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- In-Depth Look at Ultrasonic Wire Splicing
- Automated Electrical Testing for Harnesses
- Automating High Voltage Cable Connector Assembly

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Company Profile: Northcomm Technologies

By Joe Tito
Wiring Harness News

We’ve covered many inspirational boot strap stories in previous Profiles. The story of Mark Danon, the owner of Northcomm Technologies, is very inspiring, but also somewhat unique. Many embarking on their entrepreneurial venture have come from positions of engineering or technical sales who started their business in their garage or basement. Mark Danon was an NYPD police officer who started his business in a tiny New York City apartment. But the beginning of this story goes back much further than that — back to Mark’s college days in New York.

During summer breaks throughout college and graduate school,

Mark worked for a couple of two-way radio dealerships. Both carried equipment manufactured by a major player in the public safety communications arena. “Doing that job through those many summers, I saw a lot of interesting opportunities where these dealerships were making one-off products to satisfy customer requirements,” he recalled. “These were products where it seemed as though someone should be mass producing them. And more often than not, they were cable assemblies.”

Upon completion of his master’s degree, Mark went to work for the NYPD in a number of different capacities. He started as a uniformed officer, then a sergeant, and eventually obtained a position at headquarters. During this last assignment, he worked on large citywide projects standardizing process and procedures across precincts. “My work at the police department was really about my interest in public service,



Mark Danon tuning and testing an RF filter called a duplexer, highlighting Northcomm’s servicing capabilities.

and I really enjoyed that job.”

Throughout his time at NYPD, Mark continued to reflect on his days at the radio dealerships as he began to see problems with communication equipment. His intimate knowledge and interest surrounding two-way radio systems led him to create a solution in the form of a single product. That product was a multi-conductor cable assembly that would allow operators of a very popular transmitter to connect that transmitter to third-party audio routing devices. “The reason I targeted this specific transmitter is because it was the most popular public safety transmitter out there, and integrating it through its audio routing system is a key thing that end users would want to do,” he explained.

Mark came up with a design, standardized the cable, and began build-

ing it in his apartment using mostly manual processes. He started selling through word-of-mouth, leveraging his dealer relationships and the many contacts he made during his years in the communications industry.

Through further iterations of the product to accommodate different configurations, the focused product line was showing signs of becoming an economically viable and a full-time venture. As a bonus, Mark really liked the work, so he took the leap.

Over time, Mark established some strong relationships with a major public safety communication OEM. He was approached and asked if he could make a very specialized microphone device, for one of the largest 911 call centers in the United States. “This microphone system would al-

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Reshoring Canada: New Organization to Advocate for Canadian Supply Chain Modernization and Resiliency

Recently, a group of former parliamentarians announced they are forming a new organization called Reshoring Canada. This non-partisan advocacy organization is designed to promote a modern, secure, and less risky supply chain.

“The pandemic has exposed risk in our supply chains, a place where we didn’t know to look. This will make way to find solutions for our people and our economy,” said Hon. Tony Clement, former federal Industry Minister and Co-Chair of this initiative.

“Canada cannot rely on friendly neighbours or business savvy executives to make our supply chains work.

The threat is real, and it’s coming from unforeseen directions,” said Sandra Pupatello, former Ontario Minister of Economic Development and Trade and Co-Chair of this initiative.

“New risks in our supply chain are national, coast to coast to coast, issues,” says Brian Storseth, former Alberta parliamentarian and Co-Founder of this group. “This impacts every sector from oil and gas, to mining, to manufacturing, to food

Reshoring Canada will analyze and offer solutions to key stakeholders that can make changes to support our industries and secure jobs. Its first order of business will be to move

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Automated Electrical Testing for Harnesses

By Ray Mumma
Cirris Systems

This is the first of a series of articles about the basics of automated electrical testing. Think about the series as answers to questions you were afraid to ask. We’ll start with simple concepts and mix in a few more complex topics over time, so hopefully there will be a little bit for everyone. As always, the best place to start is at the beginning.

What is automated (or automatic) electrical testing and what are its benefits? To answer these questions, we must first consider the characteristics of the products with which we are working. Electrical assemblies, whether simple cables or more complex assemblies like wiring harnesses, printed circuit boards or wired cabinets, all include interconnections. For the purpose of this

discussion, these interconnections are most often made using insulated wire or copper traces on printed circuit boards and they provide the paths used for routing electrical signals. These interconnections are referred to as circuits or electrical networks (nets). Nets may have two or more terminations, usually made in connectors, lugs, stripped wire ends, terminal strips etc.

The quality of connections can be quantified by their electrical resistance measured in Ohms (indicated by the Ω symbol). Connections with too high a resistance are most often the result of manufacturing defects. Assembly drawings or associated specifications typically define what constitutes “too high” by specifying the maximum allowable resistance of a “good” connection. Occasionally, drawings will neglect to include this information and we’ll discuss in

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Wiring Harness News (ISSN 1097-0789) is distributed bi-monthly to wiring harness & cable assembly shops, cord set manufacturers, and to companies (OEMs) that process electric and optical wire & cable.

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Wiring Harness News
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Office Hours: 8:00 a.m. - 4:00 p.m. CST
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From the Editor

Shaping Content at Wiring Harness News

The pandemic has certainly shaped and accelerated trends in many aspects of our private and professional lives. It has, no doubt, had a profound affect on your business. As demands shift, and product mixes change, we want to make sure we are fine-tuning our content to meet your developing objectives.

It's obvious you folks are no longer just slapping terminals on processed wires. Those days were over years ago. Some trends we hear about with harness manufacturers involve, sensor technology and integration, RF & microwave components/processing, box builds, HV cables, and automation (definitely automation). We have tried to increase coverage in these areas.

We need your input however, to make sure we are covering the reader's needs adequately. Please take a moment to think about the subjects you would like us to cover. Then drop me a line directly by phone or email. You can also email these suggestions to info@wiringharnessnews.com.

We would like you to think of Wiring Harness News as your research arm. This is your publication, and we would love to hear from you!

Kindest Regards,

Joe



Joe Tito
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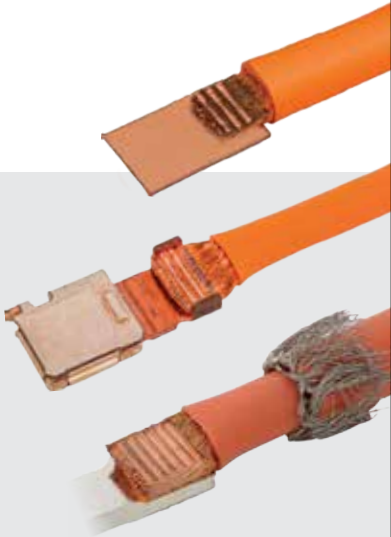
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Billboards and ... Wire Harnesses?

By Loren Smith

Why would messages on billboards that have nothing at all to do with our industry make me think of wire harness companies?

When my wife and I recently went on an extended car trip, we encountered billboard after billboard displaying nearly identical messages spelled out in giant letters: “Guaranteed offer. I’ll buy your house.” Although these entreaties had no relationship to our industry, they did spark recognition of some truths about the selling process that very much relate to our industry.

This phenomenon--the widespread appeals to homeowners to respond to a ready buyer--is a clear illustration of the efficiency of the marketplace. In other words, the spread between what homebuyer A willingly puts on the table, and the valuation result that will be achieved through a competitive process also involving homebuyers B, C, D and E explains the proliferation of billboards my wife and I saw on our trip.

The individuals or corporate entities who pay for these billboards operate on a fairly simple business model: They calculate the assumed market



Loren Smith CEO
Blue Valley Capital

price for a house, and then offer X percent less than that--on an attractive, immediate cash basis--yielding a group of homeowners who will jump at the immediate offer.

This is not a new business model, but the current hot housing market has increased the spread between a single buyer valuation and a valuation based on a competitive process. This substantial spread is sufficient to justify investing in multiple billboards on the interstate.

Continued on page 8

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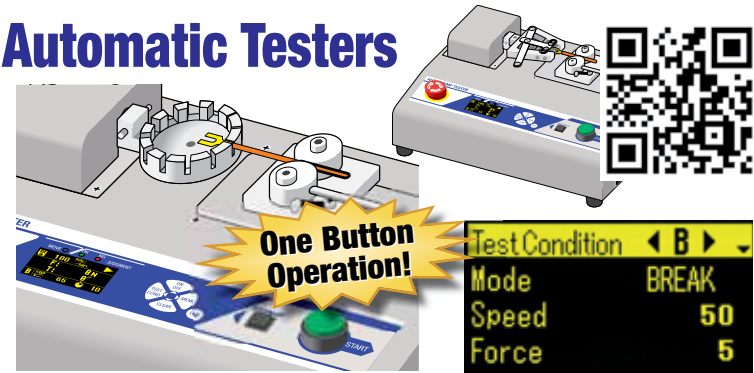
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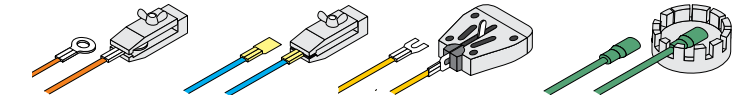
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Billboards and ... Wire Harnesses?

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Once new owners complete a purchase transaction, they put the house on the market and take whatever time is needed to realize the true valuation and a significant profit. I can think of no clearer illustration of the value of a competitive process. If a competitive process did not regularly yield a higher price than a single offer, my wife and I would not have seen all those billboards on the interstate.

This reality has repeatedly been my experience in the wire harness industry. Many owners who come to me already have a single buyer offer in hand, but they want to verify that

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Loren Smith can be reached at lms@blvcapital.com or www.bluevalleycapital.com.



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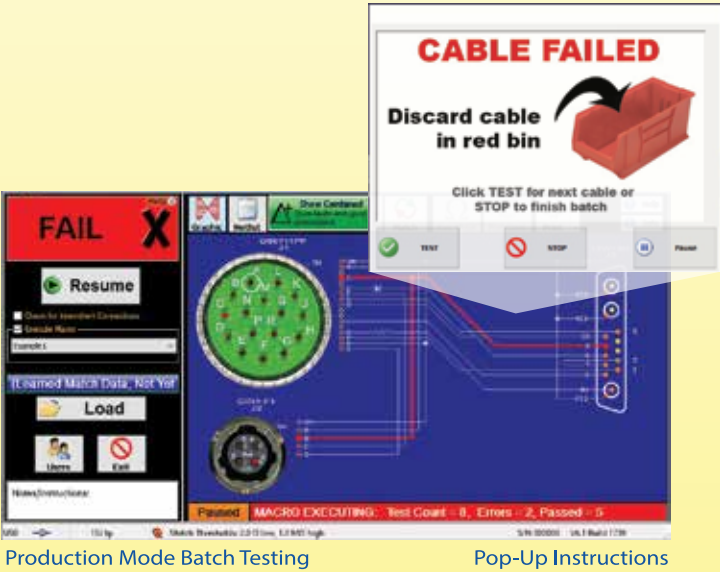
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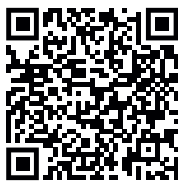
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Reshoring Canada

Continued from page 1

from anecdotal evidence of risk to hard data. With the help of key industry associations like the Canadian Manufactur-

ers & Exporters, Automotive Parts Manufacturers' Association and Ontario Mining Association, Reshoring Canada will

be reaching out to businesses across the country to solidify the kind of data required to make substantial recommendations to government and other key stakeholders.

Businesses and interested stakeholders are encouraged to visit our website and sign up to participate.

Taking Back Supply Chain Security

When Harry Moser began the Reshoring Initiative in the U.S., there was a belief that a rising tide raises all boats. Reshoring Canada also hopes to positively affect current trade deals and the CUSMA partner-

ships. Dennis Darby, president/CEO of Canadian Manufacturers & Exporters (CME), has stated, "Canada, Mexico, and the United States don't trade with each other anymore - we build things together," and this is what Reshoring Canada aims to help with.

Reshoring Canada plans to aid key stakeholders who can make changes that support Canadian industries and secure jobs. Its first order of business is moving from anecdotal evidence of risk to hard data.

The organization recently launched its first countrywide survey to identify supply chain challenges faced by industry partners in several sectors of the Canadian economy. Several Canadian industry associations are assisting by surveying their members, which will lead to more targeted and concrete data.

With the help of these key industry associations, Reshoring Canada will be able to solidify the kind of data required to make substantial recommendations to the government and other key stakeholders.

