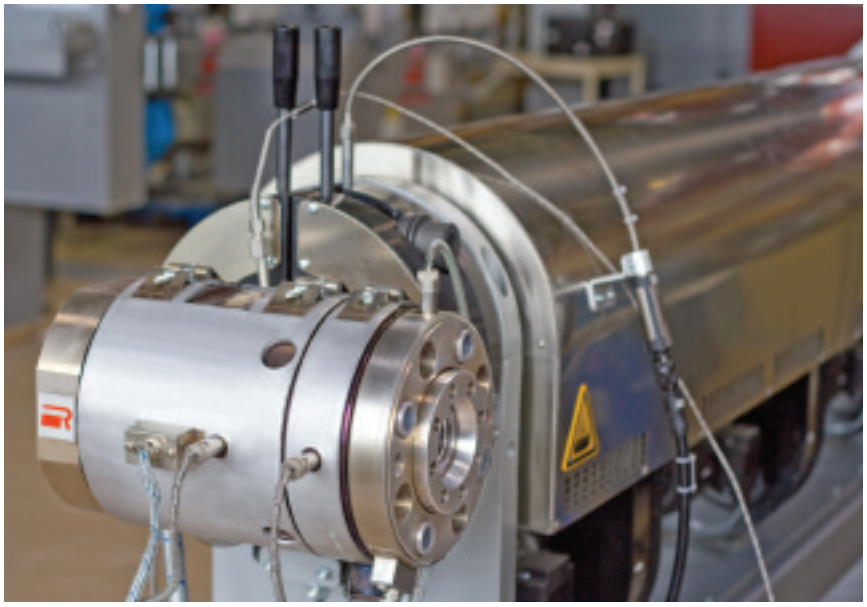
Crosshead developments

The challenge in distributor design is to find the optimum dimensions to attain a balanced flow at the exit. Rosendahl's distributor design is said to ensure homogeneous material flow, independent of the processed materials and output. Optimised material flow provides high centricity and allows a reduction in average wall thickness, therefore reducing manufacturing costs. Using the latest finite element simulation programmes, Rosendahl conducts mechanical calculations and rheological analysis of its crosshead series. Rosendahl's crosshead series now includes a range of crossheads for cables up to 110mm in core diameter.



▲ *Rosendahl's RX45 crosshead*

The simulation also enables analysis of pressure, temperature rise, velocity, stress and strain rate distributions over the entire simulation domain. Especially when designing the distributor, it is important to adapt the distributor's channels to the flow path of the melt.

In order to offer a broad material spectra, Rosendahl partnered with university institutes to research a wide range of materials for the cable industry, and now offers a material database that includes standard as well as special material (such as foamed material blends, LSOH or XLPE). Rosendahl's ongoing communication with polymer manufacturers guarantees up-to-date technology. As a supplier of extruders, crossheads and of complete extrusion lines, Rosendahl understands the polymer extrusion process. Integrated simulation results, together with experiential data, have facilitated the optimisation of the head design and, ultimately, a higher quality of extrudate.

Rosendahl Maschinen GmbH – Austria **Fax**: +43 3113 5100 59
Email: office@rosendahlaustria.com **Website**: www.rosendahlaustria.com

Lead extruders

JCDOFAMA's YQL series machine is designed to continuously compound a lead sheath over cable, or for vulcanizing rubber pipe. The lead layer's outer diameter can be between 10mm and 150mm. The pressure and temperature for extruding remain constant, so the difference in the thickness of the lead layer is controlled within a small range.

▲ *JCDOFAMA's YQL series machine*

Deyang Jiechuang Wire & Cable Machinery Co Ltd – China **Fax**: +86 838 2800877
Email: dofama-mj@163.com **Website**: www.jcdofama.com

Portal machine

The Sampsistemi division of SAMP SpA has a new generation of self-traversing portal payoffs and take-ups to complete the range of powerful machines for cable extrusion.

Multiflex-25 is a multi-material extrusion screw. The new portal machine's maximum reel flange diameter is 5,000mm for a maximum weight of 60 tons.

Each model has a very wide reel range; for example, a 3,000mm (20t) model loads reels with flange diameters between 900mm and 3,000mm and it runs at 300m per minute.

Thanks to the wide bobbin range, customers will need only a limited type and number of spare parts.

All machines are engineered to increase the production efficiency and don't have gearboxes, chains or belts for the power transmission.

The SAMP payoffs and take-ups only use AC motors for accuracy of the machine movements.

In addition, the set-up time is said to be much lower than the standard market average.

The machine is extremely flexible due to the beam telescopic device and a new changeover system. SAMP recently supplied Nexans with eighteen of these machines.

SAMP SpA – Italy
Fax: +39 051 370860
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Website: www.sampspa.com

Continuous extrusion of copper bus bar

Beijing Holland's continuous copper extrusion machine model, TLJ400 will fabricate wide cross section copper bus bar. With one size (20mm diameter) rod feeding, the machine extrudes copper bus bar of 170mm width and 2,000mm^2 cross-section area. The end products are widely used as large copper conductors, and semi-products of copper strip and copper foil.

▲ *Copper extrusion machine TLJ400*

Testing and metal flow analyses have ascertained the optimum materials for die and tooling, and the precise flow patch design to withstand huge friction and pressure during extrusion. The feeding rod is not heated before extrusion, making the process and operation easy.

Offering the convenience of easily sourced 20mm rod, continuous production, different sizes of product, less scrap and easy operation, the TLJ400 machine has become popular with copper bus bar producers, taking the place of traditional hydraulic extrusion presses in some areas.

Over 100 machines have been installed worldwide and a larger machine is in development.

Continuous extrusion technology is also suitable for the production of aluminium cladding steel wires and aluminium cladding cables.

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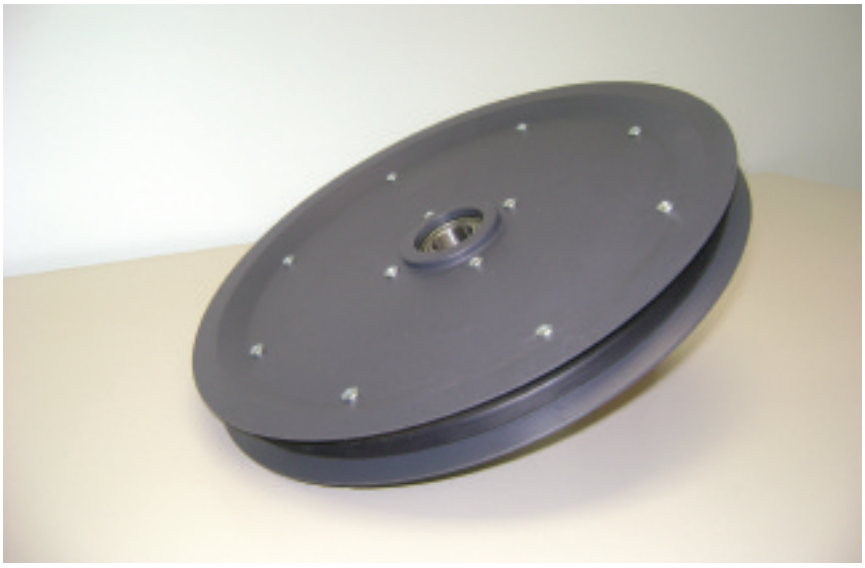
Pulleys for extruding

Wyrepak offers a range of guide pulleys highly suited for extruding wire. In particular, the WP series pulleys have nitrile rubber contact rings. This hardwearing rubber ensures smoothness and dampens vibration.



▲ *WP pulley with rubber contact ring*

A variety of sizes are available from a contact surface diameter of 2.5" up to 22". The contact rings are replaceable. Larger pulleys can be fitted with single or double bearings: double bearings improve stability.

Wyrepak also has available its UA series of small pulleys. All have solid polished ceramic contact rings and are available with contact ring diameters of 15mm, 20mm, 30mm, 40mm and 50mm.

Wyrepak Industries Inc – USA
Email: sales@wyrepakind.com
Fax: +1 860 632 5775
Website: www.wyrepakind.com

Spools for extrusion processes

The A Appiani Srl product range includes spools for extruding applications. Traditionally, standard single-flange pressed spools (BCG-type) or composite ABS-steel spools (P-type) are used in extruding processes. Above all, the second type, P-type, is widely used for the extrusion of telephone and communication cable, and fibre optics.

In response to the need for lower cost spools offering high performance (high speed through efficient dynamic balancing) and longer cable lengths with higher weight capacities, A Appiani has focused more on the manufacture of partially machined and dynamically balanced structural steel reels suitable for the extruding process. This kind of reel is also suitable for the extruding process of large size cables.

Features and advantages of the P-type:

- Lighter structure than traditional BCS reels. Traditionally, in extrusion, there are no heavy weight spools, so a lighter structure is more appropriate
- Quick to assemble
- Geometrically perfect with minimum tolerances and reduced concentricity due to partial machining and dynamic balancing according to Q16 ISO 1940
- Suitable for high speed processes up to 25m per second
- Full machining of the barrel if required

Options available include pockets for reel lifting and handling, and screwed or pressed interchangeable bores with hardened steel bushes or other special materials. An alternative to the BCS reel is the BAP-type (double flanged pressed steel reel); a partially machined and dynamically balanced reel, which is also suitable for the extruding process.

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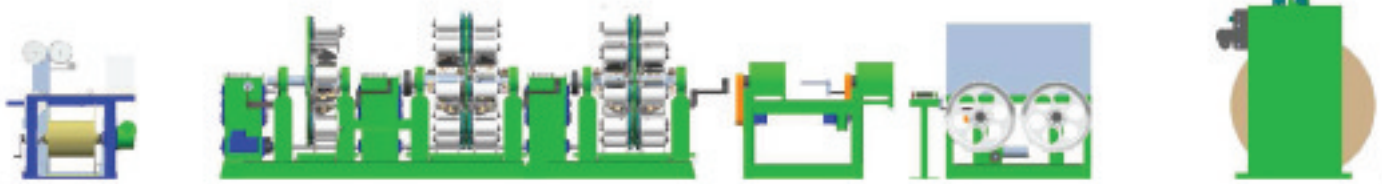
Wire Stranding Machine



Complete lines

Queins & Co GmbH, a manufacturer of heavy-duty stranding equipment, also builds complete extrusion lines.

Immediately available from stock is a combined extrusion line for XLPE (silane processed), PVC, PE and TPR – three extruders with 65mm, 150mm and 90mm screw diameters. This line also includes a Plasticolor mixing station, Sikora measuring heads and a Medek & Schörner hot stamping marking device. Payoff and take-up will accommodate 2,500mm reels.

▲ *Extruders and accessories available from Queins & Co*

Also available, with short delivery times, are new belt-type caterpillars and various models of new payoff and take-up stands, as well as a choice of pre-owned extruders and accessories.

Queins & Co GmbH – Germany
Email: info@queins.com
Fax: +49 2472 3014
Website: www.queins.com

Pultrusion line

ELMECC-WTS, a manufacturer of machinery for wire and cable, has launched a new line of UV-curing systems for fibre-reinforced polymers (FRP) and glass fibre reinforced polymers (GFRP), forming an element of a pultrusion line.

Rigid fibrous polymer strength members are manufactured with high quality thermosetting resins and combine high mechanical properties – high strength and tensile modulus – with the light weight of GFRP products.

A further benefit consists in low elongation thermal expansion, similar to optical fibres, as well as all dielectric properties necessary for optical fibre applications.

The plant is composed of a payoff for glass fibre cops, complete with fibre braking device, a first resin tank, first UV lamp (first layer), second resin tank, second UV lamp (second layer), pulling caterpillar or capstan and take-up for spools up to 1,000mm diameter.

One electrical cabinet is supplied complete with PLC, line software with automatic control system for the UV lamps, and a Siemens touch panel with colour graphics display.

ELMECC-WTS – Italy
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New TPEs

A new series of Elexar® thermoplastic elastomer (TPE) compounds for wire and cable, from the Thermoplastic Elastomer Division of Teknor Apex Company, provides a combination of RoHS compliance, UL-V0 flame retardance, and excellent performance over a wide range of end use conditions. The Elexar high-performance FR series includes six grades, with Shore A hardness ranging from 58 to 85, upper use temperature from 105ºC to 125ºC, low-temperature flexibility down to -50°C, excellent UV resistance, and good oil resistance. For applications where appearance is critical, the compounds provide excellent colourability and non-blooming surfaces, according to Keith Saunders, market manager.

"Elexar HPFR compounds embody a hard-to-find combination of outstanding end-use performance and compliance with the stringent standards required in the global marketplace," said Dr Saunders. "Conventional flame retardant TPEs not only fail to comply with the RoHS directives but are more limited in terms of flame test ratings and service temperatures. In addition, their flame retardant formulations often present the problem of blooming or surface staining."

▲ *Elexar HPFR used for a typical cable*

Teknor Apex suggests evaluating Elexar High-Performance FR compounds for use in insulation and jacketing for automation and control cables, fibre optic cables, low-voltage power cables, appliance wire, and flexible cord. The new Elexar compounds meet standards specified under UL 1061 and unlike conventional TPEs, pass the UL VW-1 vertical flame test for cable jacketing.

Teknor Apex Company – USA **Fax**: +1 401 728 5680 **Email**: tpe@teknorapex.com **Website**: www.teknorapex.com

Comprehensive extrusion range

Threesixty Extrusion Technology designs, manufactures and installs continuous rotary extrusion equipment, tailored to meet specific production requirements from solid aluminium conductors through to aluminium clad steel wire (ACS wire), powder processing and large copper busbar.

There are five standard continuous extrusion machines in the Threesixty range, to cover most product sizes and applications:

- The RX-320 for simple profiles in copper or aluminium up to 60mm
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- The RX-530 for up to 200mm diameter
- The entry level TX-320 for sheathed products up to 20mm
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Cross-head for XLPE and thermoplastics HFFR compounds

The extrusion head is among the components that ensure and maximize the functionality and potential of an extrusion line. The quality of an extruded material is directly and exponentially proportional to the proper functioning and design of the extrusion head.

The size of the axial and distribution channels is important to ensure the regularity of the flow and avoid high kinetic differences in the material which cause localised overheating of the material, and also to avoid degradation or thermo-stress of the material, ensuring the right conditions for both melt and mixing.

Equally important is the assembly, sizing and centring of the tools to be used. For this reason an extrusion head has been developed that allows balancing of the piezo-kinetic effect for sensitive materials (HFFR, LSOH, XLPE cross-linkable by monosil, visico and sioplas processes).

Pressure and temperature transducers detect the condition of the processed material to avoid overpressure and heat strokes, as in the case of halogen-free materials. To optimise the system, a pair of special semi-compression tools were developed.

During production it is possible to vary the pressure and temperature of the molten material by adjusting the axial position of the tip or die. As a result of that procedure, it is possible to improve the adhesion of polymer on the cable, so avoiding defects such as surface vibrations, micro-crack, localised overheating and shark-skin effects.

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Central tube cable ribbon coupling

Patrick Van Vickle, Lindsey Alexander, Steve Stokes: Sumitomo Electric Lightwave

Abstract

The advent of dry central tube ribbon cable has introduced challenges in evaluating key cable parameters that are not required for gel-filled central tube cable. When developing new test methods and criteria it is important to directly relate the test method and criteria to functional cable requirements.

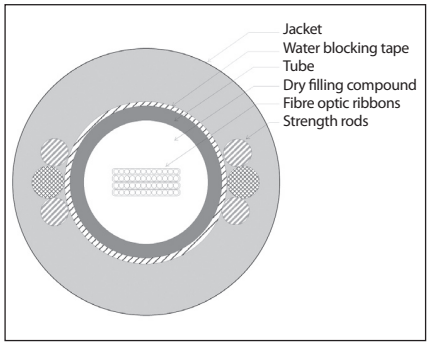
Ribbon coupling has been one of the most challenging areas of activity. Through extensive experimental and theoretical analysis it is shown that an absolute ribbon coupling value does not ensure cable performance; it is shown that for some designs an overly high coupling value may be detrimental. For each cable design and dry technology, an optimised ribbon coupling must be found through testing directly related to actual cable lifecycle events.

1 Introduction

Dry central tube ribbon cables were introduced in 2001[1]. Different methods to block the ingress of water in the central tube have been introduced, but all designs rely on a super absorbent polymer filling compound as a replacement for gel in the central tube as shown in *Figure 1*.

The time and material savings in cable preparation are the driving benefits to these cable designs. The industry realised, however, that with the new design, new performance issues might need to be addressed[1,2,3].

▼ **Figure 1**: *Cross section of dry central tube ribbon cable*



An exhaustive list of reliability tests was developed. These tests included aged water penetration, humidity aged water penetration and repeated water penetration. In addition to variations of water penetration testing and internal freeze tests a ribbon movement issue may need to be addressed. Installed cables will likely be exposed to events or forces that cause vibration or movement during the installed lifecycle. These conditions may cause unwanted ribbon movement. For example, it has been demonstrated that cables with low ribbon to central tube coupling force may have ribbons pumped out of the tube during a galloping condition[2].

The industry has struggled to agree on a series of functional tests related to real-world conditions that a cable may undergo during installation and lifecycle.

The primary focus is the test method and acceptable values for ribbon coupling to protect the cable from high cable strain events.

In the following sections each condition is discussed followed by testing methods that may be used to evaluate cable against these conditions. Finally, experimental results for the test methods are discussed.

2 Applications and environmental conditions

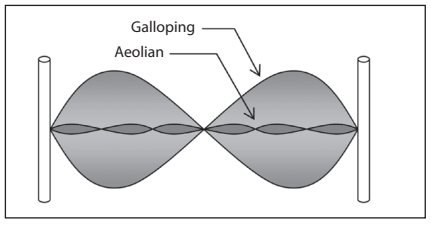
The conditions that a cable may see during its life have been discussed previously in numerous papers[4,5,6]. For the purposes of this paper they have been separated into two categories, vibration events and high strain events.

2.1 Wind induced galloping and environmental vibration

An aerial cable may undergo two main categories of vibration, galloping and Aeolian. The categories are separated by their frequency and amplitude. Galloping vibration is described by its high amplitude and low frequency. Aeolian vibration has a high frequency and very low amplitude, approximately half the cable's diameter.

An illustration of these two types of vibration is shown in *Figure 2*.

Lashed aerial cable may gallop with the proper conditions so it is important to test this specific condition. The conditions of Aeolian vibration are rare in nature in lashed aerial cable installations. The multi-degree of freedom systems typically have too much damping to allow a resonance in the span with an amplitude equal to half the cable diameter. While lashed aerial cable is unlikely to resonate at frequencies required for Aeolian vibration, it may simulate environmental vibration from sources such as railway beds or auto traffic on a bridge or slope.



▲ **Figure 2**: *Cable vibration conditions*

2.2 Strain Events

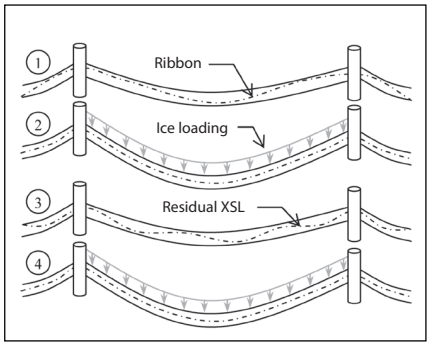
Strain events may occur in many different circumstances. Most cables strain during installation. Once installed, cables also see repeated strain from ice loading or from accidental dig-ups. In each case the amount of ribbon movement is important. The concern is that the ribbon movement does not translate down the entire length of the cable, consuming all ribbon excess length and subsequently causing damage to the fibre. Installation procedures have required slack loops of cable, which are an ideal way to lock the ribbons to the cable in the event of an extreme strain event. However, as discussed in the following sections, the cable strain from these conditions is highly unlikely to lead to damaging ribbon strain.

2.2.1 Ice loading

Fibre optic cable deployed in regions where ice build-up is likely must be capable of sustaining the loads and elongations likely to be encountered. The National Electric Safety Code (NESC) describes scenarios of ice build-up and wind conditions by region of the country[7].

From these inputs, elongation of a cable subjected to these conditions may be calculated and any resulting ribbon elongation may be predicted.

Under ice loading conditions cable will elongate. If the cable elongation exceeds the cable's intrinsic excess ribbon length, ribbon will be pulled in from an adjacent cable section as shown in *Figure 3*, items 1 and 2. If the cable elongation resulting from the load event exceeds the intrinsic ribbon excess length of all adjacent spans, ribbon may be pulled tight against slack loops or closures if slack loops are not present. This condition exists for both gel and dry cables. As the ice load is released, the ribbon pulled in from adjacent cable sections creates a new permanent excess ribbon length in the cable, as shown in *Figure 3*, item 3. During the next ice loading event the cable will elongate, but since ribbon excess length equal to the strained cable length is already present, no further ribbon will be "pulled" into the section, as shown in *Figure 3*, item 4. The cable has essentially reached a new equilibrium.



▲ **Figure 3**: *Ice loading conditions*

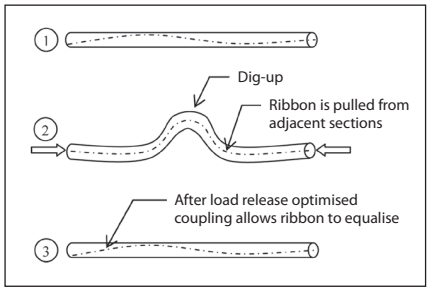
Once this process is understood, the analysis of the magnitude of the cable elongation, induced ribbon excess length, and robustness of the cable design may be analysed. Performing the catenary calculations for these scenarios on a "worst case" lashed aerial cable and span length, the cable elongation achieved was less than 0.05% for NESC heavy ice loading conditions[8]. With this knowledge it is imperative to ensure that the cable design is capable of accommodating this amount of ribbon excess length with neither attenuation loss nor imparting damage to the fibres. The intrinsic ribbon excess length value is designed to exceed this cable elongation.

2.2.2 Cable dig-up

Occasionally cable is mistakenly dug up by a backhoe or similar piece of digging equipment when the proper precautions are not followed prior to beginning work. When this occurs, a highly localised section of the cable span is subjected to high strains. The strained region has been estimated to be between 5m and 50m[4]. Generally this cable section is removed and replaced.

The question has been posed as to the effect of direct exposure to the high strain on the adjacent cable sections. Estimation of a 50m cable section exposed to a strain, with a load that is near the breaking strength of most cable designs, results in ribbon pulling in from the adjacent sections and may indeed pull tight against slack loops in both dry and gel filled cable.

The ability of the cable and ribbon to absorb this strain depends on the cable design, the intrinsic excess ribbon length, and the length of the adjacent section of cable. Whatever coupling is present will either prevent or allow the ribbon strain from transmitting down the cable length and prevent or allow the cable to equilibrate after release of the load. *Figure 4* illustrates this event.



▲ **Figure 4**: *Dig-up strain event*

Viscoelastic gel filled cable has the unique ability to both couple the ribbons to the cable and allow the ribbons to relax over time. The time required to equilibrate may be long, longer than suggested pull rates for cable coupling testing. Temperature of the gel also plays a large role in the viscous drag imparted to the ribbons and may greatly affect the rate of relaxation. A dry coupling agent does not exhibit this property.

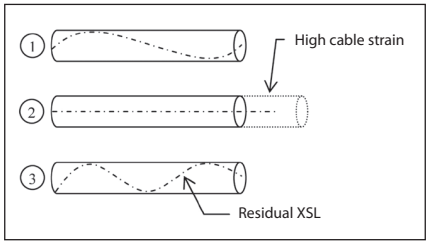
Cable strains that result in a force that overcomes the dry coupling force, which is almost certain in this scenario, may not allow the adjacent sections to equilibrate. For this reason a direct correlation to gel filled coupling is hazardous, and testing related to real-world cable lifecycle events is so important.

2.2.3 Installation

During installation a localised section of cable is subjected to a large strain. It has been reported with some cable designs that this will cause the ribbons to remain stationary while the cable is pulled over them, as shown in *Figure 5*. When the load is released there is no tensile force on the ribbons at the exposed end, so some length of ribbon remains within the cable. An installer is likely to be alarmed to see no ribbons exposed at the end of the cable after the cable pulling is complete!

This specific end condition also exists for some gel filled designs when subjected to certain installation conditions.

The solution is to remove a small section of cable jacket, usually less than 1m, to recover the ribbons. The question again returns to what effect does this condition have on the cable section as a whole?



▲ **Figure 5**: *Installation strain event*

The answer comes from the same factors mentioned earlier, the cable design, initial excess ribbon length and coupling. Clearly if the cable design was such that no cable strain resulted from the installation load then no ribbon movement issue is present, but this results in a large, overly stiff and costly cable. A balance of robust cable design and optimised coupling is the key.

3 Functional test development

3.1 Vibration test method

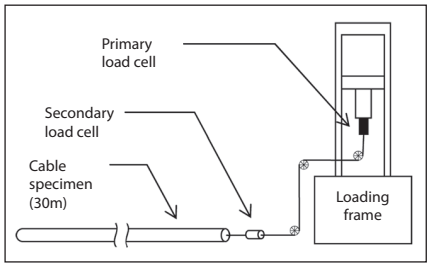
The tests that most accurately simulate the high and low frequency vibration seen in galloping and environmental vibration exist in the IEEE 1222 test method for All Dielectric Self Support Cable (ADSS)[9]. Attention was most recently paid to the low frequency vibration response in the galloping test, but the high frequency Aeolian vibration test may also offer important information. To perform this test the cable was placed in a self-supporting condition and strained to twice its rated installation load to meet the test setup requirements. The test does however allow a measurable span of cable to be vibrated with frequencies similar to what may occur if placed near railways or auto traffic. The duration of the test is also extensive: 100,000,000 cycles.

3.2 Ribbon coupling and strain event test methods

The test method published by a major telecommunications provider uses a fixed 30m cable specimen. The ribbons from this cable are then attached to a load frame and the force required to initiate movement of the ribbons within the fixed cable sheath and tube sample is monitored[10]. A fixed value of 0.036lbf *(lbf = pounds force)* times the number of fibres in the cable is the required minimum force for passing test results.

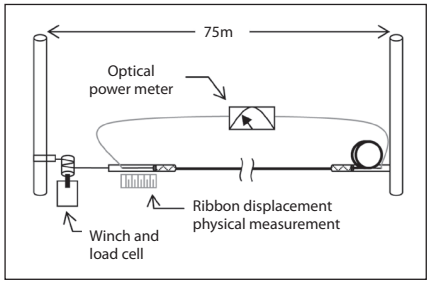
For some cables, especially with lower fibre counts, questions have been proposed about the interaction of the test apparatus given the inherent friction of the pulleys involved.

A solution was proposed that elevated the cable sample from the ground to a tray to attempt to eliminate at least one pulley. Another solution introduces a second load cell, located directly in-line with the cable sample. The loading frame load cell is still monitored and the frame controls the rate of movement fixed by the method at 100 ±25mm per minute, but the in-line secondary load cell gives the absolute load. This apparatus is shown in *Figure 6*.



▲ **Figure 6**: *Ribbon coupling testing apparatus*

This update to the small-scale cable testing apparatus helps ensure more accurate results for coupling force, but a test that could create a high strain event was needed. Using an electric winch and load cell, a cable was strained between two anchored poles, 75m apart. By carefully gripping the cable, the ribbons were exposed at both ends and spliced to an optical power meter operating at 1,550nm. The ribbons were also placed in such a way as to allow physical linear movement to be measured on one end while the other end was put into slack loops to simulate field conditions. The cable strain event apparatus is shown in *Figure 7*.

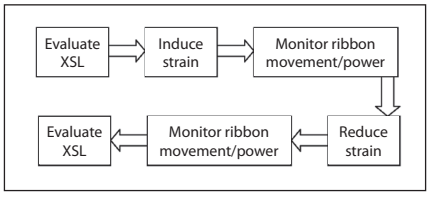


▲ **Figure 7**: *Cable strain event apparatus*

Prior to beginning, and upon completion of, the cable strain event test the cable sample is tested for ribbon excess length (XSL) to remove the possibility of excessive ribbon to cable length differences skewing the results.

The cable sample then proceeds through the remaining testing procedure described in *Figure 8*.

▼ **Figure 8**: *Ribbon strain event testing procedure*



Coupling Fill Ratio	Fibre Count	No Ribbons
19%	12	1
24%	12	1
25%	60	5
29%	48	4
36%	48	4
37%	144	12
38%	108	9
41%	96	8
45%	144	12
51%	12	1
56%	48	4

▲ **Table 1**: *Cable samples for coupling evaluation*

4 Cable test samples

To achieve a thorough understanding of the coupling phenomena, a large number of cable samples were tested. Some of the samples were variations of cables currently offered in the existing product line; others were custom created to achieve the best test resolution possible.

Coupling fill ratio, the ratio of filled area to tube area, was a parameter applied for this analysis.

5 Experimental test results

5.1 Aeolian vibration

Aeolian vibration has been previously examined and shown to present no permanent attenuation or significant ribbon movement[3].

