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Company Profile: **Park Manufacturing**

By Joe Tito Wiring Harness News

f you've read many of our industry profiles, you are no doubt intrigued by the boot strap stories they contain. Harness manufacturers seem to have taken some extraordinary paths to success. Park Manufacturing is certainly no exception. I recently spoke with Kevin Knutson, President, and Marlys Dunne, Vice President, about the company's genesis.

Park Manufacturing was started by Bernie Miller in 1946. Prior to that, Bernie had been contracted to produce saw blades for Shopmaster, a woodworking catalog company. Shopmaster sought expansion into

other products and markets. They had an idea for a Christmas tree stand that had multiple built-in outlets for light strings. They knew Bernie was a tinkerer and approached him to help design and build the new product. It's the product that launched Bernie into electronics and was the impetus for the formal creation of the company in St. Louis Park MN. After operating in his kitchen for a short time, Bernie opened the first Park Manufacturing facility in town.

Bernie sold the business to Art Torgerson who moved the facility to Cedar, MN in the early 1960's. Art continued to produce electronic assemblies and eventually sold the business to Denny Kleven in 1989. Denny is the current owner of Park



Complex Assembly at Park Manufacturing

Manufacturing. Recognizing the need to expand to accommodate automation and a growing workforce, Denny opened a state-of-the-art facility in Cambridge, MN in 2000.

Today, Park manufactures cable and wire harness assemblies along with electromechanical assemblies for specialty automotive (agricultural, construction and trucking equipment), mil/aero, industrial and medical markets. "I started here in 1999

and at that time we were concentrating mostly on industrial markets," Kevin mentioned. As they improved their work standards and quality profile, the company began to move into these other markets. "We are a lowvolume/high-complexity manufacturer, and we have developed a niche that we focus on."

Chatting briefly about some specific products the company makes,

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Reshoring Opportunities for Harness Manufacturers

By Joe Tito Wiring Harness News

few years back, Harry Moser, Founder and President of the Reshoring Initiative®, came and spoke about his organization at an industry event. The mission of the Reshoring Initiative is to bring good, well-paying jobs back to the US by helping companies more accurately assess their total cost of offshoring products. The goal is to shift the collective thinking that offshore is always cheaper by highlight-

Harry - Well, ripe for the picking, yes. But many of the apples are high on the branches and will require a little work. If you look at the statistics I provided, the line chart (Figure 1 - Page 6) shows that compared to China, for 8% of the products the U.S. wins on price. We win 32% on total cost of ownership (TCO) considerations. Basically, if you are just looking at the FOB price, very little is reshorable. But based on TCO, 32% is reshorable. The numbers would be higher still if all companies used TCO, since the economy would grow so much more and become

Boeing Partners with College in Cable Harness Bootcamp

By Shalin Jyotishi

he pandemic has prompted more consumers to seek out shorter, non-degree credentials such as certificates, industry certifications, occupational licenses, and other upskilling opportunities that require less time or financial investments in comparison

need new jobs-oriented skills.

Many bootcamp providers have closed in recent years reportedly due to a lack of alignment with employer needs, and according to Career Karma, an organization offering a bootcamp directory and coaching, 72 percent of bootcamps charge more than \$10,000 which can rival the tuition for many quality degree programs at

to a traditional degree program.

Following the trend, skills-building "bootcamps" have also emerged as an increasingly popular mechanism for career preparation. Rightly or wrongly, bootcamps can sometimes get a bad rep as "fly by night" operations orchestrated by greedy companies or individual "gurus" looking to make a quick buck off those who urgently

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public community colleges.

Additionally, there is no nationally standardized way for consumers to evaluate the effectiveness or labor market outcomes associated with bootcamps, which can make it difficult to tell which programs are worth their salt.

ing its true cost compared to domestic manufacturing. Harry has worked with countless manufacturing companies giving them the ammunition to target these opportunities.

With all that has transpired over the past couple years, it seemed reasonable to reach out to Harry to check on the progress his organization is making, and review some of the tools available to wire harness and cable assembly manufacturers to directly target the reshoring of the complex assemblies that U.S. manufacturers excel at producing.

WHN - How much business is ripe for the picking? How much business can U.S. manufacturers make the case for reshoring?

more efficient as we rebuilt supply chains here.

Generally speaking, Chinese inflation has been higher than U.S. inflation. I've got a chart showing unit labor cost for a bunch of countries including China and the U.S. Our dollar cost per hour of labor has remained flat, while China's is up 400% since 2000.

WHN - What are some of the tools available to readers from the Reshoring Initiative to convince OEMs that offshore isn't always cheapest?

Harry - The TCO Estimator is a free online software to help companies make better sourcing decisions

Continued on page 6



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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.

Copyright 2021 International Harness Resources Inc., (IHR Inc.)

Wiring Harness News PO Box 669 • Schererville, IN 46375 USA wiringharnessnews.com

Office Hours: 8:00 a.m. - 4:00 p.m. CST (Monday-Thursday) Printed in the USA



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From the Editor Greetings Readers,

In the last issue, my rant...I mean position...on sourcing closer to home, wherever home is, struck a cord. I received many positive comments. Since then, I reached out to Harry Moser of the Reshoring Initiative, for his input on the subject. Harry shared some great insights in a Q & A that starts on the front page of this issue. For me, the money quote is, "Putting products in boxes and shipping them for four to eight weeks adds zero value." That nails it! Harry gives some extremely useful tips for helping manufactures convince OEMs that offshore is not always cheaper. I sincerely hope you give the article a look.

Now, we are seeing even more supply chain woes. This time caused by cybersecurity issues. Earlier this year, we reviewed the DoD's new cybersecurity framework. They are requiring strict adherence for all suppliers, at any level, in DoD programs. It's certainly something to take seriously if you are in that realm. You can review that article in the Jan/Feb issue, or just go to our website and type the word "cybersecurity" in the search box under the More tab.

It might be a good idea for any company, whether they are supplying to the DoD or not, to follow these guidelines. At WHN, we have taken this issue very seriously and have greatly enhanced our own cybersecurity efforts. I hope you will consider doing the same.

Keep plugging away,

PS - Ideas for articles? Contact me! Joe@wiringharnessnews.com



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Reshoring Opportunities for Harness Manufacturers

Continued from page 1 _

about offshore vs. domestic. It can also be used to sell against imports. TCO quantifies 29 costs and risks, often balancing a 15% to 20% FOB price disadvantage vs. offshore. The TCO Estimator is recognized on multiple U.S. Department of Commerce websites. Repeated international studies document the value of using



TCO instead of FOB price for sourcing and siting decisions. We recently helped one company win a \$60 million order vs. a Chinese competitor using the TCO Estimator. It's useful and it's free, and that's always a great combination.

Another great tool is the Import Substitution Program (ISP). A company contacts us and we identify the biggest importers of the products the company produces. We then determine the tonnage being brought in and uncover the offshore sources. Then, the company uses the TCO Estimator to convince that importer to buy from them instead. It's very simple. It gives you leads, and it gives you a sales tool to close some of those leads.

The conversation goes like this: I see you're bringing in 20 containers

of product a year from China. We've automated, and we think we've got labor cost down to 15% or 20% of total cost, so the offshore producer can't be more than 10% or so lower than we are. We've calculated 20 points of hidden costs with the TCO calculator so we think you will be 5% better off buying from us.

There is a fee for this. But we are also marketing it through Manufacturing Extension Partnerships (MEPs). These are non-profit affiliates of Commerce, and there's one in every state. They are there to help small businesses like harness shops. We are marketing through MEPs in Ohio, New York, Illinois and Rhode Island, and other states are considering it. For companies in those states, the

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Reshoring Opportunities for Harness Manufacturers

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MEP's pay for our service. Anybody in those states can contact us, or they can contact the MEP and say, 'Hey we want to play.' If your state is not on this list and you're working with an MEP, let them know about this program. We'd like to have more states on board!

WHN - Harry Moser is sworn in as the 48th President of the United States. Describe the new administration's trade and industrial policy.

Harry - People say it's not good to pick companies and it's not good to pick industries. In principle I agree. That's why I say, don't pick industries, pick industry. The only reason we are in the position we are with computer chips and other goods is we haven't been competitive in making those things for so many years.We are totally dependent on China and it's just insane. Those mission critical industries are gone because we did not have a cohesive industrial policy. We have to recover from 40+ years of de-industrialization.

We have also had too many kids go to university and not enough of them learning a vocation like toolmaking and welding. At some point you have to reverse that if you want to succeed.

Government data shows that 35% of the people who have university degrees are in jobs that don't require them. So, to say we want more people to go to college and never question the logic...that's just stupid!

There has been a turn-around in some places. The community college system has put in a lot more manufacturing curriculum. There's one example I often mention. In Milwaukee, there's a community college called Milwaukee Area Technical College. They brag about the fact that they are the second largest graduate school in Wisconsin. So only the University of Wisconsin at Madison has more people attending who already have bachelor's degrees. They've got thousands of degreed people coming back to get a technical or associate degree so they can make a living.

The most important objective of sound trade and industrial policy is reducing our manufacturing cost by 20% vs. most other countries; We do this partially through automation. People always say, 'Well, if we do that, we're not going to add any jobs, we're just going to have robots, and that's no good.' But I say we will lose more jobs to Chinese automation if we do not automate, then we will lose in the U.S. if we do automate. China is over

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there dramatically increasing their productivity through automation, and they're still willing to work for a third of what our people are. How do you compete? Automation!

Another area we need to look at is our tax policy. It's tough to get politicians to think about it because it's really one of those third rail things, but we need a value-added tax (VAT). Increasingly, I'm seeing economists come around to saying the only way to get the kind of money and incentives we need is to have a VAT. If you tax work and capital as high as you have to in order to get the trillions of dollars the government wants to spend, a lot of people are going to stop working and stop investing. The economy won't grow. Whereas, with a VAT, you won't have as much of that effect. But you have to offset that. You have to eliminate some other taxes like Social Security and Medicare so that the worker comes out about the same. That's the tricky part.

Finally, we have allowed the

value of the dollar to rise too much relative to other currencies. We need a 20% to 30% lower USD.

WHN - In a recent *From the Editor* in WHN, the point was made that there is wisdom in sourcing critical supply chain elements closer to home... wherever home is.You concentrate on U.S. reshoring, but is it wise for other countries/regions to do the same?

Harry - Yes! Putting prod-

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ucts in boxes and shipping them for four to eight weeks adds zero value. Most reasonably densely populated regions should produce goods within 1000 miles from where they are consumed. It's good for environmental policy, it makes economies more resilient, and it helps with income equality. We currently cooperate with Reshoring Canada, Holland, UK and Italy in these endeavors.

None of these things I've outlined here are easy. But if it were easy, they wouldn't need me!

