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SPECIAL SECTION MACHINE TOOLS

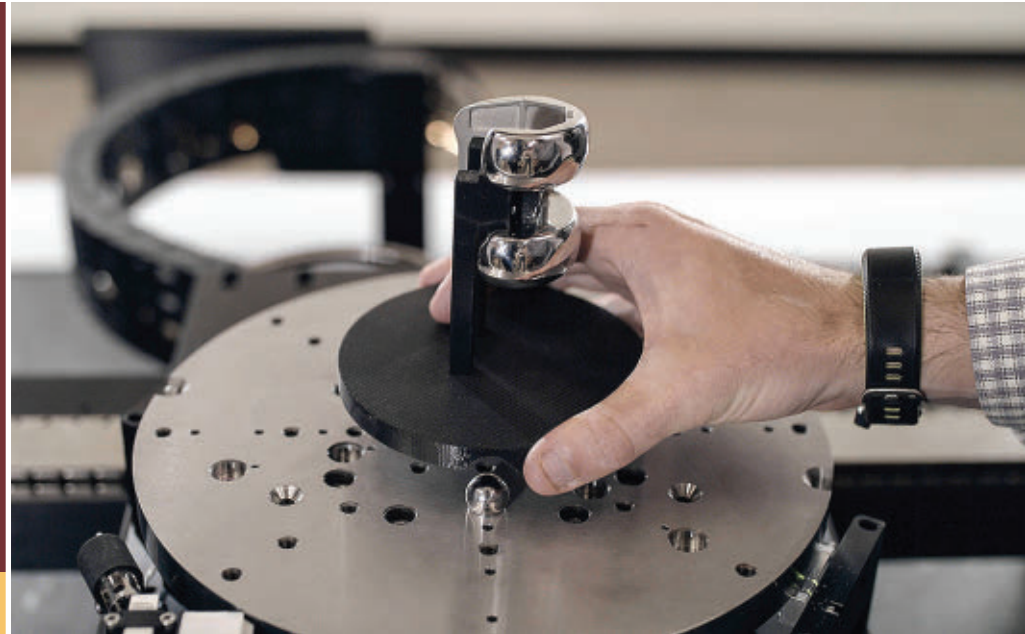


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► Measure Without LOSING TIME

*A high-precision system enables
3D inspection in real-time.*

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Scalable Quality Inspection

Capable of detecting defects of less than half the width of a human hair, the 3DQI robot cell from ABB Robotics eliminates the need for manual inspection while substantially reducing faults and errors.

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All-Seeing Smart Dock

4SIGHT Logistics Solution's Connect Digital Dock provides real-time access and management to a variety of dock data and KPI's—granting full control over an entire dock operation via remote monitoring.

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From the Control Room to Your Ears

The Picavi Cockpit is an intelligence solution that takes Assisted Reality supported picking to its full potential with voice messages that allow the control room to communicate with individual workers.

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Record Working Dimensions

Featuring one of the largest working volumes on the market, the XXL-Box Laser Marking Station from SIC Marking US features a Ytterbium-doped fiber laser source which is durable and easy to implement.

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MH&L Material
Handling
& Logistics

BONUS ISSUE

The State of U.S. Logistics in 2020.....p. M1

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- NEMA 3R, 4 and 12 Double-Door Floor Mount

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PRODUCT SPOTLIGHTS



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New Pig Corporation's Shoe Sanitizer Floor System removes dirt and debris, sanitizes, and dries shoes upon entry to any facility.



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Able to detect the smallest leaks, the UL3000 Fab ULTRA from INFINICON, Inc. reduces evacuation time and downtime in production facilities.



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Grizzly Industrial's portable end mill sharpener provides easy sharpening with its simple design and two grinding wheels.



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The PY L-S visual alarm from Pfannenberg USA comprises a temperature monitoring system that can flag individuals with elevated temperatures for further health screening.

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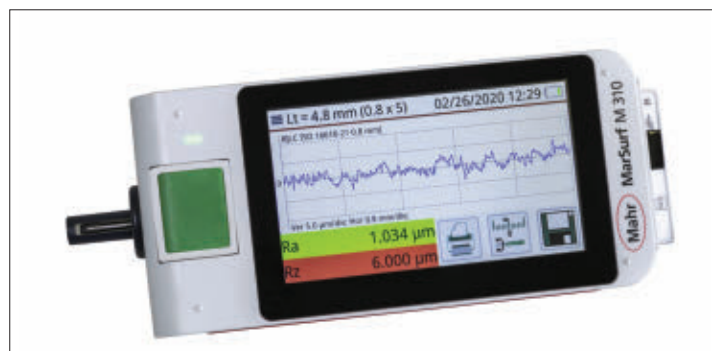


Rugged Logistics Tablet

The **TOUGHBOOK A3** tablet offers features that are tailored to the needs of the mobile workforce, including outdoor viewable screen and Panasonic's patented rain-touch functionality. With a 10.1-in. screen and 6-ft drop rating, the tablet is suited for users across industries to tackle the toughest jobs and mission-critical applications.

Panasonic Corporation of North America

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Mobile Surface Measurement System

MarSurf M 310 mobile surface measurement system brings ease-of-use to new levels with a large, illuminated, rotatable 4.3-in. high-resolution touch screen built right into the unit. It provides high-precision measurements to test surface roughness on small and large workpieces. The portable unit brings features including automatic reports in PDF format and a barcode or data matrix scanner.

Mahr Inc.

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Chain Selector App

A mobile app from Drives features a collection of robust tools that make it simple and convenient to find the right chain for a new and existing drive or conveyor applications. Called **Chain Engineer**, the app allows engineers and maintenance professionals to select, interchange, configure, and track elongation from their desk or mobile device.

The Timken Company

MORE ONLINE: nedinfo.com/76479-3

Multi-Gas Monitoring Solutions



For personal gas monitoring, the **BW Icon/Flex Platform** introduces portable, wearable multi-gas detection solutions. The platform features a slim profile, Bluetooth-enabled configuration, and Infrared lower explosive limit sensor for 2-month battery runtime. Each option is lightweight with one-button operation and includes simple icons to indicate gas alarms and device status. Workers use Bluetooth and pair their smartphone with the detector to create organized reports.

Honeywell Safety & Productivity Solutions

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Fully Connected Logistics

MyWay, a digital supply chain platform, drives real-time operational decisions. Leveraging AI and machine learning, MyWay is a 360-deg., end-to-end platform designed for use by all stakeholders in the supply chain. It enables shipments to be tracked in real-time, visible through its global map. Additional features include shipment notifications, messages, and document upload for quick sharing.

QULOI

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Lone Worker Protection

With the **eSENTINEL app**, employees gain basic security measures for day-to-day use. With ECOM terminal devices, the app is linked to the red emergency button on the hardware. With third-party hardware, a red emergency button is shown on the display. This enables the worker to send an alarm notification in a dangerous situation in a flash.

ecom instruments GmbH

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Reliable Field Tablet

Android Tablet MDA-100 represents a combination of the most rugged features and modules in a compact, 10-in. screen platform. The device is ready for OEM/ODM design and manufacturing. Fully rugged, fully IP65 waterproof, and 4ft Drop/Shock Protection (MIL-STD-810G compliant), the product withstands the harshest environment with drops, dust, water, falls, and vibration. It can also be running without interruption rather than having to stop for a battery recharge with internal hot-swappable battery design, making it perfect for field workers.

Estone Technology

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Storage for Bulky Tools

The 32-in. **Three-Drawer Roll Cart** comes with ample room to house tools of all sizes while easily moving them throughout the shop or hangar. The cart comes with 2 and 4-in. deep drawers, and a third, extra-deep 6-in. drawer that's ideal for power tools, diagnostics, and other bulkier tools. Flip the lid open on top of the box to find a 7-in. deep compartment with vertical pry bar storage.

Snap-on Tools

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Shoes for Mobile Workers

The **Sprint collection** is a modern take on safety footwear that is lightweight and flexible, designed with the durability you expect. Its Alloy Safety Toe protects against impact and compression, offering the strength of a steel toe in a lightweight and more compact format, with reinforced sidewalls and slip-resistant rubber outsoles to keep you on your feet.

Caterpillar Inc.

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SCARA Robot Series

The **LS3-B SCARA** and **LS20-B SCARA** robots include a batteryless encoder, a lower cable duct profile that is ideal for hard to reach work cell layouts, built-in camera cable for easy vision system setup, and a top-of-arm layout for enhanced usability. The LS3-B has a payload of 3kg and a 400 mm reach, while the LS20-B has a 20 kg payload and available reach of 800 mm and 1,000 mm.



EPSON Robots

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Thermally Conductive Epoxy

EP29LPA0HT is a two-component, NASA low outgassing approved epoxy system featuring a long working life of 8 to 10 hours per 1,000-gram batch. Due to its low exotherm and flowable consistency, this product is suitable for specialty potting applications where large masses of the epoxy need to be cured.

Master Bond Inc.

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Make Disinfecting A Breeze

Birko Mobile Mister allows facilities to carry out more frequent sanitation during and following the COVID-19 pandemic. Made with stainless steel construction for corrosion resistance, the mister is an effective and portable system. It uses non-toxic sanitizer to reduce viruses, bacteria, and pathogens on surfaces by 99.99% in all environments and includes various misting nozzles, which reach elevated and hard-to-reach target areas.



Birko

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Wet & Dry Vacuum



EasySwitch Wet-Dry Vac simplifies the filter change process when switching from vacuuming a dry material to a liquid or vice versa. Using minimal compressed air, the EasySwitch is a powerful pneumatic vacuum that is ideal for any application—wet, dry, light, and heavy. The fast and tool-less conversion to vacuuming liquids is done by releasing one latch, removing the filter element, and securing the latch. Simply reinstall the filter into the lid assembly for dry materials.

EXAIR Corporation

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Lift Tables Keep Workpieces Close at Hand

Hydraulic and Pneumatic lift tables with an optional turntable keeps workpieces close at hand. Eliminating unnecessary reaching and other operator movements enhances ergonomics and speeds production. The positioners are available in various lift capacities, base and turntable sizes, and vertical travel. With the inclusion of a heavy-duty, 360-deg. turntable, they are ideal for palletizing, de-palletizing, work station assembly, and more.

Verti-Lift, Inc.

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NEW SOURCES



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are puncture/tear resistant

Woven Contractor Bags are the most durable and reusable bags on the market; each can hold up to 110 lb. and be reused up to 5 times. Their durability and patented poly-woven plastic fiber construction technology creates a seamless solution for disposing of unwanted materials.

Haultail

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Message Mats Reinforce Safety

keep facilities cleaner and safer

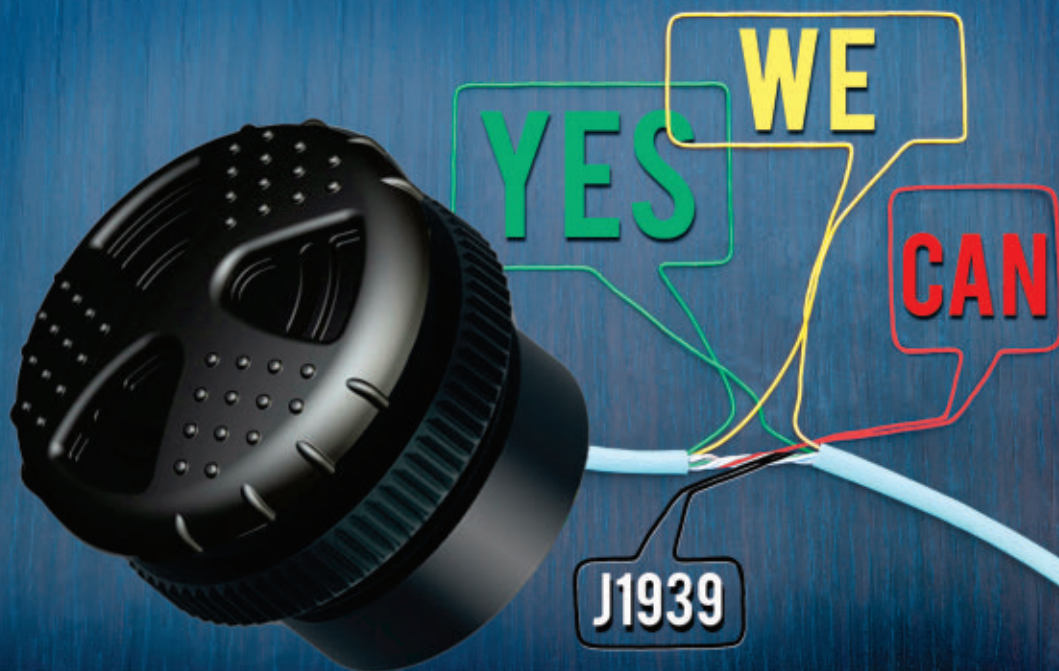
As more businesses search for ways to operate while keeping employees safe, the **194 Safety and 195 Slogan Mats** effectively convey the proper safety recommendations outlined by the CDC to limit the spread of COVID-19. Both mats are made from a high-quality fiber with a heavy-duty vinyl backing that creates surface friction. They effectively absorb dirt and moisture and are slip-resistant on smooth floors such as wood, marble, tile, or concrete.

NoTrax

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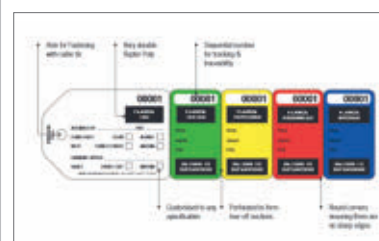
Heavy Equipment Lubricant

helps waterproof electrical gear

StrikeHold anti-corrosion protectant, lubricant, and cleaner is available to help prevent heavy equipment failure and downtime due to rust from frequent exposure to moisture and environmental contaminants (salt, nitrogen, dirt, dust, etc.). As an anti-corrosive protectant, it goes on wet and dries in place, leaving a hard finish coating. The coating protects equipment against the effects of moisture and corrosion, even against saltwater, while repelling sand, dirt, and dust.

StrikeHold

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Flange Management Tags

can tear to show completion

A family of tough and multi-colored **Flange Management Tags** provide at-a-glance inspection status. TUFFA tags are made from specially made polypropylene, so they are durable, tear-resistant, water-resistant, and UV resistant. Highly visual at a glance status signifies each stage of inspection—flange assembled, flange tightened, flange broken and inspected.

TUFFA Products

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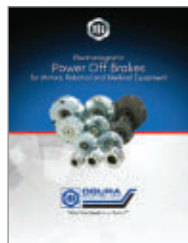


Flexible Flat Cables

This 52-page catalog offers an extensive selection of 700+ standard part numbers, 27 new products, custom capabilities, specification tables, and technical field sales support tools.

Cicoil Corporation

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Power-Off Brakes Brochure

This brochure features electromagnetic power-off brakes for the ever-expanding robotic and medical equipment markets. For these varied applications, the brochure highlights six different styles of holding brakes—representing around 120 standard models.

Ogura Industrial Corp

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Material Handling Catalog

This interactive catalog lets you browse through 400+ pages of over 1,000 different product lines tailored to material handling applications.

Vestil Manufacturing Corp.

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Fume Hood Catalog

This catalog showcases HEMCO's complete line of products including lab fume hoods, enclosures, lab casework, lab countertops, sinks, service fixtures, exhaust blowers, ventilation, filtration systems, and modular room structures.

HEMCO Corporation

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2020 Caster & Wheel Catalog

Spanning more than 200 pages, this catalog offers a full look at Caster Concepts' product offering as well as helping you to choose which product works best for your application.

Caster Concepts, Inc.

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KROHNE Product Overview

Browse through a comprehensive listing of flow controllers as well as level, measurement, and temperature devices for your processing applications.

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Güdel Inc.

