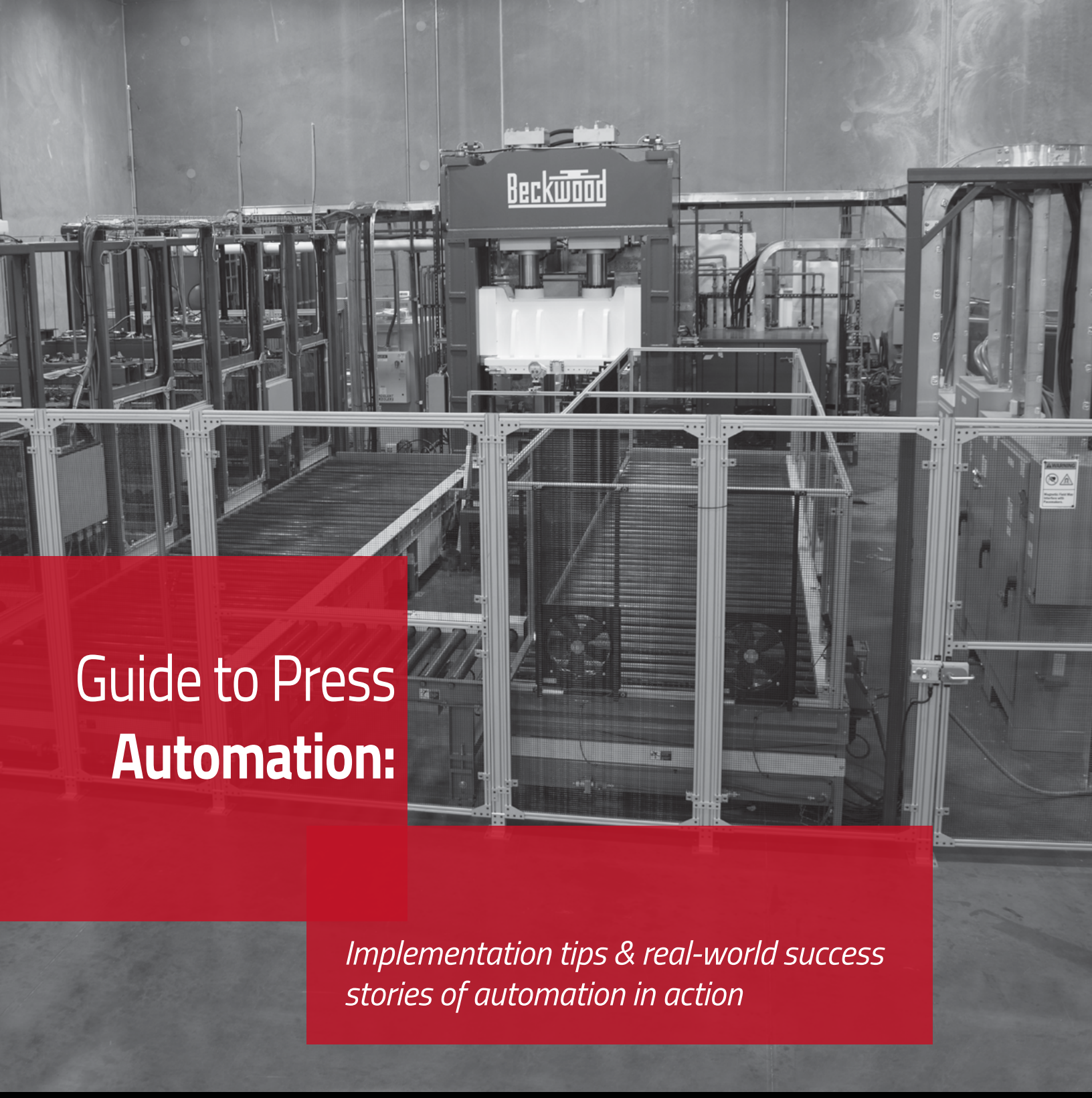


Guide to Press **Automation:**

Implementation tips & real-world success stories of automation in action

A Beckwood Press Company White Paper

Beckwood

Table of Contents

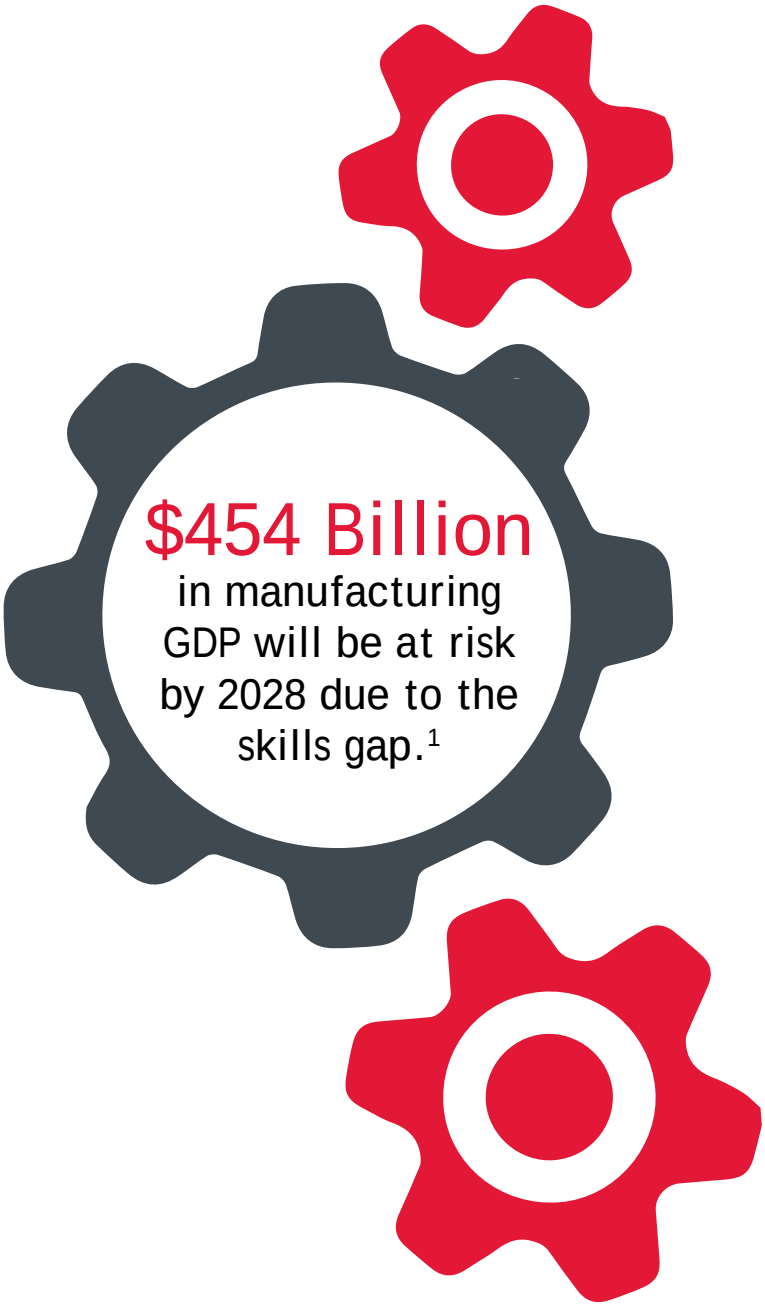
Beckwood

Introduction

Automation, in today's industrial landscape, takes a variety of forms. From conveyors and pick-and-place systems to robots, cobots and IIoT-connected machinery, finding ways to optimize internal processes to increase throughput is one of the biggest challenges manufacturers face.

Many people associate automation with increased speed, and while automation in workcells often increases throughput, its benefits stretch beyond pure speed.

Determining whether an operation is well-suited for automation hinges on a number of factors. This whitepaper explores how to know when your operation is ready to automate.