Companies that are interested in participating in the survey can visit reshoringcanada.ca/supplychainsurvey. For further information, contact:

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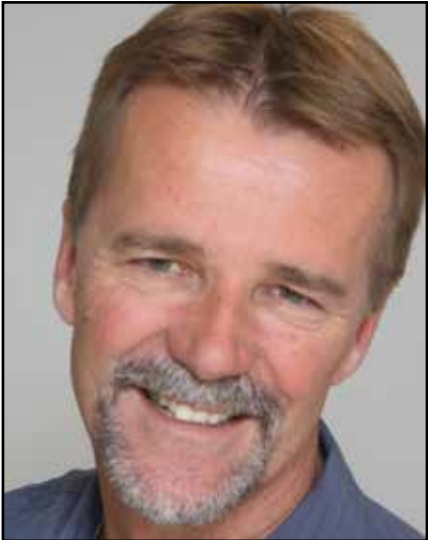
LEADERSHIP
PUTTING INSIGHTS INTO ACTION

Leading to Win: Best practices learned from a 40-year career

By Paul Hogendoorn

I'm a half-dozen weeks into "non-employment", which is a new and interesting condition for me. I've been writing this column for 16 years now, typically writing about the business stresses and challenges that kept me awake most Sunday evenings, along with the opportunities and ideas that kept me going back to work on Monday mornings anyway. Building a business or running a plant is not easy; there is a relentless pressure to deliver something 'tangible' every day, week, month, and year.

Many others in the organization have different degrees of separation in their lives. the longer term, big picture objectives can be deferred to others, and shorter-term objectives can be delegated. There is an "off switch" they can apply, and even though many opt to leave it on most of the time, that option is still theirs'. But, if you are the leader, there really is no "off switch", unless you have the company running very smoothly like a flywheel spinning on its own momentum. But in that case, you likely have effectively delegated the leadership to another person, and that per-



Paul Hogendoorn

son relates to what I'm saying here. I've been asked to continue writing this column for a while longer, and its something I'm glad to do. I've had the privilege of visiting hundreds of manufacturing plants all over the world, spending time on the floor, working with people and on machines (I loved that part), planning, executing, failing and succeeding, and always growing. It would be tempting to add "improving", or "continually improving", but I'll be

Continued on page 15

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Leading to Win: Best practices learned from a 40-year career

Continued from page 13

frank – that wasn’t always the case. In the next few columns, I’ll share some of the best learnings from both the good and bad experiences, and key lessons other leaders taught me along the way.

Tip #1: “Don’t make a big production out of it”. If you want to be innovative, or try something really different, do it quietly and on a small scale — “Under the radar” in other words. Most people resist and even oppose change. (I’ll deal with this more in a book I’m writing). They may clamour for change, but they really just want to be heard and considered. When it comes right down to changes actually being discussed openly, resistance builds on the floor (fueled by natural skepticism), and through the ranks of management (fueled in part by career defensiveness). In both cases, change disrupts their sense of security. The best way to avoid the near certain resistance and opposition to your idea is to prove it first in a small, non-threatening way. If it works, you have tangible evidence — ‘certainty’ to combat doubt. It’s still early enough to let others buy into the idea and adopt and embrace it and be part of it as it gets planned for larger rollout. If the small project fails, its not an ‘epic fail’ that gets in the way of future ideas and initiatives you might bring forward. Remember, manufacturing is largely filled with ‘tangible and tactile’ people. They like to see, feel and experience. They are not as likely to buy into things that are still abstract, or feel like marketing, sales or slogans. Do it small and succeed or fail under radar. If the small project works, consider that the official starting point. Achieve “undeniability” first and then it can’t be resisted or opposed by people on the floor or in the management ranks.

Tip #2: “You and your people are the smartest people in the room”. Over the years, I developed a healthy skepticism towards consultants, government sponsored funding programs, and people being positioned as specialists and ‘experts’ in their field. There is an army of people lined up to

tell you or your people how to do your or, their job better. They have a vocabulary that only they understand, and they use it to quickly tilt the conversation to where they become the smart ones to prove you and your people need them to really improve your operation. The truth is, you and your people are the smart ones; you are the people that built the business, run it successfully, and have figured out how to get things done, day in and day out. They need to be learning from you before they can offer you any insight of any value at all.

There are good ones, and there is a place for them. But always remember your people know your company, plant and product, far better than they ever will. The best they can

do, in my opinion, is bring in a good project process, help you be accountable to the goals you set, and ‘coach’ you and your people to be the best they can be. Your business will only ever be as good as your people can make. A good coach will make your people better, and your people will make your company better. The consultant, or government funding programs, or ‘experts’ can’t. Only you and your people can. ‘Training’ is one thing, ‘teaching’ is another. What you and your people would likely benefit most from is ‘coaching’. You train people to follow a process, perhaps a refined process, but its a process none-the-less. Teaching is important, but with the Olympics freshly in mind, every successful athlete needs

quality coaching to achieve their goal. It’s the coach that gets the most out of the athlete’s potential, making sure the hours, dollars and energy invested in training, pays off.

Those are my first two big tips as I share the best things I’ve learned working with hundreds of successful manufacturers and their amazing, often unheralded people. Feel free to send me a note at **Hogendoorn.paul@gmail.com** if there’s a specific topic or question you’d like me to address in a following column. Manufacturing created and continues to sustain our socioeconomic well being. We are in it together!

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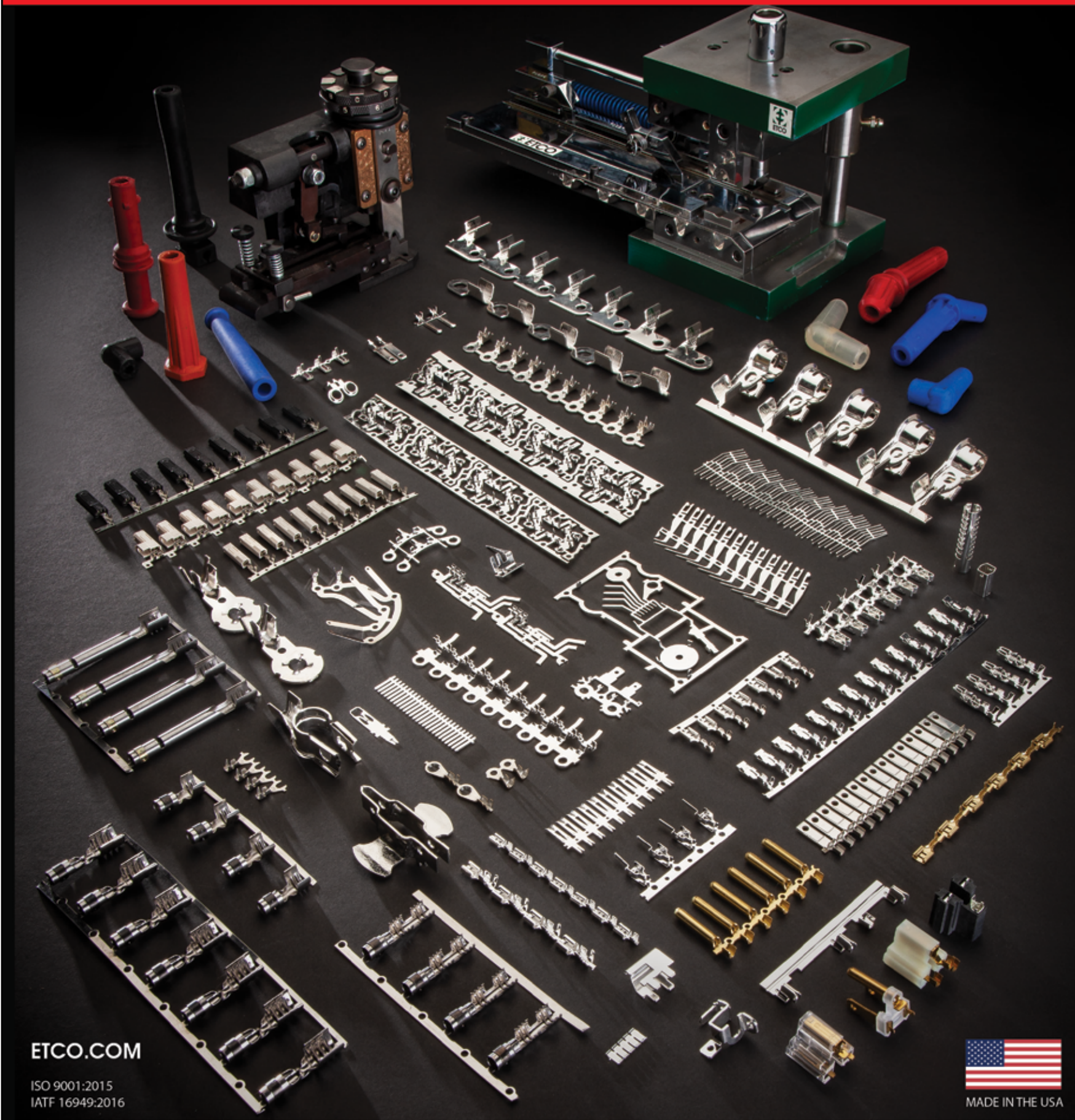
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NEWS PLUGS



TSR Capital Acquires Thermosleeve USA, a Leading Supplier of Heat Shrinkable Products

Thermosleeve will remain in current CA location and founder David Levy will stay active in the company.

US Distribution LLC, a TRS Capital company, is acquiring Thermosleeve USA. Thermosleeve is the leading supplier of heat shrinkable products in the United States. Located in Cerritos, California, the company will remain in that location. Thermosleeve founder David Levy will continue to be active in the company, overseeing the transition and helping with future growth. Current Sales Manager Johnson Yan also continues in his position, along with Stephanie Malloy who helps oversee customer support and order scheduling from the factory. Day-to-day operations, sales, and marketing will be overseen by Tim Bagley.

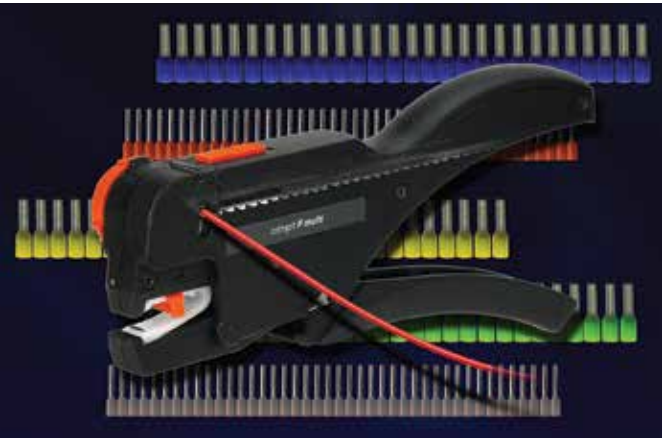
“I bring my thirty-plus years of experience in sales within the fastener, industrial, electrical, automotive, and retail markets to the team, and look forward to helping grow the Thermosleeve brand throughout all of North America,” said Tim Bagley, Thermosleeve Director of Business Development.

“With this acquisition, we continue our commitment to American business,” said TRS Capital Founder and CEO Robert Sires. “We are proud to add Thermosleeve to our active portfolio, which includes other U.S.-based companies such as US Meltblown (which makes the critical filter medium for medical grade PPE) and Movita Organics (which makes organic women’s vitamins). We have always felt strongly that it is vital to keep jobs at home to strengthen our country’s economy, and this is even more important in today’s environment.”

TRS Capital, an early stage investment company dedicated to investing in American success, provides not only funding but also consulting services to help companies thrive. The TRS Capital team has more than 200 years of combined

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Automated Electrical Testing for Harnesses

Continued from page 1

a future article how to calculate this pass/fail threshold. For those who like to read ahead, the IPC/WHMA A-620 specification provides a reliable source of information on the topic.

Another critical characteristic of wired assemblies is electrical isolation. It's well understood that the quality of connections within a circuit is critical, but the electrical isolation of circuits is of equal importance. The quality of the isolation can also be evaluated by a resistance mea-

surement, but instead of expecting a very low resistance as in the case of a connection, a very high resistance is expected between nets and between any positions in the assembly that should have no connections, such as empty, unused positions in connectors.