Harry and I would love to bear of your resboring cases. We would like to show that buyers should consider U.S. sources. It's not necessary to name customers. Contact joe@wiringbarnessnews.com

Many thanks to Harry Moser for helping put this article together. If you would like more information on the TCO Estimator or the ISP programs, visit reshorenow.org. You will find a plethora of information to help bring manufacturing back to the U.S.

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Boeing Partners with College in Cable Harness Bootcamp

Continued from page 1 _

But we shouldn't throw the baby out with the bathwater. When executed strategically by a credible education provider and with the learner and employer needs in mind, bootcamps can maximize affordable training outcomes for busy learners.

The bootcamp inspiration recently struck at The Boeing Company and its partner Mesa Community College located in the Greater Phoenix area.

In 2019, the aerospace giant, one of the top fifty largest employers in Arizona, approached Mesa to help train four hundred and fifty electrical technicians skilled in electrical wiring and harness within two and a half years.

Mesa, a recognized leader among community colleges in the manufacturing workforce ecosystem, has long offered customized training and nondegree programs to meet labor market demands.

But fulfilling this tall order didn't necessitate a new certificate or degree program. Instead, Mesa and Boeing partnered to create a unique, stackable, customized, and for-credit training program structured as a Cable Harness Wiring Bootcamp.

In 36 hours of in-classroom instruction, bootcamp completers earn the IPC A-620 Industry certification, three credit hours, and an interview with Boeing on-site at Mesa - for \$270 with full tuition reimbursement upon successful completion.

Students attend the bootcamp for just four hours a day over nine days. The first week focuses on theory while the second week is focused on hands-on learning. Nine adjunct faculty on loan from Boeing and on Mesa payroll teach each of the nine courses.

Students pay the all-in bootcamp cost amounts of \$270 which is fully reimbursed by Mesa upon successful completion, thanks to Mesa's grant funds from state, federal, and private sources.

So far, Mesa and Boeing claim a near 100% completion rate. Upon completion, students who pass Boeing's background checks are invited to interview on-site at Mesa. The 3-credit hours can count as a technical elective for a certificate of completion or associate's degrees Mesa offers.

So far, 355 students have completed the bootcamp, 234 students have been interviewed, and 211 have been offered jobs (Due to the COVID-19 pandemic, Boeing paused hiring until this summer). Mesa's surveying of

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Boeing Partners with College in Cable Harness Bootcamp

Continued from page 13 _

program graduates revealed that students who weren't hired by Boeing have leveraged their new skills for other opportunities or continuing education.

While Boeing is Mesa's primary partner, other national and regional employers have also said that they value the skills obtained through the

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The starting salary for Boeing technicians who complete the bootcamp is \$18 an hour and some technicians are paid \$23 an hour depending on experience. Both wage rates are respectable when compared to the \$11 minimum wage and the \$12.29 local

& Shielding

living wage threshold in the Pheonix-Mesa-Scottsdale region – especially considering the fact that the program only takes nine days and is free for completers.

The bootcamp serves a diversity of learners from many walks of life:

* Fifty-six percent of graduates are adults over the age of 25, and two percent of graduates are even in high school, aged 15-17.

* A quarter of graduates are female (notable given that U.S. manufacturing jobs tend to be maledominated), almost eight percent of graduates are veterans, and fifty-five percent are first-time credential earners.

* Forty percent of graduates are minorities, mirroring the diversity of the state.

Compared with those hired from Boeing's typical staffing agency, Bootcamp graduates made significantly fewer errors once hired.

Graduates are happy with their career outcomes and a new set of transferable skills. "The harness and

cable assembly bootcamp was exactly what I needed. It helped me get to my goal as a permanent employee," said Jocelyn Johnson who completed the bootcamp and now works at Boeing. "The job at Boeing means a lot to me and my family."

Mesa was similarly pleased with their outcomes. "Mesa offers a variety of jobs-oriented degree and non-degree programs, but Bootcamps offer one of the fastest returns for our students and employer partners. If codesigned in a reciprocal way, colleges can be much more agile in responding to the needs of their students and the local economy," said Leah Palmer, Executive Director of Mesa's Arizona Advanced Manufacturing Institute.

Earning a degree in an in-demand field from affordable, quality public institutions can still yield the greatest return on investment for students, but a degree isn't necessary to secure a quality life. As more colleges and universities explore bootcamps as a new model for career preparation, employers, institutions, students, and local economies may stand to benefit.

For more information, contact Shalin at Jyotishi@newamrica.org.



PUTTING INSIGHTS INTO ACTION

Finishing Well

By Paul Hogendoorn

What does it mean to "finish well," and how important is it to do so? That's a question I have thought about from time to time over the last dozen years, but more so the last few months having made the decision to transition from an active leadership role in a business I co-founded eight years ago to a role far less active or involved, and still largely undetermined (but that specific conversa-

tion would be more about "beginnings" and starting next chapters, while this column is all about finishing well). A few months ago, I identified June 30 as the finish date, with the goal of channeling my efforts towards finishing well.

Throughout our careers, we do not get much practice "finishing well." We get far more practice starting new projects. We conceive more ideas and projects in our minds than we get the chance or opportunity to start; we start many projects that iterate so much that when they end, they don't seem at all like the project we started. And many of the projects we start stall at some point along the way, or get pushed out so often they simply peter out, or just blend into our daily working existence. That all speaks to the reason why finishing well is often so difficult to do, but it's also the biggest reason why it is so important to do. Here are, in my opinion, and based only on my personal experience (I've had more than one crack at this), the top three reasons why finishing well is so important:

to be able to look back at what you started and see it continue on. If you think that the demise of a company after your departure is proof of your value to that organization, you've completely missed the point, and you haven't finished well. True leaders recognize that they have done their job well when the organization does as well, or even better, when they are not there day to day and are no longer critical to the achievement of the goal.

Reason two: making room for your team to grow. By the end of your term, you will have spent the best part of your personal abilities – your time, energy, talent, learned skill, acquired experience, etc. – and the next stage or phase of the project/ dream/vision will require more than you have left to offer. It would be a selfish (and likely delusional) thought to convince yourself that a team of people you have selected, brought along and mentored wouldn't be ca-



Paul Hogendoorn

pable of taking the project/vision/

Continued on page 17



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Reason one: enduring legacy. If you finish well, whatever it was you started has the chance of continuing on well beyond your involvement. If you are an entrepreneur, or are proud of what you have helped build, you will ultimately want



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Finishing Well

company to the next level as well as you could do yourself. If you did your job right after the starting period and in the active working period, you would have those people in place, and they would be ready to take on the challenges. Finishing well means making room for them to grow.

Reason three: creating new opportunities for "starts." Throughout my working career, I've had a habit of always keeping my plate full of projects and responsibilities, usually to the point of just overflowing a bit. (Or a lot). In many ways, this was unavoid-

able - it's what kept me motivated, striving to reach the next level. or to break through beyond the next boundary. Sometimes, it was just a matter of necessity - there was not enough resources, and no one else available to do something that needed to be done. The problem with having a lot of unfinished things on your plate is that it keeps you from starting other things. You have to finish some things in order to gain the capacity to start other things. Now, in my case, that means contemplating a whole laundry list of personal things that I put on the shelf along the way, and with so many important, ongoing (i.e. unfinished) projects perpetually spilling over the edges, the personal list has begun beckoning more



Continued from page 15 ____

persistently. I am forced to face the reality that "able time" is a finite thing. Finishing well on current projects is what creates the capacity to start well on new projects.

Unfortunately, it often takes a whole career to learn how to finish well. We get so much more practice and experience starting than we do finishing, and by the time we get to the finishing stage, we have to start to try to figure everything out. It's not easy, but as I hope I illustrated above, it is critically important – finishing well is at least as important as starting well and executing well, and perhaps even more important. The true measurement of finishing well is often not what happened while you were there, but what happened there after you finished.

Paul Hogendoorn cofounded FreePoint Technologies in 2013, bringing innovative and effective IIoT technologies to the manufacturing sector to help them achieve their Industry 4.0 objectives. Previous to that, he cofounded OES, Inc in 1981 as well as helped launch multiple other ventures. He can be reached at paul.bogendoorn@gmail.com



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Company Profile: Park Manufacturing

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Kevin noted the assemblies they are making for the forcedair patient comfort blankets. "They are the pre- and postoperative warming and cooling blankets and we have been building those products since before I started." He also mentioned some assemblies they make for medical research

equipment. The company also has some emergency equipment manufacturers in their back yard and produces assemblies for fire trucks and ambulances. They are also a secondtier producer for a company that builds a myriad of military products.

Continued from page 1 _

The discussion turned to



The company motto serves as a constant reminder.

how Park brings in new business. "We attend the Design-2-Part show and we also have an outside sales force that work geographical territories around the five-state area." Kevin said. "We are also working with a customer who has an international sales force, and we are starting to collaborate with them on the sales end."

One of the best ways Park markets their business is through customer visits. "It does a lot when we bring people into the facility to see us in action," Marlys stressed. "Once they get in here and see what we can do, it's really a game changer." The company hopes to resume visits as things return to normal, following the effects of the pandemic.

the

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Kevin and Marlys agreed, however, that overwhelming factor in their growth over the years has been through wordof-mouth and based the reputation on they have built. Speakspecifically ing of their entry into the specialty automotive industry, Kevin said, "The company had a design for intent issue and we saw the issue and solved it. And you know how it goes, you get a purchasing agent from one company who moves to another and the business in that market grows from there." Marlys added, "When you get that relationship with the customer and you start making one product, they get to know you and what you can do. Once you get the relationship with the engineers in these OEM businesses, you get written into their designs." Kevin made a specific point of recognizing the outstanding suppliers who were instrumental in the company's growth. "We've been using Cirris testers since I joined 21 years ago. I used to work directly with Marlin Shelly on problems I had with my programs back in my early days. Tim MacAlpine over at Komax and Darren Teasck with Schleuniger...those were our sales contacts back in the day and they



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Soldering Assembly at Park Manufacturing.

helped us tremendously."

Marlys mentioned they lost a lot of business to low-cost alternatives in Mexico and China through the years, but that some of that business is coming back due to the relationships they have built within the OEMs. They are grasping the true overall price of sourcing overseas and realizing the cost benefits of dealing with companies like Park on many complex assemblies.

One of the major challenges Park faces is bringing in new personnel to their company. They have come up with some pretty innovative ways to get the word out about opportunities at Park. Marlys recently developed a plant tour video in conjunction with the Chisago Lakes School District. It's was just one in a series the school district has developed to highlight manufacturing opportunities in the area. "I've been working on this program for a long time, and four years ago, I had the privilege of handing out the first technology scholarship at the high school in my community," she remembered. With \$250K in scholarship money to hand out every year, this was the first to be awarded to a student wishing to attend a technical school, and it has grown from there.