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Safety Solutions

Banner's Safety Solutions catalog highlights the latest safety solutions including hand, finger or body detection, area detection, safety relays and controllers, safety switches, and enabling devices.

Banner Engineering Corp.

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3D Printing Products



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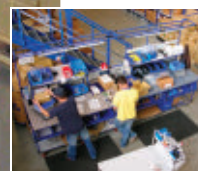


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Demystifying Generative Design

An opportunity for manufacturers to reduce material costs, streamline the design process, and produce more sustainable products.

By Tristan Gunderson

Emerging technology takes time to become mainstream in the manufacturing industry. Raised on traditional processes and tried-and-true methodologies, designers tend to forego advantageous moves to new platforms. When the opportunity arises to reduce manufacturing costs, increase productivity, and improve product design, however, it is imperative manufacturers take note and learn to adapt.

Generative Design may seem like an abstract concept and difficult to onboard, but much like CAD software introduced digital tools to make it easier to draw and revise parts, Generative Design technology introduces ways to improve and accelerate the design process.

Most misconceptions about Generative Design include the impression that it is complex or the idea that it will replace engineers and designers. In actuality, Generative Design provides a way for engineers to quickly explore various design alternatives that enhance and augment existing work processes.

To best understand how Generative Design fits into the product lifecycle one can look at a 7-step structure: Ask and Research, Imagine and Plan, Create and Test, and Improve.

ASK AND RESEARCH

As with any design, the “ask and research” phase is critical. Without a clear understanding and specificity of the project constraints, the work can fail before it even begins. Whether designing a new part or reimagining an existing one, Generative Design requires an intimate knowledge of the part, its use, and its interactions with other parts.

The first step in Generative Design is to develop the foundational model for the software. This model includes the base geometry and constraints the program needs to develop its own designs. While this can seem confusing or overwhelming, it uses similar tools to other 3D modeling software. The engineer inputs information on necessary geometry and obstructions for mounting and interactions with other parts, load conditions, manufacturing requirements, material, a minimum accepted factor of safety, and other data to guide the design.

IMAGINE AND PLAN

Once the design criteria is set, Generative Design does its part refining the model using algorithms to optimize the design. This could mean reducing material usage or maximizing strength while maintaining the weight of the

original part. This process allows engineers to quickly develop a series of unique models and directly compare them by weight, volume, material, sustainability, machine time, cost, and more.

As with any design, this process isn't guaranteed to result in the perfect design on the first try. The key to Generative Design is speed and diversity. While it may take several iterations and changes to the initial conditions to land on the best design, Generative Design provides the ability to quickly explore varied avenues. It can run assorted materials or manufacturing options side-by-side, potentially eliminating weeks of work exploring a wrong path.

CREATE AND TEST

While traditional prototyping is an option, computer modeling and simulation can quickly validate results. The output from the Generative Design tool provides both a 3D model and Finite Element Analysis (FEA) simulations for all input load conditions. This allows for rapid prototyping and further comparison and validation of designs.

It is important to also assess the manufacturability at this point. While there are settings to select manufacturing methods, tool settings, and minimal part thicknesses, it is still possible for the design to be inefficient or outside the scope of existing manufacturing capabilities. The software can also generate a cost analysis based on material use and manufacturing methods or simulate a tool path to determine machine time.

IMPROVE

It is this step in the design process that has caused the most confusion and misconceptions surrounding Generative Design. For some industries, this step can be skipped or significantly reduced as they have the technology to manufacture complete models generated by a computer. For most manufacturers, however, this would be the time to simplify the design and adapt manufacturability to available machinery.

Using the generated model, the FEA results, and manufacturing analysis, engineers can interpret the results and modify them to capture the design intent in a more manufacturable manner. By using techniques like consolidating and standardizing limbs, creating flat surfaces or standard fillets, and reinforcing connection points, engineers can



craft a final product that revolutionizes the design without the need for expensive new equipment.

Another, more accessible, example of generative design is a case study of an elevator door drive wheel wherein the process helped to literally reinvent the wheel. The original carbon steel part was cut down to the sleeker aluminum design using Autodesk Fusion 360. While this new design boasted over 30% material reduction by volume and over 75% reduction by weight, it was deemed unsuitable for manufacturing.

However, by modifying the new design (removing thin and unwanted geometry, flattening surfaces, re-establishing symmetry, and strengthening the central connections) the final model had comparable machine time to the original by 3-axis milling or reduced lead time by casting while remaining within 2% of the volume and weight reduction achieved by the generative design.

SUSTAINABLE MANUFACTURING

Generative Design is still a new technology in the manufacturing world and is constantly improving and evolving. It isn't a substitute for engineers but rather a tool for them to elevate their designs. Once they're able to look past the preconceived notions about Generative Design, they'll see that the benefits are well worth the effort.

The first thing any company will appreciate is the savings on part production, as reduced material use not only saves the cost of the raw material but also shipping expenses. The redesigns can also lead to reduced machine times and quicker time to market. Most importantly all of these factors contribute to a more sustainable manufacturing process. **NED**

*As an Applications Engineer at Nashua, New Hampshire-based M2 Technologies, **Tristan Gunderson** provides support and consulting services to help customers optimize their software utilization and design processes. He works to promote sustainable and efficient manufacturing through the implementation of simulation and generative design.*

For more, visit newequipment.com/21137345

Risk Monitoring Keeps Employees Strong

It's not always enough to prevent injuries, but rather understanding when and why injuries occur in the first place.

By Laura Davis

How do you get better at a sport without risking injury? The advice is to take it slow; don't do too much too fast. Train, track your progress, listen to your body, and know when to stop.

This advice is really no different for professionals in the material handling field taking on heavy lifting day in and day out. Employees go through training, have best practices, know not to lift too much on their own, know when to ask for help, and know when to stop before they obtain an injury.

Nowadays, most people use smartwatches and fitness trackers to keep track of and improve their health. We have access to tracking steps, calories, sleep, heart rate, exercise, etc. Now the manufacturing industry has a wearable that will help them do the same—but instead of simple tracking, it identifies potential risks in the warehouse to prevent injuries. The FUSE Platform from StrongArm Technologies is a risk monitoring IoT wearable that collects data on environmental and ergonomic factors to help prevent injuries to workers.

New Equipment Digest spoke with Mike Kim, co-founder and CTO of StrongArm Technologies to find out how this risk monitoring device identifies risks and improves employee health over time.

NED: What is the FUSE Platform and what does it do?

MK: The FUSE Platform is a leading-edge, IoT enabled platform designed to deliver actionable, real-time ergonomic and environmental safety data, all toward the goal of keeping Industrial Athletes™ everywhere proud, protected, and productive.

NED: What sorts of risks does the wearable sensor identify and how does it identify them?

MK: FUSE identifies ergonomic, musculoskeletal injuries from manual material handling risks. It also promotes proximity-based safety and analyzes environmental factors such as temperature, humidity, noise, and general air quality to assess risk, capturing these inputs on the bodies of workers with the FUSE Risk Management Platform. Using proprietary algorithms with real-time edge computing and detailed analytics with our cloud platform, we are able to identify and alert the uses of various risks in the workplace.

NED: What data does it provide to the employee? How are employees notified of a risk?

MK: It provides safety performance, trends, ways to improve, and the various different factors. Employees are notified in various ways depending on the severity and nature of the risk. In many cases, we provide real-time alerts on the body to ensure challenges and concerns are addressed as close to the event to help prevent injuries before they happen. In other cases, data is aggregated and post-processed to provide detailed trends, information, and tips to improve over time.

NED: How does FUSE learn over time? Does each individual gain a tailored assessment over time?

MK: FUSE doesn't technically learn on its own over time, but rather it captures safety metrics per aggregated job functions, feedback alerts, and safety metrics to help improve the overall safety performance. We have seen over a 50% reduction in injuries year over year thus far. In the future, we are definitely interested in taking a more personalized approach



StrongArm Technologies

to providing feedback and training that is tailored to the individual based on their experience.

NED: Does the wearable need to be worn with other equipment, such as an exoskeleton? Or can it be used as a standalone product?

MK: The wearable can be worn in conjunction with other equipment, as well as a standalone product. Since our sensor provides alerting capabilities, in addition to capturing safety data, it is great for running experiments and understanding the safety impact in the workplace. Simple questions like, how does this exoskeleton impact safety or how does a change in the rack height of this shelf from 3 ft to 6 ft impact safety are made possible now with our platform and data.

NED: What was the biggest challenge in developing FUSE?

MK: The biggest challenge was distilling for the various stakeholders in the value chain, from the Industrial Athlete to the organizations that employ them and the carriers that insure them, how the data could be most impactful to increase safety in the workplace. When we started nearly 7 years ago now, the industrial wearable technology space was non-existent and there wasn't really any roadmap that we could compare off of either.

NED: Can any workers benefit from FUSE in the industry or is it better suited for warehouse jobs where people are doing a lot of heavy lifting?

MK: Initially, we built the platform to help Industrial Athletes in environments with repetitive, heavy lifting as well as tough environmental factors like temperature, humidity, noise, and air quality. With the COVID-19 pandemic, we've been called on to help address a broader set of workers and we have delivered.

NED: FUSE recently added a social distancing and contact tracing feature—can you explain how that works and what it measures?

MK: Today we are leveraging Bluetooth as our primary option for detecting distance between two sensors. It's specifically measuring RSSI (Received Signal Strength Indicator) between two Bluetooth devices that can be calibrated to a relative distance to one another.

NED: How far is the Bluetooth range? Will it cover an entire facility or can it be customized for certain distances?

MK: The Bluetooth range varies based on the need or functionality. For our system, we have optimized the parameters to be accurate within 6 ft to ensure proper data capture and alerting. In certain scenarios, we are able to make that threshold lower or higher as needed.

NED: Are different sensors needed for the social distancing features or are these capabilities now integrated into the platform?

MK: We like to consider ourselves as the "one-stop-shop." Every feature is fully integrated into the platform. **NED**

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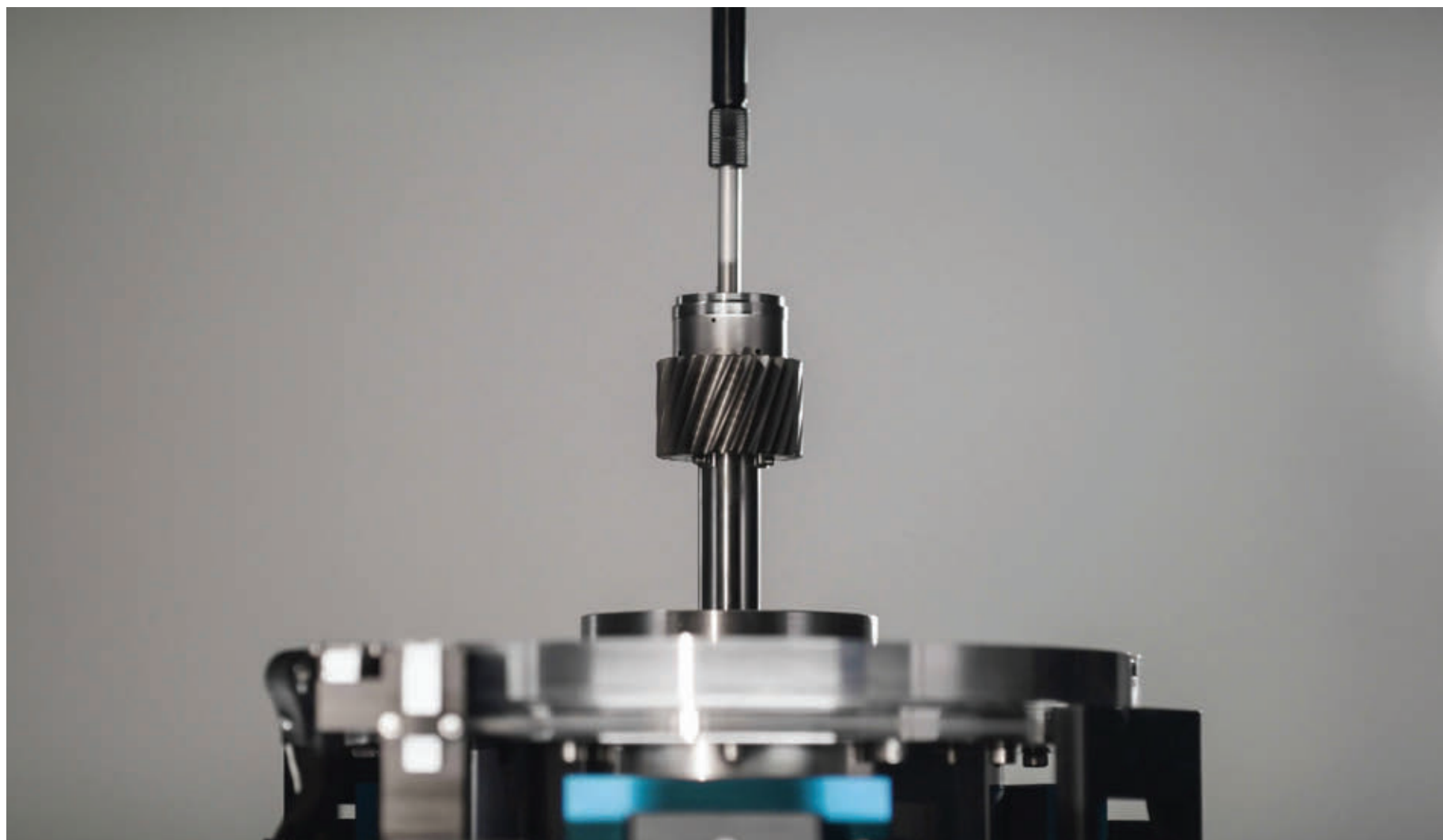
By DWFritz Automation

All images courtesy of DWFritz Automation.

Conventional measurement systems such as coordinate measuring machines (CMMs) are typically used for quality control in various industries. Most traditional contact-based inspection systems are characterized by long measurement cycle times. Changeovers to measure other parts and the attendant programming also add to the delay. Further, contact-based measurement technologies are not suitable for generating large amounts of data points required for complex surfaces. Because of these limitations, systems like CMMs are not an ideal solution for 3D inspection on the production line. To solve these problems, the ZeroTouch measuring platform uses multiple non-contact sensor technologies to rapidly measure in three dimensions and in real-time.

ZeroTouch's proprietary software then creates a highly accurate dense 3D point cloud. In addition, by simplifying complicated programming procedures, ZeroTouch reduces the system configuration time to just a few hours saving substantial production time and costs.

"Quality control is critical in production operations," explains David Mendez, vice president of the ZeroTouch business unit at DWFritz Automation. "Preparations, such as programming, as well as the measuring process itself, often take a great amount of time and result in high costs. In addition, inspection tasks requested for manufacturing often collide with other measurement requests such as those from other manufacturing lines, pre-production tests or even R&D." The measurement platform features a 5-axis architecture that



Providing the operator a tool that is easy to use to perform rapid quality checks of various types of parts produced by different lines is vital to ensure the qualification of manufacturing lines, in addition to speeding up the production ramp.

captures millions of data points per second in a single scan to create a dense 3D point cloud. The system enables the rapid measurement of complex part geometries and precise inspection of the most complicated parts with high repeatability.

The system uses a unique planar air bearing design that minimizes tolerance stack error. The near-zero friction design provides an extremely smooth, high-speed motion of precision stages and improves gage repeatability and reproducibility (GRR). In contrast, tactile probes typically operate at slower speeds as they require physical contact with the part surface. Contact measurements are primarily limited to 2D scans—typically generating sections or contours whereas ZeroTouch can generate complete 3D surfaces with an accurate and dense grid of data points. Acquisition of the data points is extremely rapid, at a rate of up to 4 million points/s. In addition, the system combines various technologies such as laser and chromatic confocal sensors with high-resolution cameras with multi-spectral illumination. Further, the user has flexibility in choosing the right sensing technologies to get the most optimal measurement results. For example, shiny or specular surfaces will require specific sensors such as white light confocal or interferometric sensors. On the other hand, laser profile sensors may be needed for surfaces with “matte” like finishes.