Although it's an incomplete description, some may refer to this type of quality assessment as "opens and shorts" testing. The description is incomplete because the resistance of

Continued on page 20

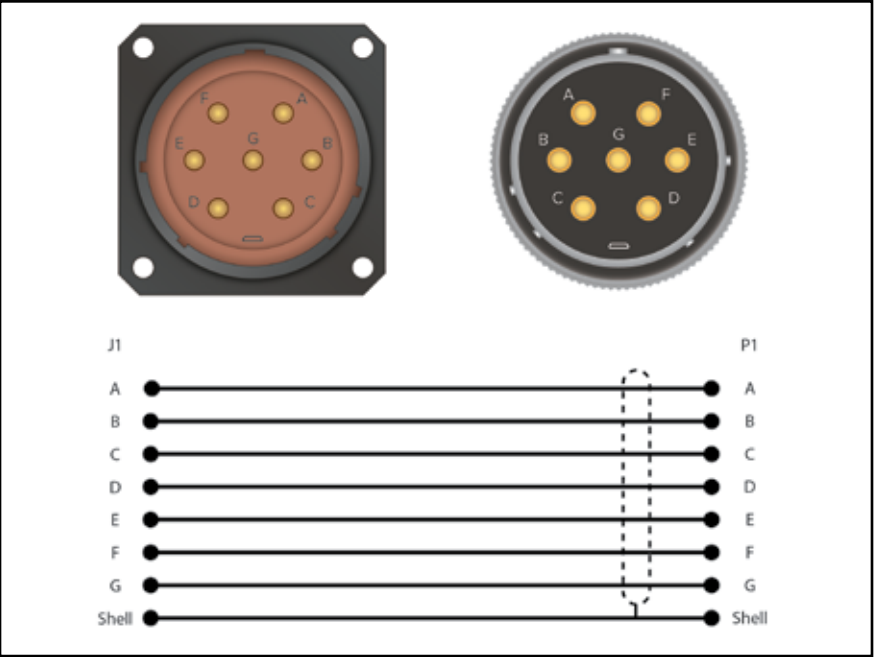


Figure 1. Example Connector Schematic

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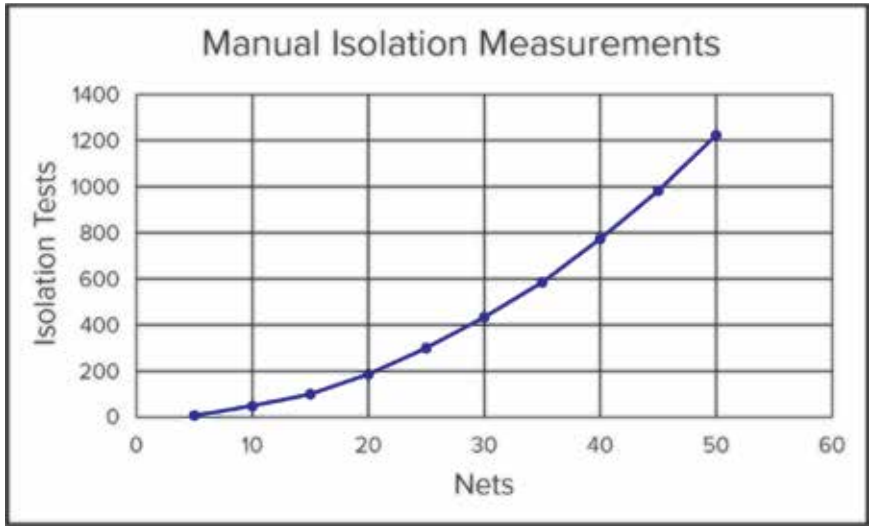


Figure 2. Isolation tests required.

shown in Figure 2 is that when manual testing is used, isolation testing is often skipped altogether.

This is the point at which the basic benefits of automated testing become obvious. Although it's a dramatic oversimplification, it may help to think of an automated tester as a multimeter with many leads, instead of only two. This is accomplished by switching the measurement capability of the tester through a relay matrix controlled by software.

To take advantage of the tester's capabilities, it's necessary to connect the tester to the product. This requires some type of test fixture. A simple example would be test cables with connectors on one end that mate with the tester and connectors on the opposite end that mate with the product. This is an investment not required with manual testing. How-

ever, with the product connected to the tester, the tester can automatically switch the relays to rapidly perform each continuity measurement, compare the measured value to the threshold and determine a pass/fail condition.

When performing isolation testing, the tester has a distinct advantage over manual testing. As a benefit of its architecture, instead of performing measurements from each net to all other nets one pair of nets at a time, the tester can measure from one net to all other nets in one measurement. It does this by applying a voltage to one net while holding all other nets at ground, measuring the current and using Ohm's law to convert the measurement to resistance. (Note that the exact method used by different

Continued on page 22

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Automated Electrical Testing for Harnesses

Continued from page 21

equipment will vary, but it's helpful to simply conceptualize the voltage being applied to one net while all others are held at ground.) Only if a failure condition is detected, is it necessary to measure the resistance between nets in individual pairs to identify the net to which the failure occurred. The result is that a typical, thorough test of the assembly, including continuity and isolation testing, can be accomplished in a matter of seconds without the possibility of human error.

While our sample product was a very simple assembly, it's still readily apparent that automated testing provides a more reliable result, especially considering the differences between manual and automatic isolation testing. On the financial side, it's important to recognize that while automated testing requires an investment in equipment, test fixtures, and programming, a fair comparison with the cost of manual testing cannot be made without including the labor for isolation testing. It must also be noted that the per unit cost for au-

tomated testing declines with higher quantities, repeat runs and product complexity while the per unit labor cost for manual testing may decrease slightly with higher quantities based on the learning curve, but it will remain relatively constant. Manual testing higher quantities also leads to worker fatigue and inattention, which increases the probability of errors. Finally, regarding product complexity, automated electrical testers typically can perform more than simple continuity and isolation testing and often provide the capability to test components such as resistors, diodes, capacitors and depending on the equipment, some add the capability to perform high voltage dielectric withstand and insulation resistance testing, all of which expand the advantage of automated testers.

Next session we will discuss how automated testers perform measurements.

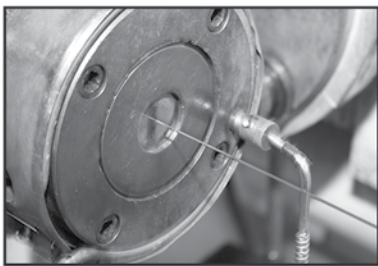
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Northcomm Technologies

Continued from page 1



Mark was happy improving lives as a police officer, but he is even happier that he is producing products that touch many more lives.

low 911 dispatchers to speak directly with the police, fire and EMS people,” he described. “I knew exactly what they wanted as far as form, fit, function and durability, because I knew the culture.”

Within a month, he handed a prototype to the OEM who showed it to the customer. It was no surprise to Mark that they loved it, and soon orders were pouring in. “Every single 911 call that goes through this major public safety radio system, goes through a microphone and preamplifier made by Northcomm Technologies.”

The ball was rolling, and Mark was contacted by different project managers and field people at the OEM to see if he could produce more products to solve other problems. “At this time, we were focusing mostly on multi conductor wire harness products, and I thought that we needed to find a way to decrease the human touch, and increase our ability to have higher throughput with fewer errors,” he explained. “I know everybody says this, but for me it really is about impeccable quality, and 100% perfection is what I’m after every time. The people that are using this stuff are doing a job that I used to do, and I take that very personally.”

In pursuit of this goal, Mark began researching automation products that would increase his throughput while satisfying his obsession with quality. One supplier in particular emerged favorably in Mark’s eyes. “I know this is going to sound like a sales pitch for Schleuniger, but it’s really not. I found out about them and this entire world of professional cable harness manufacturing equipment.” The Schleuniger salesperson paid him a visit, and Northcomm started with one machine, a UniStrip 2300. “Eight or ten Machines later, and I can produce one of these assemblies in about 1/10 of the time that I used to with microscopically inspectable perfection, and the product just continues to improve.”

Also around this time, it became painfully obvious to Mark that his New York City dwelling was not going to sustain the growth of his fledgling business. “From a facility standpoint we needed to leave New York City, but it was mostly for personal reasons. I mean, I thought it was cool to leave New York before Covid — the economics just made sense.”

With family in Texas, Mark had become familiar with the Dallas-

Continued on page 25



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Northcomm Technologies

Continued from page 23 _____



Northcomm tries to avoid manual assembly processes, but some products require careful hand soldering.

Fort Worth area. There were plenty of houses available that would give him the extra space he needed to grow the business. “I didn’t want to invest in buying a building just then. I wanted to invest in machinery because it was the machinery that was allowing us to be hyper competitive.” Mark found a home in the DFW area that had an extra outbuilding space to accommodate their needs. They fitted those areas with workstations for the various processes and testing procedures.

Mark has always sought to move Northcomm in new directions, seeking the next best move in technology to develop the product line. He saw the need to push the company in the direction of RF. “I knew we needed to be doing something with 50-ohm

coaxial cable, and we couldn’t do that until we bought the machine to touch that kind of wire,” he explained.

Somewhat serendipitously, Mark was then approached by another project manager at the OEM to solve a problem they were having building the transmitters for a large metropolitan rail system. The transmitters were going into very specialized cabinets, and the OEM couldn’t use their normal coaxial cable because it wouldn’t fit. “They needed somebody to manufacture the coaxial cable sets to connect those transmitters to what are called combiners. And those combiners connect those transmitters to the antennas which represent the spinal cord of the entire system,” Mark detailed. “If those cables aren’t

_____ Continued on page 27



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Northcomm Technologies

Continued from page 25



Inspection of Amphenol RF right angle connectors on RG-400 cable assembly.

perfect, you will have any number of very hard to diagnose problems with the system. It's not just a 'works or doesn't work' situation. You could have intermittent problems, noise, interference or a whole number of things."

Of course, he told them he could absolutely do it. He created a design spec that the customer reviewed and liked. For Mark, this was the opportunity that would allow him to buy the expensive coaxial equipment. "We went to Schleuniger and they gave us a fabulous deal on our first coax ma-

chine. We promised the customer we were going to deliver in four to eight weeks, and we got it done in two." Northcomm already had invested in a Rohde & Schwarz vector network analyzer to measure RF components, so they were able to serialize and provide individual data on every single cable. That level of data has become the hallmark of the company's coaxial cable products.

After that great success, Mark began to look at his business as not

Continued on page 29



Inspection of Amphenol RF right angle connectors on RG-400 cable assembly.

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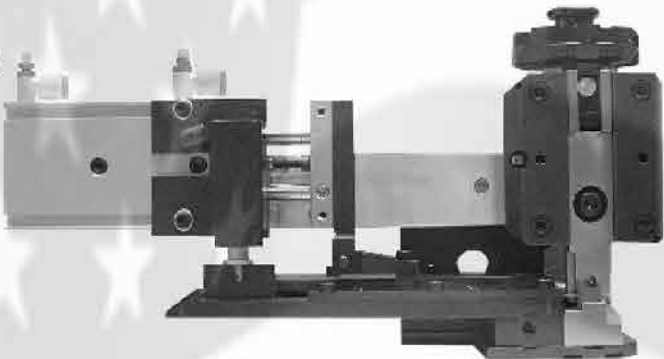


Model 1700

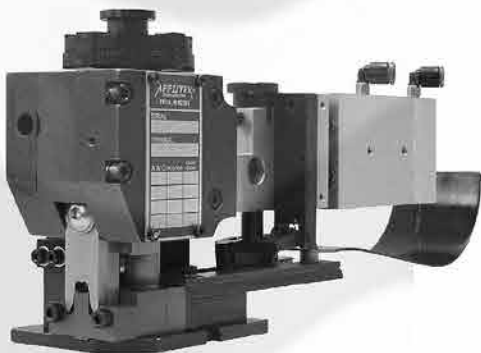


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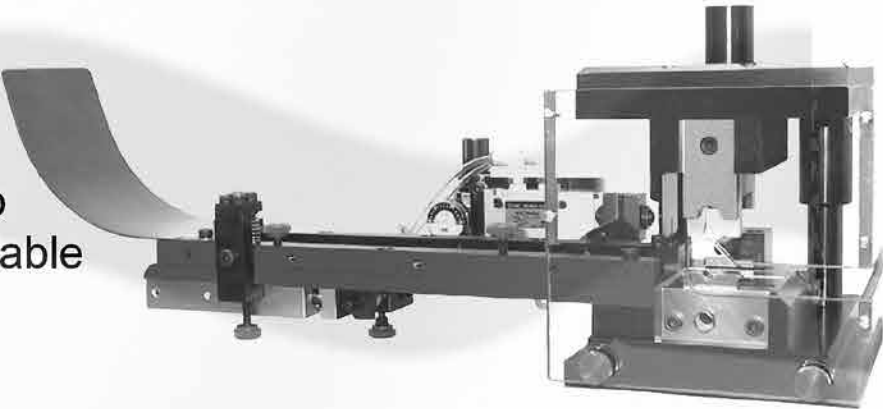


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Northcomm Technologies

Continued from page 27

just wire harnesses, but as an entire product portfolio in support of public safety two-way radio communications. “I said that I would like to think about eliminating multi-conductor cable harness assemblies in certain spaces, and substitute those for circuit boards.” Mark saw an opportunity with an interface plug used in the backbone transmitter of practically every major public safety radio system in the United States. “That interface plug presented an enormous number of connection challenges, and the OEM’s solution was a very large and complex cable harness assembly. The customer needed a lot of rack space if they wanted to plug into this connector, and rack space is like New York City apartment space — there’s a big premium there.” So, Mark developed a small circuit board that eliminated all of the cabling and allowed the OEM’s customers to rapidly plug into the base station without complicated wiring and without losing precious rack space. “It’s just a little circuit board, and it’s one of those ‘I should’ve thought of that’ products, and we’ve been selling a whole bunch of those to The US government. And so, circuit boards have now become an actual vertical for us because we developed the expertise and the vendor network to help us get that done.” Mark thought of the idea one day while standing at the car wash waiting for his car. Three months later, he had a product, with a patent pending, ready for sale, and in the customers hands.