Kevin mentioned another way they attract new talent is by providing harnesses for complex projects at local technical schools. "We do a lot at the Cambridge-Isanti School with the robotics team," he outlined. "But the biggest program we do is up in tance gas and electric vehicle team. There are some pretty tight requirements there, and we have been supplying all of their wiring, including battery leads, and connectors for the last 10 years." These activities in the community have raised the local profile of Park Manufacturing and have helped in their recruiting efforts.

The other major challenge they face is not unique to Park Manufacturing. It's something we are all facing, and that is material shortages. "I've been in industry 25 years and I've never seen anything like this," Marlys recounted. "The situation is crippling so many businesses. Our suppliers are having trouble getting raw materials, and they can't get people to work."Then there is the added problem with logistics. "Just yesterday we had a customer who needed product to keep their lines going.We were all lined up to ship it via a wellknown common carrier, but they were concerned about the carrier's ability to deliver and actually had an employee drive here to pick up the parts." She told about other parts that were stuck in Port in Portland because there is no one available to unload the ship. "We used to say it's day-to-day in contract manufacturing, but now it's hour-to-hour." Still, she is very proud of their accomplishments. "It's been a constant scramble, but knock on wood, we've never forced a customer's line down."

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Continued on page 20

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Company Profile: Park Manufacturing

I asked what makes Park Manufacturing an unmistakable supplier to their customers. Kevin mentioned their company motto which is 'We don't do average, we do awesome'. "One of the ways we achieve this is through our customer service team who constantly interface with the customer's purchasing department and engineering staff. It's also through our outstanding quality department. We shoot for a low defect rate and strive for 50 ppm or better. And we always strive for 100% ontime delivery. We are currently running at 99.5% which is kind of un-



heard of in our industry."

Wrapping things up, Marlys wanted to stress their efforts towards constant process improvement and their room for growth:

"We've been in this facility since 2000 and have worked very hard internally on process improvement and maximizing efficiency.We are putting the best talent in the right places and that's really done a lot for us. It's helped our bottom line, and it's also helped open up capacity. So, we've been on a very strong mission over the past two years looking for new work. We've got the ability, we've got the capacity and we've got a fantastic first article team.

Continued from page 19 _____



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You Don't Always Score from the Red Zone

By Loren Smith

Getting the final steps of a deal done can be like moving the football down the field at the end of a close game ... on the ground ... a yard at a time. When you finally reach the red zone, every move is crucial and exhaustion is a key factor. In the deal world we say that a stiff challenge often arising toward the end of negotiations is "deal fatigue."

The cliché "There are no easy deals" is absolutely true. And when the process has paralleled an arduous march down the field, the final stages can be fraught with impatience and even distrust, jeopardizing all the time and effort invested in coming to terms on a sale. Either the seller or buyer can kill it.

Here is an example from several years ago that illustrates the precariousness of deal fatigue.

Having been retained to sell a \$40M harness company in the Southwest, we crafted a CIM (confidential information memorandum) and engaged in dialogue with a wide variety of prospective buyers. Eventually, one of them emerged as the hands-down choice. Not only had he offered a price and terms that far exceeded the other buyers, but he also knowingly overlooked certain obstacles in a way that no one else had. We soon signed a letter of intent with the buyer and started down the path of due diligence.

While the buyer was relatively sophisticated, having acquired a number of companies during his career, the seller was not. She had spent her career operating a business, and this was her initiation in forging a deal.

Nevertheless, we moved fairly quickly through the due diligence process, which included both accounting and legal activity. But then, when the seller was required to provide additional information, the process slowed. Her inexperience with consummating deals was one challenge, and the thinness of her



Loren Smith CEO Blue Valley Capital

management structure was another. She had to expend significant time and energy to gathering information while continuing to head the day-today operation of his company.

As a result, when we finally entered the red zone, the seller was exhibiting severe deal fatigue and blamed her weariness on what she felt was an unfairly long process. I assured her that the buyer's requests had been normal and that he now needed only to explain a few issues that had surfaced toward the end of due diligence and provide a forecast for the coming year to satisfy the buyer and cross the goal line. But mentally, the seller was gassed. Her efforts to develop the last elements of critical information were half-hearted, and the deal caved in.

This unfortunate outcome occurred despite my practice of always orienting an inexperienced seller to the demands of the sale process and the realities of deal fatigue. I had done so with this seller, but maintaining commitment through the red zone turned out to be too much for her. When I think about the risks that keep deals from happening, this ranks very high on the list.

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Improving Practices: A Candid Conversation with Randy Cherry - IPC

f you've attended the EWPT Expo or any WHMA Conferences, you likely ran into the smiling face of Randy Cherry, Director of Validation Services at IPC. Randy has made a career of working with companies in the electronics industry. His knowledge of the harness industry is vast, and he has a near

f you've attended the EWPT photographic grasp of the WHMA/
Expo or any WHMA Confer ences, you likely ran into the g face of Randy Cherry, Di of Validation Services at IPC.

As things open up, Randy is resuming his audit schedule. I thought it would be a good idea to touch base with him to see what he is noticing

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ATLAS WIRE LLC Registered to ISO9001 Certificate No. 10000854 IATF16 4705 S. Coach Drive Tucson, AZ 85714 (520) 747-4500 (520) 747-5800 fax info@atlaswirecorp.com in the field. Overall, he thinks the industry is doing a very good job at adhering to quality standards set forth by IPC/WHMA A-620. But he does see some concerning patterns and areas for improvement. Following are some of Randy's observations.

Automated Equipment

During my visits to cable and wire harness companies, I notice some really good practices, but also some notso-good. I do notice manufacturers tend to hang on to legacy equipment a little too long. They try to make these older machines perform year after year. At some point, they start having some quality issues. They're just not getting the clean cuts or the good of crimps they did when the equipment was newer, for example.

Another thing I notice at the wire harness companies I visit; is they typically fall behind on preventive maintenance (PM) for their assembly equipment. I do not need to overstate how important PM is to the manufacturing process. Downtime cannot be tolerated because a key piece of equipment is unable to perform at peak efficiency. A solid PM program or schedule should automatically alert the maintenance technician so that nothing is missed. They will get much more consistent results over the life of the equipment this way.

Hand Crimpers

I notice particular neglect when it comes to hand crimpers. With older hand crimpers, verification of a solid crimp sometimes gets overlooked. When a company is assembling a very complex harness that requires several unique hand crimpers, this verification becomes especially difficult; but it really needs to happen. Companies should follow the guidelines in section 19 [A-620] and use wires and terminals to make some sample crimps. They should perform a pull test and/or dimensional testing on samples from each hand crimper and track the results (Statistical Process Control). If a hand crimper fails to meet the test requirements for a certain crimp and wire gauge it should be replaced or repaired.

Many of the hand crimpers I'm seeing are not designed for continuous use in an industrial setting. They were purchased at the local hardware or department store. These hand crimpers were not designed to provide a consistent crimp per IPC standards. IPC/WHMA-A-620D for Class 3 requires that all crimp tools, including hand crimpers, control the



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crimping operation to the extent that once the crimping operation has begun, the tool cannot be opened until the cycle is complete. In other-words, a full-cycle/ratcheting tool is required for Class 3 crimping.

It is a good idea to list all the hand crimpers and machine crimping tools on the Production Traveler/Work Order or a Work Instruction. Too often I see operators using the wrong hand crimper or do not have the crimping machine set-up properly to produce an acceptable crimp to the customer's drawing. Having a pictorial document or spreadsheet showing the crimp height information for the family of terminals being used saves time during new job setup.

Soldering:

Another area of concern involves using different solder alloys for wire tinning and soldering wires to printed circuit boards. I never saw this issue until the industry moved from tin/lead solders, to lead-free. For example, I have seen operators tinning wire with a SAC 305 lead-free solder alloy, and then try to solder the wire to a printed circuit board with a 63/37 tin/lead alloy. Since the melting temperatures of each solder alloy combination are different, you will never achieve a good intermetallic bond. Plus, you've now contaminated the SAC 305 alloy with lead. It's a good idea to review how you tin your stranded wires and how you plan to attach them to the printed circuit board.

A big concern I have is with operators mixing solder fluxes. It is a bad idea! The fluxes need to be compatible. You need to use the same external flux for tinning wires that will be in the flux cored solders for attaching the wires to the printed circuit board.

Cleaning is another area that does not seem to get much attention when tinning or soldering wires. Flux has a tendency to wick up under the wire

insulation when processing steps are not followed, or if proper cleaning is overlooked. Trapped flux residue under the wire insulation will result in corrosion of the wire over time. IPC/WHMA-A-620D calls for the use of low activity fluxes (L0 and L1) for tinning and soldering. Many companies have started using no-clean fluxes and solders which may not need to be cleaned. Regardless of which flux or flux cored solders you select, always review the manufacturers requirements for cleaning. The goal is to have either a clean tinned wire or. if any flux reside is left behind, it is benign.

I have one more observation on the wire tinning process. Folks should always remember to have the solder tinning pot added to the preventive maintenance schedule for replacement and replenishment. Typically, these solder pots are very small and only hold a few pounds of solder. It is not cost effective to analyze the solder if the amount is small. Replacing and replenishing on a regular basis ensures your solder alloy stays below the maximum limits for solder bath contamination (IPC/WHMA-A-620D Section 4.1.1.1.1 Table 4-1). It's a good idea to track the daily, or weekly usage of the solder tinning pot to determine the frequency for replacement and replenishment. You may need to have a few solder samples analyzed to establish a benchmark of data to determine how often this should be done. The used solder alloy material can be scraped and reclaimed by an authorized vendor to get back some of the value.

Training:

Other challenges that I see involve an overall lack of training due to high employee turnover and a limited talent pool of candidates. IPC now offers Wire Harness Assembly for Operators training. This on-line or instructor lead course provides an

Continued on page 25



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Improving Practices:

Continued from page 23

overview of useful information and tips for cable and wire harness operators. This training course is targeted for operators who are new or need a refresher to the cable and wire harness assembly methods. (See full article on WHO on page 57).

Ultrasonic Welding for Splices

During my travels, I get to see many innovative solutions in the cable and wire harness industry. The increased use of ultrasonic welding for splicing is one example. It is especially useful if you are splicing two different materials. An example would be welding copper and aluminum stranded wires together. This wire combination appears most often in automotive applications. Remember you need to keep the equipment very clean and well-maintained to ensure ultra-sonic weld integrity.