During the development of ZeroTouch, special attention was given to problems that conventional CMMs face: obtaining quick, accurate, and reproducible results to keep pace with manufacturing cycle times. Most traditional inspection systems have issues specifically with speed, ease-of-use, and machine availability. As a result, traditional measurement technology does not lend itself to inline inspection or even fast sampling.

Providing the operator a tool that is easy to use to perform rapid quality checks of various types of parts produced by different lines is vital to ensure the qualification of manufacturing lines, in

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Further time is saved by the simplicity with which parts and assemblies can be placed on the measuring table, instead of requiring complex positioning fixtures. The variety of available sensors allows 3D measurement or any kind of surfaces including mirror-like ones.

addition to speeding up the production ramp. CMMs are typically located in environmentally controlled inspection rooms, which often impact machine availability. If the parts are to be inspected in the metrology room during the production process, part “queues” are to be expected, due to limited machine availability coupled with long CMM setup times.

ZeroTouch has been designed precisely to mitigate these issues by being fast, flexible, easy to use, and compatible with the manufacturing environment.

ZeroTouch enables 100% part inspection. In addition, the ZeroTouch is characterized by its ease of use. By giving the operator an easy-to-use tool, different types of parts produced on different lines can be quickly inspected. Such capability will enable the rapid qualification of manufacturing lines and speed up production ramp.

ZeroTouch's unique architecture features 5 independent axes; a rotating bridge—Gonio like—equipped with multiple,

non-contact sensors, including lasers and chromatic confocal sensors, which dramatically increase inspection speeds in measuring the entire part surface, as there is no sensor change time. The sensor bridge is configurable allowing for the most optimal and appropriate sensor selections to suit part geometries and surfaces, in addition to the complex dimensions being measured. Such innovations associated with a horizontal rotary table and 3 translation axes result in higher throughput of parts and increased capacity, enabling 100% in-line inspection rather than just sampling.

The innovative design of ZeroTouch presents a remarkable improvement in surmounting the challenge of repeatability in a hostile manufacturing environment. Since it can perform multiple measurements in parallel using different sensors, parts and assemblies can be analyzed significantly faster than a conventional CMM.

“The sensors can be configured to the specific GD&T measurements and the part, and in one scan the system can capture data points to create a high-density 3D model,” says Mendez. “This makes it possible to measure objects made of a wide variety of materials with complex geometries, including holes, undercuts, bevels, and surfaces, quickly and with micrometer precision. At the same time, the system provides very high reproducibility and repeatability of results.”

The various non-contact sensors on the metrology bridge can be easily calibrated by software directly via the metrology platform. Further time is saved by the simplicity with which parts and assemblies can be placed on the measuring table, instead of requiring complex positioning fixtures. This not only decreases the metrology preparation time but also enables direct cost savings in fixture design, development, and management.

“It was also important that ZeroTouch shows no signs of wear, and delivers the same performance year after year,” says Mendez. “So we gave it a planar air bearing system.” The moving parts, such as the measurement platform and sensors, generate virtually no friction during the measuring process. Part inspection plans can be created within a few hours and stored in the manufacturing execution system (MES) for management and retrieval. “The user is assisted by menu-guided intuitive tools, making deep programming knowledge superfluous now,” says Mendez. “Instead, inspection plans can be prepared using drag-and-drop functions.”

The various non-contact sensors on the metrology bridge can be easily calibrated by software directly via the metrology platform.



DWFritz Automation developed the ZeroTouch metrology platform to dramatically improve part measurement and inspection times. The system uses multiple non-contact sensor technologies to capture the measurements in three dimensions and in real time.

Measurement data for each component is retained to ensure data integrity. Thereafter, component-specific plans can be accessed in the MES for fast measurement. Optionally, components or assemblies can be given barcodes to be read by an onboard barcode reader. The respective inspection plan is then automatically loaded from the MES. The control software provides high personal safety by ensuring that the system does not move as long as the doors of the switchgear cabinet are open or if the system light curtain has interference.

The three-dimensional point cloud can be analyzed immediately after the measurement process. Integrations to proven analysis tools enable the accurate comparison of the scan results with part CAD models or a reference part previously scanned and measured to not only check for geometric and dimensional tolerances but for other previously undetected issues such as surface aspect defects. Using statistical process control (SPC), faults or outside-tolerance deviations can be quickly detected and appropriate reporting can be sent back to the MES. This could enable the adjustments of process parameters in upstream manufacturing processes to minimize rejects downstream.

The current system measures 240 x 150 x 190 cm (L x W x H) and weighs 3,550 kg. It can measure parts measuring up to 300 x 300 x 300 mm and weighing up to 10 kg. It uses a high-performance GPU PC with Intel Core i7-7700T Processor and two capacitive industrial monitors with touchscreens. **NED**



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Material Handling & Logistics®



Material handling and logistics will play a leading role in post-COVID-19 supply chains. p. M2



**7 Ways the Pandemic
Has Sped Up Supply
Chain Sustainability**
p. M8

Managing the Supply Chain in a **CHANGED WORLD**

Material handling and logistics will play a leading role in assuring resilient supply chains in a post-COVID-19 world.

By David Sparkman

With the transformation of the supply chain wrought by the Coronavirus pandemic, manufacturers are going to require from their logistics service providers increased agility, financial stability, transparency and speed—and some companies are seriously considering insourcing at least some of those services.

That is the conclusion of researchers and company executives who contributed to the 2020 State of Logistics Report issued in June by the Council of Supply Chain Management Professionals (CSCMP). The report was sponsored by Penske Logistics and the research was performed by the Kearney consulting firm.

"It is abundantly clear logistics have a driving role in assuring resilient supply chains," declares Michael Zimmerman, partner with Kearney and co-author of the 2020 report. "Logistics practitioners will need to become even more agile as they navigate recovery in the second half of 2020 and into 2021."

According to Marc Althen, president of Penske Logistics, "With the reopening of American businesses, many supply chains have become off-balance. Supply chain managers must rely on



solid data and experienced advice as they move forward. This is an important time to reevaluate your supply chain, from distribution points to modes of transportation."

Rick Blasgen, president of CSCMP, agrees. "To say that everything changed is an understatement. Many in our industry have led efforts in adapting, innovating and managing through unprecedented disruption while simultaneously creating new operating models." The three keys to being prepared for the future, he says, are being able to adapt, improvise and overcome.

When the State of Logistics Report was first created more than three decades ago, its main purpose was contributing to the policy debate over economic deregulation of trucking by measuring the positive impact deregulation had on logistics costs over the previous year. After several years of proving the beneficial effect of deregulation on costs, the report added more data about other modes and services.

In recent years that focus has shifted to providing more of an outlook for what is expected to happen to the industry, while continuing to analyze the previous year's performance in various sectors. The 2019 report found that U.S. business logistics costs in general last year rose 0.6% to \$1.63 trillion, or 7.6% of 2019's \$21.43 trillion GDP. Compared to the 7.9% of GDP in 2018, this reflected achievement of better productivity overall.

That seems like ancient history now. The economic slowdown seriously impacted most of the economy, including logistics. Even before COVID-19 hit, a slew of truckload haulers had begun declaring bankruptcy. Some shippers now face higher rates, while others are greeted by over-capacity.

"To get through trying times, all parties will need to make smart investments in technology and use such technologies to deepen collaboration," the Kearney researchers state. "Supply chains will need to become more resilient, better able to adjust to and recover from future difficulties. The shift away from single-source, cost-focused supply functions may pose new challenges to logistics—which itself is having its resilience tested in this crisis."

MIXED PICTURE FOR PROVIDERS

Most freight in the U.S. is transported at least at some point by trucks. Trucking was already slowing down in 2019 after a torrid 2018, the report notes. After two years of scarce capacity and increasing rates, the 2019 market balance tipped in favor of shippers. They regained buying power and were able to negotiate lower rates and secure capacity.

At the same time, fleets experienced reduced profits and ended up ordering fewer new trucks. Beyond the resumption of a boom-and-bust cycle now exacerbated by COVID-19, big carriers are turning to technology investments that promise to increase efficiency, while others are staring into the abyss.

On June 30—a week after the CSCMP report was published—the federal government loaned \$700 million under the CARES Act to less-than-truckload (LTL) carrier YRC in exchange for a 29.6% equity stake in that Teamsters union employer.

Small fleets will need to scramble to survive, the Kearney researchers assert. "Smaller carriers, especially those in highly affected industries, must look to app-based solutions and brokers to provide access to better fit routes and backhauls."

Railroads continued to grow profitability despite declining 2019 volumes, which was largely the function of having pushed costs onto their shippers in recent years through the adoption of Precision Scheduled Railroading (PSR), and by changing demurrage and accessorial fees to turn into a revenue stream by monetizing the inefficiencies the railroads created themselves.

However, the COVID-19 pandemic slashed volumes by another



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roughly 25%, and railroads face high fixed costs to maintain their networks in their core carload business. To generate more revenue, the major freight railroads are looking again at intermodal, which they had treated like the proverbial red-headed stepchild during their rush to embrace PSR.

Given intermodal's cost and carbon-footprint benefits, shippers are keen for better prices and reliability. According to the researchers, the railroads have taken notice of this, and say they are working on ways to improve their intermodal networks.

On the other side of the intermodal equation, ocean shipping saw volumes soar in 2018 in anticipation of U.S. tariffs, but both in 2019 and this year the industry has managed to find new sources of pain. Shippers found they had entered 2019 with excess inventory that reduced their ocean shipping needs, and ocean carriers were hit with new and expensive environmental regulations.

In the wake of COVID-19, additional financial strain is likely to continue well into the future. "Ship and container imbalances and capacity uncertainty have driven up spot-market prices and suspended normal contracted rate negotiations as the demand picture remains clouded," the researchers explain.

U.S. ports began 2020 by enjoying growing shipment volumes and improving efficiencies, but the pandemic soon left them reeling as they had to deal with dropping volumes, congestion and hundreds of thousands of boxes stranded at terminals.

EXPECT WAREHOUSING GROWTH

Last year, warehouse rents continued rising and vacancy rates stayed near historic lows. E-commerce continued to drive growth, especially in regard to smaller, high-amenity urban warehouses operating closer to the customer base, the report notes.

Inventory storage costs grew 6.6% in 2019 because warehousing capacity remained tight, which in fact has been the case for many years, although the pace of construction also increased. "Warehouses delivered the highest square footage completed in a single quarter on record—and the market quickly swallowed it up," the Kearney researchers report.

In 2020, the researchers expect that disruption of consumer supply chains stemming from the Coronavirus pandemic will drive a new surge in warehousing demand, especially for temperature-controlled warehouse space as more consumers order food online. But that won't be the only driver.

The researchers estimate that a 5% bump in safety-stock inventory will require about 750 million square feet of additional industrial space as companies soften their former lean-inventory strategies, such as Just-in-Time and Quick Response.

"The rise in stock levels should spur industrial activity, given the expectation that the warehouse construction pipeline will remain full and warehouse availability will remain tight," they predict.

These trends demand greater attention to efficient management of both private warehouses and companies providing third-party logistics (3PL) warehouse services, which help customers manage other supply chain needs by providing trucking, freight brokerage, freight forwarding, packaging and materials handling, along with other specialized services.

Technology is also being deployed to boost efficiencies in both warehouses and distribution center operations. "Pandemic e-commerce is leading to an expected increase in adoption of warehouse automation solutions to keep costs and operational complexity in check even further," the researchers explain.

Sales of autonomous mobile robots are estimated to double to \$27 billion by 2025, they point out. This and other tech solutions put the industry in a good position to support a vigorous recovery.

BUILDING ON LOGISTICS' SUCCESS

The pandemic tested 3PL service providers without warning, confronting them with sudden stops and surges, depending on which industries they served, and this is expected to have lasting effect. Most heavy manufacturing, the automotive industry and important segments of basic chemicals came to a stop when factories closed because demand had evaporated.

"The 3PLs and supply chains serving the hospitality and restaurant industries were mostly stopped cold," the report says. "On the other hand, high-tech products such as microprocessors continued to fly across the globe, still needed for providing inputs to crucial computers, servers and military products." In ad-



THE STATE OF THE U.S. LOGISTICS MARKET, 2020	
TRANSPORTATION COSTS (IN BILLIONS)	
Motor Carriers	\$680
Parcel	\$114
Railroads	\$84
Air	\$75
Water	\$48
Pipeline	\$57
Subtotal	\$1,059
INVENTORY CARRYING COSTS	
Storage	\$150
Financial Cost	\$169
Other (obsolescence, shrinkage, insurance, etc.)	\$136
Subtotal	\$455
OTHER COSTS	
Carriers' Support Activities	\$60
Shipper's Administrative Costs	\$56
Subtotal	\$116
TOTAL LOGISTICS COSTS	\$1,630
Source: CSCMP's 31st Annual State of Logistics Report; A.T. Kearney analysis	

dition, consumer packaged goods and grocery demand surged as people hoarded and then shopped while adhering to shelter-at-home orders.

The report remarks that a number of 3PLs were able to redeploy some of their people and assets from the halted and slowed industries to the ones that experienced surges. "Most shippers we spoke with reported that their 3PLs had a 'we're in this together' attitude rather than invoking force majeure clauses," the researchers reveal.

However, the report's authors warn that 3PLs need to keep investing in technology and sharpening their expertise. "Some shippers told us that advances in technologies (warehouse management systems, transportation management systems, track and trace) make the insourcing decision easier to take."

They add, "Those shippers committed to buying talent and innovation from 3PLs reported that they were seeing incremental improvements in creativity, such as the campus model for 3PLs where multiple shippers are served from the same group of facilities, or the buildup of 3PL last-mile networks and extra cross-dock capacity that can help shippers with surges."

The impacts of the COVID-19 crisis have opened the eyes of customers and providers alike to the value of technology in supply chain management, the researchers stress. "Even providers previously hesitant to invest in shipment location tracking or electronic signatures, claiming such digital technologies were unnecessary, are now embracing them as table stakes."

With rising labor costs, and despite the COVID-19-induced recession, shippers and 3PLs look to automation and robotics to make logistics more efficient—not just by achieving control over complex and unpredictable product flow, but also by helping gain greater control over labor costs.

While the Kearney researchers believe that serious growth and application of autonomous trucking is still five to 15 years away, they note that legions of mobile robots are already working alongside humans in many warehouses and DCs.

The logistics industry had exhibited very good fundamentals before the pandemic devastated the economy, and those will help it weather the current storm, the researchers claim. "Although almost nobody saw the COVID-19 crisis coming, the state of the industry in 2019 suggests that it could recover quickly."

They contend that the rapid deployment of professional skill and quick actions taken to find creative solutions by logistics professionals on display from the early stages of the pandemic should bode well for the future of the industry.

"Logisticians rolled up their sleeves instead of hiding behind their contracts. People across the industry—indeed, across the world—are coming together to face this dramatic crash and rebuild from it. Players in the logistics industry are seeing the rewards of collaboration, which now motivate them to go further with bold new solutions."

The researchers summarize their view: "In general, winners will emerge from this crisis with more digitally savvy logistics operations, especially in the areas of creating transparency and interfaces while reducing needs for physical labor across modes and nodes." **MH&L**

David Sparkman is founding editor of ACWI Advance (www.acwi.org), the newsletter of the American Chain of Warehouses Inc., as well as a member of the MH&L Editorial Advisory Board.

A Whole New Way of Looking at WAREHOUSE SAFETY

Four forklift experts weigh in on how new designs and technologies are making the workplace safer.