Alongside the circuit board product, the OEM recently selected Northcomm in a competitive bid to manufacture all the coaxial cables for all of the cabinets within one of the largest police radio systems in the United States. “As far as I know, this particular system is one of the largest police radio systems in the United States by a mile. That project is going to keep us busy for years,” Mark outlined.

For that project they actually beat out other vendors, not just because

they offered the highest quality, but because they were able to offer traceable data with every single cable sold. “We offered them the performance data and serialization for each cable, and that gave them the confidence to know that they were not going to have any problems with our products because they are tested in a very rigorous and verifiable way.”

With all these major successes and because he now has employees, Mark is in the process of looking for a larger location to house the operation. “I don’t believe in renting or leasing anything, so we want to build a small building and actually take that next step. It’s an expensive proposition, but it’s necessary to sustain our growth.”

In conclusion, Mark had this to say about his experience thus far:

I’d like to tell you that from a personal standpoint this experience of running a small business and being able to have the honor of servicing these incredibly meaningful customers has been the most exciting experience of my life. It was very difficult leaving the NYPD because I absolutely loved my job. I got to work with incredible people doing incredible work that I just loved. A lot of people don’t understand that law enforcement is about improving the lives of others. And now I get to make these products that help people improve the lives of others. It’s just incredibly fun. So, for me, it’s not just manufacturing cable assemblies or wire harnesses. It’s an entire product portfolio, and I’m always thinking about what we are going to do next.

The future looks bright for this innovative manufacturer. If you’d like to see some of the incredible products Northcomm is marketing, jump on their website at northcommtechnologies.com. And keep an eye on them as they blaze a trail in the two-way communications arena.

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THE

POWER WOMEN

OF THE WIRE HARNESS INDUSTRY

By Melissa Femia

This edition of The Power Women series features a young lady who I previously had the pleasure of employing at Jana Diversity Solutions, Veronica Felix Elguezabal. She is currently in the role of Quality & Environmental Systems Coordinator at St. Clair Technologies. Not only is she a qualified female engineer, but she also has a long-term interest in supporting and celebrating successful females in

technology and manufacturing. Veronica grew up in Guaymas, Sonora, Mexico. At the tender age of 5 years, her parents divorced and her mother had to work to support both Veronica and her sister. Because her grandfather watched her when she was not in school, he had a lot of influence in her life. While he was not an engineer, he worked at the electrical station in Mexico. He often spoke about his job and the subject of electricity. She was also fortunate to have had exposure to an uncle who was the first engineer in their family, a

civil engineer. From a young age, he encouraged her to pursue a degree in engineering. On the other hand, her schoolteachers questioned her about a career path in teaching or law or other more traditional female jobs. While she performed well in school, the familial discussions led her to her engineering path more so than her scholastic conversations with teachers or counselors. She knew she wanted to pursue engineering, and eventually opted toward a degree in Industrial & Systems Engineering at the Instituto Tecnológico de Guaymas in Sonora, Mexico (ITSON). Veronica ultimately became the first female engineer in her family.

Veronica noted that her engineering major (Industrial & Systems Engineering) was evenly represented by males and females. She advised that some of the other majors such as mechanical and electrical engineering were heavily male-dominated from the attendance perspective. Throughout her collegiate experience, she did not have any concerns or challenges due to being female.

Upon completion, she was hired as a student at St. Clair Technologies as a process technician. After completion of her assignment, she then attained a position at Access Electronics where she worked as a calibration technician. At that point, she moved because she was interested in attaining more knowledge in a different industry. In 2009, she opted to relocate to Tijuana for personal reasons. There, she worked as a Jr. Process Engineer at NPA of Mexico. After leaving the work environment for a couple of years to have and raise her son, Veronica then returned to Guaymas and St. Clair Technologies in 2011 where she worked as a Board Tooling Technician. After a short-term period, she was promoted to the position of Quality Engineer. In the quality engineering position, she was integral in working with customers to assure excellent customer satisfaction. She learned about and prepared customer PPAP (Production Part Approval Process) documents. She was also



Melissa Femia

responsible to ensure compliance to ISO 16949 / TS 16949, AS 9100, and ISO 14001 and became well acquainted with AIAG (Automotive Industry Action Group) Core Tools. In addition, she worked with internal teams to provide root-cause analyses for any quality issues cited by customers. As the scope of the Quality Engineer position is wide, she became an expert at quality systems throughout the duration of her 6 years in the role.

In 2018, Veronica was asked to move to Jana Diversity Solutions for a temporary assignment and took the role of Quality & Environmental Supervisor. She went from working at a very established business of 75+ years to a new, start-up company. She utilized her vast knowledge of quality systems to lead Jana Diversity Solutions in the creation of new processes and procedures. She was the corporate Management Representative, and helped Jana Diversity Solutions become IATF 16949-certified. Most notably, her quality focus and support of plant floor operations helped to ensure that Jana Diversity shipped high-quality parts—a necessity for a small, growing company.

Again in 2019 and per plan, Veronica returned to work at St. Clair Technologies. She was promoted to the position of Quality & Environmental Management System Coordinator. In her new role, she is responsible for roughly the same scope of responsi-

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bilities as her Jana Diversity role, but for a much larger company.

During evenings and in addition to her primary job assignment, Veronica has also been an auxiliary instructor at ITSON. In this role, she teaches university students about guideline norms such as ISO 9001, ISO 14001, IATF 16949, ISO 22000, and ISO 45001. She prepares and delivers the lessons. Additionally, she participates on departmental committees and advises on curriculum improvement opportunities. She is also taking on the special project of creating a women’s professional conference for communication and networking purposes. This conference will highlight important functions performed by females and will allow students to gain professional mentors to ultimately further their motivation and advancement in industry or academia.

Thank you, Veronica, for sharing your story with *Wiring Harness News*. Also, I would like to extend a shoutout to St. Clair Technologies for promoting a strong, experienced female in to one of the highest-ranking positions in the company. Through Veronica’s hard work ethic and subject expertise and St. Clair’s acknowledgement of her contributions, other



Veronica Felix Elguezabal

females can see their own potential for upward mobility.

If you are interested in sharing the stories but missed the original WHN distribution, the articles are available on the Jana Diversity Solutions website at www.janadiversity.com, or at wiringharnessnews.com.

If you know a female engineer who would make a great candidate to feature in the Power Women series, please direct them to me at femia@janadiversity.com

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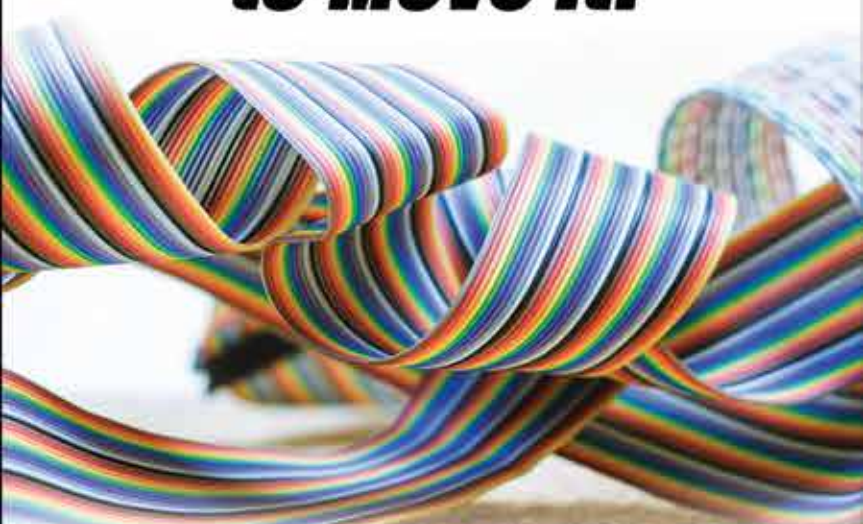
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WHMA/IPC plans to expand the Educational Offerings at EWPTE in support of our mission to lead, educate and connect with companies in the cable and wire harness industry. We invite engineers, researchers, academics, technical experts, and industry leaders to submit technical conference abstracts for the Electrical Wire Processing Technology Expo (EWPTE), to be held May 10-12, 2022 at the Wisconsin Center in Milwaukee, WI.

Expert technical presentations are being sought in the following areas:

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- Quality Requirements
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- Wire Harness Troubleshooting
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- Wiring Harness Education and Training
- Connector Advances
- Tooling
- Process Equipment/Productions
- Calibration
- Ultrasonics Splicing and Terminating
- Harness Design Drawings Engineering

- Overmolding
- Testing - Electrical/Environmental/Mechanical
- Electric Vehicles (EV)/Electric Mobility
- Cleanliness and FOD
- Wiring Harness Rework

Abstract and Proposal Instructions

An approximate 300-word technical conference abstract summarizing original and previously unpublished work covering case histories, research and discoveries must be submitted. The submission should describe significant results from experiments and case studies, emphasize new techniques, discuss trends of interest, and contain appropriate technical test results. Final selected presentations will be limited to 30 minutes. Technical conference paper abstracts and course proposals are due November 16, 2021.

Conference Timeline

- Proposals due Nov. 16, 2021
- Acceptance by Dec. 20, 2021
- Papers are due March 14, 2022
- Final presentation revisions due April 11, 2022

For more information about the Electrical Wire Processing Technology Expo's Conference, please contact David Bergman, WHMA Executive Director and IPC Vice President of Standards & Technology at David.Bergman@ipc.org.

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In every issue of Wiring Harness News, Anixter will bring you informative articles about wire and cable technology.

Conductor Resistance

In one of our previous Wire Wisdoms, “Conductors – The Electron Superhighway,” we discussed different size conductors and the reasons for their existence. One of the principal reasons for having different size conductors is due to resistance. Resistance is defined as the opposition to the flow of electrical current through a conductor. It’s important to point out that conductivity and resistivity (the property that determines final resistance) are inversely proportional. The more conductive something is, the less resistance it will have. This Wire Wisdom will examine how resistance affects wire and cable.

glass), but resistance is much lower in metals such as silver and gold. Even though gold and silver have low resistances, they are too expensive in most cases to be applied in any form other than plating.

Copper is the Most Common Conductor


In the late 1700s, copper was found to be a more cost-effective option than silver. Its low resistance, wide availability and relative low cost launched it to the top of the preferred conductor charts. The amount of copper products consumed in the USA last year could make a 12 AWG wire long enough to make 140 round trips to the moon.

All Objects Have Resistance


The best conductors in the world, excluding superconductors, have some resistance. Even though most people believe gold is the best conductor because of its common use in high-end consumer products, it is actually silver (gold is used on these products because it does not corrode easily and can be left untreated on a shelf for months or years). Electricity can flow through nonmetals as well (e.g., wood, plastic, rubber and

Aluminum

Aluminum is another widely used material to conduct electricity. With conductivity 62 percent of copper, it has a slightly higher resistance than gold but with a relatively low weight, given its level of resistance. It is also cheaper than copper on a pound-for-pound basis. However, more conductor volume is required than copper, which means it is not as ideal for small applications with space constraints.



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How Does Resistance Affect Your Product?

Resistance is the opposition to the flow of electrical current, more specifically, nonvarying current (i.e., direct current (DC)). Impedance is the opposition to the flow of varying current (i.e., alternating current (AC)). These two are sometimes used interchangeably by the novice, and for many applications, they have the same results. In fact, they share a common unit: the ohm.

Because ohms represent the amount of resistance a wire or cable will have, it is generally desired to keep the number of ohms as low as possible. The primary reason for this is efficiency. In most applications, a lower resistance means less power is converted to heat and lost to the surrounding environment and more of the supplied power gets to its intended destination. It also means that the wire and cable will run cooler and the power source can be smaller for a given load. Because heat can cause catastrophic failure or shorten the life of a wire or cable, it's good to minimize the amount of heat generated by resistance in the wire. Because electrical power is generally expensive to generate, in renewable energy applications, by portable generators or by your alternator, it's always desirable to optimize the conservation of power in the conductors.

How Do I Minimize Resistance?

Other than choosing an efficient material, such as copper, there are a

couple of simple things that can be done to reduce the resistance of a conductor. Conductors have lower resistance at lower temperatures. Keeping a conductor cool will help keep the resistance low and reduces the amount of power lost to conductor heating. Installing a conductor in a location with cooling airflow will help make it more efficient because it'll keep the resistance lower (it will also help prevent premature aging of the insulation and jacket materials).