5.2 Strain event ribbon movement versus coupling force

To validate the correlation between coupling force and ribbon movement, the coupling force measured using the loading frame was compared to the ribbon movement observed using the strain event apparatus.

▼ **Figure 9**: *Ribbon movement versus coupling force*

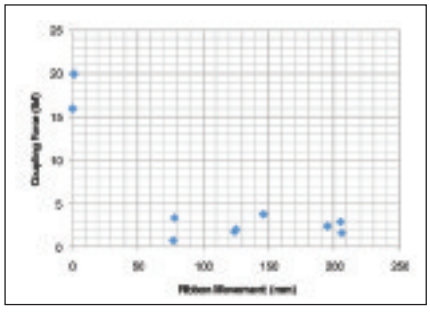


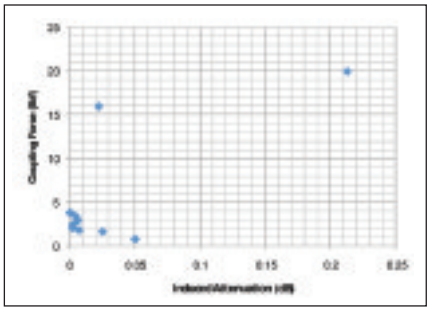
Figure 9 demonstrates that above a threshold of coupling force, ribbon movement is certainly retarded.

Below this threshold the coupling force is not a good indicator of ribbon movement.

5.3 Coupling force versus induced attenuation

The next relationship of interest was the amount of attenuation change induced after a load release from a high strain event versus the coupling force from the loading frame apparatus.

Figure 10 demonstrates that, at very high coupling resulting in only a few millimetres of ribbon movement, a large attenuation increase is possible.



▲ **Figure 10**: *Induced attenuation at release versus coupling force*

The high coupling does not allow the ribbons to redistribute or relax.

The one data point illustrating this phenomenon does not indicate that this is always the case.

More testing at this coupling level would be necessary to better define the amount of coupling and exact circumstances that would cause this issue.

This particular event occurred with a 48-fibre count cable comprised of four 12-fibre ribbons.

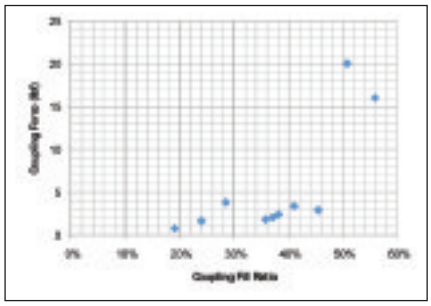
Unlike gel filled cables, dry central tube ribbon cables do not have means to keep the ribbons in a uniform stack.

The dependence on a uniform ribbon stack for anti-buckling is suspect and this condition may also present itself for higher fibre count cables as well.

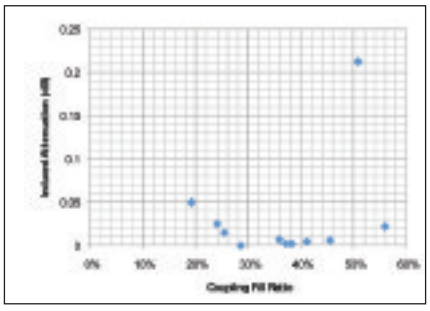
The level of coupling that begins to cause this issue is higher than allowed by current design practice for commercialised cables of this design.

To ensure robust design, the new design parameter was established that related the filled area of the tube to the available area.

An upper limit on the new parameter, coupling fill ratio, would be set to limit induced attenuation.



▲ **Figure 11**: *Coupling fill ratio versus coupling force*



▲ **Figure 12**: *Coupling fill ratio versus induced attenuation*

5.4 Coupling fill ratio

The validity of the new coupling fill ratio parameter was analysed against experimental results. *Figure 11* shows that at approximately 50% coupling fill ratio the water blocking elements begin to compress and impart significantly higher coupling force.

This indicates that there is a threshold below which this parameter does not correlate with coupling force. For this cable design a linear relationship of coupling force does not exist.

Finally, *Figure 12* demonstrates the need to set the coupling fill ratio parameter below 50%. All attenuation results below this level are 0.05dB or less.

6 Conclusions

Savings in installation cost and time for dry central tube cables are obvious, and these cables have been well received in the industry.

The new technology, however, needs to be examined and new test methods developed. When this work is undertaken it is of utmost importance to set the criteria to best match functional field requirements.

The underlying technology for dry cable is common, but the delivery of the super absorbent polymer differs and not all cable designs behave alike. To ensure the most robust cable performance each design must be verified to meet functional requirements including vibration and high strain events.

The results of testing demonstrate that this design of dry central tube ribbon cable is robust.

Designs that allow as much as approximately 200mm ribbon movement during a high strain event show no measurable attenuation effects; this indicates a robust cable with a balance between coupling and fundamental cable design.

It was shown that a highly coupled cable might exhibit attenuation loss after high strain events. Since it is likely that a design will undergo a strain event that exceeds even the highest coupling, it is imperative that in all designs a balance between ribbon coupling and overall cable design is achieved.

The criteria for ribbon coupling must be independently established for each dry technology and cable design.

This should be accomplished through testing that is directly related to events likely to be experienced by a cable during its lifetime. ■

7 Acknowledgments

Special thanks to Amy Wilson and Mohammad Giahi of the Sumitomo Optics Lab for their work in collecting this data. Also thanks to Dean Dancy of Sumitomo Process Engineering for assistance in producing the cables for testing.

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ADM – Anpassungsfähige Gewindewalzentechnologie

Präzision, stabile Verfahren und frühzeitige und effektive Fehlererkennung stellen für die Produktivität Schlüsselfaktoren dar. Mit dieser Vorstellung im Kopf hat EW Menn in Partnerschaft mit Brankamp, die Einstellung an Gewindewalzen per Knopfdruck von EW Menn mit der Fachkenntnis der Prozessüberwachung von Brankamp kombiniert, um ADM herzustellen. ADM steht für "Adaptive Die Match" und beschreibt ein System, dass elektronisch die Einstellung an Gewindewalzen mißt und bewertet sowie automatisch korrigiert während die Maschine läuft, ohne die Produktion zu unterbrechen und ohne die Unterstützung eines Bedieners zu erfordern. Gleichzeitig findet die Standard-Prozessüberwachung statt.

ADM gibt es nur bei EW Menn-Maschinen in Kombination mit den Prozesssteuerungssystemen von Brankamp.

EW Menn ist auch im Bereich von Sonderanwendungen tätig, wie z. B. mit dem Warmwalzsystem, das die Erwärmung der Rohlinge ermöglicht, unmittelbar bevor sie in den Walzenbacken zugeführt werden. Ursprünglich für Raumfahrtanwendungen mit Titan und

▲ *Mit ADM ausgerüstetes Modell AF61 von EW Menn*

hochspeziellen Legierungen entwickelt, wird durch dieses System eine erhöhte Materialverdrängung ermöglicht, was wiederum Umformverfahren ermöglicht, die sonst ohne eine Erwärmung und eine hohe Erweiterung der Möglichkeiten des Flachbackenwalzverfahrens nicht erreicht werden könnten.

EW Menn GmbH – Deutschland
Fax: +49 2733 7781
Email: mail@ewmenn.de
Website: www.ewmenn.de

Neue Wickellösung

Windak hat bekannt gegeben, dass sein erster automatischer Wickler neuer Generation, FC5, erfolgreich in Finnland installiert wurde.

Nach Aussage von Urban Bollo, Geschäftsführer von Windak Schweden, ist der FC5 automatische Flex-Wickler die erste Maschine, die von Windak als Teil einer neuen Generation erschwinglicher Automations-Verpackungslösungen eingeführt wurde.

"Wir haben verstanden, dass der Markt heute kostengünstige Lösungen fordert, die eine kurze Amortisationszeit mit höchster Flexibilität und Produktivität aufweisen."

FC5 ist kompakt und nimmt eine große Auswahl an Kabeldurchmessern und Spulenabmessungen auf. Die Aufwicklung erfolgt vollautomatisch mit oder ohne Umreifer oder Haltewendel. Ohne Umreifer oder Haltewendel wird die Spule vor dem Auslauf aus dem Aufwicklerkopf mit Dehnfolie eingewickelt.

▲ *Neuer FC5 Aufwickler von Windak*

Windak – Schweden
Email: info@windakusa.com
Website: www.windakusa.com

Software-Partnerschaft

Cimteq, der Anbieter der Kabeldesign-Software CableBuilder, hat ein Partnerschaftsabkommen mit SAP unterzeichnet, um die Leistungsfähigkeit seiner Software bei der Erstellung von Fachberichten, Herstellungsanweisungen und Online-Katalogen zu erhöhen.

CableBuilder, das weltweit von Draht- und Kabelherstellern für Design, Kostenvoranschläge, Kostenberechnungen und Datenblätter eingesetzt wird, bietet nun einen integrierten Berichtsmotor als "Crystal Reports" an.

Die Crystal Reports-Software ermöglicht es den Anwendern von CableBuilder interaktive Berichte zu entwerfen, die als Mustervorlage zum Zweck der Datenformatierung des CableBuilders eingesetzt werden. Diese Berichte können statisch oder interaktiv sein und eine Vielzahl von Aufgaben abdecken, von den Herstellungsanweisungen bis hin zu Datenblättern und Analysen der Kostenvoranschlags-Leistungs-Analyse.

Nick Hirst, ein Anwendungsberater bei Cimteq, äußerte sich zu dieser Integration: "Durch Crystal Reports kann der Kunde Berichte zur Herstellungsanweisung mit einer besseren Formatierung und mit genaueren Informationen erzeugen, demzufolge können Unklarheiten reduziert sowie einige der Ursachen von Ausschuss und Nachbearbeitung beseitigt werden."

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Flexible Masse für Kabelrohre

Evonik Industries hat seine Produktpalette flammgeschützter Polyamid 12-Massen für Kabelschutzrohre und –schläuche erweitert. Mit der hochflexiblen Formmasse Vestamid® EX9203 schwarz reagiert das Unternehmen auf die weiter steigenden Anforderungen in der Elektro- und Kabelindustrie.

Halogenfrei flammgeschützte Kabelschutzrohre und –schläuche sind besonders bei dynamisch hoch belasteten Anwendungen gefragt, z.B. in Schienenfahrzeugen, in Industrieanlagen sowie im Maschinenbau.

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Auftrag aus der Türkei

Rautomead wurde ein Festauftrag von Elsan Elektrik Gerecieri SA aus Denizli, Türkei, für die Lieferung einer RS 3000/6 Stranggießmaschine für Kupferwalzdraht erteilt, die zur Herstellung von Lackdraht eingesetzt wird.

Die Fachkenntnis von Rautomead im Bereich Graphittiegel und elektrische Graphitwiderstand-Heiztechnologie eignet sich ausgezeichnet für die Kupferwalzdrahtherstellung.

Das ganz aus Kohlenstoff bestehende Behältersystem wirkt als stark reduzierende Umgebung und wirkt der Gefahr entgegen, dass das keramisch feuerfeste Material durch geschmolzenes Kupfer verunreinigt wird. Diese Faktoren sichern den hochwertigsten sauerstofffreien Kupferwalzdraht.

Elsan wird seine eigene Betriebsplattform und Kathodenversorgung bauen, jedoch entsprechend den Projekten von Rautomead.

Markenkomponenten der Standard-wickler von Rautomead werden als Kits für die örtliche Herstellung geliefert.

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Website: www.rautomead.com

Unternehmenszusammenschluß im Bereich Spulenhandhabung

Tulsa Power Holdings Corporation hat den Unternehmenszusammenschluß von Reel-O-Matic Inc mit Tulsa Power Inc bekannt gegeben, beides Unternehmen von Spulenhandhabungsausrüstungen für die Verarbeitung und den Vertrieb von Kabel, Draht und anderen flexiblen Materialien.

Die Fertigungsanlagen in Oklahoma City bzw. Tulsa, in Oklahoma, bleiben erhalten. Das gesamte Schlüsselpersonal wird weiterhin am jeweiligen Standort bleiben, mit Terry Simmons als Präsident von Reel-O-Matic, und Mike Spence als CEO von Tulsa Power.

Die Unternehmen stellen Ausrüstungen für Auf- und Abwickler mit oder ohne Welle her sowie Hochgeschwindigkeitsspuler, Wickelausrüstungen und Raupenabzüge. Sie sind unter anderen im Design und in der Entwicklung Kunden angepasster Handhabungsausrüstungen für Hersteller und Vertreiber von Draht, Kabel, Drahtseil spezialisiert.

Reel-O-Matic Inc – USA
Website: www.reelomatic.com

Tulsa Power Inc – USA
Website: www.tulsapower.com

Supraleiter für Netzknoten des amerikanischen Energiemarkts

American Superconductor Corporation hat bekannt gegeben, dass für das Projekt Tres Amigas - der erste Netzknoten des inländischen erneubaren Energiemarkts - supraleitende Energierohrleitungen ausgewählt wurden.

Supraleitende Strompipelines schließen Gleichstrom (GS) -Supraleiter-Stromkabel der Übertragungsebene angetrieben durch Hochtemperatur-Supraleiter (HTS)-Draht sowie leistungsstarke Spannungsquellen-Wechselstrom-/Gleichstrom-Umformer von AMSC ein. Das Projekt Tres Amigas vereinigt zum ersten Mal die drei amerikanischen Stromnetze (Eastern Interconnection, The Western Interconnection und The Texas Interconnection) um einen schnelleren Einsatz der erneubaren Energie zu ermöglichen und die Zuverlässigkeit des amerikanischen Elektrizitätsnetzes zu erhöhen.

AMSC – USA
Website: www.amsc.com

Auftrag für eisbeständige Kabel im Barentsmeer

Nexans erhielt von Sevmash (Russlands wichtigstem Schiffbauunternehmen) einen Vertrag über 6 Millionen Euro um Steuer,- Instrumentations – und Stromkabel, die extrem niedrigen Temperaturen und Eisbelastungen widerstehen können, für die Meereis geschützte stationäre Ölplattform Pirazlomnaya im Baratsmeer zu entwickeln, herzustellen und zu liefern.

Die Prirazlomnaya-Plattform wurde speziell zur Entwicklung des Prirazlomnoye-Ölfelds gebaut und ist das erste Ölherstellungsprojekt im russischen Arktis-Schelf.

Das Gebiet ist extrem niedrigen Temperaturen und hohen Eisbelastungen ausgesetzt. Mit nur 110 eisfreien Tagen jährlich, beträgt die durchschnittliche Jahrestemperatur –4°C während die Wintertemperaturen bis auf –50°C sinken können. Für diese rauhen Betriebsbedingungen wird eine einzigartige Kombination von Unterwasserkabel-Technologien gefordert, um Niedertemperaturbeständigkeit mit feuerhemmenden, raucharmen und halogenfreien Eigenschaften zu bieten.

Ungefähr 850km Sonderkabel für Sevmash werden in den spezialisierten Anlagen von Nexans Kukdong Electric Wire Co, Korea, hergestellt. Die Produktion hat bereits begonnen und die Lieferungen werden bis Ende 2011 fortgesetzt.

▲ *Die Prirazlomnaya-Plattform wird eine tägliche Kapazität von 22.000 Tonnen Öl und 1 Million Kubikmeter Gas haben*

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Bandkopplung für Zentraladerkabel

Von Patrick Van Vickle, Lindsey Alexander, Steve Stokes: Sumitomo Electric Lightwave

Übersicht

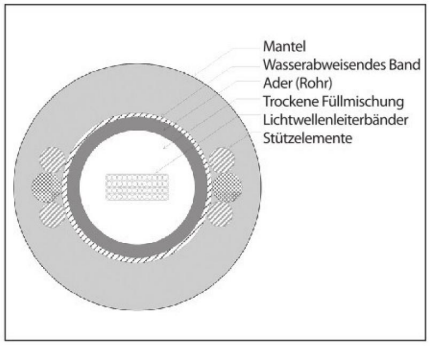
Das Aufkommen von Bandkabeln mit trockener Zentralader (Rohr) hat zu Herausforderungen bei der Auswertung von Kabelschlüsselparametern geführt, die für gelgefüllte Zentraladerkabel nicht erforderlich sind. Bei der Entwicklung neuer Prüfmethoden und -kriterien ist es wichtig die Prüfmethode und das Kriterium direkt mit den praktischen Kabelanforderungen zu verbinden.

Die Bandkopplung war dabei einer der herausfordernsten Tätigkeitsbereiche. Ausgeweitete empirische und theoretische Analysen zeigen, daß ein absoluter Bandkopplungswert die Kabelleistung nicht garantieren kann; es wird angezeigt, daß für einige Aufbauten ein übermäßig hoher Kopplungswert schädlich sein könnte. Zu erforschen ist für alle Kabelaufbauten und Technologien der trockenen Kabelader eine optimierte Bandkopplung durch die Prüfung von Ereignissen, die direkt mit dem tatsächlichen Lebenszyklus des Kabels verbunden sind.

1 Einleitung

Bandkabel mit trockener Zentralader wurden 2001 eingeführt[1]. Verschiedene Methoden wurden eingeführt, um den Wasserzutritt in die Zentralader zu blockieren, jedoch stützen sich alle Entwürfe auf eine superabsorbierende Polymerfüllmischung als Ersatz des Gels in der Zentralader, wie in *Bild 1* dargestellt.

▼ **Bild 1**: *Querschnitt von Bandkabeln mit trockener Zentralader*



Die Kosten- und Zeiteinsparungen bei der Kabelvorbereitung sind die wichtigsten Vorteile dieser Kabelaufbauten. Jedoch erkannte man in der Industrie, daß mit diesem neuen Aufbau neue Leistungsaspekte angesprochen werden müssten[1,2,3].

Eine erschöpfende Liste von Zuverlässigkeitsproben wurde entwickelt. Diese Proben umfaßten die Eindringung von stillen Wasser, die Eindringung von stillen Wasser durch Feuchtigkeit und die wiederholte Wassereindringung.

Neben den Abweichungen der Wassereindringungsproben und der inneren Frostproben sollte man sich mit dem Thema der Bandbewegung auseinandersetzen. Die verlegten Kabel werden wahrscheinlich Ereignissen oder Kräften ausgesetzt, die während des installierten Lebenszyklus Schwingungen oder Bewegungen verursachen. Diese Bedingungen könnten zu unerwünschten Bandbewegungen führen. Zum Beispiel wurde bewiesen, daß es vorkommen könnte, daß bei Kabeln mit einer niedrigen Kopplungskraft zwischen dem Band und der Zentralader im Falle einer galoppierenden Schwingung, Bänder aus der Ader ausgestoßt werden könnten[2].

Die Industrie hatte Schwiergkeiten sich auf eine Reihe von Funktionsprüfungen zu einigen, die sich auf praktische Bedingungen beziehen, denen ein Kabel während der Verlegung und dem Lebenszyklus ausgesetzt werden könnte. Zunächst fokussierte man sich auf die Prüfmethode und annehmbare Werte für die Bandkopplung, um das Kabel vor hohen Verformungsereignissen zu schützen.

In den nachfolgenden Abschnitten wird jede Bedingung behandelt, gefolgt von den Prüfmethoden, die eingesetzt werden könnten, um das Kabel unter diesen Bedingungen zu bewerten. Schließlich werden Versuchsergebnisse für die Prüfmethoden behandelt.

2 Anwendungen und Umwelteinflüsse

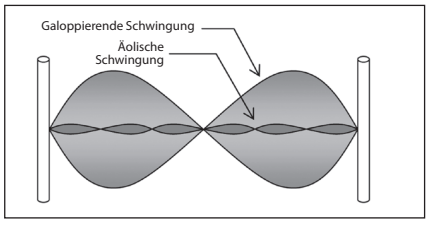
Mehrere Berichte haben sich bereits mit den Bedingungen befaßt, denen ein Kabel während seiner Lebensdauer ausgesetzt wird[4,5,6]. Zum Zwecke dieses Artikels wurden diese Berichte in zwei Kategorien unterteilt: Schwingungsereignisse und hohe Verformungsereignisse.

2.1 Durch Wind induzierte galoppierende Schwingungen und Umweltschwingungen

Ein Luftkabel könnte zwei Hauptkategorien von Schwingungen unterzogen werden und zwar galoppierende Schwingungen und äolischen Schwingungen. Die Kategorien werden anhand deren Frequenz und Amplitude aufgeteilt. Die galoppierende Schwingung wird durch ihre hohe Amplitude und niedrige Frequenz beschrieben. Die äolische Schwingung weist dagegen eine hohe Frequenz und eine sehr niedrige Amplitude auf, zirka die Hälfte des Kabeldurchmessers. Eine Abbildung dieser zwei Schwingungstypen ist im *Bild 2* dargestellt.

Luftkabel des Typs „lashed" (volldielektrisches an der Freileitung verbundenes optische Kabel) könnten unter bestimmten Bedingungen galoppierende Schwingungen aufweisen, daher ist es wichtig diese spezifische Bedingung zu prüfen. Die Bedingungen, die in der äolischen Schwingung auftreten, sind in der Natur nur selten in Luftkabelinstallationen des Typs „lashed" vorhanden. Die Systeme mit mehreren Freiheitsgraden weisen in der Regel zu viel Dämpfung auf, um eine Resonanz im Teilstück mit einer Amplitude zu ermöglichen, die der Hälfte des Kabeldurchmessers entspricht. Während

das Luftkabel des Typs „lashed“ nur unwahrscheinlich bei solchen Frequenzen mitschwingt, die für die äolische Schwingung erforderlich sind, könnte es jedoch die Umweltschwingung von Quellen simulieren, wie z. B. von Eisenbahntrassen oder von Fahrzeugverkehr auf einer Brücke oder an einem Hang.



▲ **Bild 2**: *Kabelschwingungsbedingungen*

2.2 Verformungsereignisse

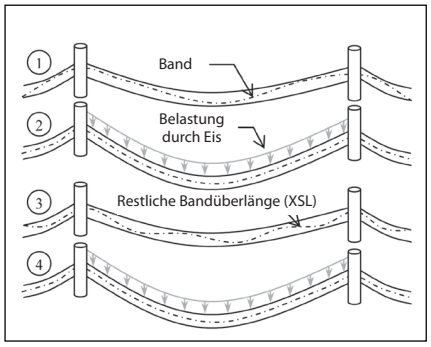
Verformungsereignisse könnten unter vielen verschiedenen Umständen auftreten. Die meisten Kabel werden während der Installation verformt. Nach der Installation werden Kabel auch einer wiederkehrenden Verformung durch Eisansammlung oder unbeabsichtigte Ausgrabungen ausgesetzt. In jedem Fall ist der Umfang der Bandbewegungen von Bedeutung. Es ist in der Tat wichtig, daß die Bandbewegung nicht die ganze Länge des Kabels nach unten zieht, wodurch die komplette Bandüberlänge verbraucht werden würde und demzufolge Schäden an der Faser verursacht würden. Bei den Installationsverfahren wurden zugspannungslose Kabelschleifen gefordert, die sich im Falle eines extremen Verformungsereignisses ideal dazu eignen die Bänder an das Kabel zu schließen. Wie jedoch in den nächtsten Abschnitten näher erklärt, ist es äußerst unwahrscheinlich, daß die Kabelverformung unter diesen Bedingungen zu schädlichen Bandverformungen führt.

2.2.1 Belastung durch Eis

Lichtwellenleiterkabel, die in Regionen wo Eisbildung wahrscheinlich ist, müssen in der Lage sein eventuellen Lasten und Dehnungen zu wiederstehen. Das NESC (National Electric Safety Code) beschreibt die Szenarien des Eisaufbaus und der Windbedingungen entsprechend jeder Region eines Landes[7]. Aus diesen Eingaben kann die Dehnung eines Kabels das diesen Bedingungen ausgesetzt wird, berechnet werden, sowie jegliche sich daraus ergebende Banddehnung vorhergesagt werden.

Unter den Bedingungen der Belastung durch Eis dehnt sich das Kabel aus. Falls die Kabeldehnung die innewohnende Bandüberlänge des Kabels überschreitet, wird Band von einem anliegenden Kabelabschnitt eingezogen, wie in *Bild 3*, Position 1 und 2, dargestellt. Wenn die Kabeldehnung, die sich aus dem Ladeereignis ergibt, die innewohnende Bandüberlänge aller anliegenden Teilstücke überschreitet, sollte das Band eng gegen zugspannungslose Schleifen gezogen werden oder, falls zugspannungslose Schleifen nicht vorhanden sind, eng gegen Verschlüsse gezogen werden. Diese Bedingung gilt sowohl für gelgefüllte Kabel wie für Kabel mit trockener Zentralader. Wenn Eis sich zurückbildet, bewirkt das von den anliegenden Kabelabschnitten eingezogene Band eine neue permanente Bandüberlänge im Kabel, wie in *Bild 3*, Position 3, dargestellt.

Während des darauf folgenden Eisbelastungsereignisses dehnt sich das Kabel aus, da jedoch die Bandüberlänge, die der verformten Kabellänge entspricht, bereits vorhanden ist, wird kein weiteres Band in den Abschnitt “eingezogen”, wie in *Bild 3*, Position 4, dargestellt. Das Kabel hat somit ein neues Gleichgewicht erzielt.



▲ **Bild 3**: *Eislastbedingungen*

Ist dieses Verfahren erst einmal verstanden, können die Analyse der Größe der Kabeldehnung, die induzierte Bandüberlänge und die Robustheit des Kabelaufbaus untersucht werden. Durchgeführte Kettenberechnungen für diese Szenarien an einem Luftkabel des Typs „lashed“ bei einer Teilstücklänge wie im “schlimmsten Fall”, ergaben eine erzielte Kabeldehnung unter 0,05% für starke Eislastbedingungen nach NESC[8].

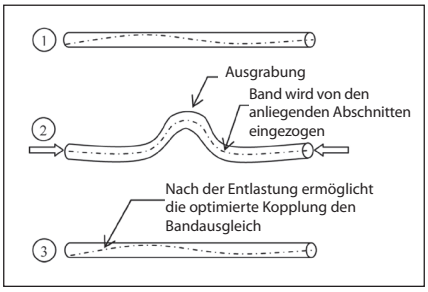
Gemäß dieser Kenntnis muss zwingend sichergestellt werden, daß der Kabelaufbau diese Menge an Bandüberlänge ohne Dämpfungsverlust aufnehmen kann und ohne dabei die Faser zu beschädigen. Der innewohnende Wert der Bandüberlänge ist so festgelegt, daß diese Kabeldehnung übertroffen wird.

2.2.2 Kabelausgrabungen

Manchmal wird ein Kabel versehentlich durch Bagger oder ähnlichen Grabvorrichtungen freigelegt, wenn vor Arbeitsbeginn die entsprechenden Vorkehrungen nicht getroffen werden., In diesem Fall wird ein ganz spezieller Abschnitt des Kabelteilstücks hohen Verformungen ausgesetzt. Es wurde geschätzt, daß der verformte Bereich zwischen 5m und 50m liegt[4]. In der Regel wird ein solcher Kabelabschnitt entfernt und ersetzt.

Die Frage wurde auf die Wirkung der direkten Aussetzung einer hohen Verformung auf die anliegenden Kabelabschnitte gestellt. Die Einschätzung eines 50m Kabelabschnitts, der einer Verformung in der Nähe der Bruchfestigkeit der meisten Kabelaufbauten ausgesetzt wird, führt zum Einziehen des Bands aus den anliegenden Abschnitten und könnte tatsächlich gegen zugspannungslose Schleifen bei einem Kabel mit trockener Zentralader wie auch bei einem gelgefüllten Kabel dicht anziehen.

Die Fähigkeit des Kabels und des Bands diese Verformung aufzunehmen hängt von dem Kabelaufbau ab, sowie von der innewohnenden Bandüberlänge und der Länge des anliegenden Kabelabschnitts. Unabhängig von der vorhandenen Kopplung führt diese dazu, daß die Bandverformung entweder vermieden oder auf die Kabellänge übertragen wird und es ebenfalls vermieden oder ermöglicht wird, daß sich das Kabel nach dem Entlasten ausgleicht. *Bild 4* stellt dieses Ereignis dar.



▲ **Bild 4**: *Verformungsereignis wegen der Ausgrabung*

Ein mit viskoelastischem Gel gefülltes Kabel besitzt die einzigartige Fähigkeit die Bänder an das Kabel zu koppeln und im Laufe der Zeit eine Entspannung der Bänder zu ermöglichen. Die erforderliche Zeit zum Ausgleichen könnte lang sein, länger als die empfohlenen Ziehraten für die Prüfung der Kabelkoppelung.