By Dave Blanchard

One of the biggest challenges for manufacturing and warehousing companies is finding and retaining talent, and this disturbing statistic certainly is a factor: In OSHA's ranking of the top 10 safety violations in the workplace, forklift operations came in seventh, as OSHA reported 2,093 violations involving forklifts in 2019. And according to the Bureau of Labor Statistics, forklifts were the cause of 74 fatalities and 9,050 non-fatal workplace injuries or illnesses with days away from work in 2017. So in the wrong hands (particularly the untrained or under-trained), these vehicles are quite deadly indeed.

Seven years ago, *Material Handling & Logistics* and its sister publication *EHS Today* helped to launch National Forklift Safety Day, an annual event that focuses on the safe use of forklifts and the importance of operator training to foster a safety culture within manufacturing and distribution environments. Although this year's



VR instructional tools can help attract new talent to the industry.

event ended up going virtual (due to the COVID-19 pandemic), we asked safety experts at several of the major forklift manufacturers to participate in a discussion of current efforts being made to improve overall warehouse safety, and what steps safety profes-

sionals should take to ensure that forklift operators and pedestrians alike go home safely every night.

Participating in the forklift safety roundtable (in alphabetical order) are:

- Don Buckman, EHS manager, Americas Division, Yale Materials Handling Corp.
- Ron Grisez, director of product safety, Crown Equipment.
- Jack Kaumo, director of iWAREHOUSE technology solutions, The Raymond Corporation.
- Tom Lego, brand ambassador, Toyota Material Handling.

MH&L: What are the main reasons that so many accidents happen in a warehouse and on a loading dock? What are the most typical types of accidents?

RON GRISEZ: That's a bit like asking why so many car accidents happen at intersections. There are a variety of factors and reasons, with each accident offering something unique. The more important question to ask is how can we make intersections safer, or in this case, warehouses.

It's important to remember that warehouses and docks are dynamic environments with a lot of activity. Also, while some forklifts may appear smaller than an automobile, they are typically many times heavier, especially when they are carrying a load. This is why forklift safety must never be casual or considered an afterthought.

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culture that reduces accidents, you must take a holistic approach that considers each aspect of safety while emphasizing the role of the individual. Vital components of a holistic program include:

Training that extends beyond forklift operators.

Equipment design that takes an operator-centric approach.

Connectivity that provides more visibility and awareness.

Improvements that are informed by data analytics.

Compliance management that controls access and automates processes.

That being said, a number of our customers begin their safety improvement journey by looking to reduce forklift impacts. Fleet and operator management systems enable managers to collect a wealth of data that helps create an accurate picture of how the vehicle and operator are performing. Which operators are exhibiting incorrect behavior? Which areas of the facility or shifts see the most impacts? Facility leadership can then use this data to make adjustments in training, maintenance and facility layout. They can also set thresholds to quickly be alerted when an impact occurs so they can investigate.

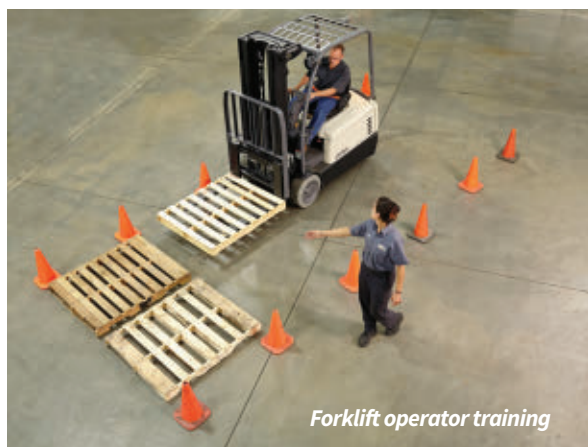
TOM LEGO: People may think that accidents occur when equipment malfunctions. This is actually quite rare. Warehouses and distribution centers are dynamic places and have processes that involves drivers, operators and the environment. The starting point for everyone is to have good, reliable equipment that is being properly maintained and in dependable condition through proper routine maintenance and daily inspections. Toyota, through our dealers, helps make sure these types of scenarios are safer by assisting customers with choosing the right equipment for the right job. Other safety considerations might include:

- Is the operator properly trained and using the forklift for its intended use?
- Does the operator have a daily inspection checklist for the forklift?
- Are there improvements in warehouse layout, traffic flow, markings, or separations that should be made?
- Are there any blind spots? Does lighting need to be improved? Are there surfaces that need additional traction?
- Are there other accessories which might be considered that could help support operators and those interacting with the equipment?
- Are there adequate procedures in place for good clear communications between workers or pedestrians in the area and the forklift operators?

DON BUCKMAN: Like many supply chain challenges, labor is a good place to start. Warehouses have extremely high turnover—46.1% in 2019. And with such high turnover, you have a lot of people coming into new roles, without a lot of time and experience in that position, much less in that specific operating environment. In some cases, operators may have zero experience.

In addition to a lack of experience and training, some other causes of forklift accidents include:

Speeding: OSHA advises drivers to stay at or below 5 miles per hour.



Operating with an elevated load: Operators are encouraged to carry loads as near to the ground as possible.

Insufficient warnings and markings: In workplaces with both foot- and forklift traffic, it's important to mark forklift zones.

Operator inattention and distraction, along with a lack of understanding the differences of a lift truck vs. a pedestrian vehicle (e.g., stopping distances, center of gravity, steering swing, etc.) can also impact overall lift truck safety, including property damage.

JACK KAUMO: Proper application and pedestrian and operator training are key to avoiding incidents. When proper training is not reinforced, pedestrians and operators are more likely to mishandle trucks or misuse designated walkways and driving lanes. Congestion due to peak busy intervals are a contributor.

How can and should training be enhanced to help operators better understand the equipment, and pedestrians become more aware of

their surroundings?

LEGO: Training never ends. We have to remember that training is both hands-on and in the classroom, and operators and pedestrians need to understand clearly that they never complete their training.

Operators need to have a dedicated safe place where they can practice and work on their skills periodically. The more often they are able to do that, the safer the operator will become in operating the equipment. Also important, and part of the ongoing conversation in the industry, is making sure that supervisors who manage forklift operators understand how that equipment works so they can be a part of improving the safety picture as well.

If you can set up a culture where people are consistently trying to share best practices and promote safety, that helps operators stay in the safety mindset. A positive safety culture, rather than a punishing culture, will always improve operators' safety compliance.

Making the learning process more collaborative often creates better understanding for the operators. At Toyota we have a process called Yokoten that revolves around sharing the best ideas with other people in the organization. Operators are learning more as they do their job each day and if they are in a culture where they can share that knowledge, with other departments or areas, the best safety ideas and insights will get shared across the entire organization.

Even something as simple as setting a standard that there should never be a paint scratch on your equipment (and that each scratch leads to investigation) helps to reset some bad habits that can grow if they are not addressed at their root cause. Just like you would investigate a scratch on your automobile and find out what caused it and how you can avoid it in the future, avoiding equipment impact always improves safety.

Pedestrian training shouldn't be overlooked. In any setting

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where material is being moved, the goal is to lay out the environment in such a way that pedestrians and material handling equipment like forklifts can be kept as separate as possible. It can be as basic as asking the question, “Is there any reason a pedestrian needs to be in this space where a forklift is operating?” Environments should be designed so that if operators and pedestrians have to be in the same space, the operator is trained to clearly see the

Safety is a top priority for every organization, but the businesses that rise above the rest are the ones that have instilled in all employees—regardless of role—a safety mindset at all times. To accomplish this, it’s important that those requiring and monitoring the safe behavior receive the training they need to take a lead role in modeling the desired behaviors.

Supervisors can be important contributors to efforts to improve

tors, supervisors, trainers, technicians and pedestrians. Participants “learn it” by completing the module, reading and reviewing any reference material, and practicing the required skills. Then they “do it” by performing what we call a “skill check” for instructors to demonstrate their ability to perform the skill. This prepares them to bring their newly acquired skills back to the job and “use it” to improve the end result of safety.



Tom Lego, Toyota Material Handling

“The goal is to lay out the environment in such a way that pedestrians and forklifts can be kept as separate as possible.”



Ron Grisez, Crown Equipment

“Effective safety management requires extending training beyond forklift operators to include managers, supervisors and pedestrians.”



Don Buckman, Yale Materials Handling Corp.

“Virtual reality simulators enable operators to practice lift truck operation in an immersive environment.”

pedestrians, and the pedestrians know where to expect operator interactions.

GRISEZ: Training, the core of most safety programs, is a fundamental element of the safety equation. Effective safety management requires extending training beyond forklift operators to include managers, supervisors and pedestrians, and making it readily accessible and convenient. Training, whether classroom-based or streamed online, must be interactive and engaging and tailored to the individual. It also needs to be designed to enable the manager or supervisor to positively influence safety by consistently encouraging and enforcing proper lift truck operation.

forklift safety, especially when it comes to sharing continuous positive and constructive feedback with operators. Training designed specifically for supervisors gives them the knowledge and tools they need to reinforce safe operating habits and reduce the need for operator retraining. Programs designed to “train the trainers” teach the proper way to conduct training and effectively utilize training materials. These programs also provide the skills needed to become proficient on safety issues, and to conduct safety inspections and workshops on the floor.

“Learn It. Do It. Use It” is the guiding philosophy behind our Demonstrated Performance Training programs. These programs offer a comprehensive range of forklift training formats for opera-

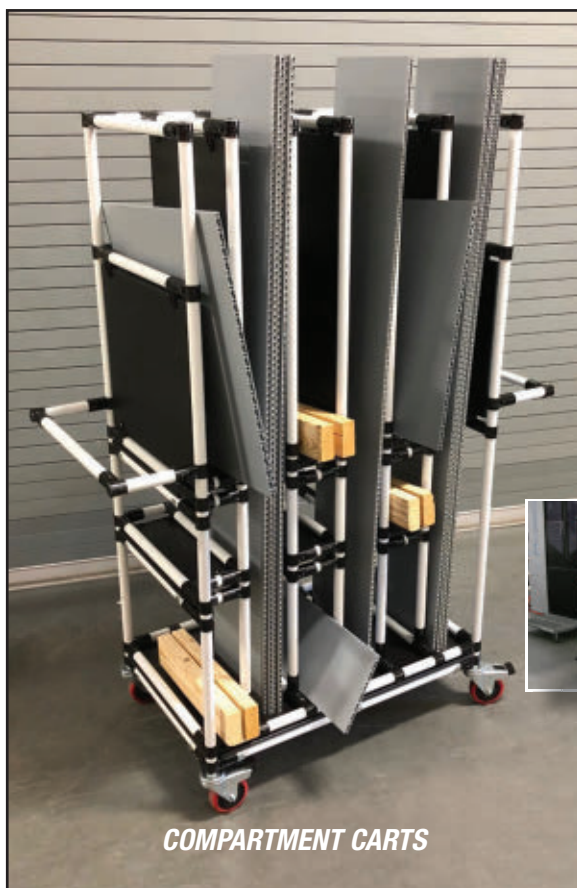
BUCKMAN: Clear explanations and consistent enforcement of rules are important, but to foster a culture of safety, organizations need to take additional steps. Employees should receive operator training that adheres to OSHA standards, which is site-specific, truck-specific and application-specific. A lift truck operator who works primarily in narrow aisles should receive training on narrow aisle trucks within the intended work environment.

New technologies can be used to augment or enhance training. For example, virtual reality simulators enable operators to practice lift truck operation in an immersive environment. This approach offers valuable experience that can help operators prepare to execute tasks and share environments with pedestrians safely

without taking an actual lift truck out of service or risking damage to equipment, facility infrastructure, or oneself. By participating in realistic 3-D environments and using actual controls and responses of real lift trucks, operators can reduce potential on-the-job training incidents, receive automated, real-time feedback and enhance skills in a controlled environment.

KAUMO: Educational opportunities have expanded beyond traditional means with hands-on opportunities and online e-learning. Ensuring that operators are learning in an engaging, realistic situation means that they’ll be more prepared to go out on the warehouse floor. In virtual reality (VR), the training is visual and using direct application, which helps promote retention. Much of the historical training methodology is classroom setting while VR allows the operator to learn and experience in an environment that is realistic and hands-on.

Our VR simulator uses VR instructional tools to attract new talent to the industry, to reach higher operator proficiency levels faster and to help ensure lift truck operators are coached more quickly and confidently before reaching the warehouse floor. It utilizes an existing forklift truck by plugging into a simulation port. After the vehicle is no longer needed for instruction, the port can be disconnected, and the forklift can be placed back into operation in the warehouse. The tool provides experiential learning in



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alternative scenarios and the ability to prescreen incoming forklift operator applicants.

Additionally, we're seeing more training programs that are specific to equipment. For example, our Safety On The Move program helps assist employers in complying with their duty to properly train lift truck operators on specific trucks. Training supervisors on proper operation and procedures is key to making sure that not



Jack Kaumo, The Raymond Corporation

"Automated trucks reduce incident-prone tasks such as driving the truck and getting on and off the vehicle."

only operators know and understand what is expected but also their leadership group knows and understands what to look for.

How have the forklifts themselves been made safer for the operators?

GRISEZ: When it includes features that provide benefits to the operator, equipment design can play a significant role in a strong safety culture. Forklift manufacturers that take an operator-centric approach to design can address issues such as visibility and ergonomics in the design phase to eliminate blind spots, reduce fatigue and integrate other features that enable and promote safer operation of the vehicle.

The most effective approach to forklift design is to integrate human factors and engineering (HF&E) logic directly into the product development process. In this approach, HF&E practitioners work as part of the design team to help ensure the operator is top of mind throughout the process. This enables the forklift to be designed around the way operators work rather than forcing operators to adapt their work habits to the vehicle's design. The more operators have to compensate for the design, the more they are likely to experience unnecessary fatigue.

Visibility is also a major area of emphasis for forklift manufacturers. By introducing forklifts with sleeker designs and wider openings around the operator compartment, sightlines have been enhanced in a variety of applications. This can help reduce the risk of accidents caused by blind spots or obstructed views.

Another area of attention is mast design. On reach and turret trucks, mono masts have become a preferred visibility option. On reach trucks, the mono mast is offset from the center of the truck. This enhances visibility, especially at height, without compromising mast strength and stability. This additional visibility also enables operators to avoid frequent bending and leaning outside of the running lines of the reach truck, helping improve safety and reduce fatigue.

KAUMO: Camera technologies improve visibility, which is especially important given the low tolerance for product damage. Often deployed with an additional monitor, camera technologies can now be incorporated into the forklift's operator display, requiring fewer devices and improving the operator interface.

Automated trucks reduce incident-prone tasks such as driving the truck and getting on and off the vehicle. Automated lift trucks are driven over optimized routes at controlled speeds, helping to avoid incidents or damage to goods, and are equipped with innovative vision guidance.

In-Aisle Detection System is a training reinforcement tool that provides notice regarding a truck's proximity to other objects. The tool uses a scanner to detect objects within an aisle, and if an object is detected, an In-Aisle Detection System equipped truck will then decelerate to a stop. The operator can then proceed manually if it is deemed appropriate. A Zoning and Positioning option ensures more reliable, repeatable operation by controlling many truck functions. Operators are able to focus on their surroundings and the task at hand instead of searching for locations, so they can learn more quickly, execute more accurately, and work more efficiently.

LEGO: Toyota designed the "System of Active Stability (SAS) that takes over 3,000 readings per second to detect unsafe operating conditions. If a safety hazard is detected, the SAS activates one if its two main features that improve lateral and longitudinal stability of the forklift.