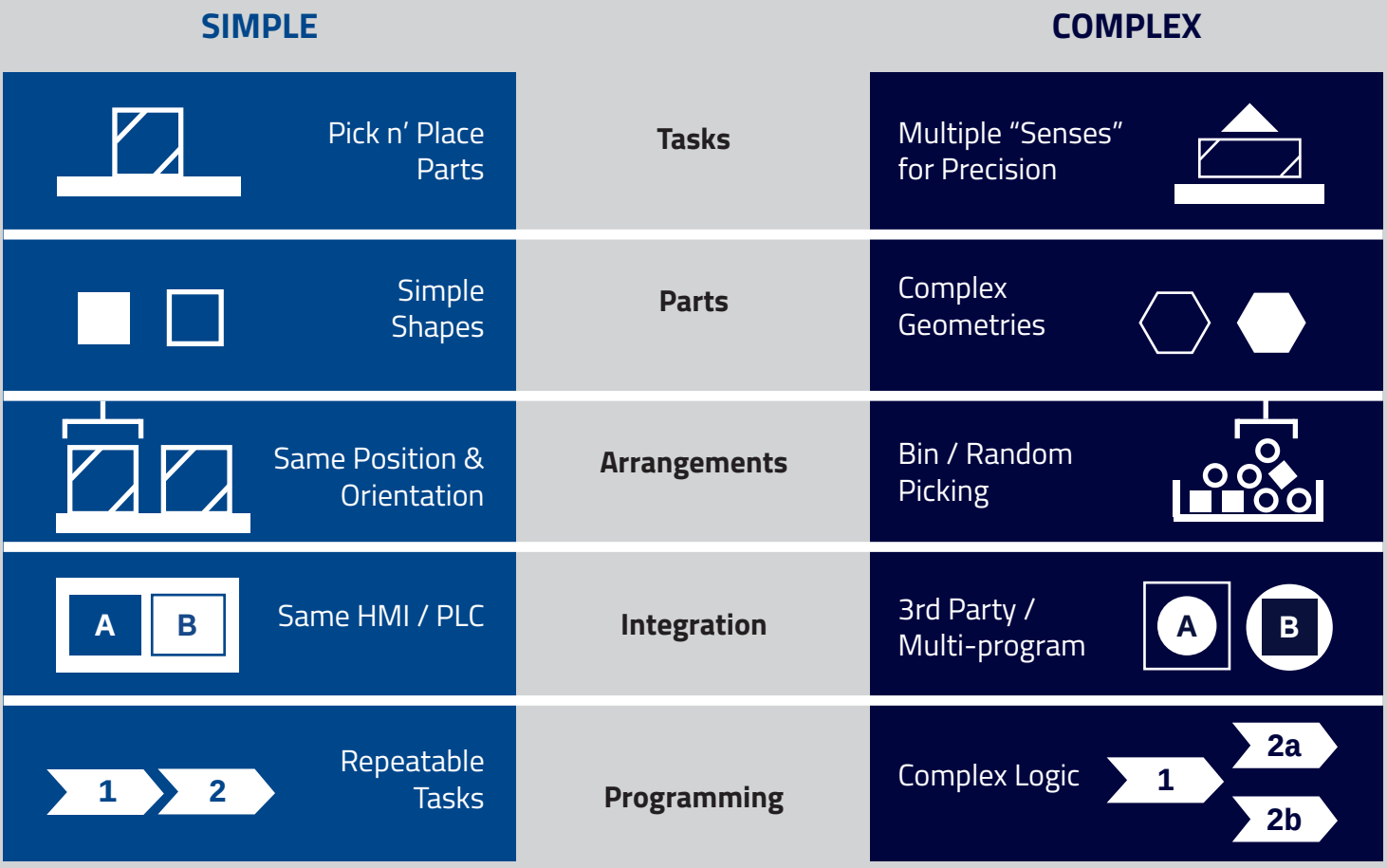


1. "Manufacturing Industry Faces Unprecedented Employment Shortfall: 2.4 Million Skilled Jobs Projected to Go Unfilled According to Deloitte and The Manufacturing Institute." n.d. The Manufacturing Institute. Accessed April 3, 2019. http://www.themanufacturinginstitute.org/News-Articles/2018/11/14-Skills-Gap-Report.aspx.

Optimizing Processes for Automation

Is your process repeatable?
In most cases, automation involves repetitive tasks that can be programmed in a black-and-white, repeatable manner. While some process variability can be overcome using vision systems and other quality control devices, a majority of applications that require a "human touch" will not be a great fit for automation.

PROCESS AUTOMATION



CASE STUDY:
Process Repeatability

Industry: Consumer Products

Application: Trimming

Automation Components:

- Servo-electric press
- Multi-axis conveyors
- Cognex Camera
- ABB Robot
- Vacuum Port

A Beckwood customer wanted to automate their trimming operation in order to reduce cycle times and scrap rates. Their existing system relied on operators manually placing parts into the press, which often led to misalignment, unnecessary die wear, and poor part quality.