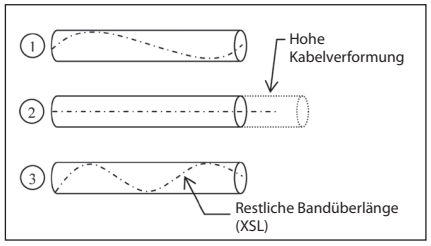
Die Temperatur des Gels spielt ebenfalls eine wichtige Rolle beim Reibungswiderstand, welcher den Bändern weitergegebenen wird und die Entspannungsrate stark beeinflussen könnte. Ein trockenes Kopplungsmittel weist solche Eigenschaften nicht auf. Kabelverformungen, die sich mit einer Kraft ergeben, die die trockene Kuppelungskraft übertrifft - was in diesem Szenarium beinahe sicher ist - könnten dazu führen, daß die anliegenden Abschnitte sich nicht ausgleichen könnten. Aus diesem Grund ist eine direkte Korrelation zur gelgefüllten Kopplung gefährlich, und deswegen ist die Prüfung von praktischen Ereignissen eines Kabellebenszyklus so wichtig.

2.2.3 Installation

Während der Installation wird ein lokalisierter Kabelabschnitt einer hohen Verformung ausgesetzt.

Von einigen Kabeldesigns wurde berichtet, dass dies dazu führen kann, die Bänder stationär bleiben wie in *Bild 5* dargestellt. Nach der Entlastung besteht keine Zugkraft an den Bändern am ausgesetzten Ende, demzufolge bleibt etwas Bandlänge im Kabel. Das Montagepersonal könnte beunruhigt sein, weil keine Bänder am Kabelende frei liegen nachdem das Kabelziehen vervollständigt ist!

Diese spezifische Endbedingung besteht auch für einige gelgefüllte Designs, wenn sie bestimmten Installationsbedingungen ausgesetzt werden. Die Lösung liegt darin, einen kleinen Abschnitt des Kabelmantels zu beseitigen, in der Regel weniger als 1m, um die Bänder wiederherzustellen. Die Frage ist aber wieder, welche Wirkung diese Bedingung gesamtheitlich auf den Kabelabschnitt hat?



▲ **Bild 5**: *Verformungsereignis während der Installation*

Die Antwort ergibt sich aus den vorab erwähnten Faktoren, d. h. der Kabelaufbau, die anfängliche Bandüberlänge und die Kopplung. Es zeigt sich eindeutig, daß wenn der Kabelaufbau derart entworfen wurde, daß sich keine Kabelverformungen aus der Installationslast ergeben, zwar kein Aspekt der Bandbewegung vorhanden ist, dies jedoch ein großes, übermäßig steifes und kostspieliges Kabel zur Folge hat. Ein Gleichgewicht zwischen einem robusten Kabelaufbau und einer optimierten Kopplung ist die Schlüssellösung.

3 Funktion-stestentwicklung

3.1 Methode der Schwingungsprüfung

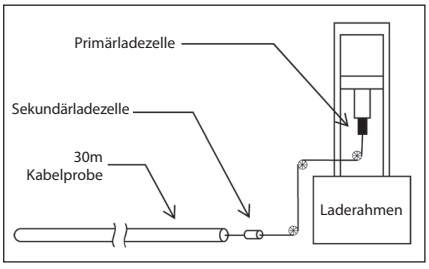
Die Prüfungen, die am genauesten die Hoch- und Niederfrequenzschwingung simulieren, die bei der galoppierenden Schwingung sowie bei der Umweltschwingung auftreten, sind in der Prüfmethode IEEE 1222 für volldielektrische selbsttragende optische Luftkabel (ADSS) beschrieben[9]. Bis zuletzt wurde der Niederfrequenzschwingungsreaktion in der Prüfung der galoppierenden Schwingung Aufmerksamkeit geschenkt, jedoch kann auch die Prüfung der äolischen Hochfrequenzschwingung wichtige Informationen bieten.

Um diese Prüfung durchzuführen, wurde das Kabel in einer selbsttragenden Umgebung verlegt und zwei Mal dessen Installationslast entsprechend verformt, um die Anforderungen des Prüfaufbaus zu erfüllen. Die Prüfung ermöglicht es jedenfalls, daß ein messbares Kabelteilstück mit Frequenzen in Schwingungen versetzt wird, die jenen ähnlich sind, die bei einer Verlegung in der Nähe von Eisenbahntrassen oder Fahrzeugverkehr auftreten könnten. Die Dauer der Prüfung ist ebenfalls zeitaufwendig: 100.000.000 Zyklen.

3.2 Prüfmethoden zu Bandkopplung und Verformungsereignis

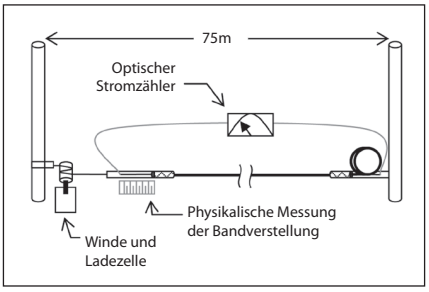
Bei der von einem wichtigen Telekommunikationsprovider veröffentlichten Prüfmethode wird eine feste 30m lange Kabelprobe verwendet. Die Bänder dieses Kabels werden dann an einen Lastrahmen angeschlossen und die Kraft, die erforderlich ist, um die Bewegung der Bänder innerhalb der festen Kabelmantel- und Aderprobe einzuleiten, wird überwacht[10]. Ein Fixwert mit einer Kraft von 0,036 Pfund (Pfundkraft) multipliziert mit der Anzahl der Fasern im Kabel ist die erforderliche Mindestkraft, um die Prüfergebnisse zu übertreffen.

Für einige Kabel, besonders jene mit niedrigeren Faserzahlen, wurden Fragen über die Wechselwirkung der Prüfgeräte gestellt wegen der inhärenten Reibung der damit verbundenen Scheibe. Eine Lösung wurde vorgeschlagen, bei der die Kabelprobe vom Boden auf eine Konsole hochgehoben wird, um so zu versuchen zumindest eine Scheibe zu beseitigen. Eine andere Lösung fügte eine zweite Ladezelle ein, die direkt inline mit der Kabelprobe angeordnet war. Die Ladezelle des Laderahmens wird weiterhin überwacht und der Rahmen prüft die Rate der Bewegung, die durch die Methode auf 100 ± 25mm pro Minute festgelegt wird, wobei jedoch die sekundäre Inline-Ladezelle die absolute Last angibt. Dieses Gerät ist in *Bild 6* dargestellt.



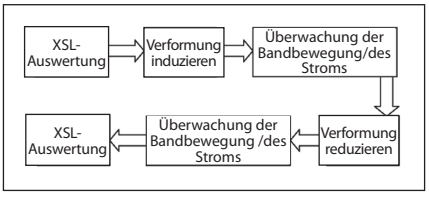
▲ **Bild 6**: *Prüfgerät für die Bandkopplung*

Dieses Prüfgerät, das entsprechend eines Modellversuchskabels aktualisiert ist, bietet eine Unterstützung um genauere Ergebnisse über die Kopplungskraft zu sichern, jedoch war eine Prüfung erforderlich, die ein hohes Verformungsereignis schaffen konnte. Mit Einsatz einer elektrischen Winde und einer Ladezelle, wurde ein Kabel zwischen zwei verankerten Polen verformt, die 75m von einander entfernt lagen. Durch ein sorgfältiges Greifen des Kabels, wurden die Bänder an beiden Enden freigelegt und zu einem optischen Stromzähler gespleißt, der bei 1.550nm arbeitete. Die Bänder wurden darüber hinaus so angeordnet, daß es ermöglicht wurde die physikalische Linearbewegung an einem Ende zu messen, während das andere Ende in zugspannungslose Schleifen gelegt wurde, um die Feldbedingungen zu simulieren. Das Gerät für das Kabelverformungsereignis ist in *Bild 7* dargestellt.



▲ **Bild 7**: *Gerät für das Ereignis der Kabelverformung*

Vor Beginn und nach Vervollständigung der Ereignisprüfung der Kabelverformung wird die Kabelprobe für die Bandüberlänge (XSL) geprüft, um die Möglichkeit der Unterschiede zwischen der Band- und der Kabelüberlänge zu beseitigen, welche die Ergebnisse verzerren. Die Kabelprobe setzt dann das restliche Prüfverfahren fort, das in *Bild 8* beschrieben wird.



▲ **Bild 8**: *Prüfverfahren für das Bandverformungsereignis*

▼ **Tabelle 1**: *Kabelproben für die Kopplungsauswertung*

Verhältnis der Kopplungs-Füllung	Faserzah	Bandanzahl
19%	12	1
24%	12	1
25%	60	5
29%	48	4
36%	48	4
37%	144	12
38%	108	9
41%	96	8
45%	144	12
51%	12	1
56%	48	4

4 Kabelprüfproben

Um eine gründliche Kenntnis der Kopplungsphänomene zu erhalten, wurden zahlreiche Kabelproben geprüft.

Einige der Proben waren Kabelversionen, die derzeit in der bestehenden Produktlinie angeboten wurden; andere wurden maßgefertigt, um die bestmöglichste Prüfauflösung zu erzielen.

Das Verhältnis der Kopplungs-Füllung, d. h. das Verhältnis zwischen dem gefüllten Bereich und dem Aderbereich, war ein für diese Analyse angewandeter Parameter.

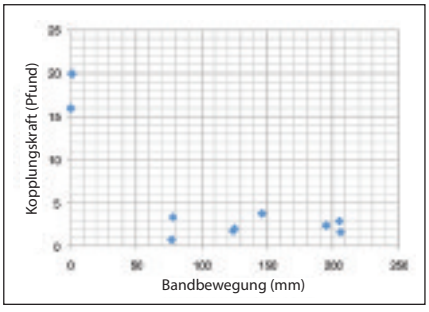
5 Ergebnisse der Versuchsprüfung

5.1 Äolische Schwingung

Die äolische Schwingung wurde zuvor untersucht und zeigte, daß keine permanente Dämpfung oder beträchtlich Bandbewegung vorhanden war[3].

5.2 Bandbewegung des Verformungsereignisses im Vergleich zur Kopplungskraft

Um die Korrelation zwischen Kopplungskraft und Bandbewegung für gültig zu erklären, wurde die mit Anwendung des Laderahmens gemessene Kopplungskraft mit der Bandbewegung verglichen, die mit Anwendung des Geräts für das Verformungsereignis beobachtet wurde.



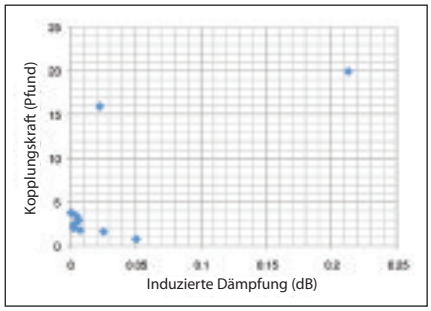
▲ **Bild 9**: *Bandbewegung im Vergleich zur Kopplungskraft*

Bild 9 zeigt, daß über eine Schwelle der Kopplungskraft hinaus, die Bandbewegung sicherlich verzögert wird.

Unter dieser Schwelle ist die Kopplungskraft kein guter Anzeiger der Bandbewegung.

5.3 Kopplungskraft im Vergleich zur induzierten Dämpfung

Das nächste interessante Verhältnis bestand im Umfang des induzierten Dämpfungswechsels nach einer Entlastung von einem hohen Verformungsereignis im Vergleich zur Kopplungskraft mit Einsatz des Gerätes des Laderahmens.



▲ **Bild 10**: *Induzierte Dämpfung bei der Entlastung im Vergleich zur Kopplungskraft*

Bild 10 zeigt, daß bei einer sehr hohen Kopplung, die lediglich zu einigen Millimetern Bandbewegung führt, eine hohe Dämpfungssteigerung möglich ist.

Durch die hohe Kopplung können die Bänder sich nicht neu verteilen oder entspannen.

Der Datenpunkt, der diese Phänomen darstellt, zeigt nicht an, daß dies immer der Fall ist. Weitere Prüfungen dieses Kopplungsniveaus wären notwendig, um den Umfang der Kopplungen sowie die genauen Umstände besser festzulegen, die dieses Problem verursachen könnten.

Dieses besondere Ereignis entstand mit einem Kabel mit Faserzahl 48, bestehend aus vier 12-Faser Bändern.

Im Gegensatz zu gelgefüllten Kabeln, haben Bandkabel mit trockener Zentralader keine Mittel um die Bänder in einem gleichmäßigen Stapel zu halten.

Es wird angenommen, daß der Knickschutz von einem gleichmäßigen Bandstapel abhängt und diese Bedingung könnte sich auch für Kabel mit höheren Faserzahlen bieten.

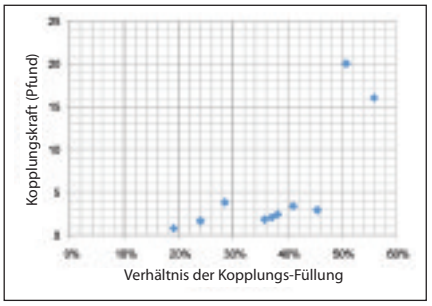
Das Niveau der Kopplungskraft, das dieses Problem zu verursachen beginnt, ist höher als durch die laufende Aufbaupraxis für handelsübliche Kabel mit diesem Aufbau genehmigt. Um einen robusten Aufbau zu sichern, wurde ein neuer Aufbauparameter kreiert, der den gefüllten Bereich der Ader mit dem verfügbaren Bereich verbindet.

Eine obere Grenze des neuen Parameters, Verhältnis der Kopplungs-Füllung, sollte gesetzt werden, um die induzierte Dämpfung einzuschränken.

5.4 Verhältnis der Kopplungs-Füllung

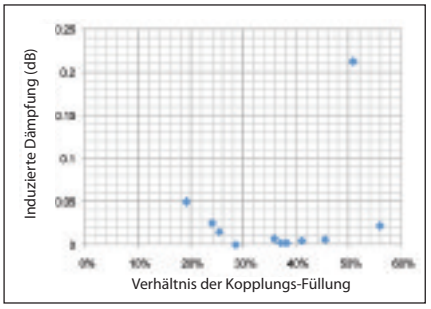
Die Gültigkeit des neuen Parameters des Verhältnisses der Kopplungs-Füllung wurde gegenüber den Versuchsergebnissen ausgewertet.

Bild 11 zeigt, daß bei zirka 50% des Verhältnisses der Kopplungs-Füllung, die wasserabweisenden Elemente anfangen zu komprimieren und eine wesentlich höhere Kopplungskraft bieten. Dies zeigt, daß eine Schwelle besteht unter welcher dieser Parameter nicht mit der Kopplungskraft korreliert.



▲ **Bild 11**: *Verhältnis der Kopplungs-Füllung im Vergleich zur Kopplungskraft*

Für diesen Kabelaufbau besteht kein lineares Verhältnis der Kopplungskraft.



▲ **Bild 12**: *Verhältnis der Kopplungs-Füllung im Vergleich zur induzierten Dämpfung*

Schließlich beweist *Bild 12* die Notwendigkeit, den Parameter des Verhältnisses der Kopplungs-Füllung unter 50% einzustellen.

Alle Dämpfungsergebnisse unter diesem Niveau entsprechen 0,05dB oder einem niedrigerem Wert.

6 Schlußfolgerungen

Die Kosteneinsparungen bei der Installation und die Zeiteinsparungen für Kabel mit trockener Zentralader sind ersichtlich. Außerdem wurden diese Kabel von der Industrie gut angenommen.

Jedoch ist diese neue Technologie noch Untersuchungen auszusetzen und neue Prüfmethoden sind zu entwickeln.

Wenn diese Arbeit unternommen wird, ist es von größter Wichtigkeit das Kriterium festzulegen, um sich am besten den Feldanforderungen anzupassen.

Die zugrundeliegende Technologie für Kabel mit trockener Zentralader ist dieselbe, doch weicht die Lieferung des superabsorbierenden Polymers ab und nicht alle Kabelaufbauten verhalten sich gleich.

Um die robusteste Kabelleistung zu sichern, um die Funktionsanforderungen zu erfüllen, einschließlich Schwingung und hohe Verformungsereignisse, muss jeder Aufbau geprüft werden.

Die Ergebnisse der Prüfung beweisen, daß dieser Aufbau des Bandkabels mit trockener Zentralader robust ist.

Die Aufbauten, die soviel wie zirka 200mm Bandbewegung während eines hohen Verformungsereignisses ermöglichen, zeigen keine meßbaren Dämpfungswirkungen; was auf ein robustes Kabel mit einem Gleichgewicht zwischen Kopplung und Grundkabelaufbau hinweist. Es wurde nachgewiesen, daß ein Kabel mit hoher Kopplungskraft einen Dämpfungsverlust nach hohen Verformungsereignissen aufweisen könnte.

Da es wahrscheinlich ist, daß ein Aufbau ein Verformungsereignis erträgt, der sogar die höchste Kopplungskraft übertrifft, ist es zwingend, daß in allen Aufbauten ein Gleichgewicht zwischen Bandkopplung und Gesamtkabelaufbau erzielt wird.

Das Kriterium für die Bandkopplung ist für jede Technologie mit trockener Zentralader sowie Kabelaufbau unabhängig festzusetzen.

Dies sollte durch Prüfungen erfolgen, die direkt mit den Ereignissen verbunden sind, die ein Kabel während seiner Lebensdauer wahrscheinlich erfährt. ■

7 Danksagungen

Ein spezieller Dank geht an Amy Wilson und an Mohammad Giahi von Sumitomo Optics Lab für deren Arbeit bei der Sammlung der Angaben für den vorliegenden Artikel.

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Технология адаптивного выравнивания матриц

Точность, стабильность технологических процессов и возможность эффективного обнаружения неисправностей на ранних этапах являются ключевыми факторами обеспечения производительности. Поэтому компания «ЕВ Менн» (EW Menn) в партнерстве с «Бранкамп» (Brankamp) объединила концепцию выпускаемого «ЕВ Менн» кнопочного механизма позиционирования матриц с накопленным компанией «Бранкамп» опытом в области разработок систем контроля за технологическими процессами и создала технологию ADM. ADM расшифровывается как Adaptive Die Match («Адаптивное выравнивание матриц») и описывает систему, которая проводит электронные замеры, оценивает положение матрицы и автоматически корректирует его в процессе работы установки, без прерывания производства и без вмешательства оператора. Одновременно осуществляется стандартный контроль за технологическим процессом.

▲ *Станок AF61 компании «ЕВ Менн», оборудованный устройством ADM*

Устройство ADM устанавливается на станках «ЕВ Менн» только в сочетании с системами управления технологическим процессом от компании «Бранкамп».

Компания «ЕВ Менн» также занимается выпуском специального оборудования, например, линий теплой прокатки, на которых обеспечивается нагрев заготовок непосредственно перед их подачей на накатные плашки. Эти системы, которые были первоначально разработаны для нужд авиационно-космической промышленности, в которой используются титановые и другие специальные сплавы, предусматривают более высокую степень вытеснения металла, за счет чего обеспечиваются параметры процесса формовки, которые не могут быть получены без нагревания, и в значительной мере расширяются возможности процесса плоской периодической прокатки.

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Новый навивочный станок

Компания «Уиндак» (Windak) объявила о завершении монтажа первого навивочного автомата FC5 нового поколения в Финляндии. По словам Урбана Болло (Urban Bollo), управляющего директора шведского отделения компании «Уиндак», станок FC5 для автоматической навивки изделий из эластичных материалов является первым агрегатом, который компания «Уиндак» представила в составе новой линейки доступных решений по автоматизации процесса упаковки. «Мы понимаем, что сегодня на рынке востребованы экономичные решения с коротким сроком окупаемости и максимальной универсальностью и отдачей».

▼ *Новый навивочный станок FC5 от компании «Уиндак»*

Станок FC5 имеет компактную конструкцию и обеспечивает обработку кабельных изделий и намотку бухт в широком диапазоне диаметров и типоразмеров. Навивка производится в полностью автоматическом режиме с использованием или без использования обвязочной машины или обмотчика. Когда обвязочная машина или обмотчик не используется, бухта перед выходом из навивочной головки упаковывается в растягивающуюся пленку.

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Партнерство производителей программного обеспечения

«Симтек» (Cimteq), поставщик программного обеспечения САПР для кабельных изделий CableBuilder, и компания «Эс-эй-пи» (SAP) подписали соглашение о партнерстве с целью совершенствования возможностей программного комплекса по генерированию отчетов профессионального качества, инструкций по изготовлению и каталогов продукции, доступных в интерактивном режиме.

ПО CableBuilder, которое используется производителями кабельно-проволочной продукции по всему миру при осуществлении проектирования, подготовке ценовых предложений, расчетах стоимости и составлении таблиц данных, теперь будет включать в себя интегрированный модуль подготовки отчетов в виде программного продукта Crystal Reports.

Система Crystal Reports позволяет пользователям ПО CableBuilder разрабатывать интерактивные отчеты и использовать их в качестве шаблонов для форматирования данных CableBuilder. Отчеты могут быть статическими или интерактивными и использоваться для самых разных целей – от составления инструкций по производству продукции и таблиц данных до анализа эффективности ценовых предложений.

Основным преимуществом системы Crystal Reports считается наличие знакомого и удобного пользовательского интерфейса с функцией «перетаскивания», аналогичного интерфейсу большинства приложений для обработки текстов.

Ник Херст (Nick Hirst), консультант компании «Симтек» по вопросам внедрения программного обеспечения, так отозвался об интеграции двух систем: «Система Crystal Reports позволила заказчикам генерировать производственные отчеты в улучшенном формате и с более точной информационной наполненностью, тем самым снижая уровень неопределенности данных и устраняя некоторые из причин отбраковки и повторной обработки деталей».

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Слияние производителей погрузочно-разгрузочного оборудования

Корпорация «Талса пауэр холдингс» (Tulsa Power Holdings) объявила о слиянии компаний «Рил-о-матик инк» (Reel-O-Matic Inc) и «Талса пауэр инк» (Tulsa Power Inc) – двух производителей оборудования для транспортировки кабельных барабанов, предназначенного для обработки и распределения кабеля, проволоки и другой продукции из эластичных материалов. Компании сохранят за собой производственные мощности, соответственно, в г. Оклахома-Сити и г. Талса (шт. Оклахома). Весь руководящий персонал на каждом предприятии останется прежним, с Терри Симмонсом (Terry Simmons) в качестве президента «Рил-о-матик» и Майком Спенсом (Mike Spence) в качестве главного исполнительного директора «Талса пауэр».

«В результате слияния с «Рил-о-матик» два уважаемых производителя с узнаваемыми торговыми марками объединяются в одно головное предприятие, что позволяет диверсифицировать существующее производство и расширить наш целевой рынок, – сказал Майк Спенс. – Мы с большим энтузиазмом смотрим на новые перспективы, которые это слияние открывает перед нашими заказчиками».

Терри Симмонс добавляет: «Обладая в совокупности почти 100-летним опытом работы и совместно используемыми технологиями, обе компании теперь имеют бóльшие возможности для расширения ассортимента и повышения качества выпускаемого ими оборудования в интересах всех сторон». Компании производят оборудованные валами и безваловые приемные и сматывающие устройства, высокоскоростные намоточные станки, станки для намотки кабеля и проволоки в бухты, а также гусеничные тянущие устройства и специализируются на проектировании и разработке специализированного погрузочно-разгрузочного оборудования для производителей и дистрибуторов проволочно-кабельных изделий, стальных канатов, а также другой продукции.

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Tulsa Power Inc – США
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Контракт на поставку устойчивого к ледовым нагрузкам кабеля для эксплуатации в Баренцевом море

Компания «Нексанс» (Nexans) получила контракт на сумму 6 млн. евро от крупнейшего судостроительного предприятия России, ОАО «Севмаш», на разработку конструкции, производство и поставку устойчивого к низким температурам и ледовым нагрузкам инструментального, контрольного и силового кабеля для морской ледостойкой стационарной нефтепромысловой платформы «Приразломная» в Баренцевом море.

Платформа «Приразломная» построена специально для разработки «Приразломного» нефтяного месторождения и является первым проектом по добыче нефти на арктическом шельфе России. Этот район характеризуется экстремально низкими температурами и высокими ледовыми нагрузками: только 110 дней в году безо льда, среднегодовая температура составляет –4 ºС, а в зимний период она может опускаться до –50 ºС. Суровые условия эксплуатации требуют уникального сочетания технических решений с точки зрения конструкции кабеля для морских работ, которые должны обеспечить морозоустойчивость, а также пожаробезопасность, низкий уровень дымовыделения и отсутствие галогенов.

▼ *Платформа «Приразломная» будет производить до 22000 тонн нефти и 1 млн. кубометров газа в сутки*

Специальные кабели для ОАО «Севмаш» общей длиной около 850 км будут производиться на корейском предприятии «Нексанс Кукдонг электрик уайр ко» (Nexans Kukdong Electric Wire Co), специализирующемся на данных типах кабеля. Производство уже началось, и поставка кабелей будет проводиться до конца 2011 года.

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Заказ из Турции

«Раутомед лтд» (Rautomead Ltd) получила от компании «Элсан электрик геречиери СА» (Elsan Elektrik Gerecieri SA) из г. Денизли (Турция) твердый заказ на поставку литейно-прокатного агрегата для производства медной катанки RS 3000/6, который будет использоваться для изготовления эмалированной проволоки.

Для производителей медной катанки опыт компании «Раутомед» в области технологий нагрева в графитовых тигельных печах и печах сопротивления весьма полезен. Система герметизации из углеродистого материала выступает в качестве сильной восстановительной среды и предупреждает риск попадания частиц огнеупорной керамики в медный расплав. Указанные факторы обеспечивают получение бескислородной медной катанки высочайшего качества.

Компания «Элсан» создаст свою собственную рабочую площадку и систему загрузки катодов, но в соответствии с расчетами «Раутомед». Фирменные компоненты стандартных моталоккатанкиоткомпании«Раутомед» будут поставляться в комплектах для местной сборки.

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Соединение оптоволоконных лент в кабелях с центральной трубкой

Патрик Ван Викль, Линдси Александер, Стив Стоукс (компания «Сумитомо электрик лайтуэйв»)

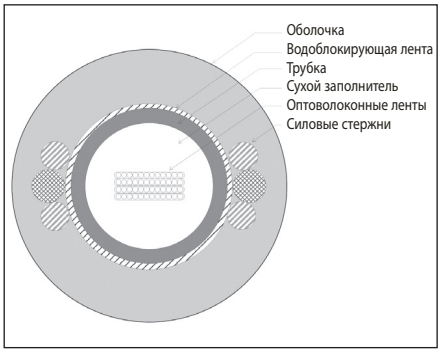
Аннотация

Появление сухого ленточного кабеля с центральной трубкой привело к усложнению задачи оценки основных технических параметров кабельных изделий, которые не требуются для кабелей с гелезаполненной центральной трубкой. При разработке новых методов и критериев испытаний важно напрямую соотносить эти методы и критерии с функциональными требованиями, предъявляемыми к кабельным изделиям. Одной из самых сложных задач является соединение оптоволоконных лент.

В результате всесторонних экспериментальных и теоретических исследований продемонстрировано, что абсолютная величина коэффициента соединения лент не обеспечивает эксплуатационных параметров кабеля; при этом исследования указывают на то, что применительно к некоторым конструкциям избыточно высокая величина коэффициента соединения может привести к неблагоприятным последствиям. Для каждой кабельной конструкции и «сухой» технологии оптимизация ленточного соединения должна производиться в ходе испытаний, непосредственным образом связанных с нагрузками, которым кабель подвергается в реальных условиях в течение его эксплуатационного ресурса.

1. Введение

Сухие ленточные кабели с центральной трубкой были впервые представлены в 2001 году [1]. С тех пор были предложены различные методы для предотвращения попадания воды в центральную трубку, однако во всех конструкциях в качестве заменителя геля в центральной трубке используется полимерный заполнитель со сверхвысокой абсорбционной способностью (см. рис. 1).



▲ **Рис. 1.** *Вид сухого ленточного кабеля с центральной трубкой в разрезе*

Для данных кабельных конструкций ключевым преимуществом является экономия времени и материалов при подготовке кабеля. Однако в отрасли возникло понимание того, что в случае использования новой конструкции может потребоваться изучение новых проблем обеспечения ее работоспособности [1, 2, 3].

Был разработан исчерпывающий перечень испытаний на надежность, который включал в себя испытания на стойкость к водопроницаемости при длительном сроке эксплуатации, испытания на стойкость к водопроницаемости при длительном сроке эксплуатации в условиях повышенной влажности и испытания на стойкость к водопроницаемости при многократном воздействии.

Помимо проведения различных испытаний на стойкость к водопроницаемости и внутреннюю морозостойкость может потребоваться решение проблемы смещения оптоволоконных лент. Установленные кабельные системы, вероятно, будут подвергаться воздействию внешних факторов и нагрузок, создающих вибрацию или смещение, на протяжении своего эксплуатационного ресурса. Такие условия могут привести к нежелательному смещению оптоволоконных лент. Например, было продемонстрировано, что в кабелях с малой величиной усилия сочленения оптоволоконных лент с центральной трубкой ленты в условиях автоколебаний могут выйти из трубки [2].