Another Toyota safety innovation is Active Mast Control (AMC) technology. AMC is a standard feature in our equipment that limits mast tilt to help stabilize a load once the mast is in the air. Both SAS and AMC are engineered to be active, rather than passive safety monitoring systems, allowing safety issues to be corrected before they become a problem, rather than after. **MH&L**

MH&L Material Handling & Logistics

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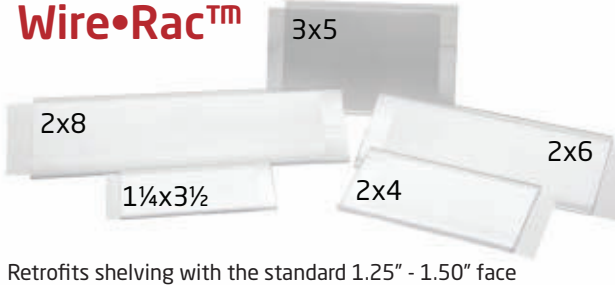
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Seven Ways the Pandemic Has Sped Up Supply Chain Sustainability

Increased automation has the potential to help reduce a company's environmental impact.

By Gary Neights

1. Increased Automation

The pandemic has accelerated investment in automation solutions to do more to limit human contact, ensure continuity, streamline logistics and increase human efficiency. In fact, some experts assert that enterprises with a higher degree of automation saw less supply chain disruption during the pandemic. Organizations are exploring opportunities to automate thousands of functions and tasks involving sourcing, procurement, order management, inventory, compliance, transportation, shipping and more. From securing supplier capacity to advance booking of transportation and real-time communication of supply and demand volume, the next few years should see unprecedented supply chain automation.

2. More Co-Innovation across Organizations

Presented with monumental challenges, the pandemic spurred supply chain partners to ask, "How can we work together to make this happen?" This collaboration meant co-innovating to find new ways to source, buy, move, store, sell and deliver. This is just the kind of cross-organizational collaboration it will take to explore

new and more sustainable ways to manage supply chains in the future. The pandemic-driven connection of disparate organizations, systems, workflows and resources in pursuit of a greater goal fore-shadows what it will take to reach Paris Agreement commitments.

3. More Visibility across the Supply Chain

Last year at this time, many were comfortable painting broad-brush strokes regarding the minutiae of vendor stock, the source materials involved in a Tier 3 supplier's components, or extensive contingency plans—but things have changed. Post-COVID supply chain stakeholders will demand unprecedented levels of visibility. This means an expectation of comprehensive, real-time supply chain status across complex, global inter-business processes and a whole new set of visibility KPIs.

4. Sourcing Closer to Home

Many enterprises are now looking to diversify their supplier base and reduce supply chain risk via closer-to-home providers. The high-profile examples made plain by 2020 include things like pharmaceuticals, rare earth minerals and key components used in the defense industry. Sourcing materials closer to home could also help lower transportation-related carbon emissions—and transportation costs. This shifting demand could help reshape a number of materials and manufacturing markets worldwide. We have already seen U.S. companies in certain sectors diversify away from places like China in search of greater supply chain resilience.



5. Reducing Waste and Cost in Manufacturing

Both resource constraints and financial pressures mean many manufacturing sectors are pushing for further waste and cost reduction. Some will continue to pursue lean manufacturing practices such as 5s methodology (6s with the addition of "safety"), Six Sigma and cellular manufacturing. Strong lean inventory philosophies did lead to a lack of resiliency in plants in 2020 due to shortages and this needs to be addressed. Still, the same tools designed to lean up operations by cutting down on safety stock or optimizing logistics usually also reduce environmental impact. The focus areas of lean manufacturing prove this out, seeking to reduce: defects, overproduction, waiting, non-utilized talent, transportation, inventory, motion and extra-processing. Lean inventory philosophies may need to be adjusted based on 2020 learnings.

6. More Efficiency through Tighter Planning

2020 supply chains held a lot of uncertainty. In response, enterprises compensated with extreme planning and communication. We've seen companies reinvent how they optimize each and every inbound and outbound load and strive for enhanced communication in all logistical matters. These have included authenticated proof-of-delivery mechanisms, automated shipment confirmations, proactive supply chain alerts and other additions. These tools could also have transformative impacts on supply chain sustainability. For example, logistics coordination for scheduling pickups can not only reduce trucking wait times and associated fees, but prevent millions of trucks from idling, providing reduction in global emissions when implemented at scale.

7. Modeling for Optimized Performance

Software-based simulations have been a terrific tool to navigate an ever-changing field of suppliers, carriers, costs, geopolitical factors, inventory, contracts, forwarders, financial metrics and other dynamics. Through computing advances such as advanced algorithms, artificial intelligence, machine learning, pervasive integration and replication, organizations are now more efficiently gaming the outcomes of alternative scenarios.

This same modeling technology could be used to monitor supplier sustainability practices and their decisions around sourcing packaging materials, recycling and fleet electrification. Modeling can improve supplier-related decision quality and efficiency when it comes to many aspects of supply chain sustainability across all supplier tiers. **MH&L**

Gary Neights is senior director, product management, with Elemica (www.elemica.com), a digital supply network for manufacturing industries.

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Machine Tools

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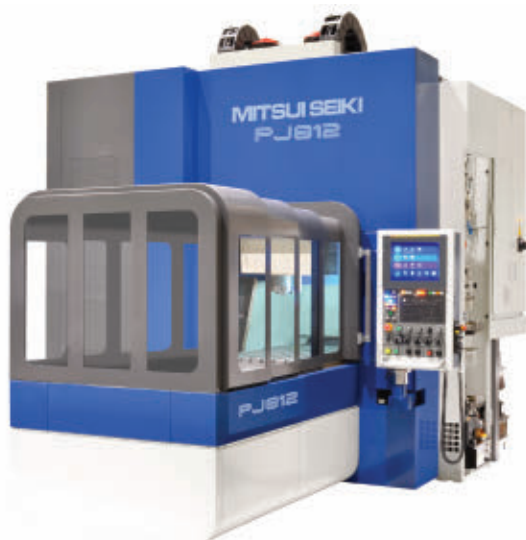
A line of digital-ready fine boring tools, the eBore Fine Boring System, make precision adjustment easy, enabling more productive, predictable, and accurate boring. The system consists of cutting units to cover a diameter range from 6 to 1,020 mm and an optional digital display that makes precision adjustments as simple as turning a screw.

With eBore, dialing in a tight bore and losing count is a thing of the past. With an adjustment accuracy of 0.002 mm, the chip and coolant-resistant device contains a glass-scale that keeps track of boring bar movement. Simply snap it in place, turn the boring head's adjustment screw by the desired amount, and the tool is ready for the next boring operation.

With eBore, there is no need to remove the boring head from the spindle for adjustment nor to count graduations or take notes. The device shuts off automatically after 30 seconds and provides more than 5,000 adjustments between battery changes.

Kennametal Inc.

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LINE OF VMCS OFFER JIG MILLING ACCURACY

A series of CNC vertical machining centers called the "J" series (for "Jig") are ideal to machine medical, optical, mold & die, and aerospace parts.

A thermal compensation system employs sensors on the machine faceplate and inside the spindle to minimize the effects of temperature changes on part accuracy and cut temperature-generated displacement by 60%. This system also reduces Z-axis thermal growth and deflection by 30%. Cooling systems for slide way lubrication and ball screw cores stabilize axis feed precision.

Mechanical design features that maximize machine rigidity and accuracy include hardened and ground tool steel box slideways as well as contact elements that enhance acceleration and reduce stick-slip.

These heavy-duty, ultra-precision machines allow for more complete machining of precision components including precision boring, milling, drilling and tapping. Machining center technology and jig borer precision in one machine.

Mitsui Seiki USA, Inc.

www.nedinfo.com/76479-28



APP PROVIDES ENHANCED TRANSPARENCY FOR CNCs

Manage MyMachines, a cloud-based "platform as a service," enables the full data tracking of machine kinematics as well as production data and serves as the initial point of entry into this digital world, combined with edge technology.

For the builder, this development translates into an immediate ability to monitor the global install base. Shops and production departments, in tandem with their system integrators and other business partners, will have a transparent display of all CNC equipment on the floor, regardless of location, brand, function or usage.

As a MindApp within the Mindsphere portfolio, Manage MyMachines is integrated into the cloud-based, open IoT operating system, as it allows access to all critical machine tool information, from bearing temperature to production by shift or job, all in a selectable priority scale.

Complete asset management is further possible as resource consumption and energy usage are trackable, all in the cloud, and all accessible through the app in real-time.

Siemens Digital Factory

www.nedinfo.com/76479-29



HYBRID EXTRUSION TOOLING

A new version of the 800 series, known as 800 Series Hybrid, seeks to overcome the challenges associated with standard extrusion applications such as difficult-to-process materials and demanding applications where there is zero fault tolerance. The challenge was to create a hybrid design that incorporates the benefits of layer overlapping while reducing unnecessary complexity and making the technology more cost-affordable. This was achieved by overlapping layers in each semi-deflector, using a single cone.

Features of the 800 Series Hybrid include eliminating weld lines in materials; reduced sensitivity to changes in viscosity; reduced sensitivity to changes in line speed; myriad material and multi-layer application possibilities; works in all tubing and jacketing applications with a wide range of materials; and more.

The 800 Series Hybrid extrusion tool reduces stagnation since overlapping layers are more inherently balanced than single layers and also because each semi-deflector is "tuned to flush." Conventional deflectors must simultaneously achieve a balance between flushing, balancing, and eliminating the weld line. There is less difference between the slowest moving material and the fastest moving material in the deflector channels, thus making the viscosity more consistent in the deflector.

Guill Tool & Engineering

www.nedinfo.com/76479-30

ADVANCED FIBER LASER SYSTEM

Designed to address the next generation of laser processing challenges, the LASERDYNE 811 employs the most current hardware and software components for flexible precision laser processing in an affordable compact platform.

The machine has the necessary flexibility and precision to perform optimized laser processing on welding, drilling, cutting, and DED additive manufacturing applications for small to medium-size workpieces. The machine is designed to take full advantage of the BeamDirector which has 90 rpm rotational speed and control repeatability of 15 arcsecs. In addition, it supports laser processing from 90 to 10-deg. off the surface of a part all the way along the axis of travel.

The S94P CNC provides control over the motion system and processes the parameters to maximize process quality while providing efficient laser processing. The controller can provide real-time pulse by pulse control, including a unique shape for each individual laser pulse and supports seven axes of simultaneous motion and additional axis as required by automation.

Prima Power Laserdyne

www.nedinfo.com/76479-31



5-AXIS UNIVERSAL MACHINING CENTER

G350 5-Axis Universal Machining Center features a compact design, maximum milling performance, high visibility, and optimized work area access. The G350 is ideal for use in aerospace, die and mold industries or medical applications.

G350 delivers a unique machine concept; three linear and two rotary axes permit 5-axis simultaneous machining and simultaneous interpolation. The machine's unique axis arrangement permits upside down machining, offering almost limitless possibilities for part machining. Meanwhile, the horizontal spindle position permits the longest possible Z-travel path and optimum chip fall.

The unique arrangement of the three linear axes minimizes the distance between the guides and the machining point (TCP), lending the machine considerable stability. Thanks to the machining center's special axis concept, the full tool length can be employed in any axis position, even with maximum part size. This "tunnel" concept provides the basis—even with extremely long tools—for being able to swivel and machine the largest possible component within the work area without collision.

GROB Systems

www.nedinfo.com/76479-32



GRINDING MACHINE TAKES ON CARBIDE

The GT-610 EZ Centerless Grinding Machine excels at thrufeed grinding hard materials such as steel, carbide, PCD inserts, and technical ceramics while operating on a much smaller footprint than the competition.

It has the ability to produce G-ratios that can exceed those of machines twice its size. When running super abrasives, a variable frequency drive on the work wheel spindle is available to increase wheel surface feet.

Built on a granite bed, the GT-610 EZ brings slide motion control to the operator at an affordable price point. Slide positioning allows for precise diameter control on close-tolerance components. The machine is also capable of gauge feedback for even more precise diameter control.

Both the template tracing work wheel and template tracing regulating wheel dressers allow for the dressing of shallow profiles. Available with a variable frequency drive on the work wheel spindle for increased wheel surface feet when running super abrasives such as vitrified CBN. Spindle RPM can be varied depending on the wheel type and wheel dressing parameters.

Glebar Company

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FROM THE COVER

3D Inspection Robot

is 10 times faster than with traditional CMM



Capable of detecting defects of less than half the width of a human hair and imperceptible to the naked eye, the 3D quality

inspection (3DQI) robot cell dramatically accelerates production by providing fast, accurate testing to make metrology easier and less time-consuming. The 3DQI eliminates the need for time-consuming manual inspection, while substantially reducing the likelihood of faults and errors. As well as increasing productivity, the solution also reduces costs by minimizing the risk of product defects that could lead to potential recalls.

Key benefits of the 3DQI include its combined speed, accuracy to below 100 micrometers and flexibility provided by its modular design, with customers able to create a solution tailored to their exact requirements.

The 3DQI is conceived for offline testing stations and its modularity allows customization or expansion to meet evolving business needs. Using a single 3D white light optical sensor to scan millions of 3D points per shot, a detailed digital model of the part being inspected can be created which can be compared to an original CAD drawing.

The sensor can be carried by any robot with a handling capacity greater than 20 kg and is compatible with a range of robots, tracks, and rotary tables, so there are no limits on the dimensions of the parts that can be inspected.

ABB Robotics

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CAST-X High Temp Heaters

feature built-in temperature sensors

CAST-X High Temp Circulation Heaters are capable of heating liquids and gases to temperatures of 1,110°F/600°C. The heaters are well-suited for laboratory applications, engine and jet fuel test benches, industrial gas heating applications, and experimental hydrocarbon heating processes. Available in sizes from 1 to 10 kW, CAST-X High Temp Heaters offer certified explosion-proof terminal enclosures and built-in temperature sensors.

Cast Aluminum Solutions, LLC

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Free 3D CAD Modeling Software

allows sketching of complex curves

Version 5.0 DesignSpark Mechanical 3D CAD modeling software offers new features and customization options after feedback from users. DesignSpark Mechanical uses direct modeling technology rather than the parametric methods, enabling users to rapidly prototype or reverse engineer any physical object. It offers built-in help text, quick-guide tutorials, example designs, and access to a 3D catalog of tens of thousands of 3D models.

RS Components Ltd.



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Labeler Achieves Precise Placement

has easy upgrades through a USB



The **LDLA-500-V2** features a larger color touchscreen, a fast CPU module, an open web path, easier and simpler screen replacement, and both ALP and LCIJ systems. Manufactured using smart sensing controls, the LDLA-500-V2 achieves precise label placements,

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SPX Flow, Inc.



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3D People Counter for Flow Management

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QORTEX People Counter delivers over 98% accuracy from pitch dark or indoor to very bright lighting conditions in full sunlight. The counter provides superior detection accuracy compared to traditional camera-based solutions and is ideal for outdoor applications. By accurately and anonymously capturing individual movements, QORTEX People Counter provides insights about the flow and number of people in retail stores, public transportation centers, stadiums, venues, and more.

Quanergy Systems, Inc.

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Lift Truck Transports Awkward Items Easily

reduces physical stress

To streamline the labor-intensive process of manually loading and unloading flat-pack and odd-shaped items, the Yale **MTR007-F Heavyweight Handler** uses floor-level base support to slide under items and a tall, tilting load backrest to support them during transport. Engineered to handle bulky, cumbersome items, the handler offers simple operation and enables operators to secure and maneuver even wedged or unbalanced product without manual intervention.

Yale Materials Handling Corp

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RFID Coded Safety Switches

provide 10-mm sensing distance

IDEM non-contact RFID coded safety switches are designed to provide interlock protection on hinged, sliding or removable guard doors. IDEM KLP-Z, KLM-Z, and KL3-Z series fit into machine guard doors to provide guard locking and a double tamper-resistant interlock mechanism. Providing position detection for moving guards, these switches remain locked until the solenoid voltage is applied to the switch.

AutomationDirect

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Cart Handles Uncommon Parts

holds up to 250 lb.