The simpler approach might be to choose a larger conductor. In applications where the product will be used continuously, a larger conductor can often pay for itself. The payback period for the increase in cost of a larger conductor can be as short as three months under the right circumstances¹. The larger conductor will have a lower resistance due to the increased volume of conductive material. Because resistance is determined by the material and the material's volume resistivity (resistance per unit volume), the more volume of material you have, the lower the resistance will be. Think of it like an interstate highway: the more lanes you have, the less resistance you will have at rush hour.

For questions on resistance or help choosing the best wire or cable for your application, visit anixter.com/contact to get in touch with an expert.

¹ Copper Facts. Electrical. Copper Development Association.

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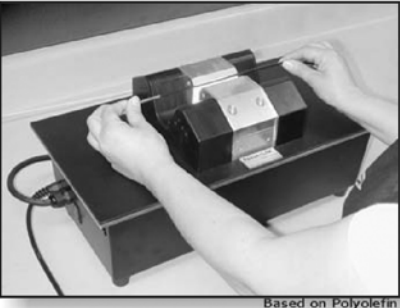
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Detailed Discussion of MIL-STD-1353 (Part 1): Tin Plating

By Laura Wishart
Lectromec

Introduction

The mating of the electrical wiring interconnect system (EWIS) is a non-trivial task. Between the functional requirements (the correct number of pins, sizing of contacts, etc.), there are also the performance requirements (operational environment, corrosion resistance, impedance matching, etc.). This is then further complicated by installation requirements (sizing), maintenance requirements (mating/demating cycles), and regulatory requirements (limitations of materials that can be used). Obviously, adding a connector to a wire harness is not a five-second activity.

In this series of articles, we will examine a few of the specific requirements of the MIL-STD-1353 in a bit more detail.

ACCEPTABLE USE OF TIN IN AIRCRAFT CONNECTORS

Tin is often considered a low-cost, highly conductive choice in material selection. In fact, it is the most common material used for soldering applications, when alloyed with Lead (Pb). On its own, however, tin can cause severe problems to an electrical system. The following examines some properties of tin, permissible applications, and limitations of its use in aircraft connectors.

TIN WHISKERING

Pure tin is known to produce “whiskers”; filament-like strands of tin protruding from the metallic surface over time.


Tin whiskers are conductive as they are an extension of the conductive tin surface; they grow gradually over time and have been observed to reach several mm in length. The conductive nature and significant length of these filaments introduces the op-

The MIL-STD-1353 explicitly prohibits the use of pure tin in plating, underplating, or as a final finish either interior or exterior of the connector surface. This is due to pure tin’s tendency to produce “whiskers” which can be extremely dangerous for the aircraft.

Tin-Lead (Pb) solder, however, is recommended by the MIL-STD-1353 in solder and benign ground applications. Any tin solder used may have a maximum of 97% tin by mass and a minimum of 3% Pb by mass and adhere to the solderability testing standard MIL-STD-202 method 208.


Other limitations of tin-plated connectors include limiting its use in high frequency applications such as radio frequency circuits. Tin plated connectors should be limited to low-frequency applications to limit the signal attenuation (more conductive platings are recommended for high frequency signal transmission applications).


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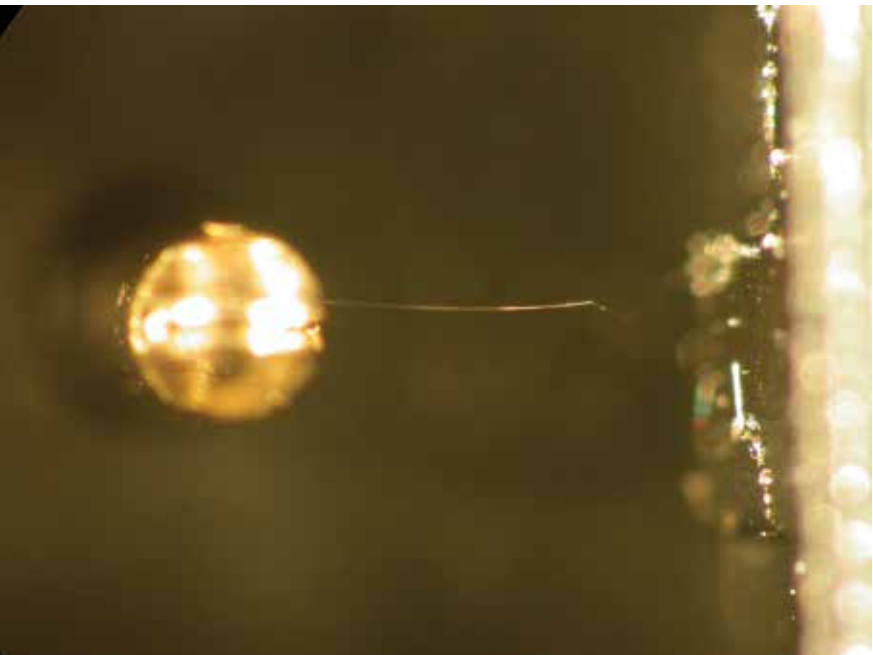
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A tin whisker growing between a d-sub shell and connector pin. This can cause a short between the two conductive surfaces.

Photo Credit to NASA Photo Gallery

portunity for short circuiting or electrical arcing between components or systems. As discussed in several previous articles, a short circuit or electrical arc on an aircraft can cause very severe physical and functional damage.

In some cases, a whisker may cause a “metal vapor arc” in which the transfer of energy is so extreme that the solid metal whisker vaporizes into a plasma with a much higher conductivity. The increased conductivity allows for the arcing of much larger currents which will result in more severe damage.

Unfortunately, there is no confirmed agreement of a single consistent cause of tin whisker formation. Common consensus seems to lean toward the idea that whiskers are formed in conditions where the tin undergoes excess mechanical stress or compression. However, methods of mitigating the formation of tin whiskers can still be developed and implemented.

Whiskering is commonly mitigated by using tin/lead alloy solder (commonly 97% tin, 3% lead); in practice, the presence of lead inhibits the growth of whiskers. Though, with recent initiatives to reduce the use of toxic chemicals, such as lead, in commercial applications, alternate options of whisker mitigation may be researched and implemented (conformal – ceramic/ polymer coating, printed circuit boards with coating).

ENVIRONMENTAL LIMITATION

Of the plating options for connectors, Tin plated connectors have perhaps the most significant limitations.

- Lowest max-temperature option. The relatively low melting point of tin makes it susceptible to inter-metallic growth at significantly lower temperatures than other plating metals.
- Lowest salt fog rating. The salt fog test is an evaluation of a plating material’s ability to withstand corrosive, humid conditions, namely salt-rich fog. A low rating in this respect implies poor performance of the material in particular climates.
- Among the highest shell to shell conductivities. The shell-to-shell conductivity test measures the volt-

age drop across a connector when placed in a standard circuit. A larger value for this test means that there is a notably larger amount of energy dissipated via the connector.

CONCLUSION

Tin can be a particularly tricky metal to work with in aerospace and other applications, particularly when one considers its strict operational limits. Clearly, the opportunity for further research exists in the understanding of tin whisker formation. Until such research is readily available, however, means can be applied to mitigate this detrimental growth and tin may continue its use as an alloyed solder and a plating in low-frequency applications.

In the next article discussing MIL-STD-1353 requirements, we will continue the discussion of plating metals and examine nickel and gold – a very commonly paired combination

About Laura Wishart, Engineer at Lectromec

Since joining Lectromec in 2019, Ms. Wishart has been a key contributor on projects involving testing of wiring system components and the impact assessment of poor installation practices on Electrical Wiring Interconnection System (EWIS) longevity. Recently, Laura’s primary focus has been on addressing the unique aircraft certification needs of high voltage aircraft wiring components and systems.

About Lectromec

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By Rob Boyd
Senior Product Manager,
Schleuniger, Inc

Electric Vehicle (EV) cable harnesses is one of the hottest topics in the world of wire processing today. It's a very new and exciting market that is changing rapidly as new technologies emerge. For those looking to expand into this market, it is important to understand the process of effectively automating high voltage (HV) cable connector assemblies.

High voltage connectors used in EV applications have many components, therefore there are several process steps that must be performed in a specific sequence. While most customers want to automate every process step, often times the cost of a fully automatic sys-

tem cannot be justified.


Some process steps are more challenging and require more precision. For instance, removing the foil layer or cutting the shield is more critical because connector performance or safety may be affected significantly. Furthermore, some process steps are required for almost all connectors and cable types whereas other process steps are required only for certain connectors. Depending on the volume of a particular connector series, it might make more sense to automate only the critical or common steps and continue the simpler or uncommon steps with manual processes. However, it can all be automated if the volumes justify it.

Currently more than 97% of HV applications require shielded cables, whether they be multi-conductor or coaxial cables. HV applications range from 3mm2 up to 120mm2 in single-conductor (coaxial) or 2x2.5mm2 up to 5x6.0 mm2 in multi-conductor cables for a tremendous variety of single- and multi-cable connectors. Therefore, customers who are serious about expanding their offering into HV cable assemblies must look at automation solutions that provide not only high precision but complete flexibility so that any investments are protected knowing that processing requirements can change in the future. It is important that systems can be expanded in the field so they can grow and adapt with your business.


Different connectors often have very different individual process steps because of their different functions and/or con-

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structions. However, there are some basic steps that apply to almost all of them and these steps pertain to properly stripping the cable and loading the ferrules.

1. Remove outer jacket & foil

Cables without a foil layer around the shield are naturally easier and faster to strip. These cables can be stripped with radiused fixed blades, rotary stripping blades, or a laser stripper.



Radiused fixed blades will likely be the fastest but perhaps not the safest for quality. If one blade is sharper than the other, the blades will not penetrate the insulation evenly and may damage the shield. If the cable is not very concentric, it is nearly impossible not to damage the shield. Finally, changing to a different cable size requires a blade size change as well.

Laser stripping is popular since there is no way to damage the shield because the laser beam is reflected off of the shield. However, if the shield is not woven tightly, the laser can penetrate the shield and damage the inner layers. Laser strippers require fume extraction since some fumes are toxic. They are also the most expensive, compared to other stripping methods.

Rotary stripping will provide the cleanest cut using blades and conductor detection systems that can prevent damage to the shield. Special processes can be used for non-concentric cables.

When the outer jacket is molded into the shield, it makes it more difficult to remove the jacket without disturbing the shield. For these cases, manipulating the slug in certain directions while pulling it off of the cable helps the slug break away from the shield.



If the cable has a foil layer, it must be stripped cleanly, flush with the outer jacket with no flags remaining. This is nearly impossible with fixed blades. It is certainly possible with a laser system unless the foil is bonded to the outer jacket. Laser systems require space for the laser to get to the foil. However, if the foil is bonded to the outer jacket, any pulling of the slug may cause the foil to tear unevenly. Furthermore, lasers will not cut where the foil overlaps.

With rotary stripping blades, it is possible to score the foil without pulling the slug. The jacket slug and foil can be removed simultaneously by manipulating the cable and twisting the slug as it is removed. The result is a clean foil cut that is flush with the outer jacket.

2. Assembling the inner ferrule

Loading the ferrule onto the cable is critical but not overly challenging if done manually. However, as mentioned, different connectors use different ferrules. Therefore, it should be possible to change over to different ferrules with a few cable- and ferrule-specific parts. The system should also have the ability to detect if the ferrule is the correct type and if it is properly oriented on the cable.



Installing the ferrule onto the cable is a step that could be done manually to save costs since automatic loading systems are quite expensive.

3. Cutting/removal of the shield

Properly cutting the shield consistently with a traditional rotary stripping unit is very challenging for HV cables especially if the cable has nonconcentric layers or is otherwise out-of-round. The integrity of the dielectric and filler are critical for proper performance of the cable and traditional rotary stripping machines risk damaging the inner layers. An anvil and punch system guarantees the inner layers will not be damaged and cuts the shield cleanly and evenly, 360° around the cable.



The resulting shield length will depend upon the ferrule being used since it will be wrapped around it. The cut must be clean and consistent, otherwise long strands may cause shorts with other components and short strands may degrade the integrity of the ferrule crimp.

Sometimes the shield length is longer than the length of the dielectric. These applications require that the shield is opened and folded back after it is trimmed so that the inner layers can be stripped.

4. Fold shield

The shield gets folded back over the ferrule but in some cases, not completely. Different connectors require different fold angles to ensure the connector fits together properly. The fold angle may be between 90° to 180° but the fold must be even, 360° around the ferrule. The shield strand ends must fall within the specified tolerances to ensure proper performance. Strands that are too may cause shorts and short strands might not secure the shield properly when the outer ferrule is crimped.



Continued on page 42

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Automating High Voltage Cable Connector Assembly

Continued from page 41

5. Removing dielectric/filler

The dielectric or filler can be removed in the same way as the outer jacket. Multi-conductor cables are not allowed to have any damage to the conductor insulation.