В результате предпринятых усилий специалистам отрасли удалось согласовать параметры серии функциональных испытаний, связанных с моделированием реальных условий, в которых кабель может находиться при установке и в период эксплуатации. Основное внимание было уделено методам проведения испытаний и определению допустимых параметров для ленточного соединения, при которых обеспечивается защита кабеля от действующих на него больших деформационных нагрузок.

В последующих разделах приводится обсуждение каждого из условий с последующим описанием методов испытаний, которые могут использоваться для проверки соответствия кабельных изделий этим условиям. Кроме того, рассматриваются результаты экспериментальных исследований для приведенных методов проведения испытаний.

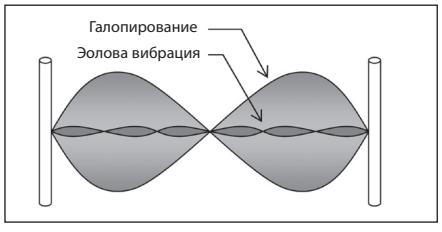
2. Условия эксплуатации и параметры окружающей среды

Условия, которые могут сопутствовать эксплуатации кабеля в течение срока его службы, ранее обсуждались в различных работах [4, 5, 6]. Для целей настоящей работы они разделены на две категории: условия эксплуатации при вибрационных и высоких деформационных нагрузках.

2.1 Автоколебания под действием ветра и вибрация из окружающей физической среды

Воздушная кабельная линия может подвергаться вибрации двух типов: галопированию («пляске») и эоловой вибрации. Указанные типы вибрации различаются по частоте и амплитуде. Галопирование представляет собой вибрацию, характеризующуюся высокой амплитудой и низкой частотой колебаний. Эолова вибрация отличается высокой частотой и очень низкой амплитудой колебаний, равной примерно половине величины диаметра кабеля. Оба типа вибрации проиллюстрированы на рис. 2.

При определенных условиях может возникать галопирование воздушного кабеля с несущим тросом, поэтому для каждого конкретного условия требуется проведение испытаний. По своему характеру эолова вибрация – явление, редко встречающееся на воздушных кабельных линиях с несущим тросом. Системы с несколькими степенями свободы обычно отличаются слишком высоким уровнем демпфирования, чтобы резонансные колебания на участке между опорами могли развить амплитуду, равную половине величины диаметра кабеля. Несмотря на низкую вероятность развития резонанса воздушного кабеля с несущим тросом до уровня частот, требуемого для возникновения эоловой вибрации, этот кабель может воспроизводить вибрацию из окружающей физической среды, возникающую от таких источников, как участки железнодорожного полотна или автомобильной трассы на мостах или крутых уклонах.



▲ **Рис. 2.** *Режимы вибрации кабеля*

2.2 Деформационные нагрузки

Деформационные нагрузки могут быть обусловлены целым рядом различных обстоятельств. В большинстве случаев деформационные нагрузки в кабеле возникают при его установке. После установки кабель также подвергается циклической деформации в результате воздействия гололедной нагрузки или случайного вскрытия при производстве землеройных работ. В каждом случае существенное значение имеет величина смещения оптоволоконных лент. Проблема заключается в том, что смещение оптоволоконных лент не передается на всю длину кабеля, а выбирает всю избыточную длину оптоволоконной ленты и, как следствие, ведет к повреждению волокна. Технология монтажа требует оставлять свободные кабельные петли, что является идеальным способом фиксации лент к кабелю в случае возникновения предельных деформационных нагрузок.

Однако, как отмечается в последующих разделах, вероятность того, что деформация кабеля, обусловленная указанными условиями, приведет к возникновению разрушающей нагрузки на оптоволоконную ленту, весьма мала.

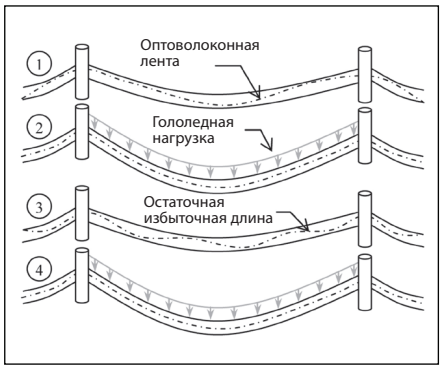
2.2.1 Гололедная нагрузка

Волоконно-оптический кабель, используемый в регионах, в которых возможно образование льда, должен обладать устойчивостью к нагрузкам и деформации растяжения, которым он может подвергаться. Национальный свод правил США по безопасному устройству электроустановок (NESC) описывает возможные сценарии образования льда и ветровых режимов по регионам страны [7]. На основании этих данных можно рассчитать величину удлинения кабеля, находящегося в указанных условиях, а также прогнозировать результирующее удлинение оптоволоконных лент.

В условиях гололедной нагрузки происходит удлинение кабеля. Если удлинение кабеля превысит величину характерной избыточной длины оптоволоконной ленты кабеля, произойдет втягивание ленты с соседнего участка кабельной сети, как показано в пп. 1 и 2 на рис. 3.

В случае превышения величиной удлинения кабеля под действием нагрузки величины характерной избыточной длины оптоволоконной ленты на всех соседних участках между опорами лента может оказаться сильно натянутой за счет использования свободных петель или запаса в кассетах, если свободных петель нет.

Это условие распространяется как на кабели с гелезаполненными трубками, так и на сухие кабели. По мере ослабления гололедной нагрузки в ленте, выбранной с соседних участков кабельной сети, образуется новая, постоянная избыточная длина оптоволоконной ленты кабеля, как показано в п. 3 на рис. 3. При последующем воздействии гололедной нагрузки кабель будет удлиняться, однако ввиду уже существующей избыточной длины оптоволоконной ленты, равной длине кабеля в деформированном состоянии, дополнительного «втягивания» ленты на этот участок происходить не будет (см. п. 4 на рис. 3). Фактически кабель достиг нового положения равновесия.



▲ **Рис. 3.** *Режимы гололедных нагрузок*

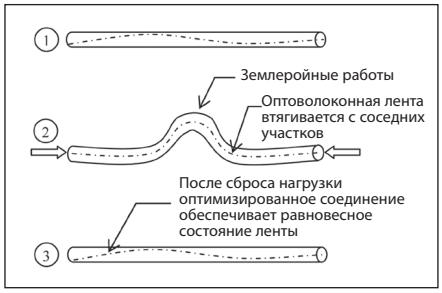
После изучения этого процесса может быть проведен анализ величины удлинения кабеля, полученной избыточной длины оптоволоконной ленты и прочности кабельной конструкции. При выполнении расчета стрелы провеса для данных сценариев с учетом длины воздушного кабеля с несущим тросом и длины пролета между опорами в самом неблагоприятном варианте полученная величина удлинения кабеля составила менее 0,05 % в условиях высоких гололедных нагрузок, предусмотренных нормативами NESC [8]. Исходя из этих данных, необходимо убедиться в том, что кабельная конструкция позволяет обеспечить такую избыточную длину оптоволоконной ленты без потерь на затухание и без повреждения оптических волокон. Величина характерной избыточной длины оптоволоконной ленты рассчитана с превышением указанной величины удлинения кабеля.

2.2.2 Землеройные работы на участке кабельной линии

Время от времени кабель может быть по ошибке выкопан экскаватором или другим землеройным оборудованием, если перед началом работ не соблюдены надлежащие меры предосторожности. Когда это происходит, на весьма ограниченном участке кабельной линии между опорами возникают высокие деформационные напряжения. По предварительным расчетам, длина участка в напряженно-деформированном состоянии составляет от 5 до 50 м [4]. На этом участке кабель обычно демонтируется и заменяется на новый.

Возникает вопрос о том, какое непосредственное действие оказывает высокая деформационная нагрузка на соседние участки кабельной линии. Согласно оценке подвергнутого деформационному напряжению кабельного участка длиной 50 м, при нагрузке, приближающейся к пределу прочности на разрыв для большинства кабельных конструкций, оптоволоконная лента втягивается с

соседних участков и в действительности может оказаться сильно натянутой за счет свободных петель как в случае с сухим кабелем, так и в случае с кабелем с гелезаполненной трубкой. Способность кабеля и оптоволоконной ленты выдерживать такое напряжение зависит от кабельной конструкции, характерной избыточной длины оптоволоконной ленты и длины соседнего участка кабельной линии. Установленная муфта, вне зависимости от ее типа, не допускает или, наоборот, обеспечивает передачу деформационной нагрузки, действующей на ленту, по всей длине кабеля, а также не допускает или обеспечивает достижение кабелем равновесного состояния после сброса нагрузки. Это проиллюстрировано на рис. 4.



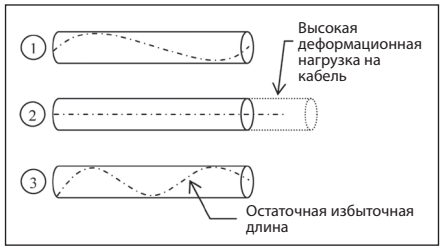
▲ **Рис. 4.** *Деформационные нагрузки при землеройных работах*

Кабель с трубкой, заполненной вязкоупругим гелем, обладает уникальной способностью обеспечивать как соединение оптоволоконных лент с кабелем, так и их релаксацию с течением времени. Для достижения равновесного состояния может потребоваться длительное время, более длительное, чем это предусмотрено для предлагаемых скоростей вытягивания при испытаниях кабельных соединений. Температура геля также играет большую роль применительно к силе сопротивления поверхностного трения, действующего на ленты, и может в существенной мере повлиять на скорость релаксации. Сухой связующий агент не обладает таким свойством. Деформационные нагрузки на кабель, в результате которых прилагаемая сила превосходит величину усилия сочленения сухого кабеля, что в данном варианте практически обязательно имеет место, могут не позволить достичь равновесного состояния на соседних участках линии. По этой причине рискованно устанавливать прямую корреляцию с гелезаполненной муфтой и столь важно проводить тестирование, связанное с оценкой эксплуатационного ресурса кабеля в реальных условиях.

2.2.3 Монтаж

В процессе монтажа на ограниченный участок кабельной линии действуют высокие деформационные нагрузки. По имеющимся сообщениям, в некоторых кабельных конструкциях это приводит к тому, что ленты остаются неподвижными в момент вытягивания кабеля по их поверхности, как показано на рис. 5. После снятия нагрузки действие растягивающего усилия на открытые концы лент прекращается, поэтому некоторая часть длины ленты остается внутри кабеля. Отсутствие видимых концов лент на срезе кабеля после завершения протяжки кабеля, скорее всего, должно послужить тревожным сигналом для монтажника!

Данное особое условие в отношении концов лент действует и в случае использования некоторых кабельных конструкций с гелезаполненной центральной трубкой при определенных условиях монтажа. Решение заключается в удалении небольшого участка оболочки кабеля, обычно менее 1 м длиной, для извлечения лент. Здесь вновь возникает вопрос о том, каким образом данное условие влияет на участок кабельной линии в целом.



▲ **Рис. 5.** *Деформационная нагрузка при монтаже*

Ответ можно найти, исходя из тех же факторов, которые были упомянуты выше: кабельной конструкции, начальной избыточной длины оптоволоконной ленты и типа соединения. Очевидно, если кабельная конструкция была такой, что в результате нагрузки при монтаже никакого деформационного напряжения в кабеле не возникло, то проблемы со смещением оптоволоконных лент не существует, однако это приводит к увеличению размеров, избыточной жесткости и росту себестоимости кабеля. Ключевым фактором является обеспечение баланса между надежностью кабельной конструкции и оптимальными параметрами соединения.

3. Разработка функциональных испытаний

3.1 Испытания на вибростойкость

Испытания, которые наиболее точно моделируют высоко- и низкочастотную вибрацию, отмечаемую при галопировании и вибрации из окружающей физической среды, предусмотрены методикой проведения испытаний IEEE 1222 для диэлектрических самонесущих кабелей (ADSS) [9]. В последнее время основным объектом исследований была реакция на низкочастотную вибрацию при испытаниях в режиме галопирования, однако испытания на устойчивость к высокочастотной эоловой вибрации также могут дать важные сведения.

Для проведения этих испытаний был подвешен самонесущий кабель, к которому была приложена деформационная нагрузка, в два раза превышающая его расчетную нагрузку при монтаже, в обеспечение требований, установленных для испытательного стенда. Тем не менее, схема испытаний допускает вибрацию на значительном участке кабеля между опорами с частотой колебаний, аналогичной той, которая может иметь место при монтаже кабельной линии вблизи железнодорожного полотна или автомобильной трассы. Продолжительность испытаний также значительна – 100 млн. циклов.

3.2 Ленточное соединение и методы испытаний на устойчивость к деформационным нагрузкам

Метод проведения испытаний, опубликованный крупным провайдером телекоммуникационных услуг, предусматривает использование неподвижно закрепленного образца кабеля длиной 30 м. Ленты из кабеля затем закрепляются на нагрузочной раме, при этом ведется контроль усилия, требуемого для начала смещения лент внутри оболочки и центральной трубки закрепленного в неподвижном положении образца кабеля [10]. Минимальное усилие, требуемое для прохождения испытаний, установлено на уровне фиксированной величины в 0,036 фс *(фс = фунт-сила)*, умноженной на число волокон в кабеле.

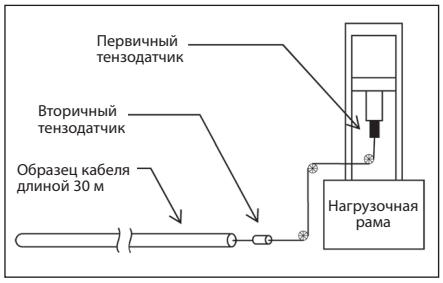
Применительно к отдельным кабелям, в особенности к кабелям с меньшим числом волокон, возник ряд вопросов, касающихся взаимодействия испытательной аппаратуры с учетом внутреннего трения вращающихся шкивов.

Было предложено решение, предусматривающее поднятие образца кабеля с поверхности земли на лоток, чтобы попытаться убрать хотя бы один шкив. В рамках другого решения предложено установить второй тензодатчик, разместив его непосредственно в одну линию с образцом кабеля.

Также ведется контроль данных тензодатчика нагрузочной рамы, при

этом рама обеспечивает управление скоростью перемещения, которая при данном методе испытаний установлена на уровне 100 ± 25 мм в минуту, однако абсолютное значение нагрузки показывает интегрированный в линию вторичный тензодатчик.

Указанное оборудование представлено на рис. 6.



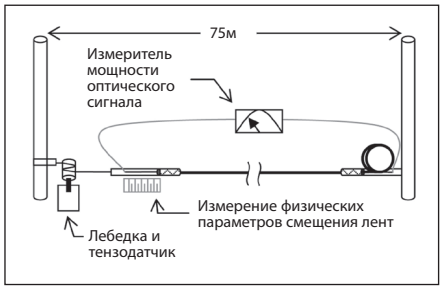
▲ **Рис. 6.** *Аппаратура для тестирования ленточного соединения*

Данная модернизация малогабаритной установки для тестирования кабеля позволяет получить более точные результаты измерения величины усилия сочленения, однако требовалось провести испытания, в рамках которых можно было бы обеспечить высокую деформационную нагрузку.

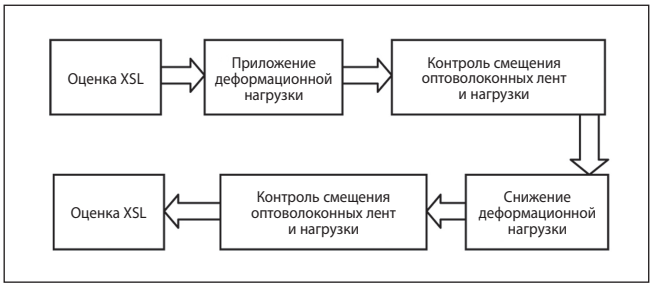
С помощью электрической лебедки и тензодатчика кабель между двумя анкерными опорами, установленными друг от друга на расстоянии 75 м, был подвергнут воздействию деформационной нагрузки.

После того, как кабель был осторожно зажат в неподвижном положении, ленты с обоих концов были оголены и подсоединены к измерителю мощности оптического сигнала, работающему на длине волны 1550 нм.

При этом ленты размещались таким образом, чтобы можно было измерить физическую величину линейного перемещения на одном конце, в то время как другой конец был сложен в свободные петли для моделирования реальных условий эксплуатации. Аппаратура для испытаний кабеля на деформационную нагрузку представлена на рис. 7.



▲ **Рис. 7.** *Аппаратура для испытаний кабеля на деформационную нагрузку*



◄ **Рис. 8.** *Процедура испытаний оптоволоконной ленты на деформационную нагрузку*

До начала и по окончании испытаний кабеля на деформационную нагрузку проводятся испытания образца кабеля для определения избыточной длины оптоволоконной ленты (XSL), чтобы исключить возможность искажения результатов за счет избыточной относительной разницы длин лент и кабеля.

Затем образец кабеля проходит остальные этапы процедуры испытаний, показанной на рис. 8.

Коэффициент заполнения в месте соединения	Число волокон	Количество лент
19%	12	1
24%	12	1
25%	60	5
29%	48	4
36%	48	4
37%	144	12
38%	108	9
41%	96	8
45%	144	12
51%	12	1
56%	48	4

▲ **Таблица 1.** *Образцы кабеля для оценки качества соединения*

4. Контрольные образцы кабеля

Для получения полного понимания процессов соединения было испытано большое количество образцов кабеля.

В некоторых случаях в качестве образцов использовались разновидности кабелей из предлагаемого в настоящее время ассортимента продукции, в других же случаях образцы были специально изготовлены для обеспечения максимальной разрешающей способности измерений.

Коэффициент заполнения в месте соединения, т.е. отношение площадей сечения заполненного пространства и центральной трубки, стал параметром, который использовался при проведении данной оценки.

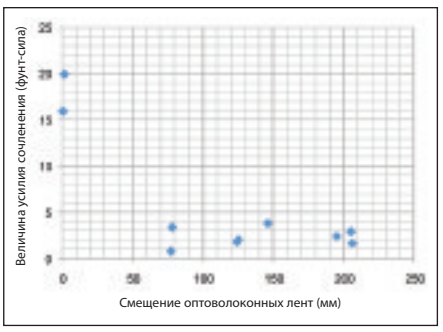
5. Результаты экспериментальных исследований

5.1 Эолова вибрация

Ранее проведенные исследования эоловой вибрации показали, что она не вызывает постоянного затухания сигнала или значительного смещения оптоволоконных лент [3].

5.2 Смещение оптоволоконных лент под действием деформационной нагрузки в зависимости от величины усилия сочленения

Для подтверждения корреляции между величиной усилия сочленения и смещением оптоволоконных лент величина усилия сочленения, измеренная с помощью нагрузочной рамы, была сопоставлена с величиной смещения оптоволоконных лент, зарегистрированной с использованием аппаратуры для испытаний на деформационную нагрузку.



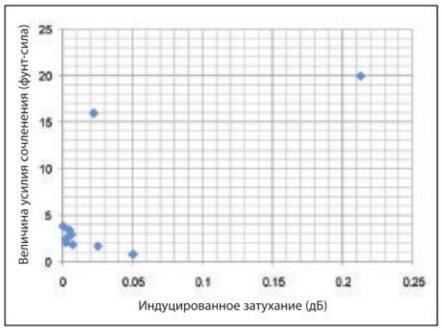
▲ **Рис. 9.** *Процедура испытаний оптоволоконной ленты на деформационную нагрузку*

Рис. 9 наглядно показывает, что на уровне, превышающем пороговое значение усилия сочленения, смещение оптоволоконных лент носит безусловно замедленный характер.

Ниже указанного порога величина усилия сочленения не является точным индикатором смещения оптоволоконных лент.

5.3 Зависимость усилия сочленения и индуцированного затухания

Следующим фактором, который представлял интерес, стала зависимость между величиной изменения затухания, индуцированного после сброса нагрузки при испытаниях с использованием высокого деформационного напряжения, и величиной усилия сочленения, измеренной с помощью нагрузочной рамы.



▲ **Рис. 10.** *График зависимости индуцированного затухания при сбросе нагрузки от величины усилия сочленения*

На рис. 10 наглядно показано, что при очень большой силе сочленения, когда смещение оптоволоконных лент составляет всего несколько миллиметров, существует вероятность существенного роста затухания. Большая сила сочленения препятствует перераспределению или релаксации лент.

Единственное частное значение, иллюстрирующее этот феномен, не указывает на то, что дело всегда обстоит именно так.

Для того чтобы более точно определить величину сочленения и конкретные условия, которые могли вызвать такой эффект, потребовались бы дополнительные испытания при данном уровне сочленения. Указанный эффект возник при использовании кабеля с числом волокон 48 шт., состоящего из четырех 12-волоконных лент.

В отличие от кабелей с гелезаполненной трубкой, в сухих ленточных кабелях с центральной трубкой отсутствует возможность фиксации лент в единой стопке.

Возможной причиной является то, что обеспечение защиты от выпучивания зависит от наличия единой стопки лент, и данное условие также может проявляться и в кабелях с бóльшим числом волокон.

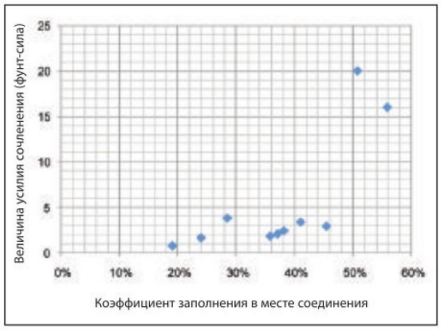
Уровень сочленения, на котором начинается проявляться указанный эффект, выше, чем это допускается существующими нормами проектирования для серийно выпускаемых кабельных изделий данной конструкции.

Для обеспечения надежности конструкции был введен новый параметр, который устанавливает взаимосвязь площади сечения заполненного пространства в трубке с площадью сечения имеющегося пространства.

Для ограничения индуцированного затухания следовало бы установить верхний предел для этого нового параметра – коэффициента заполнения в месте соединения.

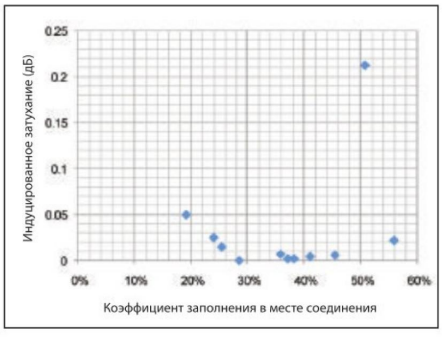
5.4 Коэффициент заполнения в месте соединения

Достоверность нового параметра, т.е. коэффициента заполнения в месте соединения, была проанализирована с учетом результатов экспериментальных исследований.



▲ **Рис. 11.** *График зависимости коэффициента заполнения в месте соединения и величины усилия сочленения*

Согласно графику на рис. 11, при коэффициенте заполнения в месте соединения, равном приблизительно 50 %, водоблокирующие элементы начинают сжиматься и обеспечивать значительно большее усилие сочленения. Это указывает на то, что существует некое пороговое значение, ниже которого данный параметр не коррелирует с величиной усилия сочленения.



▲ **Рис. 12.** *График зависимости коэффициента заполнения в месте соединения и индуцированного затухания*

Для этой кабельной конструкции линейной зависимости величины усилия сочленения не существует.

Наконец, рис. 12 наглядно свидетельствует о необходимости установления коэффициента заполнения в месте соединения на уровне менее 50 %.

Ниже этого уровня все полученные значения затухания не превышают 0,05 дБ.

6. Выводы

Экономия расходов и времени на монтаж сухих кабелей с центральной трубкой является очевидной, и на предприятиях отрасли эти кабели получили высокую оценку.

Тем не менее, новая технология требует изучения, при этом необходимо разработать новые методы проведения испытаний.

С началом этих работ очень важно установить критерии, которые будут наилучшим образом отвечать функциональным требованиям для эксплуатации в полевых условиях. Базовая технология для сухих кабелей носит единый характер, однако результативность использования полимеров со сверхвысокой абсорбционной способностью разная, и не все кабельные конструкции ведут себя одинаково.

Для обеспечения наиболее устойчивых эксплуатационных параметров кабеля каждая конструкция должна проверяться на соответствие функциональным требованиям, в том числе по устойчивости к вибрации и высоким деформационным нагрузкам.

Результаты испытаний свидетельствуют о том, что данная конструкция сухого ленточного кабеля с центральной трубкой характеризуется надежностью.

В конструкциях, которые допускают смещение оптоволоконных лент при высокой деформационной нагрузке приблизительно до 200 мм, поддающегося измерению эффекта затухания не отмечается, что указывает на надежность кабеля, в котором обеспечен баланс параметров соединения и базовой конструкции кабеля.

Было продемонстрировано, что кабель с высокой степенью сочленения может характеризоваться потерями на затухание после воздействия высоких деформационных нагрузок.

Поскольку предполагается, что конструкция будет подвергаться деформационным нагрузкам, превышающим характеристики сочленения даже самого высокого уровня, во всех конструкциях совершенно необходимо обеспечить сбалансированность параметров ленточного соединения и общей конструкции кабеля.

Критерии соединения лент должны устанавливаться для каждой «сухой» технологии и кабельной конструкции отдельно.

Осуществляться эта задача должна посредством испытаний, непосредственным образом связанных с условиями, которым кабель, скорее всего, будет подвергаться в течение всего срока его эксплуатации. ■

7. Выражение признательности

Авторы выражают особую признательность Эми Уилсон и Мухаммаду Джиахи из лаборатории оптических систем компании «Сумитомо» за проделанную ими работу по сбору представленных здесь данных.

Авторы также выражают благодарность Дину Дэнси из отдела технологии производства компании «Сумитомо» за оказанное содействие в подготовке кабелей к испытаниям.

8. Справочная литература

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[2] D Seddon, A Miller, "Ribbon stack coupling in dry single-tube cables," Proceedings of the 52nd IWCS p182-187 (2003)

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[5] K Temple, A Bringuier, D Seddon, R Wagman, "Update: gel-free outside plant fiber-optic cable performance results in special testing," Proceedings of the 56th IWCS p561-566 (2006)

[6] R Norris, H Kemp, T Goddard, "The validity of emerging test techniques for the evolving outside plant cable design," Proceedings of the 56th IWCS p555-560 (2006)

[7] IEEE - National electric safety code, Rule 250 (2007)

[8] United States department of agriculture – rural utilities service, "The mechanics of overhead distribution line conductors," Bulletin 1724E-152 (2003)

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Настоящая работа была впервые представлена на 57-ой Конференции Международного симпозиума по кабелям и проводам (IWCS) и перепечатывается с разрешения организаторов.

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Commande de la Turquie

Rautomead Ltd a remporté une commande fixe de la société turque Elsan Elektrik Gerecieri SA de Denizli pour la fourniture d'une machine de coulée pour fil machine en cuivre RS 3000/6 destiné à la fabrication de fils émaillés.

L'expérience de Rautomead dans le secteur des creusets de graphite et de la technologie de chauffage au moyen de résistance électrique est très indiquée pour la production de fil machine en cuivre. Entièrement réalisé en carbone, le système de retenue fait fonction d'environnement très réductif et évite la contamination du réfractaire en céramique par le cuivre fondu.

Ces facteurs garantissent un fil machine de la plus haute qualité et sans oxygène.

Elsan réalisera sa plateforme de commande et l'alimentation des cathodes, qui seront toutefois conformes aux projets de Rautomead.

Les composants des bobineuses standard brevetés par Rautomead seront fournis sous forme de kits pour la production locale.

Rautomead Ltd – Royaume Uni
Fax: +44 1382 622941
Email: sales@rautomead.com
Website: www.rautomead.com

Fusion dans le secteur de la manutention des bobines

Tulsa Power Holdings Corporation a annoncé la fusion de Reel-O-Matic Inc et Tulsa Power Inc, sociétés spécialisées dans la fabrication d'équipements de manutention de bobines pour le traitement et la distribution de câbles, fils et autres matériaux flexibles.

Les sociétés maintiendront respectivement les installations de production d'Oklahoma City et Tulsa, situées en Oklahoma. Chaque installation maintiendra la totalité de son personnel clé avec Terry Simmons en tant que président de Reel-O-Matic, et Mike Spence en tant que directeur général de Tulsa Power.

Les sociétés produisent des équipements d'enroulement et de déroulement avec et sans dévidoir, des bobinoirs haute vitesse, des équipements d'enroulement et des chenilles de tirage et elles sont spécialisées dans la conception et dans le développement d'équipements de manutentions personnalisés pour les fabricants et les distributeurs de fils, câbles et câbles métalliques parmi d'autres produits.

Reel-O-Matic Inc – États-Unis
Website: www.reelomatic.com

Tulsa Power Inc – États-Unis
Website: www.tulsapower.com

Supraconducteurs pour le pôle stratégique du marché de l'énergie américain

American Superconductor Corporation (AMSC) a annoncé d'avoir sélectionné les canalisations pour les lignes électriques supraconductrices du projet Tres Amigas, le premier pôle stratégique du marché de l'énergie renouvelable du pays.