Created for handling batches of uncommonly shaped parts, a **cantilevered peg cart** can handle parts placed on both sides while the open design allows all the parts to be visible which enhances visual inventory and accessibility. Each of the four shelves of the cart feature two pegs or pins that extend out both sides to hold the parts securely and safely. The cart features 6, 5-in. diameter swivel casters for easy rolling and positioning.

Creform Corporation

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Enclosed Workstation Crane

significantly reduces operator effort

A pre-engineered, enclosed track, workstation crane, the **SPANMASTER** has a capacity range from 250 to 4,400 lb. and is available in both freestanding and ceiling-mounted designs. It combines an ergonomic enclosed track bridge with a non-proprietary wide-flange or other runway systems and a unique range of motion features. The patented oscillating, articulating, and pivoting end truck design provides freedom of movement and the unique range of motion allows bridges to move freely along no matter the position of the load on the bridge.

TC/American Crane Company

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Forklift Tie-Down Clamps

offer a total capacity of 4,400 lb.

Forklift tie-down clamps are a great asset when securing loads for transport. These clamps are sold in pairs, so the entire unit is comprised of 4 pieces (2 brackets, 2 clamps). An eye bracket is positioned in front of the load while the screw clamp is placed behind the unit, closest to the forklift driver; these are put in place by sliding over the forks.

Vestil Manufacturing Corp.



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HEAVY DUTY

High Capacity Lift Tables

Autoquip Titan heavy duty lift tables have set the standard of affordable reliability for high capacity lift applications. The Titan and Super Titan product lines feature an array of lifting equipment for applications that require heavy lifting capacities. For more information about Autoquip's heavy duty lifting solutions, visit autoquip.com today.



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Frameless Protection Shields

help prevent COVID-19 transmission

The line of GermBlock framed **Cough and Sneeze Shields** has gained the addition of frameless models available in desktop, tabletop with pass through, and tabletop with criss-cross divider designs. GermBlock

frameless shields are a cost-effective solution for organizations that require easy-to-move and easy-to-clean COVID-19 barriers that focus on individual containment where social distancing is not possible due to space constraints.

Rockford Systems, LLC



MORE ONLINE: nedinfo.com/76479-45

Shoe Sanitizer Floor Mats

can hold over half of a gallon of disinfectant

The **Shoe Sanitizer Floor System** is an all-in-one system that provides employees and visitors the opportunity to safely remove dirt and debris, sanitize, and dry shoes upon entry to any facility. Simply fill mat tray with preferred disinfecting solution and immerse the soles of shoes and scrub.



While the non-slip rubber scrapers remove dirt, contaminants, and germs, the adhesive-backed runner absorbs any disinfectant overflow or splashes to provide a safe walk-off surface.

New Pig Corporation

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Mitutoyo

FROM
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Introducing the next generation of precision measurement—the **CRYSTA-Apex V Series** CNC coordinate measuring machines. Offering high accuracy, high speed, and flexibility to measure small- to large-sized workpieces for a wide variety of industries and applications, the CRYSTA-Apex V Series sets the new standard for smart factory quality measurement. The series features IIoT (Industrial Internet of Things) functionality, with integrated Condition and Status monitoring programs and a temperature compensation system that guarantees specified accuracy within a wide range of temperatures—helping to reduce measurement time and improve productivity for your facility.

Learn more at Mitutoyo.com/Crysta-AV-NED and schedule a demo today.

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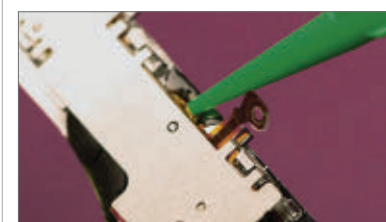


IP65 Right Angle Gear Drives *are free from bacteria traps*

Tested and certified by an independent laboratory, the **IP65 Rated Crown Right Angle Gear Drives** feature a nickel-plated housing for corrosion protection and are now available in 1:1 and 2:1 ratios, 2-way, 3-way, and Counter-Rotating shaft configurations for reliable and quiet transmission of power. Capable of speeds up to 2,000 rpm, the drives feature heat-treated AGMA Class 10 spiral bevel gears and are lubricated for life with H1 Rated Food Grade Grease.

Zero-Max, Inc.

MORE ONLINE: nedinfo.com/76479-47



Biocompatible Epoxy System *bonds, seals, and coats*

EP40Med, a two-part epoxy system, combines toughness and a low tensile modulus while providing a high lap shear strength. EP40Med resists sterilization to gamma, EtO, chemicals, and liquid disinfectants. The working life of a mixed 100-gram batch is approximately 120 to 150 minutes. The optimal cure schedule is overnight at room temperature followed by a post-cure for 2 to 3 hours at 150°F.

Master Bond Inc.

MORE ONLINE: nedinfo.com/76479-48



Component Carrier Replaces Flexible PCBs

eliminates connecting cables

HARTING has developed a solution based on 3D-MID technology that is capable of replacing flexible circuit boards. Thanks to component carriers, cost savings of up to two-thirds can be achieved. At the MID process, on the injection molded part a customized layout is applied. At electronic assembly, the components are mounted on the desired surface. The component carrier serves as a connecting element between the PCB and electronic components such as LEDs, ICs, photodiodes, and sensors. Thanks to the 3D-MID (mechatronic integrated device) technology, electronic components can be fitted directly onto a three-dimensional body without the need for circuit boards or connecting cables.

HARTING Inc. of North America

MORE ONLINE: nedinfo.com/76479-49



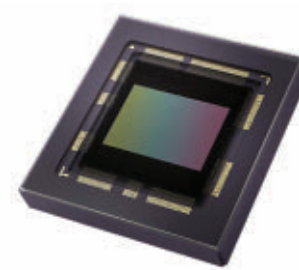
Image Sensor for Smartphones

consistently captures the best quality images

OV64B, the industry's only 64 MP image sensor with 0.7-micron pixel size, enables 64 MP resolution in a 1/2-in. optical format for the first time. This allows smartphone designers to create the thinnest possible phones with high resolution 64 MP cameras. Built on PureCel Plus stacked die technology, this sensor provides leading-edge still image captures and exceptional 4K video recordings with electronic image stabilization, as well as 8K video at 30 frames per second. These features make the OV64B ideal for the main, wide, ultra-wide or telephoto rear-facing camera in multicamera configurations.

OmniVision Technologies, Inc.

MORE ONLINE: nedinfo.com/76479-50



Compact, Global Shutter Sensor

helps to minimize camera size

Emerald 3.2 Megapixel CMOS image sensor is specially designed to tackle the challenges of emerging applications such as security, drones, and embedded vision, as well as traditional machine vision. With its 2.8 μ m global shutter pixel and innovative design, the sensor shares all of the characteristics of the Emerald sensor series: superior low-noise performance, compact format, easy integration, and a wide range of embedded features. The sensor has been designed in an ultra-compact light package format with low power and features a MIPI interface to provide a direct connection to low-cost MIPI ISPs and a central optical center that helps to minimize the camera size.

Teledyne e2v US, Inc.

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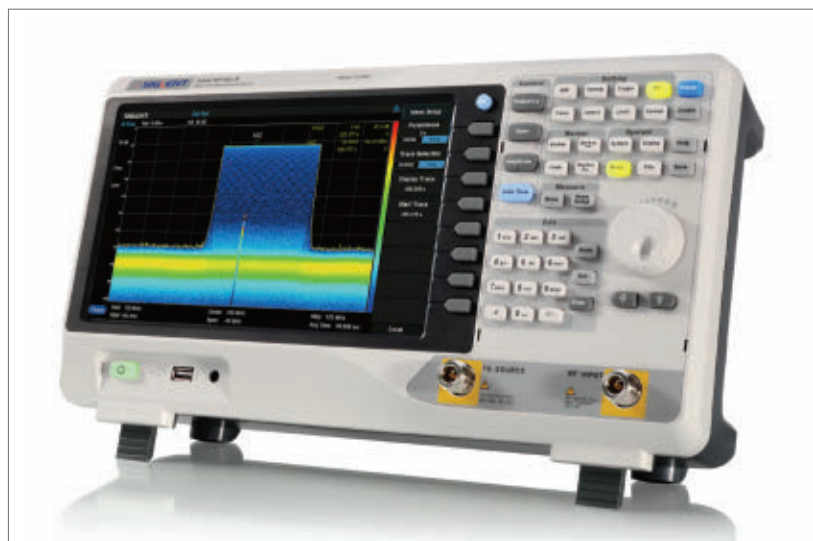
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Real-Time Spectrum Analyzers feature built-in tracking generators. **SIGLENT SSA3000X-R Real-Time Spectrum Analyzers (RTSA)** are powerful and flexible tools for complex RF spectrum and signal analysis. The analyzers provide multi-dimensional data displays, advanced triggering, and RF data capturing to assist with modern RF spectrum challenges such as frequency hopping, channel conflicts, spectrum interference, etc. These RTSAs also contain a standard tracking generator for network analysis, optional wide-band digital modulation analysis, and EMI measurement.

Saelig Company Inc.

MORE ONLINE: nedinfo.com/76479-52

3-in-1 Cable Tester

tests for open, short, miswire or split-pair faults

The **Scout Pro 3 Tester Starter Kit** is a versatile voice/data/video cable tester that locates and tests coax, data, and telephone cables in order to verify accurate cable installations each time. The Backlit LCD screen displays cable length, wiremap, cable ID, and test results and additional features include voltage warning, shield detection, auto power-off, and low battery indicator.



Klein Tools

MORE ONLINE: nedinfo.com/76479-53



Auto-Unloading Control System

automatically empties tanks and trailers

Developed to prevent product loss, contamination, and fugitive dust emissions during the unloading of powders, pellets and other bulk materials, the **mobile STP 61** pneumatic conveying control system enables process engineers to automate conveying inside the plant at the point of receiving outside the plant. The mobile STP 61 integrates a proprietary controller with a pneumatic safety valve and associated connections all set within a rolling platform for easy movement to the discharge.

Gericke USA, Inc.

MORE ONLINE: nedinfo.com/76479-55



Slim, Mobile Leak Detectors

pump air up to 36 m³ per hour

UL3000 Fab ULTRA leak detector uses the vacuum method with helium as the tracer gas in order to safely detect the smallest leaks. The UL3000 Fab ULTRA replaces the scroll pump used in previous models with a high-performance roots pump. This roughing pump allows the UL3000 to evacuate production equipment being tested much faster. Due to its high air pumping capacity (up to 36 m³ per hour), the detector reduces the evacuation time and downtime in production facilities decisively.

INFICON Inc.

MORE ONLINE: nedinfo.com/76479-54

Quiet, Cordless Compressor

handles up to 1,600 nails per charge

At only 68 dBA the **M18 FUEL 2-Gallon Compact Quiet Compressor** is 2X quieter than standard corded compressors, reducing overall noise on job sites. At less than 31.2lb., and featuring two carrying handles, it's easy to transport to and from the job site. Through M18 REDLITHIUM Battery technology, the tool eliminates the hassle of cords and delivers the power to fire up to (1,600) 18ga brad nails per charge.

Milwaukee Tool



MORE ONLINE: nedinfo.com/76479-56

Cooling Solution for Mission Critical Projects

can reduce energy costs by as much as 40%

A solution for rapid deployment in mission-critical cooling applications, **Design Envelope EVERCOOL** offers pre-engineered, feature-rich options that can be configured on-site. The platform meets the stringent requirements of the Up-time Institute for Tier III data centers while avoiding the traditional requirements of extensive site programming and customization. EVERCOOL reduces site commissioning time by up to 30% and reduces overall energy consumption, coordinating cooling system operation to reduce energy costs by as much as 40%. EVERCOOL uses an innovative design with internal redundancy and a hot-standby controller for continuous uptime.

Armstrong Fluid Technology



MORE ONLINE: nedinfo.com/76479-57

Vertical Connector for Vehicle Applications

has wide tapers for smooth and easy FPC/FFC insertion

A vertical, FPC connector with a single-action lock, the 0.5-mm pitch **FH67 Series**, satisfies severe automotive requirements. For greater reliability in harsh environments, the connector has a high retention force, high-heat resistance, and a ground pin to work with shielded FFC for advanced EMI prevention.

Hirose Electric Co., Ltd.



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Air Cleaning Blowers Eliminate Clogging



do not create hot spots

Air-Cleaning Blowers (ACBs) clean and blow air without any filter media and filter out 98+% of the mass of particles down to 10 microns, even under severe industrial and military conditions. Without filter elements, ACBs eliminate the clogging that varies air flows, air pressure, and energy consumption as well as all the maintenance that filter elements require. Used in heavy industry, mines, food processing, and military operations around the world, they can work unattended for long periods, even in remote locations.

Air Cleaning Blowers, LLC

MORE ONLINE: nedinfo.com/76479-59

Seamless Concrete Sealant

is resistant to cracking

Uniquely formulated with a textured finish to seamlessly blend with concrete, **Premium Textured Concrete** offers superior elongation and extension recovery for a more durable and long-lasting seal. A textured latex sealant, it simulates concrete allowing users to achieve more accurate color matching to common concrete material. The formula combines the extension recovery, elongation, and durability needed to properly move and flex with heavy trafficked concrete surfaces while providing a long-lasting seal that is resistant to cracking.

DAP Products, Inc.



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The True Pioneer of Electric Actuators

RACO International, LP

RACO Electric Actuators provide a reliable solution for all of your linear and rotary motion needs. A variety of design configurations provide a multitude of thrust and speed ratings. RACO Electric Actuators are designed to be robust with virtually no maintenance while also being economical to operate and friendly to the environment.



RACO MA-Series

The modular design of RACO ACME and Ballscrew Electric Actuators allow for a variety of design configurations while offering a Linear Thrust range from 70lbs to 225,000lbs, Linear Rod Speeds from 0.2"/sec to 30"/sec and Linear Travel (stroke) up to 20 ft.

RACO LM-Series

The RACO LM-Series is designed for high speeds and long travel (stroke) with capabilities that are frequently found in today's automation processes. The LM can be used as a single axis system or can be combined to form a multiple axis system.



RACO Rotary-Series

The Rotary Actuator is designed to automate the operation of valves, gates, dampers, louvers and other positioning applications requiring partial or multi-turn rotational movement.



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FROM THE COVER

Digital Dock Increases Visibility

grants full control over entire docks



Warehouse and DC dock operations of any size and scope can now interconnect their equipment with the cloud-based and data-driven **4SIGHT Connect Digital Dock**.

From retail, high-volume distribution, and warehousing dock operations to food & beverage, cold storage or industrial facilities, 4SIGHT Connect Digital Dock provides real-time access and management to a variety of dock data and KPI's. Essentially, it grants full control over an entire dock operation via remote monitoring while helping to increase both efficiency and safety.

Dock equipment that is interconnected into a system transforms traditional dock operation into one that is truly "smart." And most importantly, this innovative platform is a fully self-enclosed program that does not interact with any existing network or IT infrastructure nor does it require IT team assistance.

The heart of this digitally advanced product is either a Kelley or Serco brand Digital Master Control Panel which serves as the dock data collection point for equipment status and operation. Featuring an intuitive touch screen, the stand-alone Digital Master Control Panel provides personnel with dock equipment data, equipment status, and operations data directly to a 4SIGHT Connect Dashboard which can be viewed on any connected mobile device or computer with Internet access.

4SIGHT Logistics Solution

MORE ONLINE: nedinfo.com/76479-61

Safe Work Solutions

can easily be added, moved, or removed

Safe Work Solutions, a suite of sensing and visual indication products, provides reliable detection of individuals and clear visual assurance of a safe environment for employees and patrons of businesses and retailers. Existing solutions include occupancy monitoring, workstation/common area cleaning, and sanitization schedule alerts. With wireless technology, solutions can be deployed quickly, without disruptive and time-consuming alterations to equipment or infrastructure.