For coaxial cables, conductor detection can play a big role to ensure the center conductor is not damaged by the stripping blades. As with the outer jacket, the system must be able to accommodate non-concentric cables to provide the most flexibility.

6. Multi-conductor orientation and stripping

Prior to terminating multi-conductor cables, the cable must be oriented properly so that polarity is correct when the conductors are plugged into the connector. Sophisticated systems must be able to recognize the wire colors and then rotate the cable accordingly without losing cable position.



Once oriented properly, the conductors are formed to enable termination and according to the connector cavity pitch. Once the conductors

are properly formed, the ends should be stripped on a device with conductor detection to ensure the wire strands are not damaged.

7. Termination

Inner conductors are either crimped or ultrasonically welded to the terminals. Automation systems can integrate suitable crimping presses with crimp force monitoring systems. Ultrasonic welding systems typically have integrated monitoring to ensure a proper weld.



Automation systems that can integrate 3rd party systems are very convenient. These systems can minimize the validation process for presses and welding systems that have already gone through lengthy approval processes.

8. Multi-conductor connector loading

For multi-conductor cables that will be terminated and loaded into a connector, it is critical that the wire ends and terminal positioning are very consistent. This will ensure that the terminals will load and lock into the connectors properly.

Subsequent housings or components can be applied automatically and locked into position if volumes justify it. However, steps 1 through 4 and 6 listed above are the most common process steps for the widest variety of applications. Automating these process steps will likely give you the best return on investment since they are most commonly applied. These steps are also the most critical to ensure proper connector performance.

New visual inspection systems inspect 360° around the cable. Artificial intelligence is utilized to identify the different layers of the cable assembly to perform a thorough analysis. Numerous quality characteristics can be programmed for each assembly.

When inquiring about an automatic HV Cable Connectorization system, be prepared with the following information for all the applications you will want to run:

- Cable specifications and stripping requirements

- Connector specifications and the necessary process steps
- Quality assurance requirements
- Production requirements and/or required cycle times

With this information, the automation supplier will be able to provide recommendations on the most cost effective system for your production requirements along with the expected performance, be it a semi-automatic or a fully automatic system.

Considering how fast EV technology is evolving, automation systems should be flexible and adaptable in the field, at your facility, without major interruptions in production. For instance, it should be possible to move semi-automatic stations onto a fully automatic platform. Similarly, the fully automatic platform should be expandable as volumes increase over time. This feature will give you the most flexibility and enable you to leverage your investment moving forward.

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Box Builds *What are Ingress Protection Ratings and Why Do They Matter?*

By Rittal North America LLC

When you need a product that houses dust and temperature-sensitive objects like electrical equipment, it's important to understand what elemental factors it will need to withstand. Will it be on a boat, subject to spraying water? Will it be housed in a data center and subject to dust exposure over time? This is where Ingress Protection (IP) ratings come in — to help you find the right enclosure for your needs.

What are ingress protection ratings?
Ingress protection ratings measure resistance to environmental factors like water and dust. This standard has been adopted across many industries, such as food and beverage and automotive, due to its simplicity and efficiency. You may have seen IP and NEMA ratings (see *What is NEMA*, May/June 2020 on WWW.wiringharnessnews.com) going hand-in-hand. Both are guides for choosing the right level of protection against risks to your valuable components, but whereas NEMA

rating is the standard in the United States and Canada, IP ratings are the international standard. A universal IP system is especially helpful because it gives manufacturers and users a consistent way of tracking how safe an enclosure will be based on the elements that it needs to withstand over time.
IP ratings in detail
An IP rating is used to provide specific measurements so that you can be confident that the product you're about to buy will remain functional and safe in your unique environment.

IP Ratings are organized by levels of protection. A 0 rating offers no protection at all, while a 6 (for solids) and 8 (for liquids) offer airtight protection.
IP ratings are organized with two digits:
• The first digit refers to solids like dust
• The second digit refers to levels of water resistance
Below is a list to help explain what the numbers in IP ratings mean in greater detail:

- IP ratings for solids:**
- **0:** Not protected
 - **1:** Protected against objects larger than 50mm, such as a hand
 - **2:** Protected against objects larger than 12.5mm, such as a finger
 - **3:** Protected against objects larger than 2.5mm, such as tools and thick wires
 - **4:** Protected against objects larger than 1mm, such as small wires and screws
 - **5:** Protected against some dust and complete protection against contact
 - **6:** Dust tight with total protection against contact
- IP ratings for liquids:**
- **0:** Not protected
 - **1:** Protected against dripping water from above
 - **2:** Protected against water drops at up to a 15 degree angle
 - **3:** Protected against spraying water up to 60 degrees
 - **4:** Protected against splashing water from any direction or heavy seas
 - **5:** Protected against mild water jets from any direction
 - **6:** Protected against powerful water jets (12.5mm nozzle) from any direction
 - **7:** Protected against immersion up to one meter
 - **8:** Protected against immersion beyond one meter

Which IP rating is best for my use case?
Let's say you find an enclosure with an ingress protection rating of IP60. This means that your components are protected completely against

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dust particles, but are not protected whatsoever against liquids. This enclosure would fit in an environment like a data center that houses electrical equipment.

Keep in mind that higher ratings aren't necessarily better. For example, if your IP rating is IP67. Your components will be protected against immersion in water up to 1m, but that doesn't indicate that it provides water protection 1-6 — although your enclosure can be immersed, it may not be able to withstand high-pressure jets.

Furthermore, marking a product as "waterproof" is much more vague than providing an IP rating — it doesn't provide a clear definition of how much water it can resist. For example, "waterproof" doesn't tell you whether an enclosure is designed to remain safe through rainy days or while submerged underwater.

A device like a car door should be ingress protected against the spray of water and dust to a certain degree when closed. With that in mind, it's best to get a device with the IP rating custom-tailored to its use. For example, if you need an enclosure that can protect against harmful dust and water jets in any direction, Rittal's Baying system TS 8, with its IP rating of 55, could be a fitting choice.

Why IP ratings matter

IP codes are designed to protect items like food, electronic products, and automobiles from damage while ensuring efficiency. For products like a telecommunication or switchgear enclosure, it's important to determine the expected exposure to the elements throughout its lifetime.

And IP ratings are vital during a product's design stage — it allows the designer to achieve a set standard, or even improve upon it, depending on the intended purpose. This will help them increase usage and durability significantly. By labeling products with appropriate IP ratings, an organization is able to better describe the applications for their products, which inspires greater credibility.



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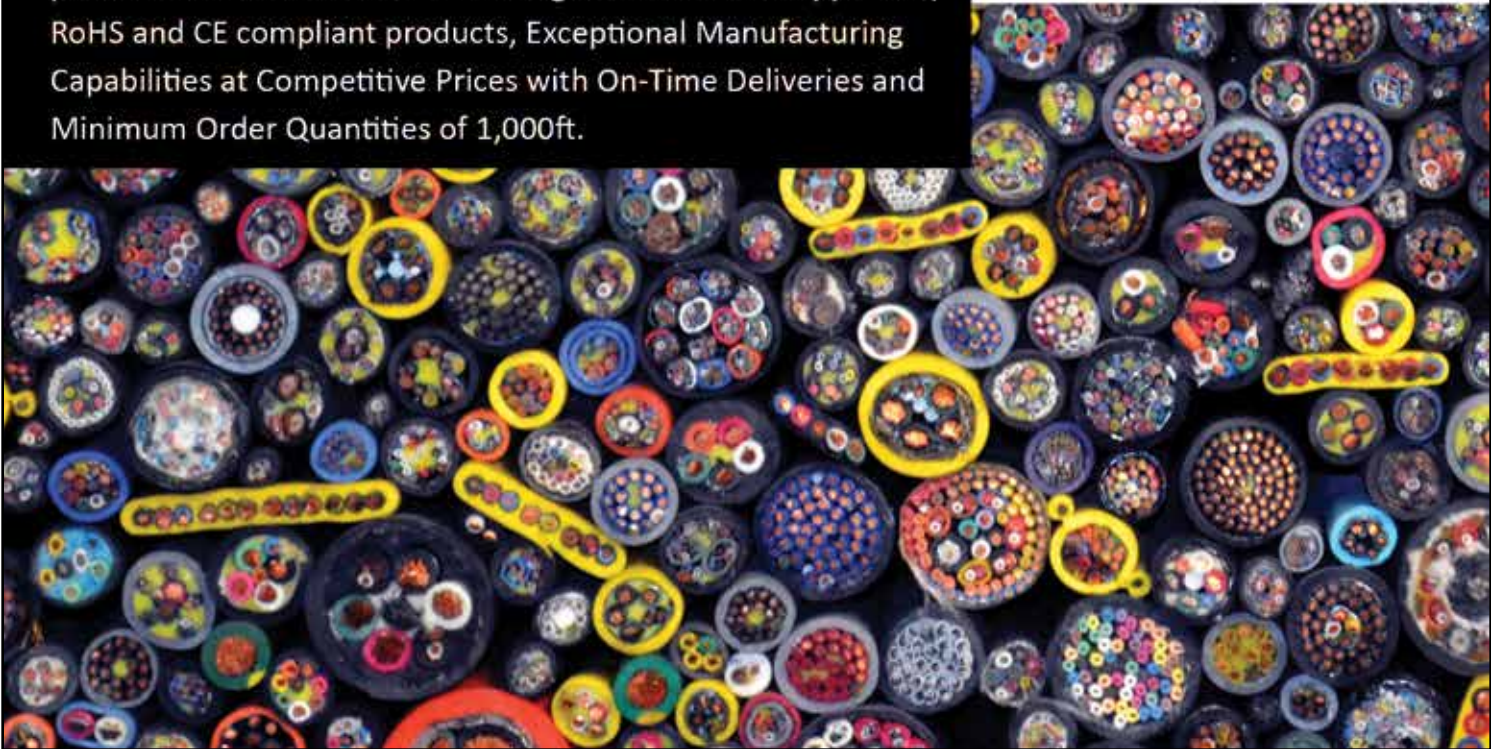
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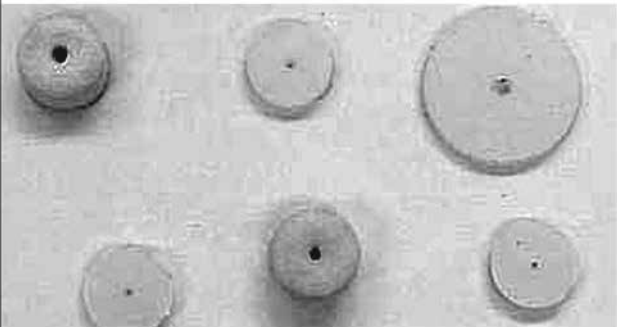
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In-Depth Look at Ultrasonic Wire Splicing

By Saeed Mogadam

In the age of electromobility and its fast-paced development, ultrasonic wire splicing continues to be up to all challenges presented by automotive industry. Through continuous development and expanding capabilities, it remains the best joining technology available today. Ultrasonic welding is a widely recognized and accepted joining process known best for its reliability, the most common applications being splicing and termination of wires to connectors (Figure 1) and is utilized in many industries - from transportation to aeronautical engineering and appliances.

Typically, applications are found in pre-fabrication, in the production of cable harnesses on the assembly board, and in the solidification of individual stranded wires. It has even become possible to link modern wire splicing systems directly to users' manufacturing execution systems (MES), thereby increasing process reliability and making quality assurance easier. The service life of a car, which faces harsh environmental conditions such as constant vibration and extreme temperatures, depends on fault-free connections. In cases like this, ultrasonic connections offer both technical and financial benefits, including low electrical resistance, cost-effectiveness, and excellent corrosion protection.



Figure 1. Spliced wires showing aluminum, copper, and dissimilar metals.



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Welding systems have also become very flexible over time. For example, copper-to-copper and copper-to-aluminum combinations in a variety of cross-sections can be welded with the same machine. There are also appropriate tools for twisted cables or multi-conductor cables with shorter stripped cable jackets (Figure 2).



Figure 2. Twisted Cables

The automotive wire harness manufacturing industry has traditionally been the single largest user of ultrasonic wire spicing since the late 1980's. An average wire harnesses contains 180 splices, and that number grows with each model year. OEMs are adding more electronic features to cars which require more splices. The splices and wire terminations together make up a long and complex heavy harness that controls the entire electrical system throughout the vehicle.

Wire splicing has always been a major focus in the manufacturing of wire harnesses due to the inherent labor intensity in wire processing. Splicing has provided a partial solution, but many splices are required. Mechanical connection (crimping) was the first method introduced for wire splicing, and it still has applications today. In some cases, the joints

are dipped in solder to improve the crimped connection.

In the early 1970's companies started to utilize resistance welding to join wires together. This process involves fusion (melting) of the material created by resistance to electrical current through electrodes.