Les canalisations des lignes électriques supraconductrices comprennent des câbles d'alimentation supraconducteurs à courant continu du niveau de transmission alimentés par des câbles supraconducteurs à haute température (HTS) et des convertisseurs CA/CC de sources de haute tension de AMSC. Le projet Tres Amigas est le premier projet conçu pour relier les trois réseaux électriques américains (Eastern Interconnection, The Western Interconnection et The Texas Interconnection) ayant le but d'adopter plus rapidement une énergie renouvelable et d'augmenter la fiabilité du réseau d'alimentation électrique étasunien.

AMSC – États-Unis
Website: www.amsc.com

Contrat pour câbles résistants aux glaces en mer de Barents

Nexans a remporté auprès de Sevmach, premier chantier naval de Russie, un contrat de l'ordre de 6 millions d'euros portant sur le développement, la fabrication et la fourniture de câbles de commande, d'instrumentation et d'énergie résistants aux basses températures et aux glaces, destinés à la plate-forme pétrolière fixe Prirazlomnaya protégée contre la glace marine en mer de Barents.

La plate-forme Prirazlomnaya a été spécialement construite pour le développement du gisement de Prirazlomnoye et constitue le premier projet de production pétrolière sur le plateau continental arctique russe. Cette zone se caractérise par des températures extrêmement basses et des charges de glace élevées. Elle n'est libre de glace que 110 jours par an, la température y est de –4ºC en moyenne annuelle et peut descendre jusqu'à –50ºC en hiver. La rigueur du climat et les contraintes imposées par les fortes charges de glace exigent des technologies de câble marin spécifiques, offrant la combinaison optimale de résistance aux basses températures et au feu, de faibles émissions de fumée et d'absence d'halogène.

Les câbles spécifiques destinés à Sevmach, totalisant environ 850km, seront produits dans les installations spécialisées de Nexans Kukdong Electric Wire Co en Corée. La production a d'ores et déjà démarré et les livraisons se poursuivront jusqu'à la fin de 2011.

▲ *La plate-forme de Prirazlomnaya aura une capacité de 22 000 tonnes de pétrole et 1 million de mètres cubiques de gaz par jour*

Nexans – France
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Technologie de réglage adaptif du roulage des filetages

La précision, les processus stables et la détection précoce et efficace représentent des facteurs clés de la productivité. En tenant compte de cet aspect, la société EW Menn, en collaboration avec Brankamp, a associé le réglage adaptif du roulage des filetages au moyen de boutons-poussoirs de EW Menn à l'expérience de monitorage des processus de Brankamp pour créer la technologie ADM. ADM est le sigle de Adpative Die Match et décrit un système conçu pour le mesurage et l'évaluation électronique du réglage du roulage des filetages et le corrige automatiquement durant l'exploitation de la machine, sans interrompre le processus de production et sans exiger l'assistance de l'opérateur. Le monitorage du processus standard a lieu simultanément.

Le système ADM n'est disponible que sur les machines de EW Menn, en association avec les systèmes de contrôle du processus de Brankamp.

La société EW Menn est également engagée dans le secteur des applications spécifiques telles que le système de laminage à chaud permettant de réchauffer les pièces brutes immédiatement avant leur alimentation

▲ *Modèle AF61 de EW Menn équipé de système ADM*

dans les plaques pour rouler les filetages. Ce système développé à l'origine pour des applications aérospatiales utilisant du titane et des alliages très spécifiques, consent une majeure expansion du matériau, en permettant ainsi d'effectuer des processus de formage ne pouvant être obtenus sans chauffage et en étendant significativement les possibilités du processus de laminage de filières plates.

EW Menn GmbH – Allemagne
Fax: +49 2733 7781
Email: mail@ewmenn.de
Website: www.ewmenn.de

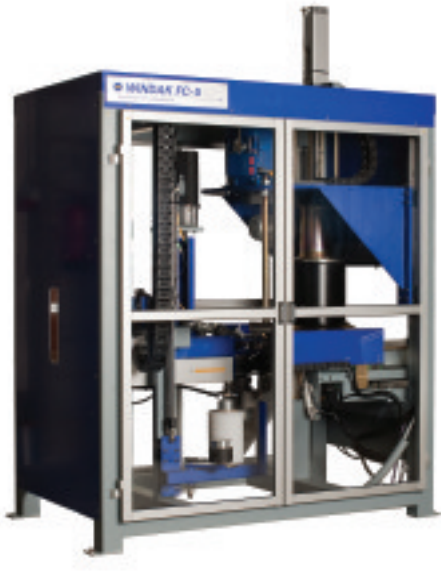
Nouvelle solution d'enroulement

Windak a annoncé que la première de ses bobineuses automatiques FC5 de nouvelle génération a été installée avec succès en Finlande.

D'après Urban Bollo, directeur général de Windak Sweden, la bobineuse flexible automatique FC5 est la première machine lancée par Windak faisant partie d'une nouvelle génération de solutions d'emballage automatique accessibles. "Nous voyons que le marché actuel exige des solutions économiques et amortissables dans des délais réduits avec une flexibilité et un rendement maximum".

La bobineuse FC5 est compacte et elle est conçue pour loger des câbles d'une ample gamme de diamètres et des bobines de dimensions différentes. L'enroulement s'effectue de façon entièrement automatique avec ou sans cercleuse ou lieuse.

En l'absence de cercleuse ou lieuse, la bobine est enroulée avec un film extensible avant la sortie de la tête d'enroulement.



▲ *Nouvelle bobine FC5 de Windak*

Windak – Suède
Email: info@windakusa.com
Website: www.windakusa.com

Partenariat informatique

Cimteq, fournisseur de logiciels de projet des câbles CableBuilder, a signé un accord de partenariat avec SAP pour améliorer la capacité de son logiciel de générer des rapports professionnels, des instructions de fabrication et des catalogues en ligne.

CableBuilder, utilisé par les fabricants de fils et câbles de par le monde pour la conception, la préparation d'offres, le calcul des coûts et l'élaboration de fiches techniques, aura à sa disposition un moteur de rapports intégré de Crystal Reports.

L'application Crystal Reports permet aux utilisateurs de CableBuilder de projeter des rapports interactifs et de les utiliser en tant que modèles pour formater les données de CableBuilder. Ces rapports peuvent être statiques ou interactifs et peuvent couvrir une large gamme d'utilisations allant des instructions de fabrication aux fiches techniques, à l'analyse des performances d'offre.

Nick Hirst, consultant en projets de Cimteq, a ainsi commenté l'intégration: "Crystal Reports a permis au client de générer des rapports d'instructions de fabrication avec un formatage optimisé et des informations plus précises, en réduisant ainsi les problèmes d'ambigüité et en éliminant quelques causes d'écart et de réélaboration des rapports."

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Website: www.cimteq.com

Composés flexible pour canalisations

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Raccordement à rubans pour câbles à noyau avec tube central

Par Patrick Van Vickle, Lindsey Alexander, Steve Stokes: Sumitomo Electric Lightwave

Résumé

L'introduction des câbles à rubans avec noyau (tube central) sec a lancé de nouveaux défis quant à l'évaluation des paramètres fondamentaux de ce type de câbles, qui ne sont pas requis pour les câbles avec un noyau rempli de gel.

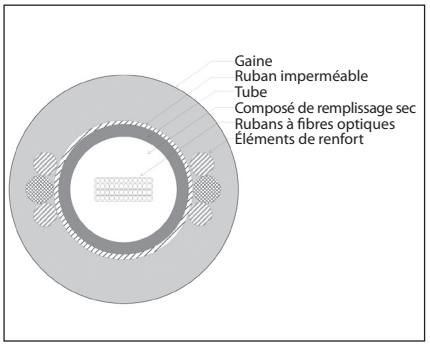
Lors du développement de méthodes et de critères d'essai nouveaux, il est important d'établir une corrélation directe entre la méthode et les critères d'essai et les exigences fonctionnelles du câble. Le raccordement du ruban a représenté l'un des secteurs d'étude les plus stimulants.

Grâce à une analyse expérimentale et théorique approfondie, il a été démontré qu'une valeur de raccordement absolue ne garantit pas les performances du câble; il a été également démontré que pour certaines configurations une valeur de raccordement excessivement élevée peut s'avérer nuisible. Pour chaque structure de câble et technologie de noyau sec, il faut déterminer un raccordement à ruban optimisé au moyen d'essais directement liés aux événements du cycle de vie effectif du câble.

1 Introduction

Les câbles à rubans avec noyau (tube central) sec furent introduis en 2001[1]. Des méthodes différentes ont été développées pour bloquer la pénétration de l'eau dans le noyau, mais pour la totalité des configurations l'on utilise un composé de remplissage à base de polymère super absorbant en remplacement du gel de remplissage dans le noyau comme illustré à la *Figure 1*.

L'économie de temps et de matériau dans la préparation du câble représente l'avantage principal de ces structures de câble. L'industrie a toutefois réalisé qu'avec cette nouvelle conception, il faudrait considérer de nouvelles hypothèses de performance[1,2,3] ce qui a amené au développement d'une liste complète d'essais de fiabilité. Ces essais comprennent l'essai de pénétration de l'eau stagnante, l'essai de pénétration de l'eau stagnante due à l'humidité et l'essai de pénétration répétée de l'eau. En plus des différents essais de pénétration de l'eau et de congélation interne, il est nécessaire de prendre en considération le problème du mouvement du ruban.



▲ **Figure 1**: *Section transversale du câble à rubans avec noyau (tube central) sec*

Durant leur cycle de vie, les câbles installés peuvent être exposés à des événements ou à des forces entraînant des vibrations ou des mouvements. Ces conditions peuvent causer des mouvements non désirés du ruban. Par exemple, il a été démontré que dans les câbles avec une force de raccordement réduite entre le ruban et le noyau, les rubans peuvent être exposés en cas d'oscillation galopante[2].

L'industrie a rejoint un accord concernant une série d'essais fonctionnels liés aux conditions réelles auxquelles un câble peut être soumis durant l'installation et le cycle de vie. L'objectif principal réside dans la méthode d'essai et dans les valeurs acceptables de force de raccordement pour protéger le câble des événements pouvant causer une déformation élevée. Les chapitres suivants analysent les différentes conditions et décrit les méthodes d'essai pour évaluer le câble dans ces conditions.

Enfin, les résultats expérimentaux obtenus avec des méthodes d'essais différentes sont également traités.

2 Applications et conditions environnementales

De nombreux articles[4,5,6] ont analysé précédemment les conditions auxquelles un câble peut être soumis durant son cycle de vie. Dans le présent article, ces conditions ont été distinguées en deux catégories: événements vibratoires et événements de déformation élevée.

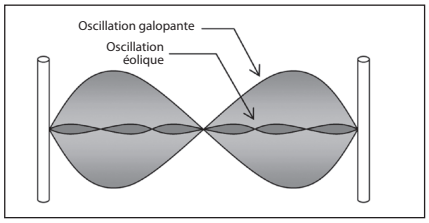
2.1 Oscillation galopante induite par le vent et vibrations environnementales

Un câble aérien peut être soumis à deux catégories principales de vibrations: galopante et éolique. Les deux catégories se distinguent en fonction de leur fréquence et de leur amplitude.

La vibration galopante est caractérisée par une grande amplitude et par une basse fréquence. La vibration éolique présente une fréquence élevée et une ampleur très réduite, approximativement la moitié du diamètre du câble. Ces deux types de vibrations sont illustrés à la *Figure 2*.

Un câble aérien ligaturé («*lashed*») peut présenter une oscillation galopante dans des conditions données; par conséquent il est important d'essayer ces conditions spécifiques.

Les conditions générant une vibration éolique sont rares en nature dans les installations de câbles aériens ligaturés. En général, les systèmes ayant plusieurs degrés de liberté présentent un amortissement excessif pour permettre des phénomènes de résonance dans une section de câble avec une amplitude égale à la moitié du diamètre du câble. Si d'un côté il est invraisemblable que le câble aérien ligaturé présente des phénomènes de résonance aux fréquences requises pour la vibration éolique, de l'autre il peut simuler la vibration environnementale de sources telles que les lits ferroviaires et routiers sur un pont ou sur une pente.



▲ **Figure 2**: *Conditions de vibration du câble*

2.2 Événements de déformation

Les événements de déformation peuvent se présenter dans des circonstances très différentes. La majorité des câbles se déforme durant l'installation.

Après l'installation, les câbles peuvent subir des déformations répétées dues à la charge causée par des formations de glace ou à des déterrements accidentels. Dans chaque cas, l'entité du mouvement du ruban est significative. En effet, il est essentiel que le mouvement du ruban n'entraîne vers le bas l'entière longueur du câble, en consommant la longueur en excès du ruban avec des dommages à la fibre.

Les procédures d'installation exigent l'utilisation de boucles de câble lâches qui représentent un moyen idéal de fixer le ruban au câble dans le cas d'un événement de déformation extrême.

Toutefois, comme l'on peut remarquer dans les chapitres suivants, il est hautement improbable que la déformation du câble causée par ces conditions entraîne des déformations nuisibles au ruban.

2.2.1 Charge due à la formation de glace

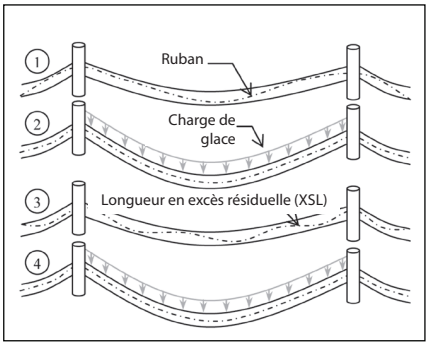
Le câble à fibres optiques installé dans les régions où les formations de glace sont probables, doit être conçu de manière à soutenir les charges et les allongements pouvant se vérifier. Le code national pour la sécurité électrique NESC (National Electric Safety Code) décrit les différentes conditions de formation de glace et de vent en fonction des régions du pays[7].

Grâce à ces informations, il est possible de calculer l'allongement d'un câble soumis à ces conditions et de prévoir tout élargissement conséquent du ruban.

Dans des conditions de charge due à la formation de glace, le câble s'allonge. Si l'allongement du câble dépasse la longueur en excès intrinsèque du ruban du câble, le ruban est tiré par une section de câble contigu, comme illustré à la *Figure 3* (points 1 et 2).

Si l'allongement du câble résultant de la charge dépasse la longueur en excès intrinsèque du ruban de la totalité des sections contiguës, il est possible que le ruban soit tendu contre les boucles lâches ou, en absence de ces dernières, contre les fermetures. Cette condition est valable pour les câbles remplis de gel et pour les câbles à noyau sec. Lorsque la charge de glace est libérée, le ruban tiré par les sections de câble contiguës, génère une nouvelle longueur de câble en excès permanent dans le câble (réf. *Figure 3*, point 3).

Durant l'événement de charge successive, le câble s'allonge; mais puisqu'il y a déjà une longueur en excès du ruban égale à la longueur de câble déformé, aucun autre câble ne sera tiré dans la section (réf. *Figure 3*, point 4). Le câble va essentiellement réaliser un nouvel équilibre.



▲ **Figure 3**: *Conditions de charge de glace*

Une fois ce processus compris, il est possible d'analyser l'entité de l'allongement du câble, la longueur en excès induite du ruban et la robustesse de la structure du câble. En effectuant les calculs caténaires pour ce type de situation et en considérant le "pire cas" de câble aérien ligaturé et de longueur de tronçon, l'on obtient un allongement inférieur à 0,05% dans des conditions de charge lourdes due à la formation de glace, conformément à la norme NESC[8].

La connaissance de ces données impose de s'assurer que la structure du câble est protégée de manière à loger la quantité de longueur de ruban en excès sans entraîner aucune perte d'atténuation ni aucun dommage aux fibres.

La valeur de la longueur en excès intrinsèque du ruban est conçue pour dépasser cet allongement du câble.

2.2.2 Déterrement du câble

Parfois le câble peut être déterré par erreur par une pelle rétrocaveuse ou par un équipement d'excavation similaire lorsque les précautions appropriées ne sont pas prises avant le début des travaux.

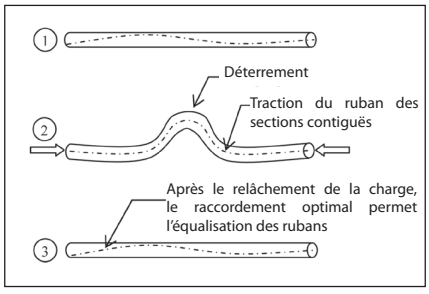
Dans ce cas, une section hautement localisée du tronçon du câble est soumise à une déformation élevée. Il a été calculé que la surface déformée est comprise entre 5m et 50m[4]. En général, cette section de câble est éliminée et remplacée.

On s'est interrogé sur l'effet de l'exposition directe à la déformation élevée sur les sections contiguës des câbles.

En considérant une section de câble de 50m soumise à déformation, une charge proche de la charge de rupture du ruban de la majorité des structures des câbles, entraîne une traction du ruban de la part des sections contiguës et peut effectivement tendre solidement les boucles lâches dans les câbles à noyau sec et dans les câbles remplis de gel.

La capacité du câble et du ruban d'absorber cette déformation dépend de la structure du câble, de la longueur en excès intrinsèque du ruban, et de la longueur de la section contiguë du câble.

Indépendamment du type de raccordement utilisé, ce dernier empêchera ou permettra de transmettre la déformation le long du câble, et empêchera ou permettra au câble de s'équilibrer après le relâchement de la charge. La *Figure 4* illustre cet événement.



▲ **Figure 4**: *Événements de déformation due au déterrement*

Le câble rempli de gel viscoélastique se distingue par sa capacité unique de raccorder les rubans au câble et permettre le relâchement de ces derniers dans le temps. Le temps requis pour s'équilibrer peut être long, supérieur aux vitesses de traction recommandées pour les essais de raccordement des câbles.

La température du gel joue également un rôle important dans le frottement visqueux imposé aux rubans et peut influencer considérablement la vitesse de relâchement. Les agents de raccordement secs ne présentent pas cette propriété.

Dans ce cas, il est vraisemblable que les déformations du câble générant une force supérieure à la force de raccordement à sec, empêchent le rééquilibrage des sections contiguës. Pour cette raison, une corrélation directe avec le raccordement rempli de gel est hasardée, les essais liés aux événements réels du cycle de vie du câble étant extrêmement importants.

2.2.3 Installation

Durant l'installation, une section localisée du câble est soumise à une déformation

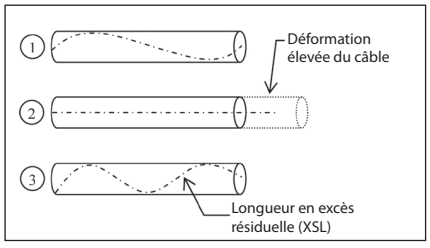
élevée. Il a été démontré que, dans cette situation, pour quelques structures de câbles, les rubans restent stationnaires durant la traction des câbles au-dessus de ces derniers (réf. *Figure 5*).

Une fois la charge relâchée, les rubans ne subissent aucune force de traction à l'extrémité opposée, et par conséquent une certaine longueur de ruban reste à l'intérieur du câble. Un installateur pourrait s'alarmer en voyant qu'il n'y a pas de rubans exposés à l'extrémité du câble une fois complétée la traction de ce denier!

Cette condition finale spécifique existe également pour certaines structures remplies de gel lorsqu'elles sont soumises à certaines conditions d'installation.

La solution consiste à éliminer une petite section du revêtement du câble, généralement inférieur à 1m, pour récupérer les rubans.

La question concernant les effets de cette condition sur la section du câble dans son ensemble se pose de nouveau.



▲ **Figure 5**: *Evénement de déformation durant l'installation*

La réponse réside dans les mêmes facteurs mentionnés précédemment: la structure du câble, la longueur initiale en excès du ruban et le raccordement.

Évidemment, si la structure du câble était réalisée de manière à éviter toute déformation due à la charge d'installation, il n'y aurait aucun problème de mouvement du ruban; toutefois, cela entraînerait un câble de grandes dimensions, extrêmement rigide et coûteux.

La solution réside dans une structure de câble robuste et dans un raccordement optimisé.

3 Développement d'essais fonctionnels

3.1 Méthode d'essai de vibration

Les essais simulant plus fidèlement la vibration de haute et basse fréquence relevée dans la vibration galopante et environnementale, sont décrits dans la méthode d'essai IEEE 1222 pour les câbles autoporteurs diélectriques (ADSS)[9].

Plus récemment, une attention particulière a été accordée à la réponse de la vibration à basse fréquence dans l'essai de vibration galopante; toutefois, également l'essai de vibration éolique à haute fréquence peut offrir des informations importantes.

Pour effectuer cet essai, le câble a été préparé de manière à être autoportant et ensuite déformé jusqu'à deux fois la charge d'installation pour répondre aux exigences de configuration de l'essai. Toutefois, l'essai permet effectivement de faire vibrer un tronçon de câble mesurable avec des fréquences similaires à celles pouvant se vérifier dans le tronçon de câble installé à proximité d'une ligne de chemin de fer ou routière. En outre, la durée de l'essai est considérable: 100 000 000 cycles.

3.2 Méthodes d'essai pour le raccordement du ruban et l'événement de déformation

La méthode d'essai publié par un important opérateur de télécommunications, utilise un échantillon de câble fixe de 30m.

Les rubans de ce câble sont appliqués à une structure de charge et la force requise pour démarrer le mouvement des rubans est contrôlée à l'intérieur de l'échantillon de la gaine et du noyau du câble fixe[10].

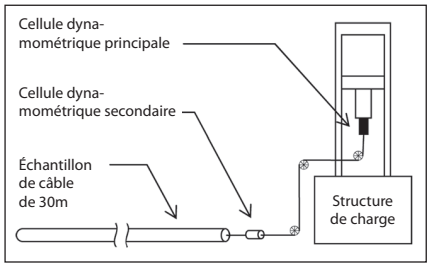
Une valeur fixe de 0,036lbf *(lbf = livre force)* fois le nombre de fibres dans le câble est la force minimale requise pour obtenir les résultats pour dépasser les résultats de l'essai.

Pour certains câbles, spécialement dans le cas d'un nombre de fibres réduit, des questions ont été posées au regard de l'interaction de l'appareil d'essai en considérant la friction intérieure des poulies. Une solution prévoyant le soulèvement de l'échantillon de câble du sol sur une console a été proposée afin d'éliminer au moins une poulie.

Une autre solution consistait à introduire une deuxième cellule dynamométrique, située directement en ligne avec l'échantillon de câble.

La cellule dynamométrique de la structure de charge est toujours contrôlée et la structure contrôle la vitesse fixée avec la méthode à 100 ± 25mm par minute, mais

▼ **Figure 6**: *Dispositif d'essai du raccordement du ruban*



c'est la cellule dynamométrique secondaire en ligne qui fournit la charge absolue. Cet appareil est représenté à la *Figure 6*.

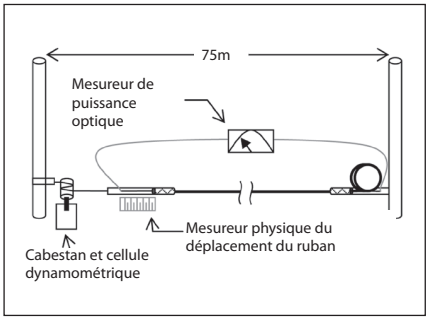
Cette modernisation de l'appareil d'essai du câble sur petite échelle contribue à garantir des résultats plus précis pour la force de raccordement, mais exige également un essai pour produire un événement de déformation élevée.

En utilisant un cabestan électrique et une cellule dynamométrique, un câble a été déformé entre deux pôles ancrés, à une distance de 75m l'un de l'autre.

En saisissant soigneusement le câble, les rubans ont été exposés aux deux extrémités et raccordés à un mesureur de puissance optique à 1 550nm.

En outre, les rubans ont été placés de manière à effectuer la mesure du mouvement linéaire physique à une extrémité, alors que l'autre extrémité a été placée dans des boucles lâches pour simuler les conditions en milieu réel.

L'appareil d'essai de déformation du câble est illustré à la *Figure 7*.

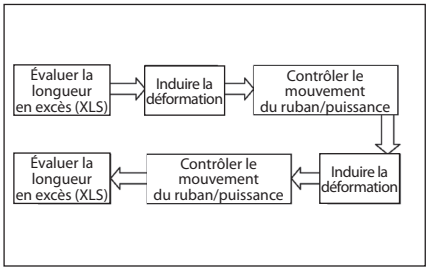


▲ **Figure 7**: *Appareil d'essai de l'évènement de déformation du câble*

Avant de commencer et une fois complété l'essai de l'événement de déformation du câble, il est nécessaire d'essayer la longueur en excès du ruban (XLS) de l'échantillon de câble pour éviter qu'une excessive différence entre la longueur en excès du ruban et la longueur du câble influence les résultats.

L'échantillon de câble est donc soumis à la procédure d'essai décrite à la *Figure 8*.

▼ **Figure 8**: *Opérations d'essai de l'événement de déformation du ruban*



Taux de remplissage du raccordement	Nombre de fibres	Nombre de rubans
19%	12	1
24%	12	1
25%	60	5
29%	48	4
36%	48	4
37%	144	12
38%	108	9
41%	96	8
45%	144	12
51%	12	1
56%	48	4

▲ **Tableau 1**: *Échantillons de câble pour l'évaluation du raccordement*

4 Échantillons d'essai du câble

Pour atteindre une compréhension approfondie du phénomène de raccordement, on a essayé un grand nombre d'échantillons de câble.

Certains échantillons étaient des versions couramment offertes dans la ligne de produits existant déjà; d'autres étaient des câbles réalisés sur demande pour obtenir les meilleurs résultats de l'essai.

Le taux de remplissage du raccordement, c'est-à-dire le pourcentage de la zone remplie par rapport à la zone du noyau, a été l'un des paramètres appliqués pour cette analyse.

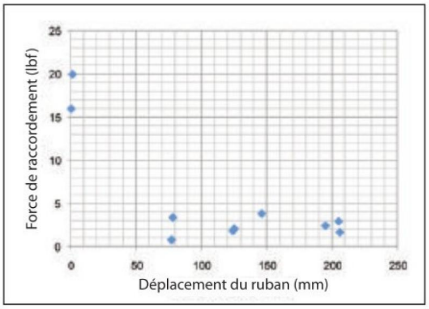
5 Résultats des essais expérimentaux

5.1 Vibration éolique

La vibration éolique a été examinée précédemment et actuellement elle ne présente aucune atténuation permanente ni aucun déplacement significatif du ruban[3].

5.2 Déplacement du ruban dû à un événement de déformation par rapport à la force de raccordement

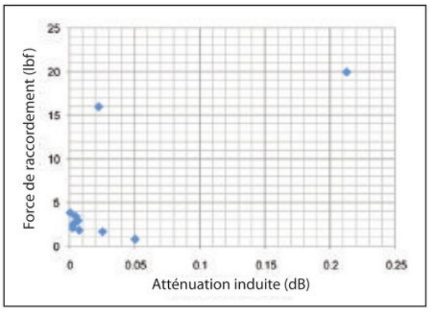
Pour valider la corrélation entre la force de raccordement et le déplacement du ruban, la force de raccordement mesurée en utilisant la structure de charge a été comparée avec le déplacement du ruban observé en utilisant l'appareil employé pour l'événement de déformation. La *Figure 9* démontre qu'au-delà du seuil de la force de raccordement, le déplacement du ruban est certainement retardé. Au-dessous de ce seuil, la force de raccordement n'est pas un indicateur satisfaisant du déplacement du ruban.



▲ **Figure 9**: *Déplacement du ruban par rapport à la force de raccordement*

5.3 Force de raccordement par rapport à l'atténuation induite

On a examiné ensuite l'entité de la variation d'atténuation causée par le relâchement de la charge, à la suite d'un événement de déformation élevée, par rapport à la force de raccordement obtenue au moyen de l'appareil de la structure de charge.



▲ **Figure 10**: *Atténuation induite au relâchement de la charge par rapport à la force de raccordement*

La *Figure 10* démontre qu'une force de raccordement très élevée entraînant un déplacement du ruban de seulement quelques millimètres, peut amener à une augmentation considérable de l'atténuation.

La force de raccordement élevée ne permet pas une redistribution ni un relâchement des rubans.

Les données illustrant ce phénomène n'indiquent pas que cette situation se vérifie constamment. Des essais supplémentaires seraient nécessaires à ce niveau de raccordement pour déterminer plus précisément l'entité de la force de raccordement et les circonstances exactes causant ce problème.

Cet événement spécifique a été vérifié avec un câble de 48 fibres pourvu de quatre rubans de 12 fibres.

Contrairement aux câbles remplis de gel, les câbles à ruban à noyau sec ne sont pourvus d'aucun moyen pour maintenir les rubans dans une pile uniforme.