Final Inspection:

One big area for debate I find in the cable and harness industry is with final harness assembly. Inspectors, operators and engineers often differ on what is acceptable, and what is not. I'm noticing that harnesses are inspected at too high of a magnification, revealing "issues" are not really defects or even bad process indicators. IPC/WHMA-A-620D has two tables (Table 1-1 and 1-2) that show the correct magnification level based on wire gauge. Typical inspection magnification range is 1.5X to 10X. The maximum referee magnification inspection range is 1.75X to 20X. You only need to use the referee magnification inspection range to verify a harness that has been rejected at the inspection magnification range. You

never need to go above 20X magnification for production harnesses, unless you are troubleshooting a particular manufacturing problem.

Use of IPC/WHMA-A-620D/Third Party Verification

Many companies that I visit are still learning and understanding the benefits of using IPC/WHMA standards. The IPC/WHMA-A-620D standard contains valuable information covering materials, methods, tests and acceptability criteria for producing crimped, mechanically secured, or soldered interconnections associated with cable and wire harness assemblies. Companies who support this standard find comfort in knowing that their manufacturing processes meet or exceed this standard.

Third party verification is another method of knowing that your manufacturing processes are compliant to this standard. IPC Validation Services is one option to accomplish this strategy. Companies that meet or exceed the IPC/WHMA-A-620D standard have set themselves apart from others in the industry. This is a key marketing advantage over the competition.

About IPC

IPC is the global association that helps OEMs, EMS, PCB manufacturers, cable and wiring harness manufacturers and electronics industry suppliers build electronics better. IPC members strengthen their bottom line and build more reliable, high-quality products through proven standards, certification, education & training, thought leadership, advocacy, innovative solutions, and industry intelligence.

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POWER WOMEN of the wire harness industry

By Melissa Femia

This edition of The Power Women series features Veronica Pirie, a Product Engineer - Electrified Power in the New Power business at Cummins Inc. Like some of the women highlighted in the series, Veronica is involved in supporting females within the engineering ranks.

Born in San Diego, Veronica spent many weekends outside with her family, including her Grandfather, a science teacher, and Campfire Kid group, a youth development organization aimed at helping kids and teens thrive at life skills. Although too young to realize she was learning about science, she believes these experiences sparked curiosity in the field at a young age.

In her 7th grade year, her family moved to Florida because the company where her father worked as a mechanical engineer transferred him to a different facility. Her mother, stayat-home parent, always had a passion for art and yarn, owning an Etsy shop for some years to sell hand-died yarn. Thus, Veronica had creative, entrepreneurial, and technical roots. Although she was in advanced classes in San Diego and Florida, she was most focused on band while in middle school and high school. In fact, Veronica had not determined a career upon applying for colleges. Enjoying the TV crime dramas, she had initially considered a career in criminology. While she also considered engineering as a potential career during her senior year, she wasn't sure of her path.

After entering college at the University of Florida, she decided to pursue engineering without knowing which area of engineering would best fit her. Initially Industrial Engineering was of interest because of the versatility of the degree. However, after hearing from a friend in the Electrical Engineering department that they had the most hands-on labs compared to other engineering departments, she decided to designate EE as her major. While at The University of Florida, Veronica was heavily involved in Women in Electrical and Computer Engineering (WECE), a student-run organization that fosters community among females and gender minorities in the discipline. Veronica joined the group during her 3rd year of engineering school upon declaring her major as EE. She held positions focused on outreach for the community and engineering peers, including President during her 5th and final school year. While involved in the organization, she and her counterparts were active in recruiting new mem-



Melissa Femia

bers as they identified females in their classes, which were 6-8% female as she recollects. The group advocated for a makerspace study lounge within the engineering building similar to the lounge devoted by the department for IEEE (Institute for Electrical and Electronics Engineers). Her team was also successful in attaining both departmental and corporate funding to populate the room with 3D printers, Arduinos, and TI boards among other tools. While in the lounge, the females developed a camaraderie and studied together. They supported one another throughout their time in the engineering program.

Veronica's first internship at Cummins was as a control engineer in the high horsepower engine area (19L+). Many of her counterparts selected internships at more traditional EE companies like software firms and chip companies. After comparing notes with them, she realized the diverse opportunities that would be available as an EE at a traditionally mechanical company. Having no prior experience with engines or wiring harnesses, her temporary assignment provided the background needed to return full-time upon graduation. After a couple of years in high horsepower, she found an opportunity in the Electrified Power business, where she is currently working as a product engineer. While she enjoyed her first role working with diesel engines, her current assignment is better tailored to her interests in working with innovating future technologies. In addition to the work content, Veronica enjoys the inclusive atmosphere at Cummins. When starting with the high horsepower wiring harness group, she worked on a team of majority female engineers. Two years later in a different department of Cummins, females still comprise most of the engineers on her team. This ratio is atypical as most technical, engineering-focused industrial groups have traditionally been heav-

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__ Continued on page 29

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The Power Women of the Wire Harness Industry

Continued from page 27 _

ily weighted towards males. She feels that she is respected by the male counterparts in her workplace. However, she does note that she did have to adapt to the water-cooler conversations based on often-different interests between the males and females. She found it challenging to contribute to conversations on the hobby-cars or most recent Indianapolis Colt's win. Over the last few years, she has learned to join these conversations by asking questions to learn about hobbies she doesn't know about and finding common interests with those individuals she has not talked to as frequently.

Like her collegiate days, Veronica is still involved in organizations that conjoin females with engineering. Two years ago, she initiated a SWENext chapter in Columbus, Indiana. The organization has been challenged by covid protocols that limited gatherings, but they are regularly meeting online with other sections in Southern Indiana. Per the Society of Women Engineers (SWE) website, SWENext is "a way for girls to become a part of the SWE engineering community as a student through the age of 18." (https://swe.org/k-12-outreach/youth-programs/).

In terms of challenges being a female engineer, Veronica did not have large obstacles to overcome. In looking back, she thinks the study lounge for the WECE group could have been allotted sooner as the campus group had been in existence for 10 years by the time she participated when finally granted the makerspace. On the positive side, Veronica thinks that engineering is a great field for women with the comparatively higher entry level salaries (versus average) in combination with the job demand. Her advice to any female consider-



Veronica Pirie

ing engineering is to not focus on the discipline of engineering if unsure, but rather just get a degree. Once the engineering diploma is in hand, the individual is not limited to working only within that particular engineering field. In Veronica's case, she preferred the new electrification technology to the diesel engine work assignment, so she simply changed groups. With a general need for engineers, the degree will equip an individual with many transferable skills, including problem solving, and make her an asset wherever her interests take her-whether a change of positions within a company or an external job change.

Thank you, Veronica, for taking the time to meet with me and for continuing to encourage females in engineering.

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 melissa. femia@janadiversity.com



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Fluoropolymer Insulation Etching for Bonding Applications in Harness Assembly

PTFE, FEP and PFA are industry for wire insulation. Their chemical and heat resistance, low coefficients of friction and stellar dielectric qualities make them the obvious choice for use in many high-reliability wiring applications (see How to Se-

aterials like Teflon[®], lect a Polymer for High Temperature Wire and Cable in the March/April widely used in our issue on wiringharnessnews.com). Their high lubricity, however, greatly reduces the bonding ability of the insulation. In order to bond, mark, pot, or mold to these materials, they must be etched in some fashion.



This task is most commonly achieved using a chemical enchant solution. Some high-reliability space applications call for additional roughing of the surface with abrasives like sandpaper.

An illustration of the effects of etching to the insulation surface is shown in Figure 1. This article deals primarily with the chemical process, and WHN was fortunate to have Amy Ricketts of Connectronics to guide us through this subject.

First, let's cover some basics. The etching process is achieved by placing the fluoropolymer wire into a sodium solution (two brands are listed in the Rescources section at the end of this article). The resulting chemical reaction removes fluorine molecules from the carbon-fluorine backbone of the fluoropolymer surface. This leaves a carbonaceous layer that allows the surface to be easily bondable. Since the etching process penetrates only to the depth of a few angstroms, none of the performance characteristics of the wire are affected.

For many applications where Connectronics needs to bond to fluoropolymer insulated wire, they purchase pre-etched wire from Wiremax, which happens to be their sister company. Wiremax is a leading manufacturer of silicon coated wire and produces pre-etched FEP wire in varying lengths, gauge sizes, colors and conductor/stranding options.

For other applications where only a small area of the wire needs to be etched, or for Teflon or PTFE coated wire, Connectronics does the etching in-house. The same chemical etchants used in large scale or continuous etching are used in spot or batch etching. The process is the same for Teflon, PTFE, FEP and PFA coated wires.

Although the etching solutions

have a fairly high flashpoint, standard precautions such as gloves, goggles, protective clothing and minimal local ventilation should be used.

Amy outlined the process they use. As with any surface preparation, if the parts are soiled, it may be necessary to wash them before etching. If this is the case, the wires should be thoroughly dried as water, acetone, alcohol or any other cleaning solvents will quickly deactivate the etching solution.



Figure 1. Contact Angle of Surfaces



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The area of the wire to be etched should be dipped into the solution for 30-60 seconds. The vessel should be of a vertical design to minimize the area of the etching solution exposed to air, as air weakens the solution. A waving action helps speed up the process. A sponge or brush can also be used. Since the process is a self-limiting reaction, there is never the danger of over-etching.

Amy indicated the wire will often turn a brownish color, but to varying degrees depending on the wire manufacturer or pigment used. It's a good idea to establish in-house standards correlating the color change to bond strength by experimenting with various scrap pieces.

It should be noted that different manufacturers of the sodium based etching solution call out slightly differing procedures. Follow the detailed manufacturers instructions for each (see Resources).

Once the etching process has taken place, the next step is to wash the parts in water for about 15 to 30 seconds. It is critical that the water used to rinse the parts is chlorine free. Since most municipal water supplies have increased chlorine levels, it's imperative to use carbon filtered, distilled or deionized water. Connectronics uses distilled water in a small vessel heated on a hot plate to about 70 degrees C.

The final step is to dip the wire in alcohol. The reaction during the etching process causes a crust to form on the surface of the wire. Since this crust can make the material less bondable, it must be removed by dipping the material in isopropyl alcohol

The finished dried parts are now ready for bonding. Even though Connectronics usually uses the parts within a day from etching, they will remain bondable for several months if stored at normal room temperature and humidity. Exposure to UV light can degrade the bonding ability, so any parts they don't use right away are stored in dark bags that refract light. Some studies show that the bond strength actually increases after 24 hours post etching. Amy mentioned the long lengths of pre-etched wire they purchase from Wiremax are stored in the same manner.

As mentioned earlier, some specific applications on Teflon wire actually call for the wire to be lightly abraded with fine sandpaper. The roughed-up surface is then processed chemically as described above.