Beckwood engineers worked with the customer to create a standardized production plan that was used to design a fully-automated cell.

The cell includes a custom Beckwood servo-electric press in conjunction with an ABB robot, in-feed and out-feed multi-axis conveyors, a Cognex In-sight 7801 series camera, and a vacuum port for scrap removal.

With their new process map and workcell, the customer is now able to trim parts in less than five (5) seconds with very little human interaction.

Beckwood

Improving Operator Safety

How does operator safety affect your production line?

Even the most experienced workers are at risk for musculoskeletal and repetitive stress injuries like strains, sprains, and tears. Many times, these injuries can even be chronic or career ending. In addition, fostering an inclusive work environment means machines should be built for all workers, including those with disabilities or physical limitations.

Many manufacturers choose to automate a process or a workflow to improve employee safety and well-being. For example, if a particular process requires an operator to continuously lift a part beyond their ergonomic weight limit, or if the cell layout requires an operator to continuously twist in an unnatural manner, automation can be a great way to mitigate the potential risk of injury. Integrating a Safety PLC to act as a communication bridge between production equipment provides a robust safety system for personnel working around the cell and protection for the equipment itself.

To ensure all governmental regulations are met, some companies even opt to use software like Safety Automation Builder® from Rockwell Automation to design a safety system that fits their operational and organizational safety goals.

2. "Employer-Reported Workplace Injury and Illnesses, 2017." 2018. U.S. Bureau of Labor Statistics. U.S. Bureau of Labor Statistics November 8, 2018. https://www.bls.gov/news.release/osh.nr0.htm.
3. "Workplace Injuries." n.d. National Safety Council - Our Mission Is Safety. Accessed April 5, 2019. https://www.nsc.org/work-safety/tools-resources/infographics/workplace-injuries.

CASE STUDY:
Shuttle Systems for Operator Safety

Industry: Defense

Application: Draw Forming

Automation Components:

- Triform 20-10-10 hydroforming press
- T-rail die staging system

Lawrence Livermore National Laboratory (LLNL) was using a decades-old hydroforming press for R&D and part production. While it made sufficient parts, it lacked the controls sophistication to make the process repeatable. Additionally, complex tool and diaphragm changes resulted in unwanted downtime. Looking for a better solution, LLNL turned to Beckwood.

Beckwood engineered and built a Triform model 20-10-10 deep draw sheet hydroforming press with an intuitive controls system that allowed LLNL to quickly and accurately control both punch position and diaphragm pressure for up to 30 individual recipe steps per cycle.

To facilitate faster die changes, Triform engineers developed an automated "T-rail" die staging system. The T-rail allows operators to prepare a second tooling cartridge while the primary cartridge is running production. Once production ends, the first tool shuttles out and the second tool shuttles into place using die rollers.

Using the T-rail has resulted in lower risk of operator injury during the die changeover process.

Beckwood

Eliminating Unplanned Downtime

How is downtime impacting your production?

Manufacturers today need more control over their processes to ensure they are running at peak efficiency. To gain this level of control, data not only needs to be gathered from production equipment, it needs to be processed, analyzed, and reported in easily digestible formats that result in quick action from management.

IIoT technologies, like Beckwood's PPM and OEE systems, automatically track machine performance by monitoring key performance indicators (KPIs). Managers can view machine status in real time and generate custom reports at programmable intervals. This technology not only monitors the number of cycles ran during the previous shift, it also provides insight as to why the machine was idle during certain times and allows maintenance to be scheduled at a time that is most convenient for the production schedule.

Determining Your IoT Readiness

The following questionnaire is designed ro help manufacturers who are looking to initiate an Industrial IoT strategy or expand upon one that already exists[4]:

1. Have you inventoried your processes, machines, and equipment that are not currently being monitored?
2. Is your organization reviewing and interpreting the data provided by your connected machinery? Are you optimizing how the data is presented?
3. Are you sharing the real-time data with employees and stakeholders?
4. Can you use the data you are collecting to improve existing products or develop new ones?
5. Have you evaluated cloud-based data platforms for computing, storage, and analytics?
6. Have you compiled and trained an internal team to build and oversee your IoT strategy?
7. Have you identified which elements of your IoT strategy will be done in-house vs. through a third-party vendor?
8. Are you planning to hire candidates with specialized data analysis skills to support your IoT strategy?