Banner Engineering Corp.



MORE ONLINE: nedinfo.com/76479-64



Scanner Simplifies Seam Weld Inspection

easily switches between directions

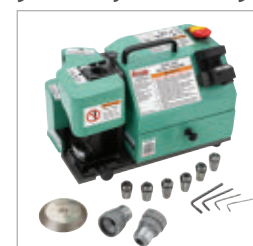
Using the **AxSEAM scanner**, inspectors can easily set up and inspect long seam welds, enabling them to work more independently in the field. The scanner's features, including tool-less probe holders and patented dome-shaped wheels, help solve typical challenges associated with this application, enabling more self-sufficient inspection on the job site. Controlling data integrity is easier with the ScanDeck module featuring LED indicators that alert the operator to a lack of couplant and when the scanning speed has exceeded the maximum acquisition rate.

Olympus

MORE ONLINE: nedinfo.com/76479-62

End Mill Sharpener

grinds adjustable angles from 0 to 3-deg.



The portable **G0921 End Mill Sharpener** grinds 2, 3, 4, and 6-flute end mills, allowing you to get the most out of your tooling. Thanks to the simple operational design, it takes zero experience to

produce optimal results. The G0921 features two grinding wheels—one for carbide bits and one for HSS bits—to help you resurface face angles from 0 to 3-deg. This end mill sharpener comes with six ER-20 collets ranging in size from 3/16 to 9/16 in.

Grizzly Industrial, Inc.

MORE ONLINE: nedinfo.com/76479-63

Wrench Keeps Dirt Out

replaces need for multiple wrenches

REED L4N1XP Thru-Bolt ratchet wrench features sealed ratchets for better performance and extra protection for jobsite conditions. The four sockets in a dog bone configuration are designed to stay on the handle, meaning no loose sockets. Length and shape of handle yield maximum leverage. Plus, a rugged grip handle provides a secure hold. This wrench replaces the need for multiple wrenches and sockets—carry one wrench for all your jobs.

REED Manufacturing



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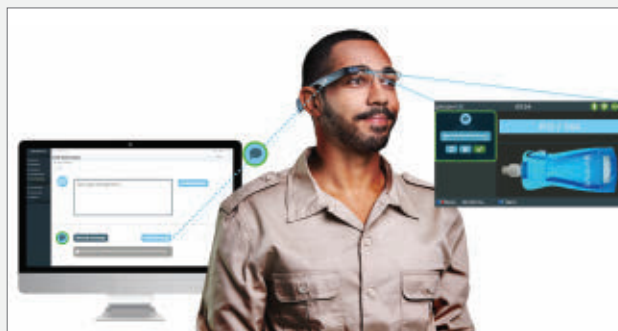
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FROM THE COVER

Smart Pick-by-Vision Solution *doubles as a communication device*



The **Picavi Cockpit** is an intelligence solution that takes Assisted Reality supported picking to its full potential. Although the solution features Mobile Device Management (MDM), it is much more than a pure administration and visualization tool.

Sensors on the pick-by-vision data glasses collect process parameters that can be evaluated in real-time using the Picavi Cockpit. This makes it possible to define customer-specific KPIs such as picks per hour, picks per location or an ABC analysis and monitor them in dashboards. The smart glasses have a remote support function that uses push notifications to allow important messages to be shared between workers and the control room during operations in both visual and audio form. The remote support function enables contactless, bidirectional, and individual communication in the warehouse.

Picavi has precisely adapted the user interface to the needs of warehouse employees. The system features two methods of communication, together with two priority levels. As well as sending text messages, the microphone in the smart glasses can be used to send voice messages between the control room and workers.

The MDM in the Picavi Cockpit ensures the functionality of the smart glasses with minimal effort. One-Scan-Setup makes it easy to add new smart glasses to your fleet. The MDM also enables wireless updates that can be installed Over-the-Air using the new software. Picavi has also integrated the Screen Cast function, which is suitable for training new employees—the real-time display of the glasses can be projected onto a monitor in no time at all.

Picavi US Inc.

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Remote I/O System

makes data exchange easier

The remote **I/O system PSSuniversal 2** has gained the addition of a head module with EtherNet/IP interface to offer the necessary openness for smooth communication in various control environments on an Ethernet basis. In the system, there is already a head module available with PROFINET PROFIsafe interface, in addition to the EtherNet/IP head module with CIP safety. The system can be adapted by changing the head module for existing system environments. The I/O modules can be used universally in an identical manner for the various safety protocols.

Pilz Automation Safety LP



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Valve Series Offers Wider Control

can be used in volatile areas

Comprised of four different styles of APVS valves, the **APVS Media Separated Valve Series** provides many options for handling caustic media, all while allowing safe operation in volatile areas. The series includes inert gas/spring-operated valves to control high-purity, aggressive, and corrosive liquid chemicals while allowing a superior flow rate. Each valve can be configured to meet user requirements with options that include various port sizes, diaphragm seal materials, pilot options, and valve function.

Spartan Scientific

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Applicator Improves Seal Quality

rapidly applies 8,500 dots per minute

Meler's **micro-precision adhesive applicator** uses advanced technology to accurately apply hot melt dots at high speed with top repeatability and long term reliability, eliminating barriers of converting from hot melt beads to dots. The microprocessor-controlled timer and driver combine immediate signal response to rapidly apply 8,500 dots per minute. The applicator features insulated pneumatic tubes and "Cool-Touch" insulated applicator covers for reduced energy consumption.



Meler USA Corporation

MORE ONLINE: nedinfo.com/76479-68



Supreme Thread Former

offers low cost, high-value production

TC470 Supreme solid carbide thread former combines a new geometry with more forming edges than comparable thread formers. The thread former features a new coating and surface treatment for better tool life, higher productivity, and increased process reliability in a large batch and high-volume production while achieving a lower cost per thread.

Walter USA, LLC

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Wastewater Turbocompressors

provide greater flow rates

The **HST 30-58-8** and **HST 30-38-2** turbocompressors offer increased flow and pressure respectively for applications in the wastewater industry. For wastewater treatment plants aiming to upgrade their aeration facilities but retain shallower tanks, the HST 30-58-8 offers efficiency at lower pressures up to 75 kPa with an extended flow envelope up to 15,000 Nm³/h. For deeper tanks with a smaller surface area, the HST 30-38-2 offers operating pressures up to 130 kPa; the flow is correspondingly lower at 10,000 Nm³/h.

Sulzer Ltd.

MORE ONLINE: nedinfo.com/76479-71

Diagnostic Encoders

allow users to perform mounting checks

The next generation of **RENCO** brand rotary encoders includes an upgraded R35i model and the R35iL low profile encoder. Both solutions have an OPTO-ASIC that provides additional features and improved functionality to users. Both encoders come with a Diagnostic and Field Programming feature that allows users to perform mounting checks, quick and simple diagnostic functions, and electronic commutation settings which can reduce the mounting time of each encoder up to 10 minutes.

HEIDENHAIN

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Socket Bit Set

allows for easy replacement of a broken bit

12 PC Torx Socket Bit Set features a wide range of sizes that can be used with the appropriate Ratchet, T-Handle or Socket Spinner Handle allowing users the ability to fasten or unfasten the most common Torx screws. The design of this set allows for easy replacement of a broken or worn bit. The tips are sized appropriately to 1/4, 3/8, and 1/2-in. Square Drives for maximum torque and minimum damage to tip or fastener.

Mayhew Steel Products, Inc.

MORE ONLINE: nedinfo.com/76479-73



Bi-Directional Gateway

enables direct cloud connectivity

With the Ixxat **CAN@net NT** and **CANbridge NT** series, users can now add smart, event-controlled network actions and versatile bi-directional MQTT-messaging to cloud applications. The Ixxat CAN@net NT and CANbridge NT product families enable smart and seamless CAN-based networking on-site and remotely. The CANbridge NT enables easy coupling of up to four CAN and CAN-FD networks using filter and translation rules.

HMS Industrial Networks

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Connectors Speed Installation

can be removed and reused

RACO 38RAC and **40RAC** push-in cable connectors make it easy to secure metal-clad cable into boxes or enclosures. These tool-less connectors quickly snap into box knockouts. The connectors save time and effort, fitting all standard half-inch knockouts in electrical boxes or enclosures. Installers simply insert a cable into the connector, then snap it into a box knockout. These connectors can also be removed and reused.

RACO International LP

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Portable & Central Vacuum Cleaner

has pick-up points for distances up to 200 ft.

VAC-U-MAX Model 1050 continuous-duty industrial vacuum cleaner is ideal for applications requiring high-volume recovery of up to 5 tons per hour of the heaviest material. The system features a "break-away" concept with the flexibility of a portable vacuum and is as powerful as a central system with multiple pick-up points for distances up to 200 ft.

VAC-U-MAX

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Signal Generator Speeds Complex Measurements

reduces phase noise interference

Keysight's enhanced PNA and PNA-X network analyzers contain a proprietary low-spurious direct digital synthesis (DDS) source, enabling customers to take accurate measurements with less phase noise interference. With the clean source signals, customers can perform two-tone IMD measurements with close tone spacing previously only possible with high-performance analog signal generators.

Keysight Technologies

MORE ONLINE: nedinfo.com/76479-77

Single-Wafer Cleaning System

can accommodate assistant cleaning methods

Ultra C VI single wafer tool targets high-throughput cleaning of dynamic random-access memory (DRAM) and 3D NAND Flash devices to support an increased production scale. The tool features 18 chambers, representing a 50% expansion on the throughput and 12 chambers included in the Ultra C V system, with the same tool width and only slightly larger in length to allow for integration into existing production lines. It performs single-wafer cleaning for advanced DRAM devices of 1y nm and beyond, as well as advanced 3D NAND devices with 128 stacked layers and above.

ACM Research, Inc.

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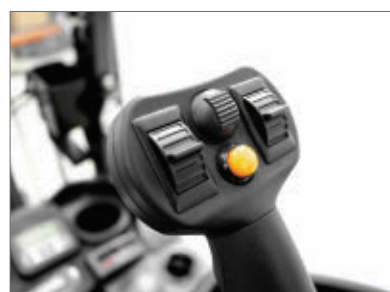
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Ergonomic Joystick With Charging Ports

makes adjustments easily

Reducing operator fatigue and optimizing productivity, the **Toyota EZ Control Joystick** offers forklift operators a convenient way to operate their equipment and approach difficult challenges with precision and ease. The ISO-style joystick features multi-function capabilities that enable forklift operators to control all necessary functions outside of braking and travel.

Toyota Material Handling, U.S.A., Inc.

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Durable Fabric Structures

are fully customizable

Combining rigid-frame engineering with the benefits of tension fabric membranes, fully customizable **fabric structures** provide flexibility for a wide array of applications and industries. The fabric buildings use a durable rigid frame to provide the ability to customize buildings to the exact width, length, and height required. In addition to long clear spans, the buildings have straight sidewalls that maximize the usable square footage inside the structure.

Legacy Building Solutions

MORE ONLINE: nedinfo.com/76479-80



Environmentally-Safe 3D Printing

A first of its kind 3D printer in the sub-\$5K category, **RIZE 2XC** uses a dual-extrusion system 3D printer unit from Sindoh Co., Ltd., which has been redesigned to run RIZE's RIZIUM portfolio of engineering-grade materials that are zero emissions, recyclable, moisture-resistant, and require minimal post-processing. RIZIUM materials are engineered for safety and user health by avoiding the airborne release of chemicals common in other filament-based 3D printers.

RIZE Inc.

MORE ONLINE: nedinfo.com/76479-81



3D Print From Anywhere

MakerBot CloudPrint allows teams to collaborate and share access to MakerBot 3D printers—even when working remotely. Prepare, queue, print, and monitor prints all from one cloud-based platform. Whether working in the same office or remotely around the world, Cloud Print allows teams to effectively work within teams both small and large.

MakerBot

MORE ONLINE: nedinfo.com/76479-82



Industrial Metal 3D Printer

Built on the EOS M 400 platform, the **AMCM M 4K** is tailored to produce large applications, with a height up to 1 m. Additional features include a robust frame design, an RFS 2.0 filter system, and optional soft recoating. Out-of-the-box, the AMCM M 4K can produce applications from a wide range of materials, including aluminum, nickel alloy, and copper alloy.

AMCM

MORE ONLINE: nedinfo.com/76479-83



Efficiently Cool 3D Printing Systems

The **Nextreme Recirculating Chiller Platform** offers temperature control of entire 3D printing systems including the power source, the laser or electron beam optics, and the thermal print head. The LCD touchscreen display allows the user to easily control temperature setpoints, flow and alarm settings, and coolant type while the coolant level can be monitored via the indicator window on the front panel.

Laird Thermal Systems

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Powder Bed Fusion Software

ESPRIT Additive for Powder

Bed is a program specifically for the powder bed fusion market; the program comes as an add-in application for SolidWorks—a CAD program. One standout feature of the software is the patented Part-to-Build. When preparing a part for manufacturing, the program automatically assigns exposure strategies based on simple inputs from the user.

DP Technology Corp.

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Tompkins International

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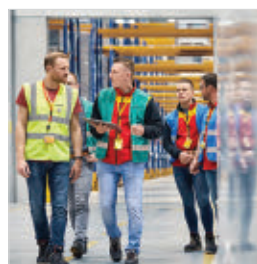
Unlimited Automation Freedom

With the ctrlX AUTOMATION platform, centralized and decentralized automation topologies can now be created flexibly. Thanks to a Linux real-time operating system, open standards, app programming technology, web-based engineering, and a comprehensive IoT connection, ctrlX AUTOMATION reduces the engineering time and effort by 30% to 50%.

Bosch Rexroth

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Platform Accelerates Warehouse Robotics Integration



A "plug & play" robotics platform, in collaboration with Microsoft and Blue Yonder, significantly reduces integration time and programming efforts to on-board automation devices into warehouse facilities, while giving customers

more flexibility in selecting suitable robotics systems according to their individual business needs. The solution leverages Microsoft Azure IoT and cloud platform services.

DHL Supply Chain

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Cobot Gripper Allows Manual Guidance

The fully electric HRC (Human-Robot-Collaborative) gripper model HRC-03 is a typical 2-jaw parallel gripper that has a maximum stroke of 10 mm per jaw and can be connected directly to the tool I/O connector on the robot flange. The gripper features a Free Drive Button, which allows the robot to be moved freely by hand to any position. This feature allows the operator to have both hands free to guide the robot.

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The Lincoln Electric Company

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Emerson Electric Co.

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Automate Nozzle Welding

PEMA Nozzle welding solution is a revolutionary system to increase the efficiency of pressure vessel production. Designed with flexibility and simplicity in mind, the solution is optimal for heavy-duty workpieces that contain thick plates and large, prepared grooves. The solution enables the automatic creation of robotic welding programs based on laser-scanned groove geometry.