Resources:

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Zuken USA Announces Cloud Storage for E3.series

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uken USA, Inc. has added cloud storage to its popular E3.series suite of products for wire harness and electrical cabinet design. Cloud Vault for E3.series is a plug-in that connects to Amazon Web Services and Microsoft Azure for project storage and management. Companies of all sizes can now take advantage of the convenience and security of cloud storage while using the E3.series design suite. Cloud service accounts are customer-controlled, providing data privacy and User access can be set at the user and configurable settings.

settings for user password change, application theme color, iteration saving, language, version increment type, and more. The commercial cloud services provide on-demand scalability, robust security, and unmatched flexibility.

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

WIRE STRIPPABILITY

he ease with which a slug of insulation can be cleanly stripped from an insulated copper or aluminum wire is a characteristic that can impact the efficiency of the stripping process as well as the quality of the termination. Wire strippability is often taken for granted, but it quickly becomes a major concern if difficulties arise-especially with high-volume production. The characteristics of wire and automated stripping equipment interact in subtle and complex ways. As a result, troubleshooting can be difficult and timeconsuming. Below is an overview of some of the key characteristics that influence wire strippability.

STRIP FORCE

The strip force of an insulated wire is the axial force required to remove a given length of insulation from a conductor in preparation for termination. The amount of friction or adhesion between the insulation and the copper conductor must be low enough for the slug to be easily and cleanly removed, yet high enough so the remaining insulation does not slide during stripping or during subsequent processing. Industry standards provide test methods to measure this force.

A typical strip force measurement method consists of the preparation of a sample of wire with a short length of insulation removed from one end of the wire while leaving a precise length of insulation undisturbed. The end of the wire is then inserted through a hole in a metal plate that is slightly larger than the copper conductor. The remaining length of insulation is pulled from the conductor by pulling the conductor through the metal plate using a tensile testing machine pulling at a specified rate. The maximum force reached during stripping is measured and recorded.

The strip force of a wire varies with length of slug, wire size, insulation type, type of stranding and other variables, but it is typically in the range of 5 to 25 pounds (22 N to 111 N). Wire manufacturers can control strip force within reasonable limits by careful control of conditions during extrusion of the insulation including conductor surface cleanliness and texture, conductor preheat, extrusion temperature, extrusion pressure, extrusion tooling and cooling rate.



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CUT-THROUGH RESISTANCE

The cut-through resistance of wire insulation must be high enough to withstand the mechanical forces of installation and usage and to comply with industry standards. At the same time, it must be low enough to permit the knives of a stripping machine to reliably cut the material. PE (polyethylene) and XLPE (cross-linked polyethylene) are common materials with relatively high cut-through resistance, while EPR (ethylene propylene rubber), silicone and polyurethane have relatively low cutthrough resistance. PVC (polyvinyl chloride) typically has a cut-through resistance somewhere between these two extremes. The knives of the stripping equipment must, of course, be sharp enough to cut cleanly through the insulation or jacket and must also be properly adjusted so the insulation is cut all the way through without nicking the copper or aluminum conductor.

CRUSH RESISTANCE

As with cut-through resistance, the crush resistance of wire insulation must be high enough to withstand installation and in-service mechanical forces and to comply with industry standards. The crush resistance of

a wire must also be high enough to withstand the force applied by the grip of automated stripping equipment. This force is often adjustable and must be set high enough to prevent slippage as the insulation slug is pulled from the conductor, but it must be low enough to not damage the wire insulation. The crush resistance of a wire depends primarily on the type of insulation, but conductor material and stranding also has an effect. Wires with finely stranded conductors typically have better crush resistance than solid or coarsely stranded conductors because the conductor strands will compress.

INSULATION HARDNESS

Insulation hardness can also affect strippability. Soft, rubbery insulations such as EPR, silicone or CSPE (chlorosulfonated polyethylene) can buckle and thus bind as they are being pulled from the conductor if adhesion to the conductor is too high, especially if the strip length is long. This phenomenon is seldom an issue with harder polymers such as PE, XLPE and FEP (fluorinated ethylene propylene). Polymer hardness is often measured and reported using a method called durometer hardness testing.

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The Pursuit of Weightless Tools

How shops are reducing occupational strain in all-day cable tie operations.

By Mike Spanjar and Joe Roberts HellermannTyton

bout three decades ago, automated cable tie appliation tools hit the manufacturing scene like a motorcycle in a bicycle race. Heads turned. Jaws dropped.

Until then, manually operated hand tools were the sole choice for manufacturers, wire harness shops and installers looking for ways to increase productivity in their bundling and securing operations. Hand tools are lightweight, portable and quite good at tensioning and cutting off cable ties.

Today's high-volume shops have a unique problem, however, as these tasks can be repeated for hours at a time. Perpetually holding an arm out over a harness or assembly and squeezing a manual trigger leads to a greater frequency of employee injuries and the associated costs.

With the advent of the automatic cable tie tool, all the manual steps involved in applying a cable tie have been reduced to the pull of a trigger. Today, the entire process takes less than a second.

An operator assembling a six-foot wiring harness with multiple branchouts, for example, can appreciate the impressive speed and repeatability of



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Robot and cobot applications take the load off the operator.

an automatic tool compared with a manual one. This is especially significant in applications where a single assembler applies hundreds or thousands of cable ties daily.

But just how maneuverable are these handheld machines, and can an operator comfortably use them daily without risk of developing a strainrelated injury?

That pesky gravity

Just like the motorcycle versus bicycle scenario, all that power adds some heft. Depending on the tool, there may be an onboard motor or two, a cable tie feeder system as well as the necessary mechanical parts. The early automatic tools were quite heavy.

In today's repetitive-strain-averse manufacturing culture, tool weight remains a hot topic. The most recent Bureau of Labor Statistics study found musculoskeletal disorders accounted for one-third of all worker injury and illness cases. These include tendinitis, trigger finger, shoulder and elbow injuries, and low back injuries.

"The shoulder joint is surprisingly weak," says Jay Kapellusch, PhD, associate professor and chair of occupational science & technology at the University of Wisconsin-Milwaukee. "Anything more than 2.5 pounds becomes a problem if you have to use it repetitively, especially if you have to move the tool around a lot, which is typically the case with a cable tie tool."

Naturally, being able to hold and maneuver the tool by hand is ideal for operations that require fastening along multiple points on an assembly. So, how can operators enjoy the benefits of an automatic cable tie tool

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The Pursuit of Weightless Tools

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without suffering arm fatigue or the resulting injuries?

Tool makers solve this issue in numerous ways - lighter materials, for example. Some have offloaded certain components from the tool, tethering them via cables and/or hoses to external base units that sit on the floor or are mounted to a rig. In the case of air-powered systems, there will also be a connection to an air compressor. This results in a much lighter tool for handheld operations. Of course, if mobility is important, users will want to consider how that method doesn't allow the the tool to stray far from its base.

A different approach keeps all the parts on the tool. HellermannTyton borrowed from an industry standard suspension system when it developed an overhead rig that makes its 3.5-pound AT2000 CPK automatic cable tying tool virtually weightless. A "bail hook" mounted to the top of the tool connects to a "balancer." The operator pulls the tool to the work by extending the balancer's recoil line, and then can let go of the tool so it returns to its ready position. The suspension system installs overhead where space is typically underutilized.

Both approaches accommodate 5,000-tie reels to reduce downtime. Between the assistive technology and the ample supply of cable ties, operators can efficiently bundle wire and cables for extended periods without landing on the disabled list.

Going hands free

Sometimes, the freedom of handheld control isn't relevant to the



Bench mount: Many handheld application tools can be bench mounted for repetitive tasks.

workflow. For operators stationed at a workbench, automatic tools adapt with a little help from another type of rig.

A bench-mount kit creates an ergonomic workstation for high-volume repetitive tasks such as applying cable ties around wire harnesses. Rather than the point-and-shoot method, the operator simply holds the bundle in place within the tool's jaws.A dedicated foot pedal activates the tool.

With a bin full of wire harnesses beside the operator, throughput is greatly enhanced compared to attaching cable ties manually. Just as important, it's much easier on the hands.

Many benchtop designs include an accessory to suspend the 5,000-piece cable tie reel, keeping productivity high for extended periods. And since the tool can be removed easily, users have the added flexibility to use it in a mobile workflow if necessary.

Going operator free

At the risk of sounding unsympathetic to the hardworking humans out there, automation in manufacturing continues to deliver gains in productivity and precision.

Robotic operations take fatigue completely out of the equation. Some automatic cable tie application tools are designed to fit right into the mix. They are typically affixed to a mechanical appendage, either stationary or reciprocating, with a mechanism to quickly cycle the tool as it moves across the work.



Hanger: An overhead suspension kit makes this autotool virtually weightless but still easy to manipulate.

Larger manufacturing centers have found this to be an ideal addition to the workflow. It allows them to better utilize their operators in other processes.

The days of excessive operator strain injuries are becoming a thing of the past, thanks to assistive technologies taking the weight out.

About the authors

Mike Spanjar is a marketing copywriter at HellermannTyton North America. A self-professed tool geek, he writes extensively about the company's full range of industrial cable management solutions.

Joe Roberts, HellermannTyton North America director of sales - tooling systems/OEM products, has been involved in the sales and marketing of tool systems for 18 years. He also currently resides on the board of directors for the WHMA/IPC Association.



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Cicoil's lightweight Flexx-Sil™ jacketed power cables offer exceptional all-weather flexibility, mechanical durability and are ideal when ease of routing is required. This combination of features makes Cicoil's power cables the optimal alternative to stiff wire, bus bar and bulky power conductors in powering propellers, electric propulsion motors, turbofan engines, and wing flaps.

Manufactured with high-strength, oxygen-free tinned copper wire, Cicoil's shock absorbing Flexx-Sil™ design is naturally more flexible than other types of power cables, and is immune to the rigors of turbulent flight, compressive force, vibration, salt spray, fungus, deicing fluid, corrosion, sunlight, acid rain, ice, UV light, humidity, ozone, steam, grease, kinking, cracking and most chemicals.

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NEWS PLUGS continued



Eurotech Blueseal Seals Vehicle Wiring Splices from the Inside

The Splice Design Toolbox for The Optimal Wire Harness Finally Complete.

BluSeal by Eurotech provides superior splice protection against water ingression and contaminants that can destroy your wire harness. Our unique

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visible in

machine for

supply level checks

Integrated blow off

Stainless steel construction

system for clean

for easy cleanup

processing

low-viscosity automotive-grade formulation has robust moisture and chemical resistance and maintains flexibility across a wide range of temperatures. Drip or dip applied, BluSeal penetrates between each wire strand and the insulating jacket, and cures to a durable and flexible barrier. BluSeal provides a permanent and effective seal, preventing corrosion failures over the life of the vehicle even on high wire count junctions.

