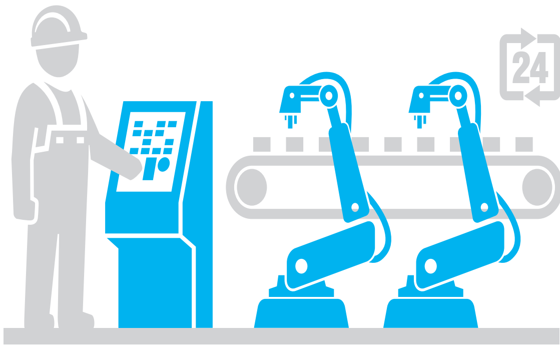
Error Proofing with Barcodes

PYRAMID SOLUTIONS

VISIONARY SOLUTIONS ▲ EXCEPTIONAL RESULTS

CELEBRATING 25 YEARS OF INNOVATION



Error proofing can be defined as the use of any automatic device or method that prevents an error or makes it immediately obvious once an error has occurred. Proper error proofing can reduce scrap and rework which results in better first time quality and greater throughput. Error proofing improves manufacturing efficiency, shipment schedules and decreases production costs. Certainly, these potential benefits warrant a closer look at error proofing.

Today, manufacturers integrate error proofing into their production environment with methods that range from simple inspection to automated alerts and alarms to product or even process modification. This whitepaper will take a closer look at error proofing within manufacturing through process modification. Specifically through the use of barcodes and barcode scanners.

Illustration: Injection Molding Machine

Consider a manufacturing application that has not yet employed barcodes or any modern error proofing techniques. Let's start with an injection molding machine (IMM) that produces plastic parts of various styles and sizes. Assume that the machine is run by one production operator, is equipped with a Programmable Logic Controller (PLC) and an associated Human Machine Interface (HMI) panel. As customer orders are received and accumulated by the plant, a batch production schedule is generated and loaded at the IMM machine. In this example, our batch order also triggers a die change to support the required production run of parts.

Typically at the beginning of a new batch order:

- The maintenance team installs a freshly prepared set of dies.
- The set up procedure of new dies includes running test pieces through the machine to ensure that all parts produced meet the customer's specifications. Other parts may be required for inspection to check for flashing, mold wear, or warpage that could affect the quality of the part. All parts produced during this set up procedure are then scrapped.
- To start the batch production run, the operator selects the part program using the HMI panel.
- After each cycle, the operator places a preprinted sticky label onto the part, indicating items such as style, part number, lot number and date produced.
- The part is then stacked into a bin or shipping container until a logistics operator removes and replaces it with an empty container.
- With each cycle of the mold machine, the PLC updates its counter until the batch order is complete.

Typically at the end of the shift:

A production supervisor writes down the amount of parts produced from each of the machine, and submits them to the front office. The front office then takes that data and enters it into the Materials Resource Planning (MRP) or Enterprise Resource Planning (ERP) System such that inventories of raw material and finished goods accounted are adjusted.

Note: Scrap has not necessarily been accounted for in our example above. An indeterminate amount of scrap was created during the set up process. Further, unknown factors such as raw material issues, machine malfunctions or operator error can cause an unpredictable amount of scrap produced during the running of the batch. To compensate for these inconsistencies, manufacturers typically estimate the amount of scrap produced from normal set up and production. These estimates may be characterized as “losses”, “shrinkage” or simply as “fudge factors”.

These fudge factors translate to a fixed number of pieces or raw material that must be backflushed from inventory. As you can imagine this process is prone to errors. Other process deficiencies exist that may also cause error:

1. There was no confirmation that the installed die mold set matched the part presented on the work order or the part program. It is not a stretch to imagine that the production of similar, but incorrect parts, could have continued through the process unnoticed by the production operator.
2. There was no confirmation that the preprinted label attached to the part matched the actual part produced.
3. There was no accurate container part count before the lift truck operator removed and replaced the container.

Adding Barcodes

To alleviate the described problems above, consider the use of barcodes. Barcodes are typically recognized as a paper label that has been fixed to a part or asset. In addition, barcodes may be etched onto a part in a process called “direct part marking” (DPM) for permanent part identification. DPM is primarily used for metal parts.

Traditional barcode technology is based on unevenly spaced “bars.” These codes, such as grocery store UPC barcodes, are termed one dimensional or 1D barcodes. Newer 2D barcodes systematically represent data using two dimensional symbols and shapes. The 2D barcodes can represent significantly more data in a single barcode than can a 1D barcode.

The following matrix outlines the different barcodes used today and their capabilities.