4. "The Internet of Things: What It Means for US Manufacturing." 2015. New York: PwC. Accessed April 5, 2019. http://www.themanufacturinginstitute.org/Research/Disruptive-Innovations-in-Manufacturing/~/media/659a17245f6f4375bcce889079427cb6.ashx.

CASE STUDY:
Using IoT to Eliminate Downtime

Industry: Automotive

Application: Trimming

Automation Components:

- 165-ton hydraulic gib-guided press
- Hydraulic bed shuttle
- Pre-preventive maintenance system

An automotive supplier needed a new trim press to manufacture components for vehicle interiors. As a critical-path piece of equipment, up-time was paramount.

Beckwood designed a custom 165-ton trim press with an on-board Pre-Preventive Maintenance System (PPM) to monitor system and component health and relay critical data to key stakeholders throughout the organization.

The configurable nature of Beckwood's PPM system ensures the customer's critical data is collected, analyzed, and distributed quickly and accurately. When early signs of required maintenance arise, the press pinpoints the affected component or system then sends automatic notifications to the operator, maintenance team, and Beckwood's service team.

More than 40 different action items and notifications, including alarms, warnings, safety system status, oil health, filter status, and valve performance are programmed into the PPM system with acceptable operating parameters for each metric.

While the PPM system offers a step-by-step guide for the customer to perform the required maintenance, Beckwood technicians can also connect remotely to the press at any time via the PressLink Connect Module. This extra support facilitates fast, easy troubleshooting, program updates, and distance learning.