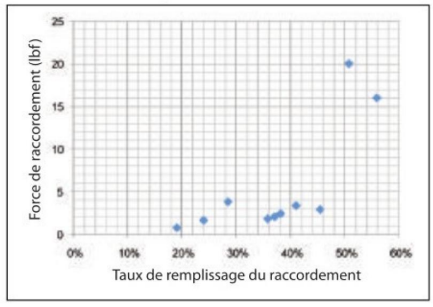
Il est supposé que les caractéristiques anti-pliage dépendent de l'uniformité de la pile de rubans et cette condition peut se présenter également dans le cas de câbles avec un nombre supérieur de fibres.

Le niveau de la force de raccordement qui est à l'origine de ce phénomène et supérieur à la limite consentie par les structures des câbles de ce type actuellement commercialisées.

Pour assurer une structure robuste, on a établi un nouveau paramètre de configuration créant une relation entre la zone remplie du noyau et la surface disponible. Il faut établir une limite supérieure pour ce nouveau paramètre, c'est-à-dire le taux de remplissage du raccordement, pour limiter l'atténuation induite.

5.4 Taux de remplissage du raccordement

La validité du nouveau paramètre du taux de remplissage a été analysée par rapport aux résultats expérimentaux.



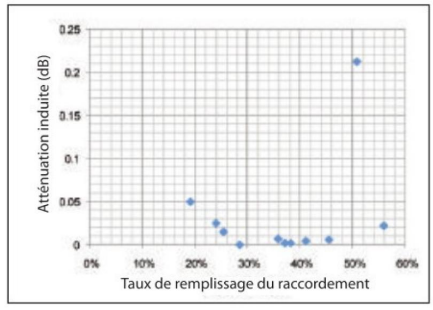
▲ **Figure 11**: *Taux de remplissage du raccordement par rapport à la force de raccordement*

La *Figure 11* montre qu'à 50% environ du taux de remplissage du raccordement, les éléments de blocage de l'eau commencent à se comprimer et à exercer une force de raccordement décidément supérieure.

Cela indique qu'il y a un seuil au-dessous duquel ce paramètre n'est pas en relation avec la force de raccordement. Aucune relation linéaire de la force de raccordement n'existe pour cette structure de câble.

Enfin, la *Figure 12* démontre la nécessité de fixer le paramètre du taux de remplissage

▼ **Figure 12**: *Taux de remplissage du raccordement par rapport à l'atténuation induite*



du raccordement au-dessous de 50%. Les résultats obtenus pour l'atténuation au-dessous de ce niveau sont 0,05dB ou inférieurs.

6 Conclusions

Les économies des coûts et des temps d'installation obtenus avec les câbles à noyau sec sont évidentes et ces câbles ont été accueillis favorablement par l'industrie.

Toutefois, cette nouvelle technologie exige un examen approfondi et le développement de nouvelles méthodes d'essai.

Lorsqu'on entreprend un travail de ce genre, il est essentiel de fixer les critères les plus appropriés aux exigences du milieu réel.

La technologie à la base des différents câbles à noyau sec est la même, mais il y a plusieurs type de polymères super absorbants et toutes les structures de câble ne présentent pas le même comportement.

Pour assurer les meilleures performances du câble, chaque structure doit être vérifiée pour garantir la conformité aux spécifications fonctionnelles, y compris les événements de vibration et de déformation élevée.

Les résultats des essais montrent que cette structure de câble à ruban à noyau (tube central) sec est robuste.

Les structures permettant un déplacement du ruban d'environ 200mm durant les événements de déformation ne montrent pas les effets d'atténuation mesurables; cela indique que le câble est robuste avec un équilibre entre le raccordement et la structure de base du câble.

Il a été démontré qu'un câble ayant une force de raccordement élevée peut présenter une perte d'atténuation à la suite des événements de déformation élevée.

Étant donné la probabilité d'une structure d'être soumise à des événements de déformation dépassant également la force de raccordement la plus élevée, il est essentiel que les structures de câble présentent un équilibre satisfaisant entre le raccordement du ruban et la structure du câble en général.

Les critères de raccordement du ruban doivent être établis indépendamment pour chaque technologie de noyau sec et structure de câble, et ce, au moyen d'essais en relation directe avec les événements pouvant se produire durant le cycle de vie d'un câble. ■

7 Remerciements

Nos remerciements spéciaux à Amy Wilson et Mohammad Giahi de Sumitomo Optics Lab pour leur contribution à la collecte des données pour le présent article.

Nous souhaitons également remercier Dean Dancy de Sumitomo Process Engineering pour l'assistance prêtée dans la production des câbles utilisés pour les essais.

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Tecnologia di regolazione adattabile della rullatura di filettatura

La precisione, processi stabili e la rilevazione precoce ed efficace rappresentano fattori chiave della produttività. Tenendo conto di questo aspetto, l'impresa EW Menn, in collaborazione con Brankamp, ha associato la regolazione della rullatura di filettatura mediante pulsante di EW Menn all'esperienza di monitoraggio dei processi di Brankamp per creare la tecnologia ADM. ADM è la sigla di Adaptive Die Match e descrive un sistema che misura e valuta elettronicamente la regolazione della rullatura di filettatura e lo corregge automaticamente durante il funzionamento della macchina, senza interrompere il processo produttivo e senza necessità di intervento da parte dell'operatore. Il monitoraggio del processo standard avviene contemporaneamente.

Il sistema ADM è disponibile esclusivamente sulle macchine di EW Menn, in combinazione con i sistemi di controllo del processo di Brankamp.

La società EW Menn si dedica inoltre al settore delle applicazioni speciali come il sistema di laminazione a caldo che consente di riscaldare i pezzi grezzi subito prima di alimentarli nelle

▲ *Modello AF61 di EW Menn equipaggiato con sistema ADM*

piastre per rullare filettature. Questo sistema, originariamente sviluppato per applicazioni aerospaziali con utilizzo di titanio e leghe molto speciali, consente una maggiore espansione del materiale, permettendo così dei processi di formatura che non possono essere ottenuti senza riscaldamento e ampliando le possibilità del processo di laminazione di filiere piatte.

EW Menn GmbH – Germania
Fax: +49 2733 7781
Email: mail@ewmenn.de
Website: www.ewmenn.de

Nuova soluzione di avvolgimento

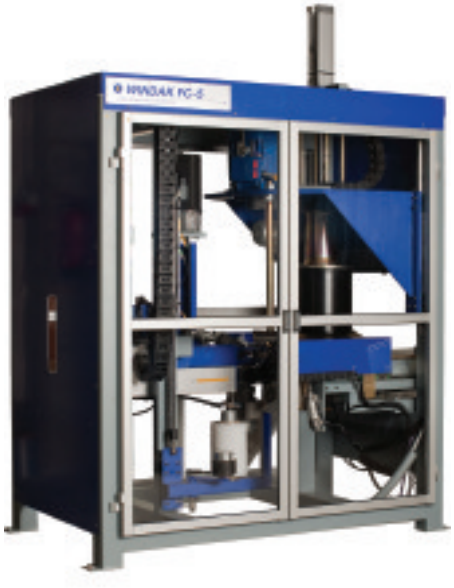
Windak ha annunciato che è stata installata con successo in Finlandia la prima delle sue bobinatrici automatiche FC5 di nuova generazione.

Secondo Urban Bollo, direttore generale di Windak Sweden, la bobinatrice flessibile automatica FC5 è la prima macchina lanciata da Windak come parte di una nuova generazione di soluzioni di imballaggio automatico accessibili.

"Vediamo che il mercato attuale richiede soluzioni economiche e ammortizzabili in tempi brevi con massima flessibilità e rendimento".

La bobinatrice FC5 è compatta ed è progettata per alloggiare cavi di un'ampia gamma di diametri e bobine di diverse dimensioni. L'avvolgimento avviene in modo completamente automatico con o senza reggiatrice o legatrice.

In assenza di reggiatrice o legatrice la bobina viene avvolta con film estensibile prima dell'uscita dalla testa di avvolgimento.



▲ *Nuova bobinatrice FC5 di Windak*

Windak – Svezia
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Collaborazione software

Cimteq, fornitore di software di progetto dei cavi CableBuilder, ha firmato un accordo di collaborazione con SAP per migliorare la capacità del proprio software di generare report professionali, istruzioni di fabbricazione e cataloghi on line.

CableBuilder, utilizzato dai fabbricanti di fili e cavi in tutto il mondo per la progettazione, la preparazione di quotazioni, il calcolo dei costi e l'elaborazione di schede tecniche, disporrà ora di un motore di report integrato di Crystal Reports.

L'applicazione Crystal Reports consente agli utenti di CableBuilder di progettare report interattivi e utilizzarli come modelli per formattare i dati di CableBuilder.

Questi report possono essere statici o interattivi, e possono coprire un'ampia gamma di utilizzi dalle istruzioni di fabbricazione alle schede tecniche e all'analisi prestazioni - quotazioni.

Nick Hirst, consulente di applicazioni di Cimteq, ha così commentato l'integrazione: "Crystal Reports ha consentito al cliente di generare report di istruzioni di fabbricazione con una formattazione ottimizzata ed informazioni più precise, riducendo così i problemi di ambiguità ed eliminando alcune delle cause di scarto e rielaborazione."

Cimteq – Regno Unito
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Composti flessibili per canalizzazioni

Evonik Industries ha ampliato la propria gamma di prodotti costituita da 12 composti in poliammide ignifugo per canalizzazioni e flessibili di protezione per cavi. Vestamid® EX9203, composto plastico ad elevata flessibilità di colore nero, è la risposta ai sempre più severi requisiti del settore elettrico e dei cavi.

Le canalizzazioni e i flessibili per la protezione dei cavi ignifughi privi di alogeni sono particolarmente richiesti per componenti sottoposti ad elevate sollecitazioni dinamiche come i veicoli ferroviari, gli impianti industriali e l'ingegneria meccanica.

Evonik Degussa GmbH – Germania
Fax: +49 2365 49 5992
Website: www.evonik.com

Ordine dalla Turchia

Rautomead Ltd si è aggiudicata un ordine fisso dalla società turca Elsan Elektrik Gerecieri SA di Denizli per la fornitura di una macchina di colata per vergella di rame RS 3000/6 destinata alla fabbricazione di fili smaltati.

L'esperienza di Rautomead nel settore dei crogioli di grafite e della tecnologia di riscaldamento grafite mediante resistenze elettriche è molto indicata per la produzione di vergella in rame. Il sistema di contenimento interamente in carbonio agisce come ambiente altamente riduttivo ed evita il rischio che il rame fuso contamini il refrattario in ceramica.

Questi fattori garantiscono una vergella priva di ossigeno e della massima qualità.

Elsan realizzerà la propria piattaforma operativa ed alimentazione di catodi, che saranno però conformi ai progetti di Rautomead.

I componenti delle bobinatrici standard brevettati da Rautomead saranno forniti sotto forma di kits per la produzione locale.

Rautomead Ltd – Regno Unito
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Fusione nel settore della movimentazione delle bobine

Tulsa Power Holdings Corporation ha annunciato la fusione di Reel-O-Matic Inc e Tulsa Power Inc, entrambe specializzate nella fabbricazione di equipaggiamenti di movimentazione di bobine per la lavorazione e distribuzione di cavi, fili e altri materiali flessibili.

Le società manterranno rispettivamente gli impianti produttivi di Oklahoma City e Tulsa, entrambi nello stato di Oklahoma. Ciascun impianto manterrà tutto il proprio personale chiave con Terry Simmons come presidente di Reel-O-Matic, e Mike Spence come direttore generale di Tulsa Power.

Le società producono equipaggiamenti di avvolgimento e svolgimento con e senza aspo, avvolgitori ad alta velocità, equipaggiamenti di avvolgimento e caterpillar e sono specializzate nella progettazione e nello sviluppo di equipaggiamenti di movimentazione personalizzati per fabbricanti e distributori di fili, cavi e funi metalliche, fra gli altri prodotti.

Reel-O-Matic Inc – Stati Uniti
Website: www.reelomatic.com

Tulsa Power Inc – Stati Uniti
Website: www.tulsapower.com

Superconduttori per hub nel mercato dell'energia americano

American Superconductor Corporation (AMSC) ha annunciato che sono state selezionate le canalizzazioni per le linee elettriche superconduttrici del progetto Tres Amigas, il primo hub del mercato dell'energia rinnovabile del paese.

Le canalizzazioni delle linee elettriche superconduttrici comprendono cavi di alimentazione superconduttori a corrente continua del livello di trasmissione alimentati da cavi superconduttori ad alta temperatura (HTS) e convertitori AC/DC di sorgenti di alta tensione di AMSC. Il progetto Tres Amigas è il primo progetto ideato per collegare le tre reti elettriche americane (Eastern Interconnection, The Western Interconnection e The Texas Interconnection) allo scopo di adottare più rapidamente un'energia rinnovabile ed aumentare l'affidabilità della rete di alimentazione elettrica statunitense.

AMSC – Stati Uniti
Website: www.amsc.com

Contratto per cavi resistenti al ghiaccio per il mare di Barents

Nexans ha siglato un contratto da 6 milioni di euro con Sevmash, il principale cantiere navale della Russia, per lo sviluppo, la fabbricazione e la fornitura di cavi di controllo, di strumentazione e d'alimentazione resistenti alle basse temperature e al ghiaccio, destinati alla piattaforma petrolifera fissa Prirazlomnaya protetta contro il gelo marino nel mare di Barents.

La piattaforma Prirazlomnaya è stata costruita specificamente per sviluppare il giacimento petrolifero di Prirazlomnoye e rappresenta il primo progetto di produzione petrolifera sulla piattaforma continentale artica russa Quest'area è caratterizzata da temperature estremamente basse e da alti carichi di ghiaccio, restando libera dal ghiaccio solo 110 giorni l'anno.

La temperatura media annuale è di -4ºC e può scendere fino a -50ºC in inverno. Le difficili condizioni operative richiedono tecnologie specifiche di cavi marini per offrire una combinazione ottimale di resistenza alle basse temperature e al fuoco, basse emissioni di fumo e assenza di alogeni.

I cavi speciali per Sevmash, per un totale di circa 850km, saranno prodotti negli impianti specializzati di Nexans Kukdong Electric Wire Co, in Corea. La produzione ha già avuto inizio e le consegne procederanno fino alla fine del 2011.

▲ *La piattaforma Prirazlomnaya avrà una capacità di 22.000 tonnellate di petrolio e 1 milione di metri cubi di gas il giorno*

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Giunzione di nastro di cavi a nucleo con tubo centrale

A cura di Patrick Van Vickle, Lindsey Alexander, Steve Stokes: Sumitomo Electric Lightwave

Sommario

L'avvento dei cavi a nastro con nucleo (tubo centrale) secco ha posto delle sfide per quanto riguarda la valutazione dei parametri fondamentali di questo tipo di cavi, che non sono richiesti per i cavi con nucleo riempito di gel.

Nello sviluppo di nuovi metodi e criteri di prova è importante stabilire direttamente un nesso fra il metodo ed i criteri di prova ed i requisiti funzionali del cavo.

La giunzione del nastro ha rappresentato uno dei settori di attività più stimolanti.

Attraverso un'analisi sperimentale e teorica approfondita è stato dimostrato che un valore di giunzione assoluto non garantisce le prestazioni del cavo; è stato inoltre dimostrato che per alcune configurazioni un valore di giunzione eccessivamente elevato può risultare dannoso.

Per ciascuna struttura di cavo e tecnologia del nucleo secco, deve essere individuata una giunzione di nastro ottimizzato tramite prove direttamente collegate agli eventi del ciclo di vita effettivo del cavo.

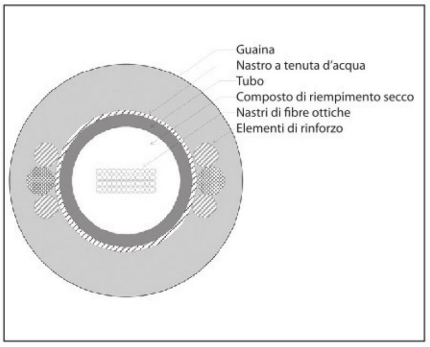
1 Introduzione

I cavi a nastro con nucleo (tubo centrale) secco furono introdotti nel 2001[1].

Sono stati sviluppati diversi metodi per bloccare l'ingresso dell'acqua nel nucleo, ma per tutte le configurazioni si utilizza un composto di riempimento a base di polimero super assorbente in sostituzione del gel di riempimento nel nucleo come illustrato dalla *Figura 1*.

Il risparmio di tempo e di materiale nella preparazione del cavo rappresenta il vantaggio principale di queste strutture di cavo.

L'industria ha tuttavia realizzato che, con la nuova concezione, si dovrebbero prendere in considerazione nuovi aspetti di prestazione[1,2,3].



▲ **Figura 1**: *Sezione trasversale del cavo a nastro con nucleo (tubo centrale) secco*

E' stato pertanto sviluppato un elenco completo di prove di affidabilità. Queste prove includono la prova di penetrazione dell'acqua lasciata a riposo, la prova di penetrazione dell'acqua lasciata a riposo dovuta all'umidità e la penetrazione ripetuta dell'acqua.

Oltre alle diverse prove di penetrazione dell'acqua e di congelamento interno, è necessario prendere in considerazione il problema del movimento del nastro. Durante il loro ciclo di vita, i cavi installati possono essere esposti ad eventi o forze che causano vibrazioni o movimenti. Queste condizioni possono provocare movimenti indesiderati del nastro. Ad esempio, è stato dimostrato che nei cavi con forza di giunzione ridotta fra il nastro e il nucleo, i nastri possono essere espulsi dal nucleo in caso di oscillazione galoppante[2].

L'industria ha faticosamente trovato un accordo su una serie di prove funzionali che abbiano una relazione con le condizioni reali alle quali può essere sottoposto un cavo durante l'installazione e il ciclo di vita. L'obiettivo principale risiede nel metodo di prova e nei valori accettabili di forza di giunzione del nastro per proteggere il cavo da eventi che possono provocare un'elevata deformazione.

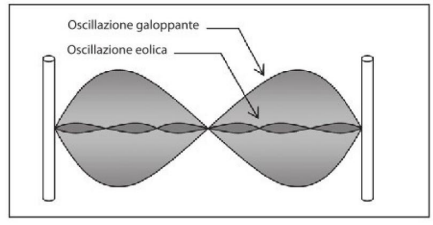
I seguenti capitoli analizzano tutte le diverse condizioni e descrive i metodi di prova utili per valutare il cavo in queste condizioni. Infine, vengono trattati i risultati sperimentali ottenuti con i vari metodi di prova.

2 Applicazioni e condizioni ambientali

Le condizioni alle quali un cavo può essere sottoposto durante il ciclo di vita sono state discusse precedentemente in numerosi articoli[4,5,6]. Nel presente articolo, tali condizioni sono state distinte in due categorie: eventi vibratori ed eventi di elevata deformazione.

2.1 Oscillazione galoppante indotta dal vento e vibrazioni ambientali

Un cavo aereo può essere sottoposto a due categorie di vibrazioni principali: galoppante ed eolica. Le due categorie si distinguono in base alla frequenza e all'ampiezza. La vibrazione galoppante è caratterizzata da una grande ampiezza e da una bassa frequenza. La vibrazione eolica presenta un'elevata frequenza ed un'ampiezza molto ridotta, circa la metà del diametro del cavo. Questi due tipi di vibrazione sono illustrati dalla *Figura 2*.



▲ **Figura 2**: *Condizioni di vibrazione del cavo*

Un cavo aereo di tipo "lashed" (cavo ottico dielettrico collegato a cavi metallici sopraelevati) può presentare un'oscillazione galoppante in determinate condizioni; pertanto è importante provare queste specifiche condizioni. Le condizioni in cui si genera una vibrazione eolica sono rare in natura in installazioni di cavi aerei di tipo "lashed".

Generalmente, i sistemi con molti gradi di libertà presentano un'eccessiva ammortizzazione per consentire fenomeni di risonanza nel tratto di cavo con ampiezza uguale alla metà del diametro del cavo. Se da un lato è improbabile che il cavo aereo "lashed" presenti fenomeni

di risonanza alle frequenze richieste per la vibrazione eolica, lo stesso può simulare la vibrazione ambientale da sorgenti come letti ferroviari o autostradali su un ponte o su un pendio.

2.2 Eventi di deformazione

Gli eventi di deformazione possono presentarsi in molte circostanze diverse. La maggior parte dei cavi si deforma durante l'installazione. Dopo l'installazione, i cavi possono subire deformazioni ripetute dovute al carico causato da formazioni di ghiaccio o a dissotterramenti accidentali.

In ciascun caso l'entità del movimento del nastro è importante. È fondamentale, infatti, che il movimento del nastro non trascini in basso l'intera lunghezza del cavo, consumando tutta la lunghezza in eccesso del nastro con conseguenti danni alla fibra.

Le procedure d'installazione richiedono l'utilizzo di anse di cavo lasche che costituiscono un modo ideale di fissare i nastri al cavo in caso di un evento di deformazione estrema.

Tuttavia, come si vedrà nei capitoli seguenti, è altamente improbabile che la deformazione del cavo causata da queste condizioni provochi deformazioni dannose del nastro.

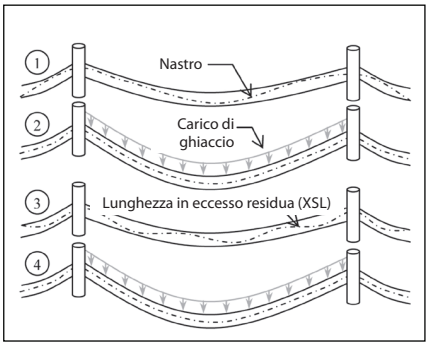
2.2.1 Carico dovuto a formazioni di ghiaccio

Il cavo in fibra ottica installato in regioni in cui sono probabili formazioni di ghiaccio deve essere progettato in modo da sostenere i carichi e gli allungamenti che si possono verificare. Il codice nazionale per la sicurezza elettrica NESC (National Electric Safety Code) descrive le diverse condizioni di formazione di ghiaccio e di vento secondo le regioni del paese[7]. Grazie a queste informazioni, è possibile calcolare l'allungamento di un cavo sottoposto a queste condizioni e prevedere qualsiasi allargamento conseguente del nastro.

In condizioni di carico dovuto a formazione di ghiaccio, il cavo si allungherà. Se l'allungamento del cavo supera la lunghezza in eccesso intrinseca del nastro del cavo, il nastro sarà tirato da una sezione di cavo adiacente, come illustrato dalla *Figura 3* (punti 1 e 2).

Se l'allungamento del cavo risultante dal carico eccede la lunghezza in eccesso intrinseca del nastro di tutti i tratti adiacenti, è possibile che il nastro si tenda contro le anse lasche o, in assenza di anse lasche, contro le chiusure. Questa condizione sussiste sia per i cavi riempiti con gel, sia per i cavi con nucleo secco.

Quando il carico di ghiaccio si allenta, il nastro tirato dalle sezioni di cavo adiacenti crea una nuova lunghezza di nastro in eccesso permanente nel cavo (rif. *Figura 3*, punto 3). Durante l'evento di carico di ghiaccio successivo, il cavo si allungherà; ma poiché vi è già una lunghezza in eccesso del nastro uguale alla lunghezza di cavo deformato, non verrà "tirato" altro cavo nella sezione (rif. *Figura 3*, punto 4). Il cavo raggiungerà essenzialmente un nuovo equilibrio.



▲ **Figura 3**: *Condizioni di carico di ghiaccio*

Una volta compreso questo processo, è possibile analizzare l'entità dell'allungamento del cavo, la lunghezza in eccesso indotta del nastro e la robustezza della struttura del cavo.

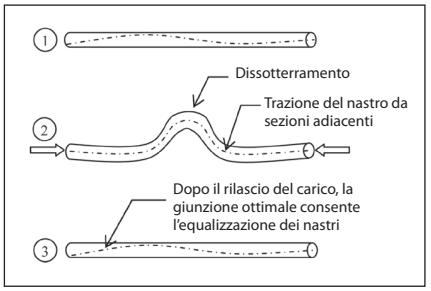
Eseguendo i calcoli a catena per questo tipo di situazione, e considerando il "caso peggiore" di cavo aereo "lashed" e di lunghezza del tratto, si otterrà un allungamento inferiore allo 0,05% in condizioni di carico gravose dovute a formazione di ghiaccio, in accordo con la norma NESC[8]. Con questi dati è imperativo assicurare che la struttura del cavo sia progettata in modo tale da alloggiare la quantità di lunghezza di nastro in eccesso senza comportare alcuna perdita di attenuazione né danni alle fibre. Il valore della lunghezza in eccesso intrinseca del nastro è progettato per eccedere tale allungamento del cavo.

2.2.2 Dissotterramento del cavo

A volte può accadere che il cavo sia erroneamente dissotterrato da un escavatore o da un simile equipaggiamento di scavo, se non vengono adottate precauzioni adeguate prima di iniziare i lavori. Quando si verifica questa situazione, una sezione altamente localizzata del tratto di cavo è sottoposta ad elevata deformazione. É stato stimato che l'area deformata si attesta fra 5m e 50m[4]. Generalmente, questa sezione di cavo viene rimossa e sostituita.

Ci si è interrogati circa l'effetto dell'esposizione diretta ad un'elevata deformazione delle sezioni adiacenti dei cavi. Considerando una sezione di cavo di 50m sottoposta a deformazione, un carico prossimo al carico di rottura nella maggior parte delle strutture dei cavi, comporta una trazione del nastro da parte delle sezioni adiacenti e può effettivamente tendere saldamente le anse lasche sia nei cavi con nucleo secco, sia nei cavi riempiti di gel.

La capacità del cavo e del nastro di assorbire questa deformazione dipende dalla struttura del cavo, dalla lunghezza in eccesso intrinseca del nastro, e dalla lunghezza della sezione del cavo adiacente. Indipendentemente dal tipo di giunzione utilizzato, questa impedirà o permetterà di trasmettere la deformazione del nastro lungo il cavo, e impedirà o permetterà al cavo di equilibrarsi dopo il rilascio del carico. La *Figura 4* illustra questo evento.



▲ **Figura 4**: *Evento di deformazione dovuta a dissotterramento*

Il cavo riempito di gel viscoelastico si distingue per la sua capacità di giuntare i nastri al cavo e consentire il rilassamento dei cavi nel tempo. Il tempo richiesto per equilibrarsi può essere lungo, superiore alle velocità di trazione raccomandate per le prove di giunzione del cavo. Anche la temperatura del gel riveste un ruolo importante nella resistenza viscosa impartita ai nastri e può influenzare notevolmente la velocità di rilassamento.

Gli agenti di giunzione secchi non presentano questa proprietà. In questo caso, è verosimile che le deformazioni del cavo che generano una forza superiore alla forza di giunzione a secco, impediscano il riequilibrio delle sezioni adiacenti. Per questa ragione, una correlazione diretta con la giunzione riempita di gel risulta azzardata, essendo le prove connesse agli eventi reali del ciclo di vita del cavo estremamente importanti.

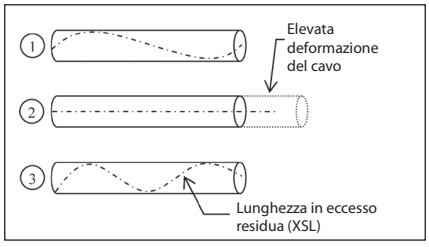
2.2.3 Installazione

Durante l'installazione, una sezione localizzata del cavo è sottoposta ad un'elevata deformazione. É stato dimostrato che, in questa situazione, per alcune strutture di cavi, i nastri restano stazionari durante la trazione dei cavi sopra di essi (rif. *Figura 5*).

Una volta rilasciato il carico, i nastri non subiscono alcuna forza di trazione all'estremità esposta, e pertanto una certa lunghezza del nastro resta all'interno del cavo. Un installatore potrebbe allarmarsi nel vedere che non vi sono nastri esposti all'estremità del cavo una volta completata la trazione del cavo!

Questa specifica condizione finale sussiste anche per alcune strutture riempite di gel quando vengono sottoposte ad alcune condizioni di installazione. La soluzione consiste nel rimuovere una piccola sezione del rivestimento del cavo, generalmente inferiore a 1m, per recuperare i nastri.

Si ripresenta l'interrogativo circa gli effetti che questa condizione ha sulla sezione del cavo nel suo complesso.



▲ **Figura 5**: *Evento di deformazione durante l'installazione*

La risposta proviene dagli stessi fattori citati precedentemente: la struttura del cavo, la lunghezza iniziale in eccesso del nastro e la giunzione. Evidentemente, se la struttura del cavo fosse tale da non comportare alcuna deformazione dovuta al carico d'installazione, allora non sussisterebbe alcun problema di movimento del nastro; tuttavia ciò comporterebbe un cavo di grandi dimensioni, estremamente rigido e costoso. La soluzione risiede in una struttura di cavo robusta e una giunzione ottimizzata.