Pemamek Oy

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Huntingdon Fusion Techniques HFT

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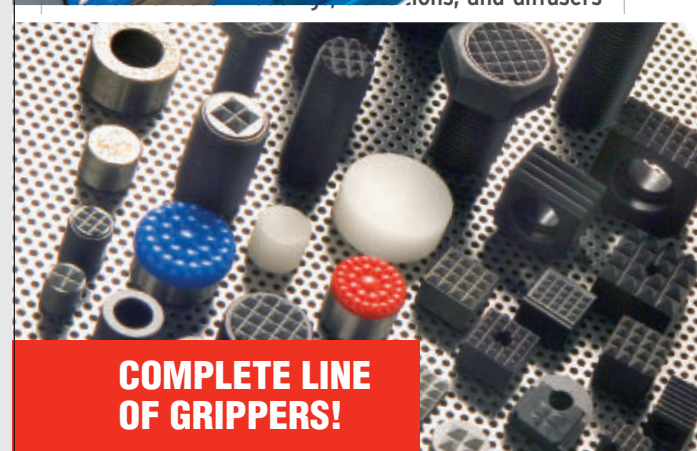


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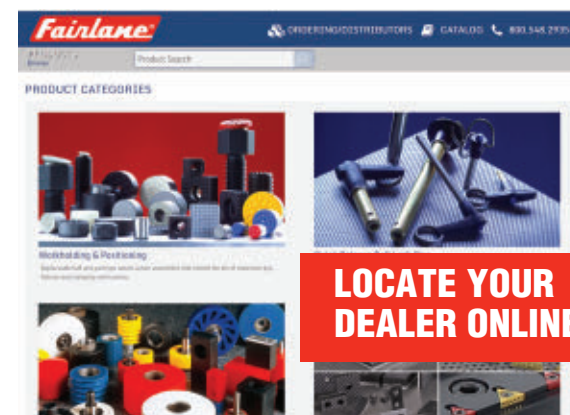
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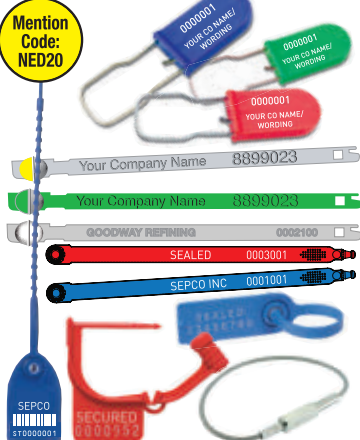
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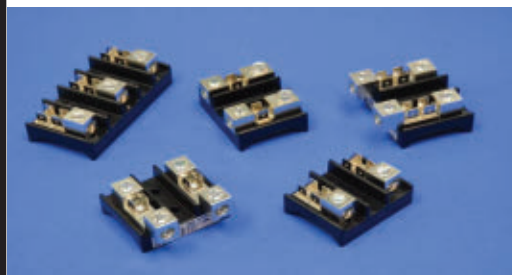
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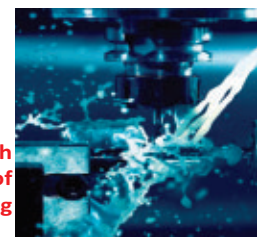
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Signaling Device Flags Infections can be easily integrated



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Pfannenberg USA

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Laser Marking Station marks all metals and plastics



The **XXL-Box** allows the marking of large parts. With an 820-mm depth and the ability to mark 520 mm parts high, this marking station has the largest volume on the market.

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- Control by the automation of a robotized cell
- Manual or motorized horizontal movement of the column
- Divider axis
- Drawer for heavy parts
- Suction and filtration system
- 3D marking or integrated reading system can be added at any time

The XXL-Box is equipped with a Ytterbium-doped fiber laser source. This latest generation technology is extremely durable, easy to implement, and requires no maintenance costs.

Capable of marking alphanumeric, barcode, and 2D Datamatrix codes in clear or deep text, the SIC MARKING laser marks all metals and plastics. The result obtained is readable with the naked eye or by proofreading cameras in a few hundredths of a second.

SIC Marking US

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Digital Panel Meter Exempt From Cybersecurity Threats

easily replaces obsolete analogs

Opening a new avenue for cybersecurity applications within Nuclear I&C rooms, the **Solid State Analog Meter (SSAM)** is a streamlined plug and play replacement of ANSI 4-in. analog meters. Designed without any digital assets and powered by CMOS logic, the SSAM series is built to easily replace obsolete analogs form, fit, and function using existing wires, panels, and necessitating only minimal operator training. The series features 4-20 and 10-50mA inputs, AC/DC Watts and Hertz or external power, and a patented signal failure alarm that warns the user of a signal or power loss for nearly an hour after the initial dead signal.

OTEK Corporation

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FROM THE EDITOR

An Uneventful Year

I spent the first nine months of my first fulltime gig in this business utterly faking it. I wrote an endless barrage of stories about giant, amazing machine tools. I fed the world dozens of articles hyping up the potential of 3D printers and outlining the potential-rich state of industrial robotics. But the fact is, I'd never actually seen any of these things in person. I'd interviewed hundreds of experts, I'd read thousands of articles and whitepapers about them, I spent my nights watching every YouTube video I could find to help me understand them better, but I'd never even touched a 3D printed part, let alone seen a machine in action.



This all changed that September as I stepped into the infinite halls of McCormick Place for my first IMTS. And there—from Mazak's city-sized booth filled with bus-sized machines chewing through metal like cotton candy, to Fanuc's giant robotic arms juggling sports cars, to (in a tiny booth way in the back) Stratasys showing off its progress in industrial 3D printing—it all suddenly made sense.

That particular IMTS was the single most enlightening experience of my professional life. I haven't missed one since—they are vital shows for me every September on even years, allowing me to watch every new design, every new technological breakthrough, every disruptive innovation ripple its way through the industry.

But this year, of course, there is no IMTS.

Of all the innumerable industries upended by the COVID-19 crisis—and our efforts to mitigate its reach—in-person events were one of the first hits. And a show like IMTS that crams 100,000+ people into those narrow aisles is no exception.

Canceling the event seems like the only responsible thing to do right now—there's no arguing with the decision. But I can't help feeling extra frustrated by this, even after six months of cancellations and disappointments.

COVID-19 hasn't stopped innovation. Quite the opposite. We're seeing whole new markets and product categories popping up seemingly out of nowhere every day, while plants and businesses across the industry discover a new need for novel applications of all these IIoT-driven, digitally transformational tools spilling onto the scene. And this is in addition to all the new products and new equipment scheduled long ago to launch at IMTS and all the iterative improvements to existing tools and equipment that occur along the way.

We're living through a once-in-a-generation manufacturing revolution here and we have nowhere to see it play out.

This has been a hard year—hard for just about everyone everywhere, for a whole host of reasons that only just starts with COVID-19. But as we put together this issue (the erstwhile IMTS preview edition) the realities of this frustrating year seem even more frustrating.

There is good work happening in the manufacturing world today—more good work and more progress than anything we've seen in decades. Innovation like this needs to be witnessed, it needs to be celebrated, people need to know about it so they can put it to work.

The state of the world may prevent us from doing this in person this year, but that's not going to stop us here. This has been our mission at NED throughout the crisis: to ensure that all of the new tools, equipment, and innovations hitting the market today still find their way to the engineers and plants that need them. We've redoubled our efforts to cover all these new products and to spread the word farther and with more impact than ever before.

This can't match the power of kicking tires and wandering through IMTS, of course, but all of our efforts are focused on making this brand, our ongoing virtual offerings, and the virtual conference & expo we are planning with our partners at IndustryWeek (www.mfgtechshow.com) provide a close second. For all the industrial powerhouses in need of the latest tools and equipment to keep the world afloat and for all the innovators trying to make an impact, we've got you.

T. Travis Hessman
Editor-in-Chief

Best Practices for Diagnosing and Correcting Soft Foot

Up to two-thirds of all rotating machinery have this problem, but it frequently goes unchecked.

By Ryan Best

Soft foot may sound like human foot disorder, but it is one of the most significant and most overlooked machinery alignment problems. Many experts estimate two-thirds of all rotating equipment in our production plants have this issue, yet it often goes undetected.

For those new to the problem, soft foot is machine-frame distortion. It happens when rotating machinery is positioned on its base, soleplate, or frame, and one or more of the “feet” fails to meet with the “foot points” on the frame adequately. A simple way of demonstrating the condition is to imagine a four-legged wooden chair and consider what would happen if one of the chair legs was shorter than the others. The chair would rock.

Same with machines; they’re set off-kilter by this distortion and will “rock” if each of the foot points on the base does not sit evenly. This ailment impacts their condition, performance, and long-term health. To correct the situation and achieve precise alignment, you must adjust all of the foot points and the entire machine frame.

Accurately identifying the reasons for soft foot in a machine and correcting it before attempting an alignment will save you time, money, energy, and potential disruption of production.

STEP 1: Learn to identify the causes, types, and effects of soft foot.

The ability to recognize the various causes, types, and effects of soft foot is a critical first step. With this knowledge, the technician is better equipped for the second step, which is to diagnose and correct the condition using specific tools.

What causes soft foot?

- Badly machined base or feet
- Warped base plate or frame
- Debris, dirt or paint under feet
- A cracked, damaged foundation
- Too many shims
- Damaged or bent feet
- Pipe strain
- Grout decay

Types of soft foot

Several categories of soft foot have been identified over the years: squishy foot, parallel soft foot, angular soft foot, and external force soft foot. Here’s a description of each type.

Squishy foot occurs when an overabundance of shims is applied to correct a soft foot problem. It also happens when a large amount of corrosion or debris builds up under the machine foot during an initial misalignment check. As the bolts are loosened during the repair, sediment and debris are released. This usually happens if the machine’s bolts haven’t been tightened for a long time—or if the machinery has never or rarely had the bolts loosened.

External force is a soft foot condition caused by electrical connections or severe misalignment in conjunction

with stiff coupling stress-induced external forces such as pipe strain. This condition is sometimes hard to diagnose and can happen at any time during machine alignment.

Parallel soft foot is the most common type of soft foot and is usually the easiest to spot. It occurs when a foot does not meet the base and produces a gap between the foot and the frame. When tightening the bolts, as the gap begins to close, the machine frame will start to warp to fit the baseplate, causing misalignment. Usually, the problem can be corrected by using shims unless you do not use the right thickness, or you use too many.

Angular soft foot occurs when a machine foot touches the base on either the side or outside of the foot. The other side of the foot is bent away, creating an angle between the base and the bottom of the foot. Angular soft foot is harder to diagnose because it takes place at an angle.

What are the effects of soft foot?

- Machine misalignment
- Distortion
- Bent shaft
- Increased load on bearings
- Misalignment of bearings
- Seal failure
- High vibration levels
- Increase in power consumption

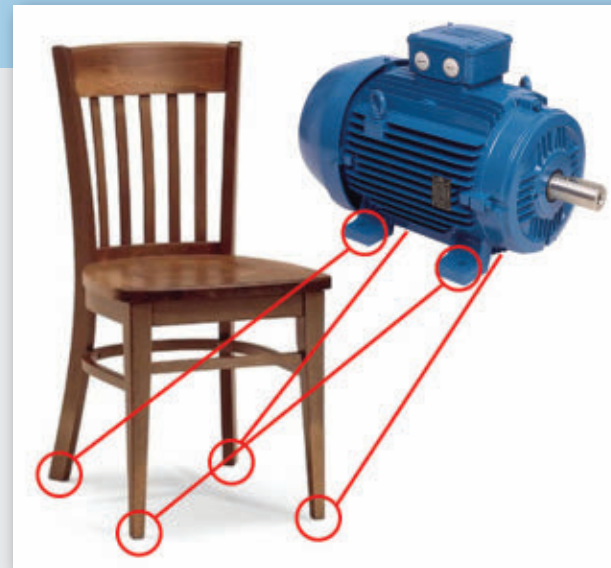
Any of these situations can destroy machinery if not checked.

STEP 2: How to diagnose and correct soft foot and the tools to use.

Undoubtedly, correcting a soft foot problem can sometimes be exasperating, partly because the process often takes longer than the subsequent machinery alignment. However, if you can stay relaxed and think strategically, there is always a sizable reward—preventing machine destruction. Measuring soft foot can be done in several ways. Confirming you have the right tools available will make diagnosis more straightforward and quicker. It’s vital to apply the procedures below during all machine alignments and installations to determine if a soft foot condition exists.

Here is a list of devices to help measure for soft foot, and tools to use to remove any debris found underneath and around the feet.

- **Feeler gauge:** Use a feeler gauge to measure gap widths or the space between two parts. The device contains numerous steel blades with diverse thicknesses that can measure up to a quarter (¼) inch to as little as 1/1000 of an inch.
- **Micrometer or digital caliper:** A micrometer can also measure gap thickness as well as confirm shim thickness. Before inserting shims under the feet, use a caliper to measure shim stacks to verify that the shims are the thickness as labeled and not defective
- **Wire brush:** Used to remove the debris or corrosion found when checking machinery feet.



• **Cleaner/degreaser:** Use a heavy-duty cleaner combined with the wire brush to degrease any current shims and contact surfaces while correcting soft foot. Brake cleaner usually works, but other popular commercial cleaners might also do the job.

• **Laser shaft alignment system:** A laser system is easy to use and can be very useful when measuring for soft foot. The advanced tool guides users through the measurement procedure using a sequence of screens leading to an auto diagnosis. A dual or single laser shaft alignment system can help correct the condition. However, a single-laser system is simpler to use and more intuitive.

Correcting soft foot with shims

An effective way to correct machine foot issues is by using shims. However, if the frame or mount is cracked, twisted, or bent, or another overall machinery destruction has emerged, correcting the condition can be more complicated.

The machine will most likely already have shims. It’s a good idea to clean any current ones and also clean the base plates and feet to eliminate any dirt and debris. It’s essential to remove any corrosion, paint, or grime that might have collected elsewhere to avoid accidentally creating a new condition, squishy foot, during alignment.

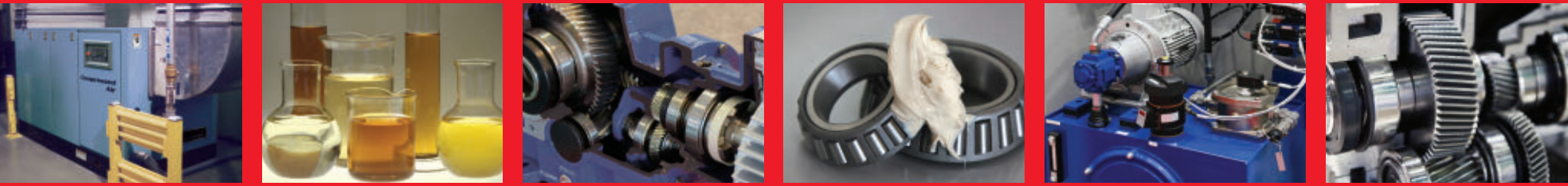
How to avoid squishy foot

Here are five rules to apply to ensure better that squishy foot does not form while trying to eliminate an existing soft foot condition.

- Shims come in many sizes, and large shims may be created on-site. When choosing the shim size, be sure to cover no less than 80% of the footprint.
- Do not add any more than four shims under each foot. Too many shims can cause a spring-like effect, i.e., squishy foot.
- Layer thin shims in between thick shims. It eliminates the potential for shim creasing and makes placement easier.
- Errors or defects sometimes occur during the shim manufacturing process. To make sure everything adds up, measure stacks with a micrometer to verify shim thickness.
- Best practices recommend measuring shims thicker than 0.030 to verify thickness. Other resources might suggest higher or lower depths, but all in all, it is up to the person doing the work.

By following these soft foot mitigation best practices, including applying the right methods and tools to diagnose and correct the condition accurately, your chances of resolving the problem and restoring machine health are much higher. Always remember to check for soft foot before aligning shafts. **NED**

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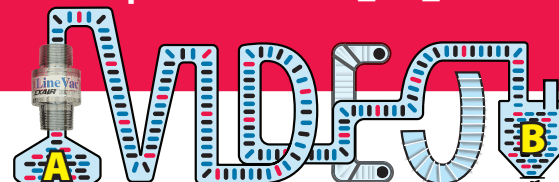
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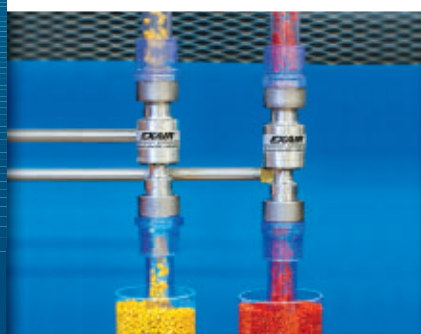
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