In the late 70's German wire harness manufacturers started to investigate the feasibility of using ultrasonic metal welding for splicing stranded wires. Soon after, American manufacturers adopted this largely unknown technology. Companies like Delphi Packard (APTIV), Yazaki, United Technologies (Lear) and Siemens spearheaded efforts to perfect this process because of the advantages it offered.

- Low temperature process does not affect material properties
- Pure metallurgical bond for many non-ferrous materials
- Ability to weld dissimilar materials
- No consumable materials such as splice clips or solder
- Environmentally friendly process
- Consistent weld quality, mechanical and electrical properties
- Fast cycle time
- Operator safety with no fumes or chemicals such as lead

The Process

There are two types of ultrasonic welding methods for metal and plastic. Linear welding is the more common technique used by all equip-

Continued on page 48



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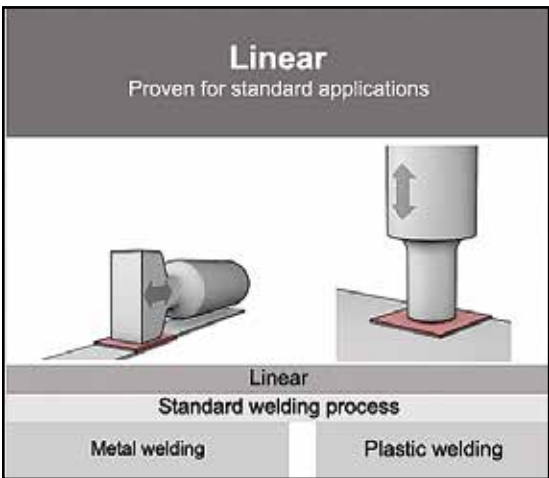
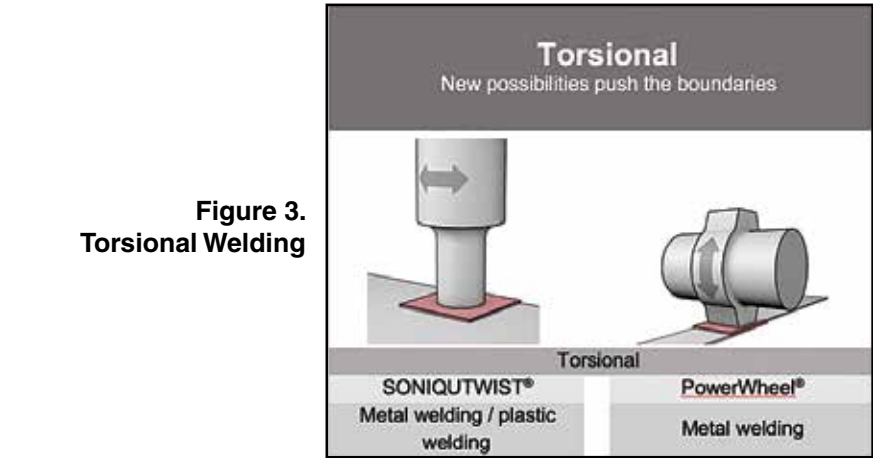




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Ultrasonic Wire Splicing

Continued from page 41




ment manufacturers and a standard for the splicing of the wires (Figure 3). Torsional welding, developed by Telsonic, came into the picture over a decade ago. The torsional welding technique can be used for most common applications in linear welding. However, because of its unique capabilities, it has certain advantages in terms of the application's geometrical shape and its gentle process that leads to a wider spectrum of ap-
plications in the market. In fact, this technology is sometimes found to be the only solution for electric car battery manufacturers and in the termination of high-voltage cables (Figure 4). Other examples where torsional ultrasonic welding proves to be the superior method are bus bars, 3D terminals and integrated gate bipolar transistors (IGBT).



Continued on page 50



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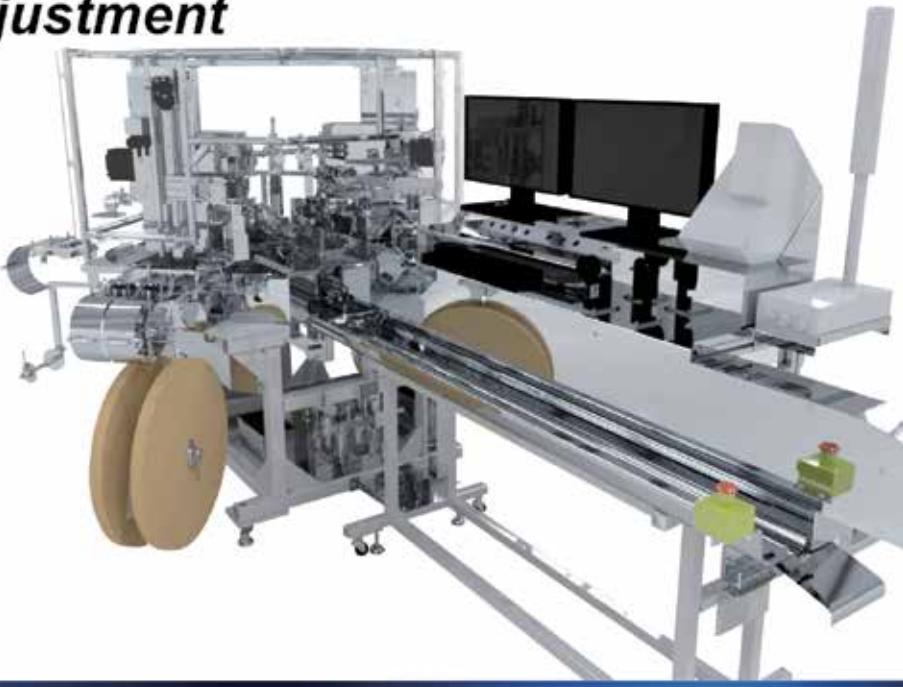
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Ultrasonic Wire Splicing

How it Works

Ultrasonic Wire Splicing

The wires are stacked between the vibrating/oscillating tool (sonotrode) and the anvil block. They are confined in a pre-determined space before the

static force is applied through the anvil. As oscillation ensues, the metal surfaces heat up, plasticize, and the strands are bonded together by intermingling at the molecular level (Figure 5.6).

Continued from page 48

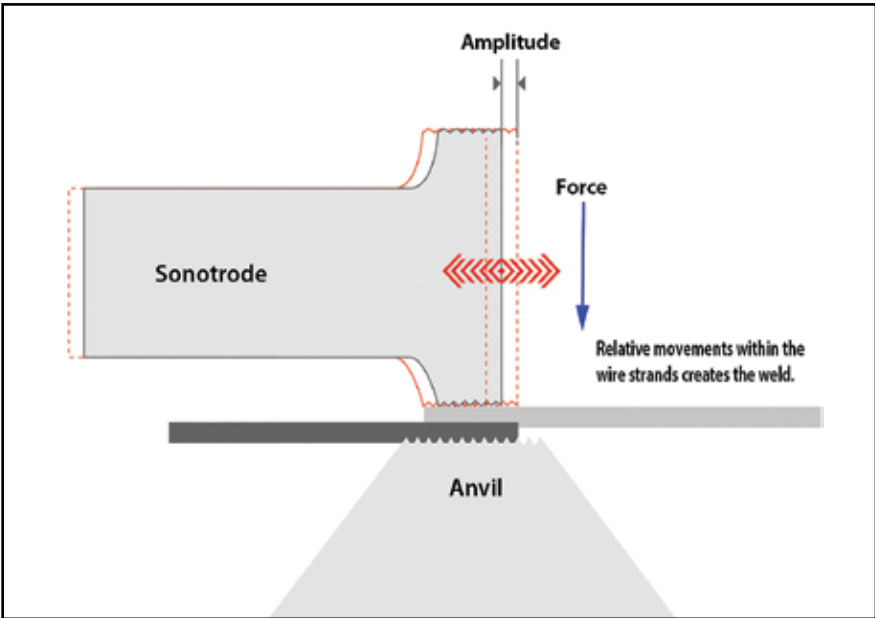


Figure 5. The vibration and motion in linear ultrasonic welding.

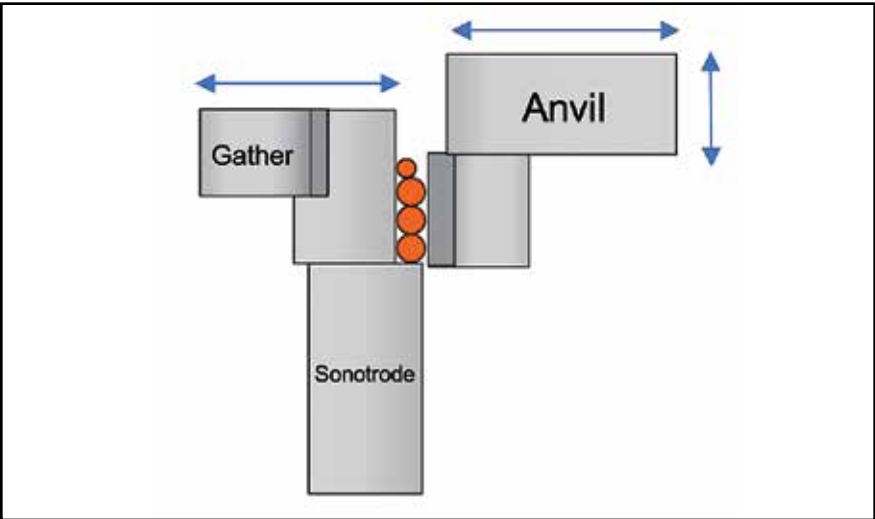


Figure 6. Illustration of the splicing process.

The result is a continuous weld with a finely grained structure similar to the structure of cold-worked metals. The entire process is very rapid, with welds typically completed in a fraction of a second. Most common splicing machines used today are operated at 20KHz frequency mechanical vibration. The vibration under the force dissipates any contaminants and starts the cold friction welding

until the splice is completed. The temperature rise of the welded material is less than 30% due to the friction force at the welding interface. Therefore, there is no hardening of the wire material which makes the wire strands brittle in the weld transition area. This is one of the many advantages over resistance welding which involves melting of the material to make the splice nugget.



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Basic Welding Parameters and Variables

Wire splicing with ultrasonics has also proved to be a high-quality and safe in practice. Because the welding parameters can be adjusted and monitored as appropriate for the application in question, this is also possible in Industry 4.0 environments now.

Welding Parameters:

In addition to the condition of the welding tools and dimensions that are always predetermined, there are four welding parameters that need to be set up. These parameters are normally predetermined by a default given by the machine controller to begin the qualification of the weld quality.

- Width of the weld: Set up by the machine
- Weld energy: The fixed number of watt-seconds to be delivered to complete the weld
- Amplitude: The oscillation that can be adjusted up to 100% capability of the sonotrode
- Force-pressure setting: To set the welding force

Quality Variables:

In order to control the process for the best quality when welding with fixed energy, the following variables are measured and are compared to the upper and lower allowed limits determined by the machine or the user.

- Weld time (duration of welding)
- Compaction height before ultrasonic is started
- Final weld height
- Power consumed

Stable Production and Data Integrity

There are other features that increase production reliability for wire splicing (all the following features are available on Telsonic machines). All splice data should be stored by the machine and preferably backed up on a local network for quality analysis and customer audits. The panel PC should be fitted with an uninterruptible power supply

(UPS) as a standard. This provides protection against voltage drops. The data for the last splice completed is saved even in the event of a power failure and the PC is shut down in an orderly fashion. This safeguards the data integrity of both the Microsoft Windows operating system and the system software (TelsoSplice® in the case of Telsonic machines). The splicing unit pneumatics are also monitored. An automatic under-pressure detection function warns the operator if the pressure is too low and stops production until the fault has been rectified, thereby avoiding the expense of rejects. Moreover, the wire splicing systems support numerous op-

tions to help increase production ergonomics and operator convenience. For example, the multi-conductor splice kit streamlines material handling during the welding process for an operator, thus reducing reject parts. There is a bad part cutter to destroy incorrect splices, preventing them from ever being passed as a good part. The optional capability to interface with a shrink oven is a practical consideration for using the correct shrinking parameters per splice which ultimately is a great improvement from the traditional heat guns that have the potential of sealing splices incorrectly. This

Continued on page 53

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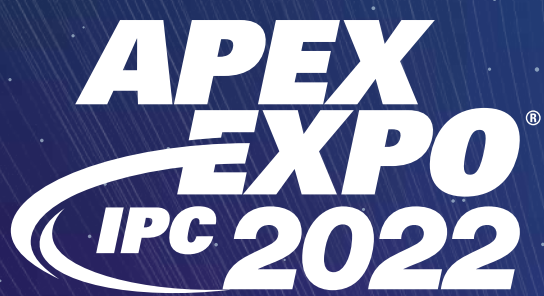
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Ultrasonic Wire Splicing

Continued from page 51

adds to production reliability, because faults of this nature would otherwise not be detected until the final check stage.