3 Sviluppo di prove funzionali

3.1 Metodo di prova di vibrazione

Le prove che simulano più fedelmente la vibrazione di alta e bassa frequenza riscontrate nella vibrazione galoppante e ambientale sono descritte nel metodo di prova IEEE 1222 per cavi ottici autosufficienti dielettrici (ADSS)[9].

Più di recente è stata prestata attenzione alla risposta della vibrazione a bassa frequenza nella prova di vibrazione galoppante; tuttavia anche la prova di vibrazione eolica ad alta frequenza può offrire informazioni importanti.

Per effettuare questa prova, il cavo è stato posto in una condizione autoportante e quindi è stato deformato fino a due volte il carico di installazione per soddisfare i requisiti di configurazione della prova. Tuttavia, la prova consente effettivamente di far vibrare un tratto di cavo misurabile con frequenze simili a quelle che si possono verificare nel tratto di cavo installato presso una linea ferroviaria o autostradale. Inoltre, la durata della prova è lunga: 100.000.000 cicli.

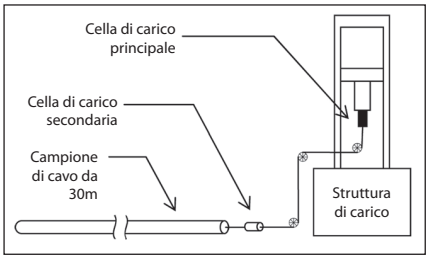
3.2 Metodi di prova per la giunzione del nastro e l'evento di deformazione

Il metodo di prova pubblicato da un importante operatore di telecomunicazioni, utilizza un campione di cavo fisso di 30m. I nastri di questo cavo sono applicati ad una struttura di carico e la forza richiesta per avviare il movimento dei nastri è monitorata all'interno del campione della guaina e del nucleo del cavo fisso[10].

Un valore fisso di 0,036lbf *(lbf = libbra forza)* volte il numero di fibre nel cavo è la forza minima richiesta per ottenere risultati validi per superare i risultati della prova.

Per alcuni cavi, specialmente nel caso di un numero di fibre ridotto, sono sorti interrogativi circa l'interazione dell'apparato di prova considerando dell'attrito interno delle pulegge. É stata proposta una soluzione che prevedeva il sollevamento del campione di cavo dal suolo su una mensola allo scopo di eliminare almeno una puleggia. Un'altra soluzione consisteva nell'introduzione di una seconda cella di carico, posta direttamente in linea con il campione di cavo.

La cella di carico della struttura di carico è sempre monitorata e la struttura controlla la velocità di movimento fissata con il metodo a 100 ± 25mm il minuto, ma è la cella di carico secondaria in linea che fornisce la carica assoluta. Questo apparato è illustrato dalla *Figura 6*.



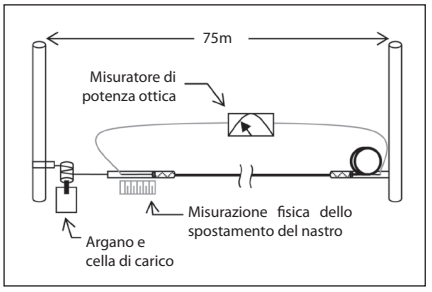
▲ **Figura 6**: *Dispositivo di prova della giunzione del nastro*

Questa modernizzazione dell'apparato di prova del cavo su scala ridotta contribuisce a garantire risultati più precisi per la forza di giunzione, ma è necessaria anche una prova per produrre un evento di deformazione elevata.

Utilizzando un argano elettrico ed una cella di carico, è stato deformato un cavo fra due poli ancorati, ad una distanza di 75m uno dall'altro. Afferrando delicatamente il cavo, i nastri sono stati esposti ad entrambe le estremità e giuntati ad un misuratore di potenza ottica a 1.550nm.

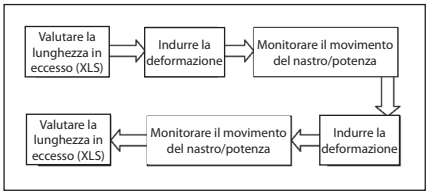
Inoltre, i nastri sono stati collocati in modo tale da consentire la misurazione del movimento lineare fisico ad una estremità, mentre l'altra estremità è stata posta in anse lasche per simulare le condizioni di campo.

L'apparato di prova dell'evento di deformazione del cavo è illustrato dalla *Figura 7*.



▲ **Figura 7**: *Apparato di prova dell'evento di deformazione del cavo*

Prima di iniziare il test dell'evento di deformazione del cavo e, una volta completato, è necessario testare la lunghezza in eccesso del nastro (XLS) del campione del cavo per evitare che una differenza eccessiva tra la lunghezza in eccesso del nastro e la lunghezza del cavo influenzi i risultati. Il campione di cavo viene quindi sottoposto alla procedura di prova descritta dalla *Figura 8*.



▲ **Figura 8**: *Procedura di prova dell'evento di deformazione del nastro*

▼ **Tabella 1**: *Campioni di cavo per la valutazione della giunzione*

Rapporto di riempimento della giunzione	Numero di fibre	Numero di nastri
19%	12	1
24%	12	1
25%	60	5
29%	48	4
36%	48	4
37%	144	12
38%	108	9
41%	96	8
45%	144	12
51%	12	1
56%	48	4

4 Campioni di prova del cavo

Per raggiungere una comprensione completa del fenomeno della giunzione, è stato testato un gran numero di campioni di cavo.

Alcuni campioni erano versioni di cavi correntemente offerti nella linea di prodotti esistente; altri erano cavi realizzati su misura per ottenere i migliori risultati possibili della prova.

Il rapporto di riempimento della giunzione, ovvero la percentuale della zona riempita rispetto alla zona del nucleo, è stato uno dei parametri applicati per questa analisi.

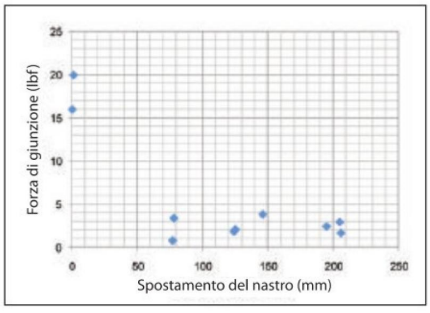
5 Risultati delle prove sperimentali

5.1 Vibrazione eolica

La vibrazione eolica è stata esaminata in precedenza e attualmente non presenta alcuna attenuazione permanente né alcuno spostamento significativo del nastro[3].

5.2 Spostamento del nastro dovuto ad evento di deformazione rispetto alla forza di giunzione

Per convalidare la correlazione fra la forza di giunzione e lo spostamento del nastro, la forza di giunzione misurata utilizzando la struttura di carico è stata comparata con lo spostamento del nastro osservato utilizzando l'apparato impiegato per l'evento di deformazione.



▲ **Figura 9**: *Spostamento del nastro rispetto alla forza di giunzione*

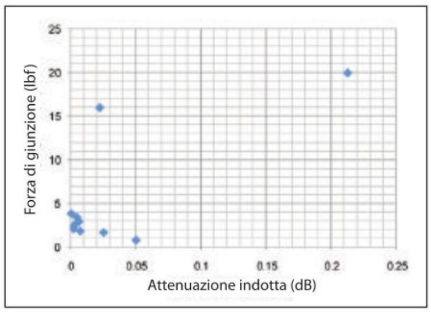
La *Figura 9* dimostra che oltre una soglia della forza di giunzione, lo spostamento del nastro è certamente ritardato.

Al di sotto di questa soglia, la forza di giunzione non è un buon indicatore dello spostamento del nastro.

5.3 Forza di giunzione rispetto all'attenuazione indotta

La relazione esaminata successivamente è stata l'entità del cambio di attenuazione prodotto in seguito al rilascio del carico da un evento di deformazione elevata rispetto alla forza di giunzione ottenuta con l'apparato della struttura di carico.

La *Figura 10* dimostra che, con una forza di giunzione molto elevata che determina uno spostamento del nastro di solo pochi millimetri, si può ottenere un aumento consistente dell'attenuazione.



▲ **Figura 10**: *Attenuazione indotta al rilascio del carico rispetto alla forza di giunzione*

L'elevata forza di giunzione non consente una redistribuzione né un rilassamento dei nastri.

I dati che illustrano questo fenomeno non indicano che questa situazione si verifica sempre.

Saranno necessarie altre prove a questo livello di forza di giunzione per determinare con maggiore precisione l'entità della forza di giunzione e le circostanze esatte che causano questo problema.

Questo particolare evento si è verificato con un cavo di 48 fibre provvisto di quattro nastri da 12 fibre.

Diversamente dai cavi riempiti di gel, i cavi a nastro con nucleo secco non presentano mezzi per mantenere i nastri in una pila uniforme.

Si suppone che le caratteristiche antiflessione dipendano dall'uniformità della pila di nastri e questa condizione può presentarsi anche nel caso di cavi con un numero maggiore di fibre.

Il livello della forza di giunzione che è all'origine di questo problema è più alto del limite consentito dalle strutture di cavi di questo tipo attualmente commercializzati.

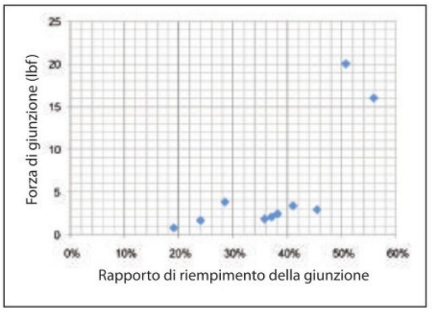
Per assicurare una struttura robusta, è stato stabilito un nuovo parametro di configurazione che pone in relazione la zona riempita del nucleo con la superficie disponibile.

Dovrebbe essere stabilito un limite superiore per questo nuovo parametro, cioè il rapporto di riempimento della giunzione, per limitare l'attenuazione indotta.

5.4 Rapporto di riempimento della giunzione

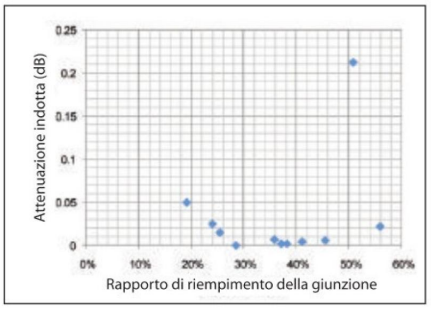
É stata analizzata la validità del nuovo parametro del rapporto di riempimento della giunzione rispetto ai risultati sperimentali.

La *Figura 11* evidenzia che a circa il 50% del rapporto di riempimento della giunzione, gli elementi a tenuta d'acqua iniziano a



▲ **Figura 11**: *Rapporto di riempimento della giunzione rispetto alla forza di giunzione*

comprimersi e ad impartire una forza di giunzione decisamente più elevata. Ciò indica che esiste una soglia sotto alla quale questo parametro non è in relazione con la forza di giunzione. Per questa struttura di cavo non esiste una relazione lineare della forza di giunzione.



▲ **Figura 12**: *Rapporto di riempimento della giunzione rispetto all'attenuazione indotta*

Infine, la *Figura 12* dimostra la necessità di fissare il parametro del rapporto di riempimento della giunzione al di sotto del 50%. Tutti i risultati ottenuti per l'attenuazione sotto questo livello sono pari a 0,05dB o inferiori.

6 Conclusioni

I risparmi sui costi e sui tempi d'installazione ottenuti con i cavi con nucleo secco sono evidenti e questi cavi sono stati accolti favorevolmente dall'industria.

Tuttavia, questa nuova tecnologia richiede un esame approfondito e lo sviluppo di nuovi metodi di prova.

Quando si inizia un lavoro di questo tipo, è estremamente importante fissare i criteri che meglio si adattano ai requisiti di campo.

La tecnologia alla base dei diversi cavi con nucleo secco è la medesima, ma esistono diversi tipi di polimeri superassorbenti e non tutte le strutture di cavo si comportano allo stesso modo.

Per assicurare le migliori prestazioni del cavo, ciascuna struttura deve essere verificata per garantire la conformità con

i requisiti funzionali, inclusi gli eventi di vibrazione ed elevata deformazione.

I risultati delle prove evidenziano che questa struttura di cavo a nastro con nucleo (tubo centrale) secco è robusto. Le strutture che consentono uno spostamento del nastro di circa 200mm durante gli eventi di elevata deformazione, non evidenziano effetti di attenuazione misurabili; ciò indica che il cavo è robusto con un equilibrio fra giunzione e struttura di base del cavo.

É stato dimostrato che un cavo con elevata forza di giunzione può presentare una perdita di attenuazione in seguito agli eventi di elevata deformazione.

Data la probabilità di una struttura di essere sottoposta ad eventi di deformazione che eccedono persino la forza di giunzione più elevata, è estremamente importante che tutte le strutture di cavo abbiano un buon equilibrio fra giunzione del nastro e struttura del cavo in generale.

I criteri per la giunzione del nastro devono essere stabiliti indipendentemente per ciascuna tecnologia di nucleo secco e struttura di cavo.

Ciò si dovrebbe realizzare mediante prove in rapporto diretto con gli eventi che potrebbero accadere durante il ciclo di vita di un cavo. ■

7 Ringraziamenti

Si ringraziano in particolare Amy Wilson e Mohammad Giahi di Sumitomo Optics Lab per il loro contributo alla raccolta dei dati del presente articolo.

Si ringraziano inoltre Dean Dancy di Sumitomo Process Engineering per l'assistenza prestata nella produzione dei cavi utilizzati per le prove.

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Pedido desde Turquía

Rautomead Ltd se ha hecho con un pedido de la sociedad turca Elsan Elektrik Gerecieri SA de Denizli para suministrar una máquina de colada de alambrón de cobre RS 3000/6 destinada a la fabricación de alambres esmaltados.

La experiencia de Rautomead en el campo de los crisoles de grafito y de la tecnología de calentamiento mediante resistencia eléctrica se acopla muy bien a la producción de alambrón de cobre.

El sistema de contención enteramente de carbón actúa como entorno altamente reductor y evita la contaminación del cobre fundido con el refractario cerámico.

Estos factores garantizan un alambrón libre de oxígeno de máxima calidad.

Elsan construirá su propia plataforma operativa y alimentación de cátodo, pero siguiendo los diseños de Rautomead.

Los componentes patentados de las bobinadoras estándares de Rautomead serán suministrados en forma de kits para su fabricación local.

Rautomead Ltd – Reino Unido
Fax: +44 1382 622941
Email: sales@rautomead.com
Website: www.rautomead.com

Fusión en el sector del manejo de carretes

Tulsa Power Holdings Corporation ha anunciado la fusión de Reel-O-Matic Inc y Tulsa Power Inc, ambas fabricantes de equipos de manejo de carretes para procesamiento y distribución de cable, hilo y otros materiales flexibles.

Las compañías conservarán las plantas productivas de Oklahoma City y Tulsa, las dos en el estado de Oklahoma. Cada planta mantendrá su propio personal clave, con Terry Simmons de presidente de Reel-O-Matic, y Mike Spence como director general de Tulsa Power.

Las empresas fabrican equipos de enrollado y desenrollado con y sin eje, encarretadoras de alta velocidad, equipos de bobinado y oruga de arrastre. Están especializadas en el diseño y desarrollo de equipos de manejo personalizados para fabricantes y distribuidores de hilo y cable, entre otros productos.

Reel-O-Matic Inc – Estados Unidos
Website: www.reelomatic.com

Tulsa Power Inc – Estados Unidos
Website: www.tulsapower.com

Superconductores para nodo americano de suministro energético

American Superconductor Corporation (AMSC) ha anunciado que ya se han seleccionado las canalizaciones que alojarán las líneas eléctricas superconductoras del proyecto Tres Amigas, el primer nodo de energía renovable del país.

Las canalizaciones de las líneas eléctricas superconductoras comprenden cables de alimentación superconductores de corriente continua de nivel de transmisión alimentados por cable superconductor a alta temperatura y convertidores de alterna-continua de fuentes de alta tensión de AMSC. El proyecto Tres Amigas es el primero ideado para interconectar las tres redes americanas de suministro eléctrico (Eastern Interconnection, The Western Interconnection y The Texas Interconnection) con el fin de poder adoptar rápidamente las energías renovables e incrementar la fiabilidad de la red estadounidense de suministro eléctrico.

AMSC – Estados Unidos
Website: www.amsc.com

Contrato de cables resistentes al hielo para el mar de Barents

Nexans ha firmado un contrato de 6 millones de Euros con Sevmash, la mayor compañía de astilleros de Rusia, para desarrollar, fabricar y proveer cables de control, de instrumentación y de alimentación resistentes a las bajas temperaturas y al hielo para la plataforma petrolífera fija Prirazlomnaya protegida contra el hielo marino, ubicada en el mar de Barents.

La plataforma Prirazlomnaya ha sido construida especialmente para desarrollar el yacimiento petrolífero de Prirazlomnoye y constituye el primer proyecto de producción petrolífera en la meseta continental ártica rusa. Esta zona se caracteriza por temperaturas extremadamente bajas y altas cargas de hielo, quedando libre de hielo sólo 110 días al año. La temperatura media anual es de -4ºC y puede descender a -50ºC en invierno. Las duras condiciones de trabajo exigen tecnologías específicas de cables marinos para ofrecer la resistencia requerida a las bajas temperaturas y al fuego, baja emisión de humo y ausencia de halógenos.

Los aproximadamente 850km de cables especiales para Sevmash serán fabricados en las instalaciones especializadas de Nexans Kukdong Electric Wire Co, en Corea. La producción ya ha iniciado y las entregas se subseguirán hasta finales de 2011.

▲ *La plataforma Prirazlomnaya tendrá una capacidad de 22.000 toneladas de petróleo y 1 millón de metros cúbicos de gas por díao*

Nexans – Francia
Fax: +33 15669 8484
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Website: www.nexans.com

Tecnología de centrado de terrajas adaptable

Los procesos de precisión estables y la detección de fallos temprana y eficaz representan factores clave para la productividad. Teniendo en cuenta esto, la empresa EW Menn, en colaboración con Brankamp, ha combinado el centrado de terrajas mediante botón de EW Menn con la experiencia en monitorización de procesos de Brankamp para crear la tecnología ADM.

ADM es la sigla de Adaptive Die Match y describe un sistema que mide y evalúa electrónicamente el centrado de la terraja y lo corrige automáticamente durante el funcionamiento de la máquina, sin interrumpir el proceso productivo y sin necesidad de intervención de ningún operador. La monitorización del proceso estándar se realiza al mismo tiempo.

El sistema ADM sólo está disponible en las máquinas de EW Menn, en combinación con los sistemas de control de proceso de Brankamp.

EW Menn también se dedica a aplicaciones especiales como el sistema de laminación en caliente que permite calentar las piezas en bruto justo antes de hacerlas pasar por las terrajas. Este sistema, desarrollado en un principio para aplicaciones aeroespaciales con uso de titanio y aleaciones muy especiales, permite una mayor expansión del material, haciendo posible procesos de conformado que no pueden ser llevados a cabo sin calentamiento y ampliando considerablemente las posibilidades del proceso de laminación de terrajas planas.

▲ *Modelo AF61 de EW Menn equipado con sistema ADM*

EW Menn GmbH – Alemania
Fax: +49 2733 7781
Email: mail@ewmenn.de
Website: www.ewmenn.de

Nueva solución de bobinado

Windak ha hecho pública la satisfactoria instalación de su primera FC5, la nueva generación de bobinadoras automáticas, en Finlandia.

Según Urban Bollo, director general de Windak Sweden, la bobinadora flexible automática FC5 es la primera máquina que lanza Windak como parte de una nueva generación de soluciones de empaquetamiento automático abordables.

"Vemos que el mercado de hoy requiere soluciones rentables amortizables a corto plazo con la máxima flexibilidad y rendimiento".

La FC5 es compacta y tiene capacidad para cables de toda una variedad de diámetros y bobinas de distintos tamaños. El bobinado se realiza de modo totalmente automático con o sin enflejadora o atadora.

Cuando no está equipada con enflejadora ni atadora, la bobina es enfardada antes de salir del cabezal de bobinado.

▲ *Nueva bobinadora FC5 de Windak*

Windak – Suecia
Email: info@windakusa.com
Website: www.windakusa.com

Colaborando en software

Cimteq, proveedor del software de diseño de cables CableBuilder, ha firmado un acuerdo de colaboración con SAP para mejorar la capacidad de su software para generar informes profesionales, instrucciones de fabricación y catálogos on line.

CableBuilder, utilizado por fabricantes de hilos y cables de todo el mundo para diseñar, preparar ofertas, calcular costes y elaborar hojas de datos, dispondrá ahora de un motor de informes integrado de Crystal Reports.

La aplicación Crystal Reports permite a los usuarios de CableBuilder diseñar informes interactivos y utilizarlos como plantilla para formatear datos de CableBuilder. Estos informes pueden ser estáticos o interactivos, y pueden cubrir una amplia variedad de usos desde instrucciones de fabricación hasta hojas de datos y análisis de rendimiento y cotizaciones.

Nick Hirst, asesor de implementación de Cimteq, comentó sobre la integración: "Crystal Reports le ha permitido al cliente generar informes de instrucciones de fabricación con formateado optimizado e información más precisa, limitando los problemas de ambigüedad y eliminando algunas de las causas de descarte y reelaboración de los informes."

Cimteq – Reino Unido
Fax: +44 1978 667 005
Email: ali.shehab@cimteq.com
Website: www.cimteq.com

Componente flexible para canalizaciones

Evonik Industries ha ampliado su gama de productos constituida por 12 compuestos de poliamida retardantes de la llama para canalizaciones y mangueras de protección para cables. Vestamid® EX9203, compuesto plástico de alta flexibilidad de color negro, es la respuesta a los requisitos cada vez más estrictos del sector eléctrico y del cable.

Las canalizaciones y las mangueras protectoras para cables retardantes de la llama sin halógenos son requeridas sobre todo para componentes sometidos a grandes esfuerzos dinámicos como los de vehículos sobre raíl, plantas industriales e ingeniería mecánica.

Evonik Degussa GmbH – Alemania
Fax: +49 2365 49 5992
Website: www.evonik.com

Empalme de cinta de cables con tubo central

Patrick Van Vickle, Lindsey Alexander, Steve Stokes: Sumitomo Electric Lightwave

Resumen

La llegada del cable de cinta con núcleo (tubo central) seco ha planteado nuevos retos en la evaluación de los parámetros clave de este tipo de cable, que no son los requeridos en el caso de cable de diseño con tubo central relleno de gel.

Cuando se desarrollan nuevos métodos y criterios de prueba, es importante poner directamente en relación los métodos y los criterios de prueba con los requisitos funcionales del cable. El empalme de la cinta ha sido uno de los campos de estudio más desafiantes.

A través de análisis experimentales y teóricos extensivos se ha demostrado que un valor de empalme de la cinta absoluto no garantiza las prestaciones del cable; se ha comprobado que para algunos diseños de cable un valor de empalme demasiado alto puede ser perjudicial.

Para cada diseño de cable y tecnología de núcleo seco, se debe buscar un empalme de cinta optimizado efectuando pruebas relacionadas directamente con los acontecimientos del ciclo de vida útil del cable.

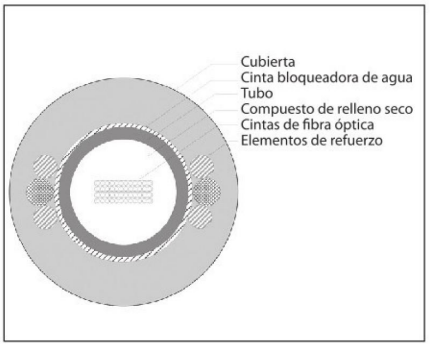
1 Introducción

Los cables de cinta con núcleo (tubo central) seco fueron introducidos en 2001[1]. Se han desarrollado varios métodos para bloquear la entrada de agua en el tubo central, pero todas las estructuras utilizan un compuesto de relleno de polímero superabsorbente en lugar del gel de relleno del tubo central, como se puede ver en la *Figura 1*.

El ahorro de tiempo y de material durante la preparación del cable son las ventajas principales de estos diseños de cable.

Sin embargo, con el nuevo diseño el sector ha observado ciertos problemas de rendimiento que deberían ser resueltos[1,2,3].

Por lo tanto, se ha desarrollado una lista completa de pruebas de fiabilidad.



▲ **Figura 1**: *Sección transversal del cable de cinta con núcleo (tubo central) seco*

Estas pruebas incluyen la penetración de agua envejecida, la penetración de agua envejecida debida a humedad y la penetración repetida de agua.

Pero, además de las distintas pruebas de penetración de agua y de congelamiento interno, es necesario considerar también los problemas debidos al desplazamiento de la cinta. Durante su ciclo de vida, los cables instalados pueden estar expuestos a eventos o fuerzas que causan vibraciones o desplazamientos.

Estas condiciones pueden causar movimientos indeseados de la cinta. Por ejemplo, se ha demostrado que en cables con fuerza de empalme baja entre cintas y tubo central, las cintas pueden ser expulsadas fuera del tubo en caso de "oscilación galopante"[2].

La industria se ha esforzado por ponerse de acuerdo sobre una serie de pruebas funcionales que tengan una relación directa con las condiciones reales en la cuales se puede encontrar un cable durante la instalación y su ciclo de vida.

El enfoque principal es el método de prueba y los valores aceptables de empalme de la cinta para proteger el cable contra acontecimientos que pueden causar alta deformación.

En los capítulos siguientes se analizarán varias condiciones y se describirán los métodos de prueba del cable en dichas condiciones.

Por último, se discutirán los resultados experimentales obtenidos con los distintos métodos de prueba.

2 Aplicaciones y condiciones ambientales

Las condiciones a las que un cable puede estar expuesto durante su ciclo de vida han sido discutidas anteriormente en numerosos estudios[4,5,6]. En este artículo se han dividido dichas condiciones en dos categorías: condiciones de vibración y condiciones de alta deformación.

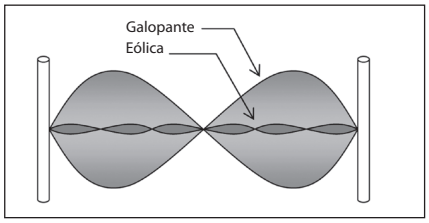
2.1 Vibración galopante debida al viento y vibración ambiental

Un cable aéreo puede estar sometido principalmente a dos tipos de vibración: galopante y eólica. Las dos categorías se distinguen por frecuencia y amplitud. La vibración galopante se caracteriza por su gran amplitud y baja frecuencia.

La vibración eólica presenta una frecuencia alta y una amplitud muy baja, aproximadamente la mitad del diámetro del cable. Estos dos tipos de vibración están ilustrados en la *Figura 2*.

Un cable aéreo atado a cable auto sustentado, puede tener oscilación galopante en ciertas condiciones; por lo tanto, es importante probar estas condiciones específicas. Las condiciones en que hay vibración eólica son raras en instalaciones de cable aéreo atado a cable auto sustentado.

Los sistemas con varios grados de libertad suelen tener demasiada amortiguación como para permitir fenómenos de resonancia en el tramo de cable, de amplitud igual a la mitad del diámetro del cable. Aunque es improbable que el cable aéreo atado a cable auto sustentado entre en resonancia a las frecuencias requeridas para la vibración eólica, puede simular la vibración ambiental procedente de asientos de ferrocarril o tráfico de coches en un puente o un desnivel.



▲ **Figura 2**: *Condiciones de vibración del cable*

2.2 Eventos de deformación

Los eventos de deformación pueden ocurrir en muchas circunstancias distintas. La mayoría de los cables se deforma durante la instalación. Después de la instalación, los cables pueden sufrir deformación repetida debida a cargas de hielo o desenterramientos accidentales.

En ambos casos la magnitud del desplazamiento de la cinta es importante porque se debe evitar que el movimiento de la cinta desplace hacia abajo todo de cable, utilizando toda la longitud en exceso de la cinta y causando daños a la fibra.

Durante la instalación se usan bucles de cable sueltos, que son la manera ideal de bloquear las cintas en el cable en caso extremo de deformación.

Sin embargo, como se analizará en los capítulos siguientes, es muy improbable que la deformación del cable originada por estas condiciones cause daños en la cinta por deformación.

2.2.1 Carga de hielo

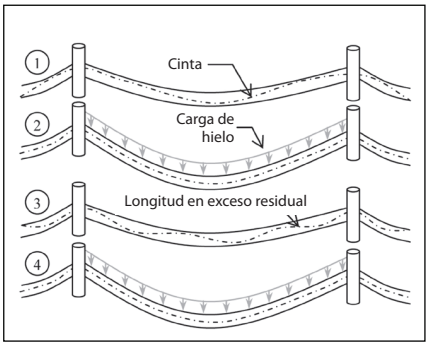
El cable de fibra óptica instalado en zonas donde es probable que se acumule hielo debe tener las características adecuadas para soportar las cargas y los alargamientos que pueden ocurrir. El código electrónico nacional de seguridad NESC (National Electric Safety Code) describe situaciones de depósitos de hielo y condiciones de viento por regiones del país[7].