With the new BluSeal Dip Machine (BDM), you can increase your splice

sealing throughput and reliability. It is specifically designed to meet the re-**Advanced Splice Sealing** Programmable for high process control Self-leveling dip-bath for easy application

quirements of major vehicle wire harness manufacturer's for ease of application and high reliability. The BluSeal is safely stored inside the machine during operation and a draw tube in inserted directly into the provided container. The unit is easily programmed for the specific splice configuration and the operation can begin. Splices are automatically detected when they are fully submerged into the BluSeal bath. Then a dip timer is started and an alarm sounds if the part is removed prematurely. Once the dip timer is satisfied, the operator is notified to remove the splice from the bath, and immediately into the blow-off-station (BOS) where any excels BluSeal is displaced from the exterior of the wire insulators. The BOS also automatically senses the presence of the splice and is activated according to the operator settings. After each cycle, the BluSeal bath is automatically refilled to the programmed level.

For a more detailed discussion on the full functionality of the Eurotech BluSeal Dip Machine, or for a live online demonstration, please email or call us for more information productinfo@eurotechdirect.com +1-330-467-0205, or visit www.eurotechdirect.com/bluseal About Eurotech

Eurotech is a proven leader in global business-to-business partnerships, providing unique products, technical sales, engineering, market development, distribution and order fulfillment for engineered products used in the global automotive and commercial vehicle industries.



Eurotech also produces and represents an exclusive group of advanced technology products, with partners headquartered in Europe and Asia, offering only highly engineered products. These products include a full range of adhesive tapes, heat shrink tubing, BluSeal splice sealer, connector systems and PUR foam quality assessment tools.

With over 200 combined years of hands-on wire-harness design and market experience, the Eurotech team can also provide value-added services and analysis in the areas of VAVE, warranty, and should-cost.

With a strong reputation of success in our markets, we leverage our access by working directly with global industrial manufactures, automotive OEMs and Tier-1 suppliers, to introduce new products, obtain certification to customer requirements, and provide program management all the way to production launch, and beyond. At Eurotech, there is nothing more important than helping our customers, and your customers, be successful.

Founded in 1998, Eurotech is a privately held company with direct sales in excess of \$10 million annually, and











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supporting an additional \$50 million client sales indirectly. The company is headquartered in Northfield, Ohio, and has additional support locations in the U.S., Mexico, and Europe.

Heilind Electronics Adds TE Connectivity's 2 mm Receptacles, Breakaway and Shrouded Headers

Heilind Electronics, a leading global distributor of electronic components and authorized distributor for TE Connectivity (TE), a global leader in connectivity and sensors, expands its range of AMPMODU interconnection solutions with the manufacturer's 2 mm receptacles, breakaway headers and shrouded headers.

These new connectors occupy 38 percent less space than traditional 2.54 mm (0.1 inch) centerline products, while reliably and economically meeting the packaging and inter-connection requirements of today's miniature, so-phisticated electronics. Available in vertical and right-angle orientations, the shrouded headers come in a double row configuration with through-hole or surface mount termination for ease of manufacturing.



AMPMODU 2 mm breakaway headers can be mounted onto boards with thicknesses of 1.6 mm or 2.4 mm, providing customers with a wide range of options for PCB assembly. The headers offer an intermateable solution with major brand receptacles via a polarization feature that favors correct mating. They are molded in a flame-retardant (UL94 V0) thermoplastic housing material that is resistant to reflow soldering temperatures, resulting in a high level of safety in harsh environments.

The products are designed for use across multiple industry segments where space constraints are of particular concern. Target applications include PLCs (Programmable Logic Controllers) and other I/O devices, servo drives, industrial automation and controls, industrial robotics, instrumentation and test equipment, building/factory automation and material handling.

Visit Heilind's website for more information about TE Connectivity's AMPMODU 2 mm Receptacles, Breakaway Headers and Shrouded Headers.

About Heilind Electronics

Heilind Electronics, Inc. (http:// www.heilind.com) is one of the world's leading distributors of connectors, relays, sensors, switches, thermal management and circuit protection products, terminal blocks, wire and cable, wiring accessories and insulation and identification products. Founded in 1974, Heilind has locations throughout the U.S., Canada, Mexico, Brazil, Germany, Singapore, Hong Kong and China.

About TE Connectivity

TE Connectivity is a global industrial technology leader creating a safer, sustainable, productive and connected future. The broad range of connectivity and sensor solutions, proven in the harshest environments, enable advancements in transportation, industrial applications, medical technology, energy, data communications and the home. With approximately 80,000 employees, including more than 7,500 engineers, working alongside customers in approximately 140 countries, TE ensures that EVERY CONNECTION COUNTS.







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NEWS PLUGS continued its robust Indus-



TE Connectivity Expands **Robust Connector Portfolio** to Meet Reliability Needs of Complex Vehicles

DT-XT sealed connector system features innovative, high-performance seal technology for commercial vehicle applications operating in harsh environments

Today's complex vehicles include more connectors than ever, which brings a higher risk of failure as one compromised seal on a single connector can result in the failure of an entire system. To address the reliability needs of its customers operating commercial vehicle applications in harsh environments, TE Connectivity (TE), a world leader in connectivity and sensors, has expanded

trial and Commercial Transportation (ICT) connector portfolio to include the DT-XT sealed connector system.

DT-XT sealed connector system features innovative. high-performance sealing technology. The advanced sealing materials and covalent bond of-

fer increased flexibility resulting in improved tear resistance and seal positioning for the ICT market. Additionally, a rear sealing cover protects against water ingress due to enhanced cable management. The connectors have a proven design that works with the industry's current standard tools and eliminates the need for costly redesigns. DT-XT connector is



IP69K-rated and J2030 powerwash tested.

"Providing customers with products that are durable as well as dependable is our priority at TE," said Ryan Wu, product manager at TE Connectivity. "DT-XT connectors are the latest addition to our DT Series within the DEUSTCH connector portfolio and offer customers a durable, rugged and reliable connector solution that also cuts costs

> and saves on assembly time."

DT-XT sealed connector system also features secure mating and unmating as the connector housing has an integrated lock that provides secure mating and electrical connection in the vehicle. Finger grips on the locking mechanism provide a ribbed surface that makes it easier to connect, disconnect and release even when fingers are wet, dirty or oily. With the range of DT-XT crimp terminals, lower insertion and withdrawal forces are possible.

TE offers the DT-XT sealed connection system in a broad range of colors and an array of custom options, enhancing poka-yoke and removing the need for labeling of wires.

For more information, visit te.com/ict.

TE Connectivity is a \$12 billion global industrial technology leader creating a safer, sustainable, productive and connected future. Our broad range of connectivity and sensor solutions, proven in the harshest environments, enable advancements in transportation, industrial applications, medical technology, energy, data communications and the home. With approximately 80,000 employees, including more than 7,500 engineers, working alongside customers in approximately 140 countries. Learn more at www. te.com and on Linkedln, Facebook, We-

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Analyzing Splice Failures in Automotive Wiring Systems

By Paul Waszkowski Eurotech

ome of the highest causes of vehicle downtime and repair are wiring related. It is difficult to get hard statistics on this topic because OEMs don't like to publish too much information on what causes their products to fail, but those of us in the industry know that this battle for environmental robustness continues, even though many technical advancements have been achieved. Most people don't realize that there were fully functional anti-lock brake systems (ABS) in the 1970's that could have saved many lives, but these mostly had to be pulled from the market due to wiring problems.

It would be a few decades later that the National Highway Traffic Safety Administration's Federal Motor Vehicle Safety Standards could finally mandate ABS for commercial vehicles and eventually passenger cars, because the electrical system state of the art finally caught up to the harsh demands of such a safety critical function.

With ever increasing content on modern vehicles and the number of wire connection points easily reaching into the high hundreds, electrical system integrity has never been more important, since a single failure can be enough to bring one of these systems down. In the past it would be common to see non-sealed connectors and electronic control units (ECUs) all around the vehicle, but now these are mostly sealed against water intrusion.

As these major electrical system components advanced in design, the stresses caused mainly by temperature changes and water contamination have pushed the failure mode to the next weakest link in the system; splices and eyelet terminals. These have long been areas of concern for corrosion, but recent field experience indicates overall electrical system evolution has made them the top focus for improvements and is driving updates to electrical standards at all of the major OEMs.

Two Interesting Examples:

A ground splice located outside on the chassis harness was in a wet environment. One of the sealed ECUs connected to this ground splice was mounted safely in the cab of the vehicle. However due to temperature changes, the air volume in the ECU caused pressure cycling that drew salt-contaminated water all the way into the ECU, filling it and causing failure. This breathing phenomenon is now recognized throughout the vehicle industry, and one OEM actu-



MS21980 • MS21981 • MS35431 • MS77066 - MS77074 • MS25274 MS25435 - MS25439 • M83519 • M23053 • MS21266 • M23190



ally refers to a sealed ECU as a, "Lung A New Approach box." A low viscosity

In another case, a splice that was thought to be sealed was exposed to water splash in the engine compartment. Water ingress progressed throughout the wire harness due to the forces of capillary action between the copper strands and the entire wire harness had to be replaced. This powerful capillary action can easily be demonstrated in the lab as shown in figure 1, using salt water.

Room for Improvement

For many years the industry has exclusively depended on adhesive lined heat shrink tubing to seal splices and protect eyelet terminals but with the new OEM test standards in place, harness manufacturers are forced to validate that the splice is sealed, and this has exposed issues. Wiring engineers can erroneously think that if the heatshrink glue flows, the splice must be sealed, but this is not always the case. As reliable as heat shrink tubing is when properly applied, there are many cases where the application process is not verified. Heat shrink tubing has also demonstrated limitations due to high splice complexity and when the geometry of a terminal is such that it cannot be sealed with the shrink tube adhesive alone. This is especially true as the number of wires terminated to a single splice junction or eye terminal increases. This has forced the industry to start looking and testing alternative solutions for wire sealing like mastics and butyls, but these have proven to have their own issues with inconsistent and labor-intensive manual application, compatibility concerns with wire insulation, and environmental deterioration.

. .

A low viscosity liquid sealer has been engineered to solve these concerns by sealing wires in an entirely new way. BluSeal is a low viscosity liquid sealer that wicks between wire strands utilizing the capillary forces and cures quickly forming a durable, semi-flexible barrier, to provide a permanent and effective sealed splice or terminal over the life of the wire harness. It has a unique automotivegrade formulation, with excellent bend characteristics over a wide range of temperatures and has extremely robust moisture and chemical resistance. Once the sealant is in place, water and contaminants are permanently blocked and can no longer wick, preventing most corrosion failures. Since the BluSeal advanced sealing method works at the wirestrand level, it can provide sealing on most splices even with high wire count and substandard construction, where adhesive lined heat shrink tubing and butyl could fail to seal. This can allow future wire harness designs to successfully combine more leads into fewer splices.