Ultrasonic metal welding is a crucial process for all aspects of wire harness assemblies due to its ability to provide a reliable bond to meet all low and high current carrying characteristics. Therefore, certain standards and specifications have been prepared by individual companies. USCAR 45 for Ultrasonic Wire Splicing is one example, as well as other specs that can be applied to most industrial products in the market.

About Telsonic

The Swiss Telsonic Group has been offering its industrial ultrasonic solutions through representation in Europe, Amer-



Ultrasonic splicing in Telsonic's TelsoSplice.

ica, and Asia since 1966. Constant innovations help to ensure that, in many applications, Telsonic has established a lead over competitors that offers added value to customers. With over 250 highly qualified staff,

the owner-managed company specializes in plastic and metal welding, cleaning, and sieving for customers in fields such as automotive, packaging, and medical technology. Visit www.telsonic.com for more info.

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NEWS PLUGS continued



DIT-MCO Now Offering Virtual Instructor-Led Training (VILT)

DIT-MCO International, a leading designer and manufacturer of electrical wiring test equipment, recently began offering virtual instructor-led training (VILT) classes for their NETS (Next Generation Test Suite) software.

Due to the ongoing challenges and concerns of in-person training, DIT-MCO is now offering virtual instructor-led training, which is a live NETS class with a real instructor. Instead of being at DIT-MCO in Kansas City, you will join the class through video conferencing. This allows you to watch and interact with the technical training specialist.

A Virtual Classroom Experience

Taking a VILT NETS class will feel like you are sitting in the classroom at DIT-MCO. It allows for real-time participation in exercises with instant feedback. It also allows for questions to be asked as they arise, not in an email or with a phone call. When you take a VILT class, you are joining a live class through video conferencing. The class may be 100% VILT or there may also be students at our facility in Kansas City being taught by the same instructor. This gives virtual instructor-led training an authentic training feel, as the virtual students are being taught the same way as the live students. VILT is available during any regularly scheduled classes, following the same format as our live classes, which is Tuesday – Friday from 8 am to 4 pm (Central Time). Custom scheduled VILT classes can also be scheduled.

Safety

Due to Covid-19 and the ongoing need for safety, VILT offers an option to avoid traveling. DIT-MCO wants to do everything possible to ensure customer safety during these times, without sacrificing the availability of training.

DIT-MCO International LLC is a worldwide leader in automated cable/harness test systems with over 60 years' experience providing test equipment for interconnect verification. Headquartered in Kansas City, Missouri, DIT-MCO has sales and service offices in the US and UK, plus authorized agents and distributors around the world.

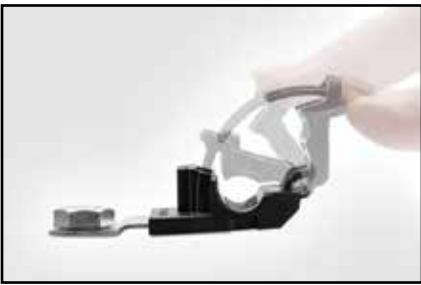
Heilind Electronics Expands Cable Management Portfolio with HellermannTyton In-Line Ratchet P-Clamp

Heilind Electronics, a premier distributor of electronic components worldwide and an authorized distributor for HellermannTyton, has introduced the in-line Ratchet P-Clamp

to its portfolio of cable management products. Engineered for heavy-duty applications, it creatively solves wire bundling challenges in OEM, automotive and solar installations.

The HellermannTyton Ratchet P-Clamp features an adjustable ratchet clamp mechanism and is offered in five sizes with multiple mounting options. The innovative design helps to reduce parts and inventory costs while saving the time required for wire harness and cable installation and maintenance.

The construction of the Ratchet P-Clamp opens the way to a more efficient division of pre- and final assembly. Simply position and fix the opened Ratchet P-Clamp first, then fasten the bundle -- or conversely, apply the clamp to the bundle first, then fasten it to the mounting point. The adjustable clamp is easy to close by hand to the precise diameter required. There is no slack and the rifling on the inside of the clamp automatically centers the bundle



and minimizes the risk of pinching.

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Creating an Intelligent Harness Drawing to Automate the Manufacturing Process Webinar

By Christine Siebert

WHMA supplier member, Zuken USA, is presenting this quarter's webinar on September 8th at 1pm CST. This webinar is intended for harness engineers, electrical engineers, harness designers, assembly and manufacturing technicians, harness production managers, quality assurance, and engineering managers.

Presenting this webinar is Sanu Warrior, Technical Marketing Manager of Zuken USA, Inc. Sanu helps customers find effective solutions to their design challenges. His work focuses on eliminating inefficiencies, improving design processes, and reducing costs to improve competitive advantages.



Sanu Warrior, Zuken USA, Inc.

Sanu will take us through a riveting 45 minute presentation and 15 minute Q & A. This webinar will discuss what is the most essential part of the harness manufacturing process? The answer differs by the role of the person answering the question. There are many steps to get from concept to a complete manufactured harness. Each step in the process depends on the previous step to move forward. The idea of design-for-manufacturing is to be aware of manufacturing and assembly challenges during the design process. Does a simple harness drawing with lines, circles, and pictures do that? No, it does not. Creating a harness design with details for driving manufacturing and assembly automation is essential for success.

This webinar will outline the basics of creating an intelligent harness design to generate accurate quotes, drive smart quality checks and create 1:1 scale manufacturing drawings. The live demonstration will include utilizing the same harness data to drive automated manufacturing tools for labeling, testing, cutting, processing, and visualizing wires. We will introduce and outline the innovative capabilities of using dedicated harness design tools like Harness Builder for E3.series to augment harness manufacturing.

What you will learn during this webinar:

- How to quickly create accurate quotes and designs from excel data
- How to effectively capture manufacturing information in the harness drawing
- How to use intelligent library parts to improve accuracy and reduce design time

- How to automate manual processes to reduce time and errors.
- How to drive next-generation manufacturing machines
- How to improve the harness assembly process using the latest automation technologies

We look forward to seeing you on the webinar on September 8th at 1 pm CST. You can register at www.whma.com or https://ipc.zoom.us/webinar/register/WN_pNjdyJk1TkO-BIBbzObdfDA.



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For more information, contact [Norm Sagon](#), WHMA/IPC sales representative.

NEWS PLUGS continued



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ETCO FWC Series Flex Circuit Connectors attach to lead wires using an “F”

style crimp by automatic wire processing equipment and have features that securely embed when staked into the foil or film substrate. Ideal for critical applications, they are designed for attaching 16 to 22 AWG wires to aluminum- and copper-foil or film laminates from 0.010” to 0.040” thick.

Supplied in strip form to increase production speeds and efficiency, ETCO FWC Series Flex Circuit Connectors can be made to OEM specifications in a wide range of sizes and thicknesses to accommodate different substrates. Available in brass and tinned high brass, applications include



capacitors, electro-luminescent lighting and displays, flexible heaters, and relays.

ETCO FWC Series Flex Circuit Connectors are priced according to configuration, and quantity. Samples and pricing are provided upon request.

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John Kusek Announces Retirement

DIT-MCO International, a leading designer and manufacturer of electrical wiring test equipment, announces the retirement of CEO, John Kusek, as of June 30, 2021.

Kusek joined DIT-MCO in November of 2007 as Chief Operating Officer, where he served until 2015. When the company was acquired by Capital for Business and Sage Capital, he assumed the roles of President and CEO. In January of 2021, David Shier was named President, and Kusek remained as CEO.

Kusek played an instrumental role in leading DIT-MCO to some of the most productive years in company history. “After almost 14 years with DIT-MCO, it’s somewhat bittersweet letting go, but I’ll certainly give it a try! I’m supremely confident the company will

continue to be in great hands moving forward, and that its best days are yet to come. Our success to this point can be attributed to our great employees, customers, suppliers, and ownership, and I sincerely thank everyone who has been a part of it. Together, these people have made it easier for DIT-MCO to maintain its status as an industry leader. Among my fondest memories is the spirit of camaraderie and purpose displayed by our workforce, doing whatever it takes to accomplish our mission,” said Kusek.

“As for the next steps in my personal journey, I foresee longer stays at the lake house, spending more time with family and friends, and resurrecting vacation plans wiped out by the pandemic. I’m somewhat ashamed to admit I still have boxes to unpack at the house from a move over a year ago, so that’s definitely on the list as well.”

President, David Shier, said, “John has presided over a period of strong growth and profitability at DIT-MCO, while valuing every employee’s needs and contributions. We appreciate the company culture that he has established as CEO. As John begins his retirement, we all wish him a long and healthy life enjoying family, friends, and well deserved relaxation.”

DIT-MCO International LLC is a worldwide leader in automated cable/harness test systems with over 60 years’ experience providing test equipment for interconnect verification. Engineering, QC/QA, manufacturing, and test personnel around the world use DIT-MCO systems to verify the quality of their products. DIT-MCO testers are used extensively in the aerospace (military and commercial), defense, and transit/rail industries. Headquartered in Kansas City, Missouri, DIT-MCO has sales and service offices in the US and UK, plus authorized agents and distributors around the world.



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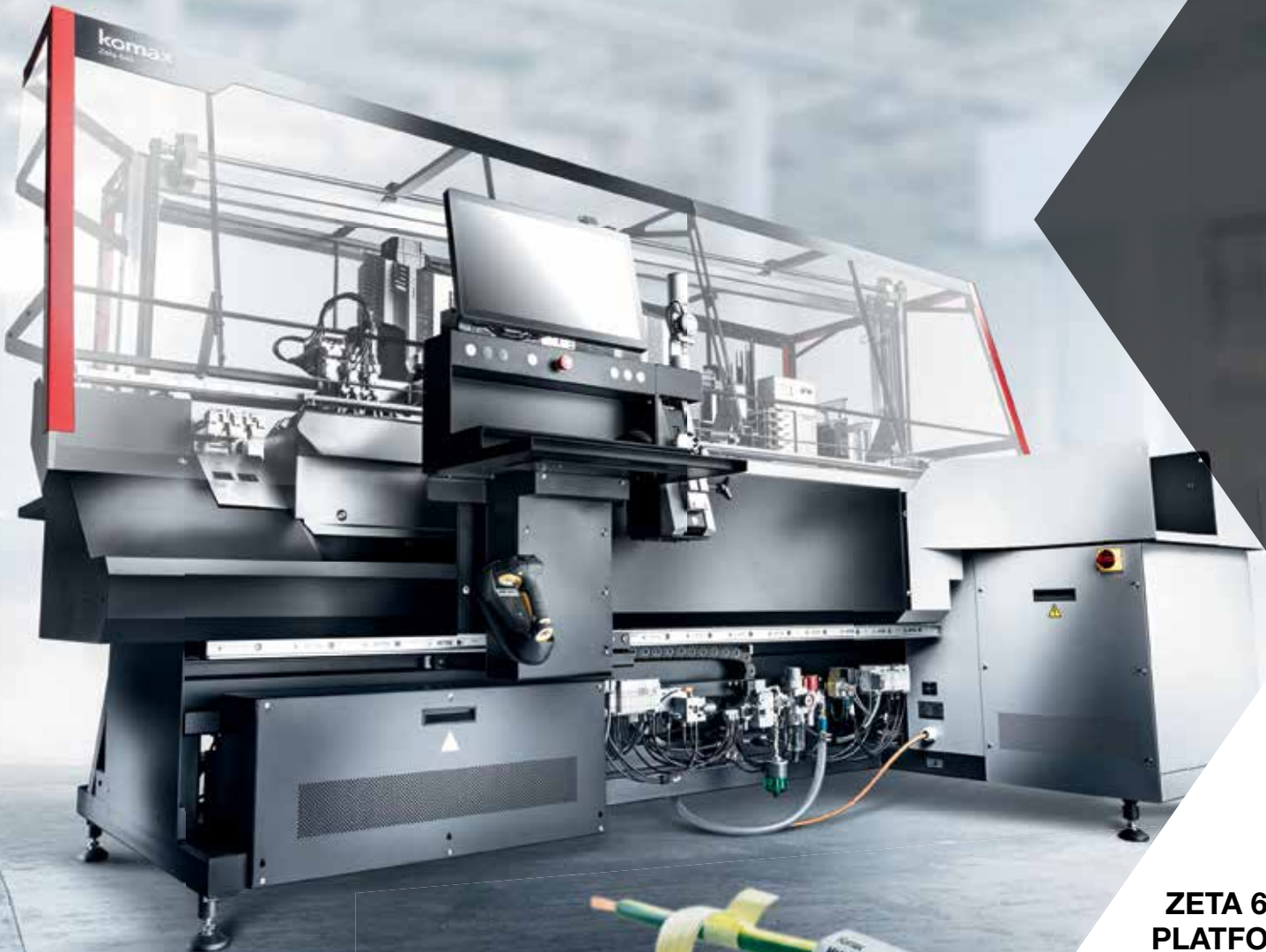
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