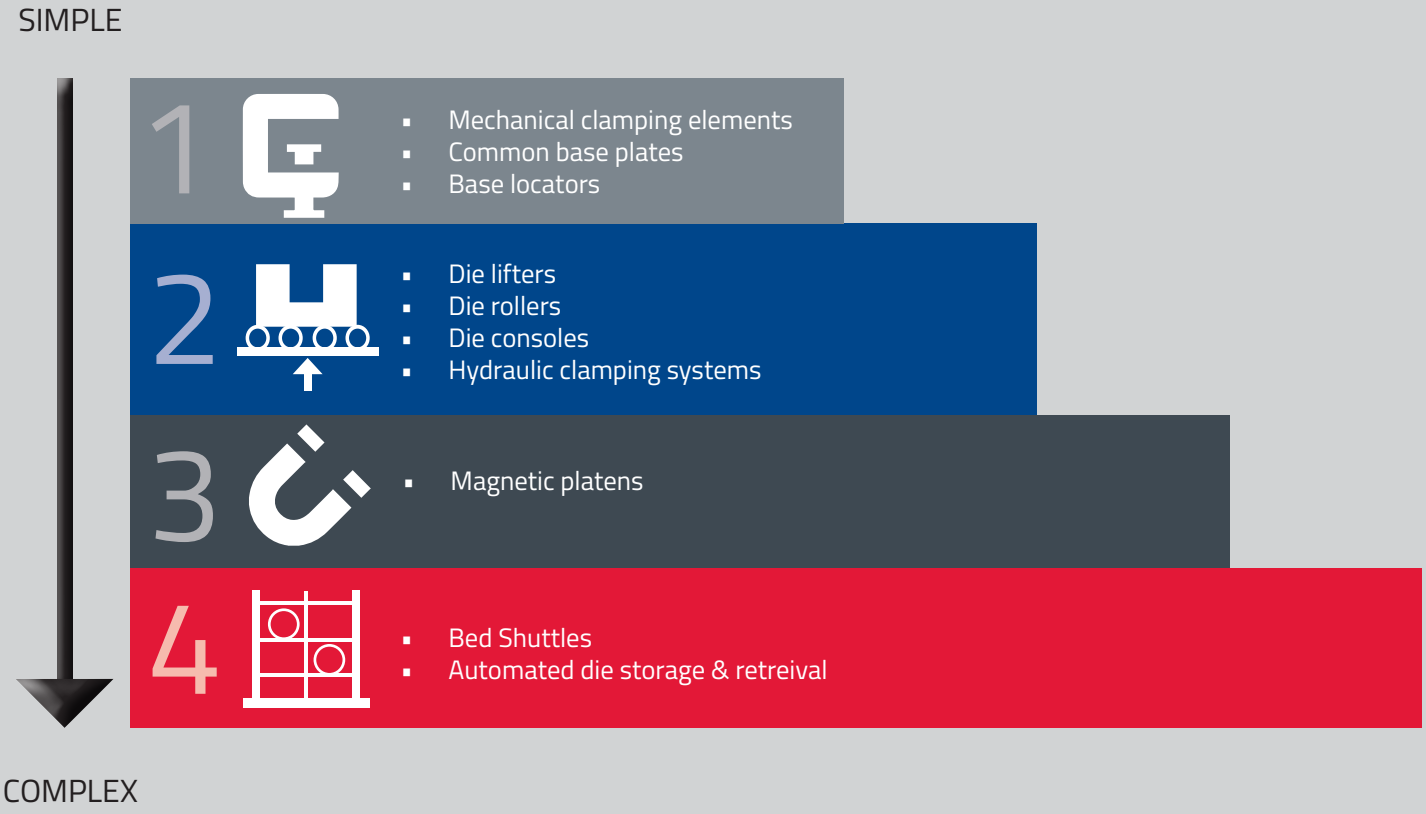
Beckwood

Installing a Quick Die Change System

How many die changes are required per shift?

With manufacturers more reliant on lean and JIT manufacturing, production runs are becoming shorter, resulting in more changeovers. Automating the die change process can result in huge time savings, but it takes more than just die clamps. A high-efficiency Quick Die Change System (QDC) should also include an Automated Storage and Retrieval System (ASRS) for automatic transfer of the tool into the press in conjunction with automatic clamping.

QUICK DIE CHANGE SYSTEM OPTIONS



CASE STUDY:
Automated Storage & Retrieval Systems

Industry: Aerospace

Application: Bulge Forming

Automation Components:

- (2) High-tonnage bulge forming presses
- (2) Automated storage & retrieval systems (ASRS)
- (2) Trolley carts
- (2) T-rail systems

A leading aerospace supplier purchased two high-tonnage triple action presses from Beckwood but needed a way to automate the die changeover process. Beckwood worked with the customer's engineers to devise a high-efficiency Quick Die Change System (QDC) with Automated Storage and Retrieval (ASRS) for automatic transfer of the tool into the press.

The ASRS can manipulate tools weighing up to 15,000-lbs and utilizes a trolley cart and T-table to stage upcoming dies while the press is running production. When the current run ends and the press is ready for changeover, airbags lift the tool, allowing it to be shuttled from the T-table into the press. Once in position, hydraulic clamps lock the tool in place, completing the die change sequence.

While the newly loaded tool is running production, the ASRS returns the previous tool to its storage location and begins to stage the next tool.

With the ASRS, this aerospace customer reduced changeover time from 2 hours to 10 minutes, with zero human touches, adding 3.5 hours of production during a typical 8 hour shift.

Beckwood

Preparing Products for Secondary Operations

Does your application require a secondary operation after formation? The use of robots and high-quality industrial cameras ensure finished parts meet stringent quality standards and are oriented for processing in a secondary operation. These automated quality-control systems are unbiased, repeatable, and can check parts in milliseconds without increasing production time.

Quality Inspection & Process Automation

Automated inspection systems make the production process more efficient, safe, and profitable. The severity of quality control issues varies depending on industry, but they can cause competitive and regulatory concerns. Consider these commonly used processes to determine the best fit for your operation[5/6/7]:

1. Alignment Feedback & Guidance: When assembling components, vision systems can provide alignment and positional feedback. Integrated PLCs and HMIs communicate data to the various machines for smooth transitions throughout the process.
2. Dimensional Measurement: Clearly defined part specifications command the system to identify critical parameters with tight tolerances. This is typically easy to develop and validate with statistical methods like measurement system analysis.
3. Surface Inspection: This can be based on cosmetic or functionality standards. The challenge lies in defining quantifiable defects that can be "seen" by the machines. In most cases the defect needs to occur and be noted before it can be corrected, which costs time, labor, and raw materials.
4. Material Presence: Control material movement through the production line and prepare it for the next stage in the workflow.
5. Part Orientation: Checks and balances ensure components are aligned correctly. Protecting the parts and tooling in difficult sensing applications.
6. Quality Control: Sophisticated vision systems validate defined standards without the risk of human error. This requires a catalog of all detectable defects and a collection of parts that are defective or nearly defective.
7. Tolerance Monitoring: Integrated systems collect data and use feedback loops to maintain multiple processes simultaneously. Machine temperature, final part positioning, die wear, and edge quality can all be monitored and reported on for continuous process improvement.
8. Traceability & Verification: Barcode detection and verification using RFID scanners can provide traceability throughout the entire process. Dedicated inspection systems integrated with packaging and logistics systems also provide further visibility beyond the shop floor.