The sealant can be applied to a terminal using a precision drop application or by dipping an entire splice into a bath. The method will depend on the splice construction and manufacture's desired process. Eurotech, producers of BluSeal sealant technology, can also provide application solutions such as a dip machine (BDM), to help reliably increase the manufacturer's splice sealing.

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BYD to Revolutionize Electric School Buses

BYD ("Build Your Dreams"), the world leader in electric vehicles, is introducing a battery-electric Type D school bus with unparalleled safety features and performance, wrapped in a sleek design that will have students wanting to step onboard.

With length options of 35, 38, and 40 feet, BYD's Type D battery-electric school bus is perfect for transporting students to classes, field trips, as well as athletic and band events. The Type D can seat up to 84 and can be equipped with an ADA liftgate. The bus has a range of up to 155 miles on a single charge.

BYD's smart technology creates a new environment where for bi-directional charging can be the norm. School buses can be charged overnight when energy demand is low, and clean emission free energy can be fed back into the classroom during school hours when the bus is parked keeping classrooms well-lit and students and teachers plugged-in.

"We are raising the bar for design, innovation, range and quality, giving parents peace of mind knowing their children are benefitting from the safest school bus anywhere," said Stella Li, President of BYD North America. "At the same time, our buses will give operators the performance and cost



savings that will make migrating to zero emission technology affordable and practical." Safety

BYD made safety the top priority in its school bus design, including such features as electronic stability control to aid handling, a collision avoidance system, and a 360-degree monitoring system to detect pedestrians and cyclists when the bus is operating at slow speeds.

In addition, BYD adds an additional layer of protection for children as they exit the bus with its Predictive Stop ArmTM, which monitors approaching traffic and notifies students when it may not be safe to cross. The Technology

The Technology

At the heart of the BYD Type D is its lithium iron phosphate battery, the safest and most reliable in the electric vehicle industry. The battery powers BYD's unique powertrain featuring high- speed, dual in-wheel traction motors which deliver outstanding efficiency.

BYD school buses are also good for any district's bottom line.

For more information, contact Samuel Kang, BYD's Head of Total Technology Solutions at sam.kang@byd.com

The Shyft Group Advances Electrified Mobility With Plan For Expansive Medium-Duty All-Electric Commercial Vehicle Chassis Platform

- Purpose-built EV specialty vehicle chassis will offer category-leading features

- Class-agnostic flexible flat modular chassis design allows integration with any specialty vehicle body manufacturer

- EV chassis can serve last mile delivery, work truck, recreational, mass transit, and other specialty vehicle segments

Shyft Innovations™, The Shyft Group's dedicated mobility research and development team, will introduce a purpose-built flat modular EV chassis to any specialty vehicle body builder. The EV-powered chassis features customizable length and wheelbase, making it well suited for a variety of vehicle types. The chassis' modular design can accommodate multiple GVWR classifications, based on build out and usage. With this high degree of configurability, the all-electric chassis is adaptable to last mile delivery, work truck, mass transit, recreational vehicle, and other emerging EV markets.

Vehicle prototypes are expected to make their way into customer accounts for route testing early in 2022 with production expected to begin in middle of 2023.

"We've listened closely to our customers and to the industry at large to design this EV chassis to address an unmet need in the specialty vehicles market," said Daryl Adams, President and Chief Executive Officer of The Shyft Group. "We have a well-established track record as a manufacturer of choice for purpose-built fleets. With nearly a decade of EV proficiency and over 15 years of alternative propulsion category experience, we're a natural choice for other body builders seeking a reliable commercial grade EV chassis," Adams said. "We

Continued on page 48

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Continued from page 47 _

the full product array spanning Class 1 – Class 7 purpose-built vehicles.

The Shyft Group is the North American leader in specialty vehicle manufacturing, assembly, and upfit for the commercial, retail, and service specialty vehicle markets. Our customers include first-to-last mile delivery companies across vocations, federal, state, and local government entities; the trades; and utility and infrastructure segments. The Shyft Group is organized into two core business units: Shyft Fleet Vehicles & Services[™] and Shyft Specialty Vehicles™. Today, its family of brands include Utilimaster[®],

1r

Royal Truck Body™, DuraMag® and Magnum[®], Strobes-R-Us[™], Spartan RV Chassis™, Builtmore Contract Manufacturing™, and corresponding aftermarket provisions. The Company employs approximately 2,900 associates across campuses, and operates facilities in Michigan, Indiana, Maine, Pennsylvania, South Carolina, Florida, Missouri, California, Arizona, Texas, and Saltillo, Mexico. The Company reported sales from continuing operations of \$676 million in 2020. Learn more about The Shyft Group at www.TheShyft-Group.com

U.S. Air Force Contract Awards

Learjet Inc., Wichita, Kansas, has been awarded a \$464,851,645 indefinite-delivery/indefinite-quantity contract for Battlefield Airborne Communications Node (BACN) Bombardier Global 6000 aircraft. This contract provides for the purchase of up to six Bombardier Global 6000 aircraft and completion work. Work will be performed in Wichita, Kansas, and is expected to be completed May 2026. This award is the result of a sole-source acquisition. Fiscal 2021 procurement aircraft funds in the amount \$70,000,000 are being obligated with the initial delivery order, FA8726-21-F-0073, at the time of award. Air Force Life Cycle Management Center, Hanscom Air Force Base, Massachusetts, is the contracting activity (FA8726-21-D-0006).

NISGAA TEK LLC, Chantilly, Virginia, has been awarded an \$18,794,450 (P00003) modification to contract

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FA8689-20-C-2011 for the delivery of hardware and software for the 2021 Remote Piloted Aircraft Special Operations Center second quarter buy. This contract modification is for procurement of hardware and software to be consumed in the creation of an end-product deliverable. Work will be performed at Warner Robins Air Force Base, Georgia, and is expected to be completed March 22, 2022.

Fuse Clip Terminals: A Case Study



Fuse Clip Connectors with insert and wire.

Project Details

Fargo Assembly of PA

Industry:

Construction, Agricultural, Heavy Truck and Off-Road Equipment

Case Challenge:

To develop a product that would eliminate overheating, connection separation, loose fuses due to truck and motor vibration

Solution:

ETCO engineers created a secondary clip component that fastened the connection in place and eliminated arcing, overheating and connection separation

Fargo Assembly of PA is a diversified supplier of power & signal distribution systems and components, serving the on and off-highway, construction, agricultural, commercial and consumer grounds care, recreational vehicle and specialty vehicle market segments. We specialize in rugged harnesses/electrical systems exposed to extreme environments.

Fargo Assembly of PA has over 40 years of experience and a proven track record in accomplishing customers' quality, cost and timing objectives.

Fargo approached ETCO with an issue specific to fuse placements with connectors. The fuses/circuit breakers used in the wiring harness connectors for construction, agricul-

were susceptible to overheating and separation if they were not properly fastened. Fargo created the Dill Blox product and wanted the fuses / circuit breakers within the products to stay in position and provide a completely secure connection. This connection would have to withstand the vibrations consistent with a variety of on and off-road conditions.



Top View Fuse Clip Connector.

ETCO engineers studied the problem and created the fuse clip terminal.The primary issue was the loosening of the fuses and connections. This could cause a series of issues once the connection was reduced or altogether severed. Arcing would lead to overheating, overheating could lead to a dangerous situation and disconnection could lead to power loss in specific functions.

The fuse clip terminal consisted

within a female connector that was force-fastened and was immovable by vibrations in application. ETCO engineers tested the connector in multiple situations to ascertain the efficacy of the product. The testing done at ETCO is performed with all products to ensure the highest standards of quality are met. ETCO created the specification based off of a pre-existing configuration to provide a high quality connection as well as creating a simplified manufacturing solution. The solution would save costs and perform flawlessly in a variety of conditions. Over 20 million parts later, the ETCO fuse clip terminal is featured prominently within the Fargo Dill Blox product.



Side view Fuse Clip Connector



Fuse Clip Connectors with insert and wire.

ETCO has provided Fargo with go-to market engineering as well as extensive support for this simple yet innovative technology. This level of engineering, service and support is what ETCO customers and partners have come to expect.

John Smith, General Manager at Fargo had this to say:

"ETCO has been an excellent partner in serving our engineering and manufacturing needs for components and wiring harness connectors. The company engineer's attention to detail and ability to quickly solve a major issue is the reason why we come to them every time. High quality solutions and cost savings means we're able to provide the same level of service to our customers while passing the cost-savings on to them."

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NEWS PLUGS continued

Custom Electrical Terminals Designed & Manufacctured to Specification

Custom engineered electrical terminals and connectors of all types that can be produced to match specific OEM design, manufacturing, and packaging requirements have been introduced by ETCO Incorporated of Bradenton, FL.



ETCO Custom Electrical Terminals can be designed and manufactured to

Amphenol ICC and TactoTek® Team to Create Automotive Grade In-Mold Connector for Smart Surfaces

USA- TactoTek® (www.tactotek. com), the Finland-based company that develops and licenses in-mold structural electronics (IMSE®) technology, and Amphenol ICC (a division of Amphenol Corporation NYSE: APH, https://www.amphenol.com) a leading global manufacturer of interconnect products, have announced that they are collaborating to develop automotive grade in-mold connectors for TactoTek IMSE technology.

IMSE parts integrate printed electronics and electronic components within 3D injection molded plastics. They combine structure, electronic functions, and cosmetics in single piece, seamless smart surfaces. TactoTek IMSE parts often connect to external system electronics or host systems.

"Standardized in-mold connectors further simplify integrating IMSE smart surfaces in all types of products, whether vehicles, appliances or smart home solutions," noted Paavo Niskala, Senior VP Research & Development at TactoTek. "In addition, the Amphenol MicroSpace™ connector enables high speed, automated IMSE production

processes for faster cycle times and Amphenol ICC. high yields."

Amphenol ICC is pleased to bring new technology products to our customers with transformational technologies like TactoTek's IMSE combined with Amphenol ICC's automotive grade MicroSpace[™] connector platform and Duflex[™] crimp technology. "By combining the technical expertise of TactoTek and Amphenol ICC, an innovative interconnect solution was created.

which combines the compact LV214 severity-2 compatible MicroSpace™ connector family with the industry proven Duflex™ crimp technology. As a global leader in interconnect solutions, we continue to drive growth by accelerating transformational technologies like TactoTek's IMSE with proven interconnect technology", savs Jerome Petit, Product Line manager at

TactoTek develops and licenses IMSE technology. The company works directly with OEMs and brands to develop production-ready prototypes. Mass production is done by TactoTek licensees.