Con esta información se puede calcular el alargamiento de un cable expuesto a estas condiciones y se puede prever cualquier alargamiento de la cinta.

En condiciones de carga de hielo el cable se alargará. Si el alargamiento del cable excede la longitud en exceso intrínseca de la cinta del cable, la cinta será tirada por una sección de cable adyacente, como se muestra en la *Figura 3*, situación 1 y 2.

Si el alargamiento del cable debido a la carga excede la longitud en exceso intrínseca de la cinta de todos los tramos adyacentes, la cinta puede ser tensada contra los bucles sueltos, o contra los cierres, si no hay bucles sueltos. Esta condición existe ya sea para cables rellenos de gel, ya sea para cables con núcleo seco. Cuando la carga de hielo desaparece, la cinta tirada por las secciones de cable adyacentes da lugar a una nueva longitud de cinta en exceso permanente en el cable, como se muestra en la *Figura 3*, situación 3.

Con la carga de hielo siguiente el cable se alargará, pero, dado que ya hay una longitud de cinta en exceso igual a la longitud del cable deformado, no se tirará más cinta en la sección, como se muestra en la *Figura 3*, situación 4. El cable alcanzará esencialmente un nuevo equilibrio.



▲ **Figura 3**: *Condiciones de carga de hielo*

Una vez comprendido este proceso, se puede analizar la magnitud del alargamiento del cable, la longitud de cinta en exceso generada y la robustez del diseño del cable.

Aplicando cálculos catenarios a estas situaciones, y considerando el "peor caso" de cable aéreo atado a cable auto sustentado y de longitud de tramo, se obtiene un alargamiento inferior a un 0,05% en condiciones de carga de hielo pesadas según el NESC.

Con estos datos es necesario asegurar que la estructura del cable pueda contener esta longitud de cinta en exceso sin sufrir pérdida de atenuación ni daños en las fibras. El valor de la longitud de cinta en exceso intrínseca está diseñado para exceder dicho alargamiento del cable.

2.2.2 Desenterramiento del cable

A veces el cable puede ser desenterrado accidentalmente por una retroexcavadora o un equipo de excavación similar, si no se toman las precauciones adecuadas antes de iniciar los trabajos.

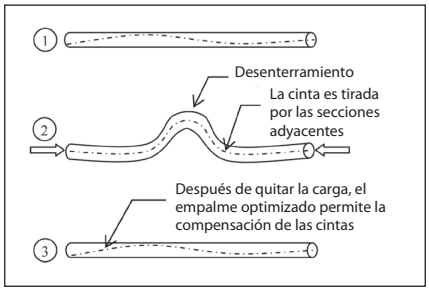
Cuando esto ocurre, una sección altamente localizada del tramo de cable es sometida a alta deformación. Se ha calculado que la sección deformada suele estar entre 5m y 50m[4]. Generalmente, esta sección de cable es cambiada.

La cuestión que se plantea es el efecto de la exposición directa a alta deformación en las secciones de cable adyacentes.

Considerando una sección de cable de 50m sometida a deformación, una carga próxima a la resistencia a la rotura de la mayoría de los diseños de cables hace que las secciones adyacentes tiren la cinta tensando los bucles sueltos tanto en el cable relleno de gel como en el cable seco.

La capacidad del cable y de la cinta para absorber la deformación depende del diseño del cable, de la longitud de cinta en exceso intrínseca y de la longitud de la sección de cable adyacente.

El tipo de empalme utilizado impedirá o permitirá transmitir la deformación de la cinta al tramo de cable, e impedirá o permitirá que el cable se equilibre después de quitar la carga. La *Figura 4* muestra esta condición.



▲ **Figura 4**: *Deformación causada por desenterramiento*

El cable relleno de gel viscoelástico tiene la capacidad única de empalmar las cintas al cable y permitir que las cintas se relajen con el tiempo.

El tiempo requerido para equilibrarse puede ser largo, mayor que los índices de tracción sugeridos para las pruebas de empalme del cable. La temperatura del gel juega también un papel importante en el arrastre viscoso dado a las cintas y puede afectar altamente a la velocidad de relajación. Los agentes de empalme seco no tienen esta propiedad.

En este caso, es muy probable que las deformaciones del cable produzcan una fuerza superior a la fuerza del empalme seco, y, por consiguiente, impidan que las secciones adyacentes se equilibren.

Por esta razón, buscar una correlación directa con el empalme con gel es arriesgado, y las pruebas relacionadas con los acontecimientos reales que se producen durante el ciclo de vida del cable son tan importantes.

2.2.3 Instalación

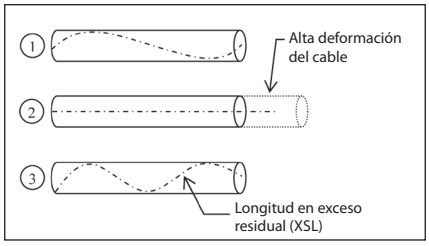
Durante la instalación, una sección localizada del cable es sometida a alta deformación. Se ha comprobado que en esta situación, para algunos diseños de cable, las cintas se quedan estacionarias mientras que el cable es tirado sobre ellas, como se ilustra en la *Figura 5*.

Cuando la carga es quitada, no hay fuerza de tracción en las cintas en el extremo expuesto y, por lo tanto, una cierta

longitud de cinta queda dentro del cable. ¡Un instalador se alarmaría al no ver cintas expuestas en el extremo del cable después de haber tirado el cable!

Esta concreta condición final se da también en algunos diseños de cables rellenos de gel en determinadas condiciones de instalación.

La solución es quitar una pequeña sección de la cubierta del cable, normalmente inferior a 1m, para recuperar las cintas. Ahora se trata otra vez de analizar los efectos de esta condición en la sección de cable en general.



▲ **Figura 5**: *Deformación durante la instalación*

La respuesta radica en los mismos factores citados antes: el diseño del cable, la longitud de cinta en exceso inicial y el empalme. Evidentemente, si el diseño del cable es capaz de soportar la carga de instalación sin sufrir ninguna deformación, entonces no hay ningún problema de desplazamiento de la cinta; pero en este caso nos encontramos ante un cable de grandes dimensiones, demasiado rígido y costoso. La clave está en tener un diseño de cable robusto con un empalme optimizado.

3 Desarrollo de las pruebas funcionales

3.1 Método de prueba de vibración

Las pruebas que mejor simulan la vibración de alta y baja frecuencia observada en la vibración galopante y ambiental están descritas en el método de prueba IEEE 1222 para cable autosoportado totalmente dieléctrico (ADSS)[9].

Más recientemente se ha prestado mayor atención a la respuesta de la vibración a baja frecuencia de la prueba de vibración galopante, pero la prueba de vibración eólica a alta frecuencia puede ofrecer también información importante.

Para efectuar esta prueba se ha preparado el cable de manera que se soporte por sí solo; luego, el cable ha sido deformado hasta dos veces su carga de instalación nominal para cumplir los requisitos de configuración de la prueba.

Esta prueba permite hacer vibrar un tramo de cable medible con frecuencias similares a las que se pueden generar en el tramo de cable instalado cerca de una línea de ferrocarril o de una zona con tráfico de coches. La duración de la prueba también es larga, de 100.000.000 ciclos.

3.2 Empalme de la cinta y métodos de prueba de la deformación

El método de prueba publicado por un importante proveedor de telecomunicaciones utiliza una muestra de cable fija de 30m.

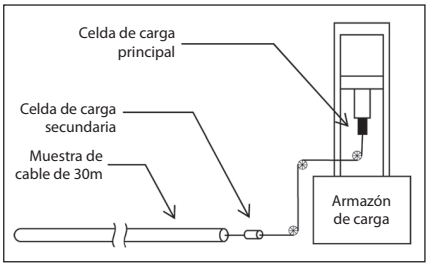
Las cintas del cable se fijan a un armazón de carga y se monitoriza la fuerza requerida para iniciar el desplazamiento de las cintas dentro de la cubierta y del tubo de la muestra de cable fija[10].

Un valor fijo de 0,036lbf *(lbf = libra de fuerza)* veces el número de fibras del cable es la fuerza mínima necesaria para superar la prueba.

Para algunos cables, especialmente los que tienen pocas fibras, se ha planteado la cuestión de la influencia del aparato de prueba, considerando el rozamiento inherente de las poleas.

Se ha propuesto una solución que prevé levantar la muestra de cable del suelo y ponerlo en una bandeja para tratar de eliminar por lo menos una polea.

Otra solución introduce una segunda celda de carga, puesta directamente en línea con la muestra de cable. La celda de carga del armazón de carga sigue siendo monitorizada y el armazón controla la velocidad de movimiento fijada por el método en 100 ± 25mm por minuto, pero es la celda de carga secundaria en línea la que proporciona la carga absoluta. Este aparato se puede ver en la *Figura 6*.

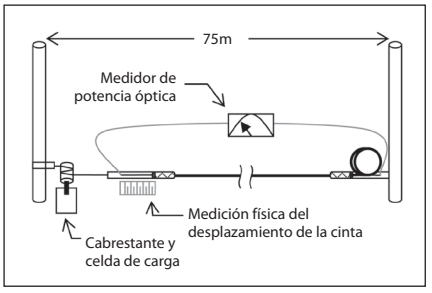


▲ **Figura 6**: *Aparato para prueba de empalme de la cinta*

Esta modificación del aparato de prueba del cable en pequeña escala ha permitido obtener resultados más precisos sobre la fuerza de empalme, pero se necesita hacer también una prueba para causar fuerte deformación en el cable.

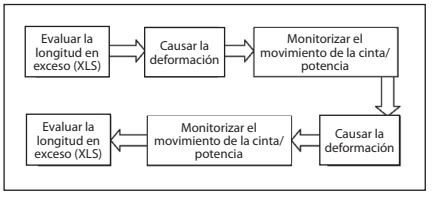
Usando un cabrestante eléctrico y una celda de carga, se ha deformado un cable entre dos postes anclados, a una distancia de 75m uno del otro. Agarrando con cuidado el cable, se han expuesto las cintas en ambos extremos; luego, se han empalmado las cintas a un medidor de potencia óptica de 1.550nm.

Además, se han colocado las cintas de manera que sea posible medir el movimiento lineal físico en un extremo, mientras que el otro extremo ha sido preparado con bucles sueltos para simular las condiciones en campo. El aparato de prueba de la deformación del cable está ilustrado en la *Figura 7*.



▲ **Figura 7**: *Aparato de deformación del cable*

Antes de iniciar la prueba de deformación del cable, y después de completarla, se debe probar la longitud de cinta en exceso (XLS) de la muestra de cable para evitar que una diferencia excesiva entre la longitud de la cinta en exceso y la longitud del cable afecte a los resultados. Luego, la muestra de cable es sometida al proceso de prueba que se describe en la *Figura 8*.



▲ **Figure 8**: *Procedimiento de la prueba de deformación de la cinta*

▼ **Tabla 1**: *Muestras de cable para la evaluación del empalme*

Relación de relleno del empalme	Número de fibras	Número de cintas
19%	12	1
24%	12	1
25%	60	5
29%	48	4
36%	48	4
37%	144	12
38%	108	9
41%	96	8
45%	144	12
51%	12	1
56%	48	4

4 Muestras de la prueba del cable

Para alcanzar un conocimiento completo del fenómeno de empalme, se ha probado un gran número de muestras de cable.

Algunas de las muestras eran versiones de cables producidos corrientemente ofrecidos en la línea de producción existente; otros eran cables creados específicamente para obtener los mejores resultados de prueba.

La relación de relleno del empalme, es decir, el porcentaje de área rellena respecto al área del tubo, ha sido uno de los parámetros aplicados para este análisis.

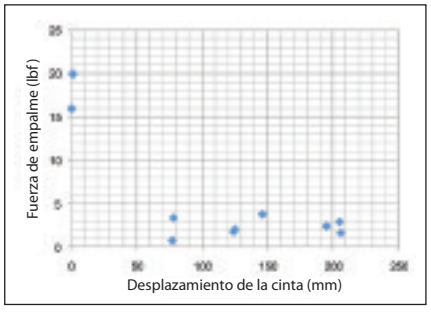
5 Resultados de las pruebas experimentales

5.1 Vibración eólica

La vibración eólica ha sido examinada anteriormente y no presenta alguna atenuación permanente o desplazamiento significativo de la cinta[3].

5.2 Desplazamiento de la cinta debido a deformación respecto a la fuerza de empalme

Para validar la correlación entre fuerza de empalme y desplazamiento de la cinta, la fuerza de empalme medida usando el armazón de carga ha sido comparada con el desplazamiento de la cinta observado usando el aparato de deformación.



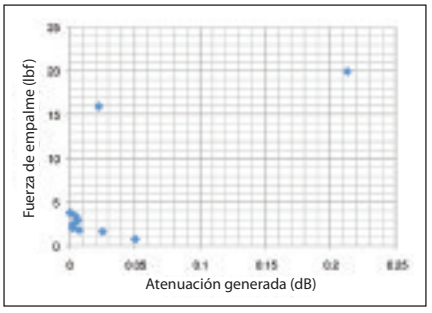
▲ **Figura 9**: *Desplazamiento de la cinta respecto a la fuerza de empalme*

La *Figura 9* muestra que por encima de un umbral de fuerza de empalme, el desplazamiento de la cinta, sin duda alguna, es retrasado.

Por debajo de este umbral, la fuerza de empalme no es un buen indicador del desplazamiento de la cinta.

5.3 Fuerza de empalme respecto a la atenuación inducida

La relación de interés examinada a continuación ha sido la magnitud del cambio de atenuación que se produce después de quitar la carga que causa alta deformación frente a la fuerza de empalme obtenida con el aparato con armazón de carga.



▲ **Figura 10**: *Atenuación generada al quitar la carga respecto a la fuerza de empalme*

La *Figura 10* muestra que, con una fuerza de empalme muy alta que causa solamente pocos milímetros de desplazamiento de la cinta, se puede producir un gran aumento de atenuación.

La elevada fuerza de empalme no permite que las cintas se redistribuyan o se relajen.

Los datos que ilustran este fenómeno no indican que esta situación se verifique siempre. Sería necesario efectuar otras pruebas a este nivel de fuerza de empalme para determinar de manera más precisa la magnitud de la fuerza de empalme y las circunstancias exactas que causan este problema.

Este evento concreto ha sido verificado con un cable de 48 fibras dotado de cuatro cintas de 12 fibras. A diferencia de los cables rellenos de gel, los cables de cinta con tubo central seco no pueden mantener las cintas en una pila uniforme.

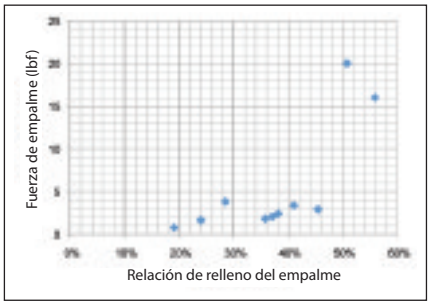
Se sospecha que las características anti-pandeo dependan de la uniformidad de la pila de cintas y esta condición también puede presentarse en cables con un número mayor de fibras.

El nivel de la fuerza de empalme que inicia a causar este problema es más alto de lo permitido en los diseños de cables comercializados corrientemente.

Para asegurar una estructura robusta se ha establecido un nuevo parámetro de diseño que pone en relación el área rellena del tubo con el área disponible. Para limitar la atenuación inducida se debería establecer un límite superior para este nuevo parámetro, la relación de relleno del empalme.

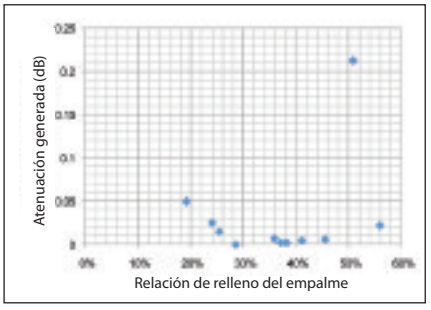
5.4 Relación de relleno del empalme

Se ha analizado la validez del nuevo parámetro de relación de relleno del empalme con los resultados experimentales.



▲ **Figura 11**: *Relación de relleno del empalme frente a la fuerza de empalme*

La *Figura 11* muestra que a aproximadamente un 50% de la relación del relleno del empalme los elementos de bloqueo del agua inician a comprimirse y a ejercer una fuerza de empalme significativamente más alta. Esto indica que hay un umbral por debajo del cual este parámetro no está relacionado con la fuerza de empalme. Para este diseño de cable no existe una relación lineal de fuerza de empalme.



▲ **Figura 12**: *Relación de relleno del empalme frente a la atenuación generada*

Por último, la *Figura 12* muestra la necesidad de reducir el parámetro de relación de relleno del empalme por debajo del 50%. Todos los resultados de atenuación obtenidos por debajo de este nivel son de 0,05dB o inferiores.

6 Conclusiones

Los ahorros en costes y tiempos de instalación conseguidos con los cables con tubo central seco son obvios y estos cables han sido recibidos bien por la industria.

Sin embargo, esta nueva tecnología necesita ser estudiada y se deben desarrollar nuevos métodos de prueba. Cuando se inicia un trabajo de este tipo es extremadamente importante fijar los criterios que se ajustan mejor a los requisitos en campo.

La tecnología de base de los cables con núcleo seco es la misma, pero hay diferentes tipos de polímeros superabsorbentes y no todos los diseños de cable se comportan de la misma manera.

Para asegurar las mejores prestaciones del cable cada diseño debe ser verificado para asegurarse de que cumpla los requisitos funcionales, incluidos los eventos de vibración y alta deformación. Los resultados de las pruebas muestran que este diseño de cable de cinta con núcleo (tubo central) seco es robusto.

Los diseños que permiten un desplazamiento de la cinta de aproximadamente 200mm a consecuencia de eventos de alta deformación no muestran cambios de atenuación; esto indica que el cable es robusto con un equilibrio entre empalme y diseño de base del cable. Se ha demostrado que un cable con fuerza de empalme elevada puede sufrir pérdida de atenuación después de eventos de alta deformación.

Dado que es probable que un cable sea sometido a eventos de deformación que exceden incluso la fuerza de empalme más alta, es extremadamente importante que todos los diseños tengan un buen equilibrio entre empalme de la cinta y diseño del cable en general.

Los criterios para el empalme de la cinta deben ser establecidos separadamente para cada tecnología de núcleo seco y diseño de cable.

Esto debería hacerse realizando pruebas relacionadas directamente con los eventos que pueden ocurrir durante el ciclo de vida de un cable. ■

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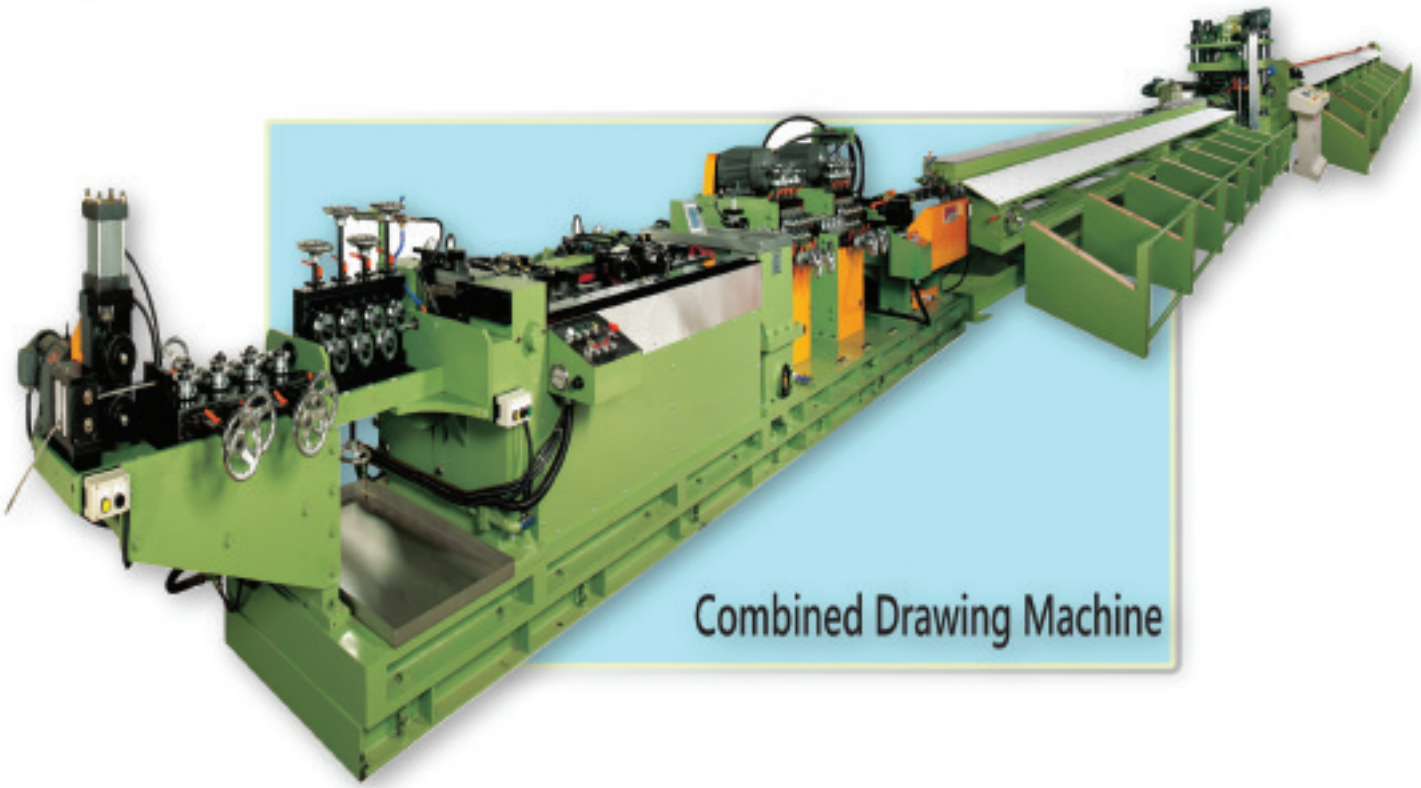

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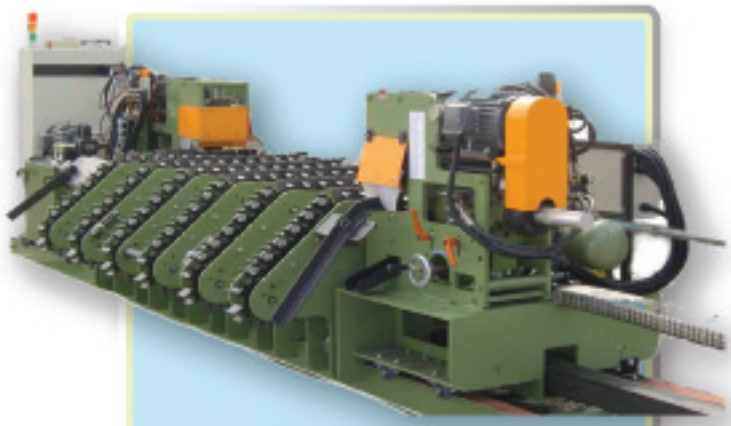

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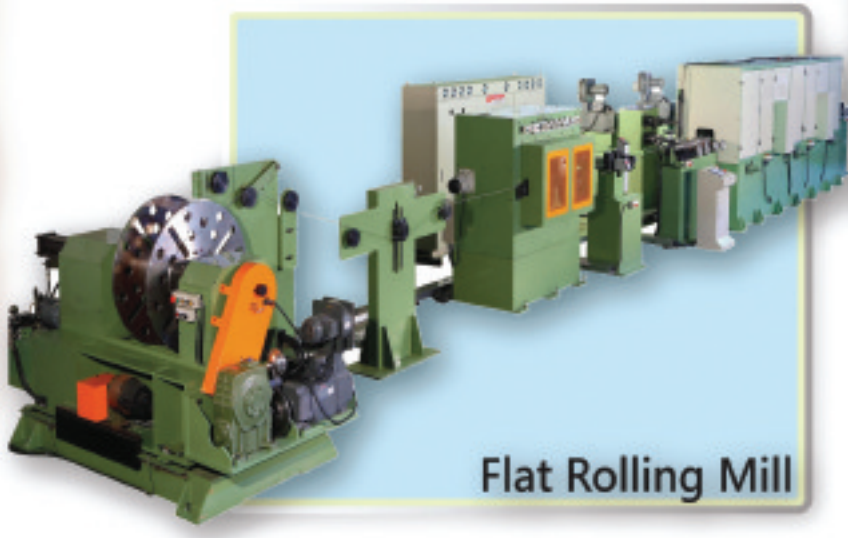

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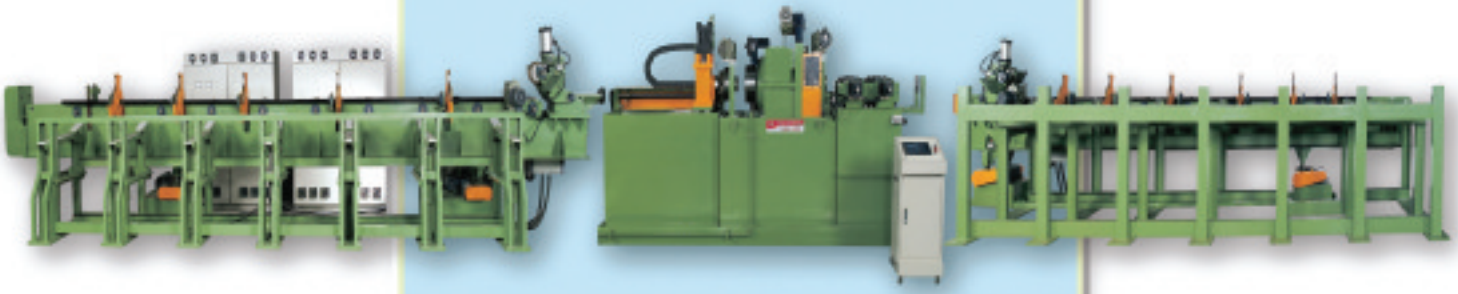

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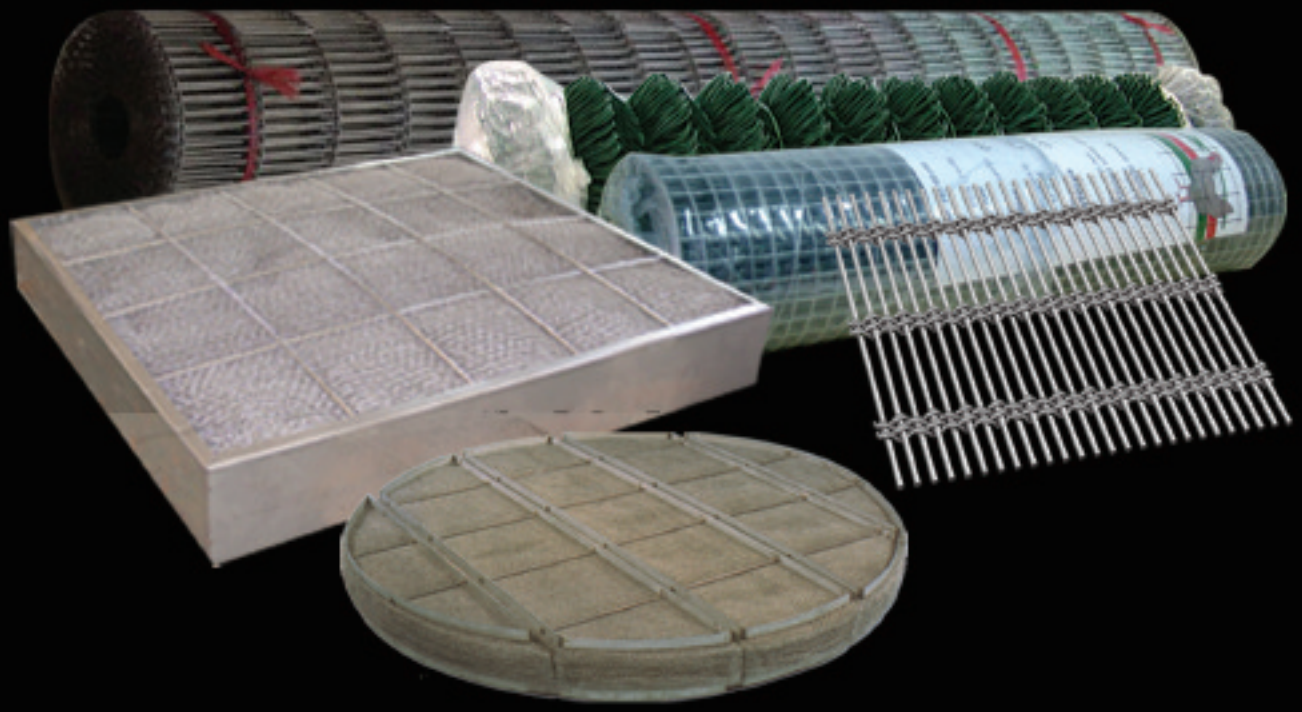

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