Technology	Application	Length	Use On	Permanence
1D barcode	Identification	Short	Anything accepting adhesive.	Depends on label stock.
2D barcode	Identification, data	Long	Anything accepting adhesive.	Depends on label stock.
DPM	Identification	Short	Hard (metal, plastic)	Yes

In manufacturing, barcodes are primarily used to identify parts or assets, including people. Some of the typical uses include:

- Check in to identify the part’s location and user.
- Trigger to display messages, work instructions or alerts.
- Identify part details and specs.
- Verify that correct part or tool is selected.
- Identify past users who worked with the part.
- Request changes to part.
- Access log notes.
- Report bugs.

Now, consider again the injection molding process illustration and explore how barcodes could be used to error proof the process and increase output with less opportunity for fudge factors.

The first potential problem previously outlined was that there is no immediate way to tell if the die set matches the part presented on the work order. Barcode solution:

- Attach a permanent barcode on each die.

- Print maintenance work orders with the associated barcodes of the die set.
- Place a unique barcode to each injection mold machine.

With the proper barcodes in place, the maintenance operator sets up the machine for the next run of parts as follows:

- Scan the work order barcode which contains the part number to produce. This information is then stored in the PLC.
- Scan the barcode on the die set to verify the work order number and die set are correctly matched.
- Scan the barcode on the injection mold machine to verify that the die set is qualified to be fitted to this machine.
- Once all three of the barcodes are verified, the correct program is selected on the corresponding HMI automatically, without production operator intervention.

To sum up, we can look beyond this injection molding example and envision a broader implementation of barcodes throughout the entire production process. Most other initiatives for barcode, use such as inventory management or track and trace, are also a form of error proofing.

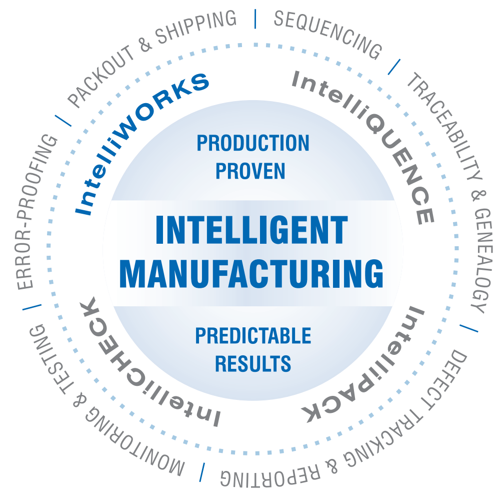
For example, track and trace initiatives require the capture and retention of such data as: material lot number, production date, time and shift, or even the specific production line, machine, tool or operator for each specific part produced. Further, by mapping operator ID with training databases, manufactures can provide further error proofing. All of this can be achieved with the deployment of barcodes.

Barcode data tracking is one of the most widely used forms of error proofing in manufacturing plants today. Successful implementation yields higher quality, better first time quality, less rework, improved manufacturing efficiency, and overall lower costs in manufacturing.

Your Error Proofing Solution: IntelliWORKS

IntelliWORKS redefines error-proofing in complex production environments. Integrating a robust combination of error-proofing, Poka Yoke, operator assistance and quality control functions to ensure the proper selection of parts.

Enabling complex assembly of customized products on a single line, IntelliWORKS provides early warning of quality and assembly issues in real time, proactively preventing defects. As a result, IntelliWORKS reduces manpower requirements, as well as costly scrap and repair operations.



Error-proofing features in IntelliWORKS leverage innovative, highly flexible technologies to deliver business benefits that extend from the plant manager to the line operator. By assuring high quality first-run assemblies, minimizing operator training, and reducing production costs, IntelliWORKS will dramatically enhance the reliability, performance, and flexibility of your assembly operations and increase revenues.

About Pyramid Solutions, Inc.

Pyramid Solutions is an innovative leader in the design and development of industrial automation solutions for discrete manufacturing and assembly operations. Specializing in production systems that focus on error proofing, sequencing, lot traceability, quality and manufacturing intelligence. Our expertise in cost effective and flexible systems offer our customers the options required to remain competitive and profitable.

Whether the solution is designed around our manufacturing execution system (MES) or a completely custom solution tailored to meet your specific needs, our experienced team of engineers will deliver an effective, flexible system that provides repeatability, control and the visibility necessary to manage your production environment.

PYRAMID SOLUTIONS

VISIONARY SOLUTIONS ▲ EXCEPTIONAL RESULTS

CELEBRATING 25 YEARS OF INNOVATION

For more information, visit

mfg.pyramidsolutions.com