Continued on page 52



APPLICATORS / CRIMPING PRESSES / TOOLING



meet precise specifications with regard to form, function, materials, packaging, and OEM production requirements. Offering rapid prototyping using 3-D solid modeling analysis, part sizes can range from 0.004" to 0.090" thick with ±0.0005" tolerances, depending upon the material and configuration.

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Continued from page 51

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automotive, smart home, appliances and other markets. TactoTek develops and industrializes IMSE technology, creates mass production ready IMSE prototypes, and licenses IMSE technology for 3rd party IMSE part design and global mass production.

TactoTek is funded by international leaders in finance and industry committed to advancing technology solutions that benefit consumers and the environment. TactoTek investors in-

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About Amphenol ICC

Amphenol ICC, a division of Amphenol Corporation, is a world leader providing interconnect solutions for the Information, Communications and Commercial electronics markets. Amphenol ICC designs and manufactures a wide range of innovative connectors as well as cable assemblies for diverse applications including server, storage, data center, networking, industrial, business equipment automotive and markets. With global presence in R&D, manufacturing and sales, Amphenol

ICC is well positioned to support customers wherever they operate. www. amphenol-icc.com

Crimping Machines for High-Voltage Applications

For the production of high-voltage connections of the Hirschmann Automotive PowerStar 40system, Schäfer offers specially developed crimping machines.

First, the terminals of the HCT4 system are crimped on two-core sheathed cables with an EPS2001 machine. In the second step, these cables are connected to the PowerStar HPS40 plugs by means of pressed shielding sleeves with an EPS3000 machine. Depending on the PowerStar 40 variant additional processing steps take place.

With integrated functions for quality assurance, global automotive standards are taken into account and plug connections succeed for the highest demands in electric mobility.

Schäfer crimping machines are currently available for the following variants of the PowerStar 40 system from Hirschmann Automotive:



 PowerStar 40 HPS40-2 (EVS 100096, EVS 100097)

• PowerStar 40 4+2 POL (EVS 100108)

• PowerStar 40-2-SCC HPS40-2 (EVS 100111)

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Low Pressure Molding Technology Meets Latest Demands for Encapsulation of Electronics and Medical Components

enkel's Low Pressure Molding technology for encapsulating electrical and electronic components in its Technomelt polyamide adhesive molding compounds is increasingly being adopted for medical, electronic components, power and industrial automation, HVAC and lighting applications. The technology offers numerous economic, process control, design and environmental advantages over alternative systems such as potting with reactive resin systems and high-pressure injection molding.

Various process advantages

Technomelt Low Pressure Molding (LPM) technology was invented some 30 years ago by Henkel (formerly called Macromelt Molding). The technology enables the quick encapsulation of delicate components by using specialized polyamides in combination with standard processing equipment and low-cost molds. Because the material is injected at a lower pressure compared to conventional injection molding processes, and non-abrasive materials are used, risk of damage to the electronics during the encapsulation process is far lower.

The technology is particularly adept at encapsulating discrete areas in complicated assembly where wiring is attached to a printed circuit board (PCB), PCBAs and other rigid component. One reason for this is that Technomelt resins, which are all unfilled, are resistant to high stresses and at the same time very flexible.

Matthew Hayward, Global Key Account for Power & Industrial Automation at Henkel highlights: "I see Technomelt as an exciting part of our Circuit-Board Protection portfolio. It offers many unique advantages that traditional potting or conformal coating is not able to provide. It is particularly well suited to high-mix low-volume applications where throughput is key. The ability to apply this material only where is needed is a huge benefit. This enables one to 'skyline' an application (encapsulating only the components that require protection), or to significantly reduce the weight due to substantially less material usage."

The encapsulating material provides exceptional electrical insulation, as well as resistance to a broad range of chemicals, extreme thermal cycling across high and low tempera-



Low pressure molding process: The bare electronics are inserted into a predesigned mold set. Technomelt encapsulates electronics at low pressure. After molding, parts get tested and moved to final assembly.

tures, and vibrations. The internal electronics are fully protected against outside elements, including ingress of water and dust, and long-term UV exposure.

Michael Otto, Key Account Manager Engineering Adhesives for Low Pressure Molding at Henkel explains: "Unlike traditional two-component reactive potting compounds, the polyamides used in the Technomelt Low Pressure Molding process are

single-component thermoplastics, molding cycle times are shorter, and there are no emissions of volatiles. Whereas conventional potting can take as long as 24 hours to complete, the Technomelt Low Pressure Molding process has a cycle time that can be as short as 30 seconds.

High sustainability

Henkel Technomelt polyamide resins are compliant with the European RoHS (Restriction of Hazardous Sub-



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stances) Directive and REACH (Registration, Evaluation, Authorisation and Restriction of Chemicals) regulations. "An additional important environmental feature of these polyamides, and one that is increasingly appreciated, is that they are largely bio-based, with up to around 80% of their content coming from renewable vegetable sources," Otto adds.

Henkel offers a range of Technomelt Low Pressure Molding resins that have been formulated for specific applications. Some, for example, have extra thermal resistance, others have improved toughness, or especially good adhesion to particular substrates.

Efficient use of material

An advantage of Technomelt Low Pressure Molding over traditional potting systems is that it is much more economical in the amount of material it uses in the finished part. In potting operations, the normal approach is to build a box around the component to be encapsulated, and then fill the box until the component is covered.

With Technomelt Low Pressure Molding, the component is placed into a mold that has a cavity geometry similar to that of the component, so that when the polyamide is injected, it forms a skin around the component that is more or less the same thickness at all points. This means that the amount of encapsulating material used per shot can be considerably less.

Costs of mold production are relatively low, especially as they are often made out of aluminum, which is much less expensive than tools made out of steel used in high-pressure injection molding. In recent years, even more cost-effective additive manufacturing (also known as 3D printing) techniques have also been adopted to make the molds.

Providing value to various markets

The need for efficient low pressure encapsulation of electronics has never been as great as it is today. The Internet of Things (IOT) and Industrial Internet of Things (IIOT) depends on a foundation of sensors and associated electronic connections and components to support all sorts of devices in the home, at work, and on the move. This trend has also led to increased network connectivity demands for data and power cables and connectors that function in the harshest environments. In the world of healthcare, patient diagnostics and sensing in real time require new electronic devices like wearable devices that are used in and outside of controlled medical environments. Technomelt Low Pressure Molding responds to all of these trends.

Continued on page 56



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Low Pressure Molding Technology

Jason Spencer, Henkel's Medical Market Segment Manager, notes: "Patient diagnostics and sensing in real time require new electronic devices that are worn in and outside of a controlled medical environment. Wearables for vital sign monitoring are becoming more important in patients' everyday lives as healthcare becomes more digitally connected."

For certain types of medical applications, Technomelt can also be used in applications that go beyond encapsulation of electronics. For example, it is suitable for attaching flexible tubing in liquid delivery systems, since it does not distort the tubing and provides a permanent, leakproof junction. Henkel introduced, Loctite PA 6951, specifically for this purpose. Loctite PA 6951 has been tested to Henkel's protocols based upon ISO-10993 biocompatibility standards, with certificates available on request.

Partnerships with equipment suppliers

In collaboration with partners producing processing equipment around the world, Henkel provides a total solution for low pressure injection molding. "These partners are critical for our success," says Otto. "Technomelt is a total system that brings together materials, machines, molds, and technical service and engineering. Our partners have their own sales forces, which adds to our ability to access and assist the vast global market."

Additionally, Otto highlights "there are many developments pushing up requirements for high-quality, lowcost component encapsulation. We at Henkel believe Technomelt Low Pressure Molding technology is an important part of the answer to these needs."

Technomelt is registered trademark of Henkel and/or its affiliates in Germany and elsewhere.

About Henkel

Henkel operates globally with a well-balanced and diversified portfolio. The company holds leading positions with its three business units in both industrial and consumer businesses thanks to strong brands, innovations and technologies. Henkel Adhesive Technologies is the global leader in the adhesives market across all industry segments worldwide. In its Laundry & Home Care and Beauty Care businesses, Henkel holds leading positions in many markets and categories around the world. Founded in 1876, Henkel looks back on more than 140 years of success. In 2019, Henkel reported sales of more than 20 billion euros and adjusted operating profit of more than 3.2 billion



Continued from page 55

Battery sensor circuit board before and after low pressure molding process. Electronic parts get protected against moisture, chemical exposure and high temperature.

euros. Henkel employs more than 52,000 people globally – a passionate and highly diverse team, united by a strong company culture, a common purpose to create sustainable value, and shared values. As a recognized leader in sustainability, Henkel holds top positions in many international indices and rankings. Henkel's preferred shares are listed in the German stock index DAX. For more information, please visit www.henkel.com.





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IPC/WHMA Launches Wire Harness Assembly for Operators Course - Online Training for Frontline Workers

By Christine Siebert

any companies in the cable and wire harmanufacturing ness industry struggle to find skilled and knowledgeable production workers, identifying a need for a comprehensive fundamental training solution. To provide that solution, IPC/WHMA launches its newest workforce development training course, Wire Harness Assembly for Operators.

IPC's Education team worked with industry subject-matter experts to develop a course that teaches the skills and competencies critical to a wire harness assembly operator.

The Wire Harness Assembly for Operators training course delivers to each participant the ability to identify and use the key tools, materials, and processes that wire harness operators need to reliably and repeatably assemble quality harnesses. The program is composed of 14 modules that allow organizations to implement customized learning paths for different roles in the organization.

Each learning module provides meaningful opportunities for students to actively engage with the content and apply what they learned in real-world contexts. The program's carefully curated video presentations, detailed illustrations, interactive activities, and practice quizzes are all formulated to make even the most complex topics easy to understand and master.

Students that successfully complete the seven mandatory modules earn an IPC certificate that identifies them as a Qualified IPC Wire Harness Operator. These certificates are serialized with a unique ID number that can be utilized for validation and are valid for a two-year period.

"WHMA members participated extensively in the development of the WHO training program by identifying the breadth of topics and field testing the course. What we've delivered is

a complete training solution for operators in the cable and wire harness industry." said Rick Bromm, WHMA Chairman/ALTEX Wire and Cable president.

Carlos Plaza, Senior Director of Education Development at IPC, commented, "The response from IPC/ WHMA members who have implemented the course has been overwhelmingly positive. Trainers are reporting that the explanations and examples used in the WHO program perfectly reflect the daily duties and

skills required of their operators."

Companies may qualify for a trial course trial. To learn more about Wire Harness Assembly for Operators, visit https://www.ipc.org/wire-harnessassembly-operators.



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WHMA membership has provided our company the opportunity to share ideas, discuss challenges and innovate through networking opportunities. We have built relationships with colleagues, competitors, and industry specialists. Those relationships have been invaluable to our organization.

Jason Zoubek, Absolute Quality Mfg., Inc.





For more information, contact Norm Sagon, WHMA/IPC sales representative.



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