5. Hamfeld, Helmut. 2016. "6 Factors to Consider Before Moving to Automated Inspection." Machine Design. July 6, 2016. https://www.machinedesign.com/manufacturing-equipment/6-factors-consider-moving-automated-inspection.
6. "Vision Inspection." n.d. Vision Inspection: Technology | ATS Automation. Accessed April 11, 2019. https://www.atsautomation.com/en/Technology/Vision Inspection.aspx.
7. Greenfield, David. 2015. "5 Keys to Automated Quality Inspection." 5 Keys to Automated Quality Inspection | Automation World. Automation World. May 5, 2015. https://www.automationworld.com/5-keys-automated-quality-inspection.

CASE STUDY:
Quality Control for Secondary Operations

Industry: HVAC

Application: Assembly

Automation Components:

- 115-ton hydraulic trimming Press
- In-feed & Out-feed conveyors
- RFID scanner
- Cognex Camera
- Go / No-Go indicator

A Beckwood customer wanted to automate the quality control of their trimming operation to ensure that the trimmed part was ready for the next stage of production. Frequently, their dies would become dull and fail to fully penetrate the rubber material. This caused the customer to use a manual inspection process that cost time and money.

Beckwood installed a vision system on the rear of the press to verify that flanges are fully removed from the finished part and conveyed into the scrap bin below. It also ensures that the part is oriented properly for the next stage of production. Depending on the inspection results, the camera will indicate to the operator via the HMI whether the part meets their internal quality requirements.

Conclusion

Low Budget? No Problem.

Due to the competitive nature of the automation industry, costs have decreased significantly and technology gains have allowed for more ROI-friendly automation. What might have been too expensive five years ago is worth checking out again.

	QUANTIFIABLE	NON-QUANTIFIABLE
TANGIBLE	**Quadrant I** • Material cost reduction • Labor savings • Inventory reduction • Scrap/waste reduction • Increased capacity	**Quadrant II** (Generally cost related) • Setup reduction • Elimination of non-value added activities - moves - inspection • Reduced manufacturing lead time • Reduced administration cycle time • Increased plant safety
INTANGIBLE	**Quadrant III** (Generally revenue related) • Increased flexibility • Improved quality • Increased market share due to new product/innovation • Price premiums due to shorter lead times	**Quadrant IV** • Improved employee morale • Improved work environment • Ability to attract better employees • Better skilled employees • Perceived technology leadership by customer • Customer requirements satisfied • Regulatory requirements met

Calculating the ROI on a complex automation system can be challenging. The Association for Manufacturing Technology (AMT) recommends looking at both tangible and intangible benefits and offers the above guide for determining ROI.[8]

Getting Started

With today's emerging technologies, integrating an automation system into your production line is easier than you may think. The PLCs commonly used to control press functionality are integrated with communication protocols that allow the machine's OEM, the end-user, or a 3rd party automation firm to seamlessly integrate a variety of automation devices including robots, linear pick-and-place or transfer systems, automated die retrieval systems, etc. into the functionality or sequence of the press.

8. "Twelve Steps to Successful Automated Manufacturing Systems." n.d. McLean, VA: The Association for Manufacturing Technology. Accessed April 5, 2019. http://www.amtonline.org/article_download.cfm?article_id=21861.

Your Automation Readiness Checklist

Since 1976, Beckwood Press Company has been engineering, manufacturing, and servicing the world's toughest hydraulic and servo-electric forming equipment from our headquarters in St. Louis, Missouri. Our customers leverage our nearly half a century of engineering and manufacturing experience to gain process efficiencies and a competitive edge.

When you buy a Beckwood press, you should feel proud that you support American manufacturing and gain peace of mind knowing that your press is Built for you. Built to last. Built in the USA.

Beckwood

2086 Fenton Logistics Park
St. Louis, MO 63026
800.737.0111
sales@beckwoodpress.com