

Jidoka Module 15

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Jidoka

Jidoka uses mistake proofing methods, such as poka-yoke, self check, and successive check, as well as visual control. We will review those methods in the Mistake Proofing Module.

This module will focus on the Jidoka principle of separating human work from machine or equipment work.

Jidoka: Key Points

- ▶ **Jidoka** is a pillar of the Global Production System.
- ▶ The key concept of **Jidoka** is one-by-one confirmation to detect abnormalities.
- ▶ There are four key principles that should always be followed when applying **Jidoka**.
- ▶ **Jidoka** is used by team members to drive continuous improvement in the quality and reliability of every process through a four step process.
- ▶ **Jidoka** brings human intelligence into the automation process with autonomation, to reduce product defect and process malfunctions.

Jidoka Principles

The four key principles of **Jidoka** are:

1. Stop and respond to every abnormality.
2. Separate machine work from human work.
3. Enable machines to detect abnormalities and stop autonomously.
4. Assure quality of everything by confirming the outcome of every process step.

These principles should be followed whenever applying **Jidoka** to a process.

Jidoka: Four Step Process

When applying **Jidoka** to a mistake prone process these four steps should be followed:

1. Detect Abnormalities.
2. Stop - Set up the production system to detect abnormalities and stop itself so quality is not affected.
3. Fix or correct.
4. Install countermeasures - The management system responds to abnormalities and installs countermeasures.

Functions of Jidoka

The main functions of ***Jidoka*** are:

- ▶ Separation of equipment or machine work from human work.
- ▶ Development of defect prevention devices.
- ▶ Elimination of defects and improvement of quality at earlier stages.
- ▶ Reduction in delays in the process flow due to defects, rework, supervision, and inspection of machines.

Standard Work Combination Sheets can be used to help distinguish or transition human work from machine work.

Functions of Jidoka

Separation of human work from machine/equipment work.

Jidoka calls for the gradual shifting of all human work to machine work, such as watching equipment for abnormalities in operation.

Development of defect prevention devices.

Instead of requiring human supervisors, equipment or machines should have the ability to detect and prevent defects from occurring or passing to the next step of a process.

Application of jidoka to process flow.

As soon as a problem or defect occurs, stop the process and take corrective measures immediately to prevent the defect from happening again. Jidoka reduces delays and stops in flow due to machine supervision, malfunctions, or defect production.

Jidoka and Autonomation

- ▶ Autonomation means “intelligent automation” or “humanized automation”.
- ▶ **Jidoka** brings human intelligence into the automation process to ensure reliability, flexibility, and precision.
- ▶ Autonomation reduces **product defects** and **process malfunctions**.
- ▶ **Jidoka** must proceed carefully. Bold steps to fully automate processes can disrupt the flow, which can in turn increase defects.
- ▶ With **Jidoka**, an automated process is sufficiently “aware” of itself so that it will:
 - ▶ Detect process malfunctions or defects.
 - ▶ Stop itself.
 - ▶ Alert the person operating the equipment.

For healthcare, Jidoka puts a powerful Toyota-proven concept into the hands of the team members, enabling the achievement of zero defects. If applied with innovation and discipline, it can eliminate harm to the patient.

Jidoka - From Manual Labor to Automation

There are four steps to transitioning from manual labor to automation. Each of these steps is concerned with the relationship between people and machines.

Step 1: Manual labor. Manual labor means that all of the work is done by hand. This makes sense only when the labor costs are cheap and/or the manual work can be done very quickly.

Example: IV infusions were originally administered manually. The RN would have to hang the IV bag, manually clamp the line and count the drip rate. The RN would also have to watch for the infusion to be complete and/or for problems with the infusion.

Step 2: Mechanization. Mechanization leaves part of the manual operations to a machine. Work is shared between the team member and the machine, but the team member still does the lion's share.

Example: Mechanization was introduced into the infusion process by placing a device on the IV line that would allow the RN to partially clamp the line to adjust the drip rate and then leave while the solution is infusing.

Jidoka - From Manual Labor to Autonomation

Step 3: Automation. At this step, all manual labor in processing is taken over by the machine. The person operating the machine just sets up the work and starts the machine. The team member can leave the machine alone at that point, but there is no way to know whether the machine is producing a defective result.

Example: IV pumps allowed the RN to set up the IV, and program the drip rate as well as the amount of time that the infusion would run. These early IV pumps did not have the ability to alert the RN for every possible defect, such as air in the line.

Step 4: Jidoka (Autonomation). The team member simply sets up the work, starts the machine, and leaves the machine to do the processing. In this case, however, the machine itself will detect when a defect has occurred and will automatically shut off.

Example: Modern IV pumps can be set up with multiple solutions, programmed and will alert for any defect and shut off the pump until the defect has been corrected

In addition to defect detection devices, **jidoka** sometimes includes auto-input (auto-feed) and auto-output (auto-extract) devices that completely eliminate the need for team member participation.

Separating Machines from Humans

Jidoka enables equipment to run without human assistance or supervision.

Separating people from machines requires careful consideration:

- ▶ Analyze the person's operations.
- ▶ Apply jidoka to each step, one at a time.
- ▶ Be cautious when investing time and money in automating a process. It is important that new equipment does not disrupt the flow of the process due to production of defects or problems.
- ▶ Consider the ratio of labor costs to equipment costs at all times.

Jidoka must proceed carefully, one step at a time.

Example of Jidoka in Healthcare

Infusion (IV) Pump:

The machine is set up by a care provider.

The machine runs.

The machine stops and an alarm goes off when there is a problem.

- Solution runs out.
- Line is occluded.
- Air is detected.

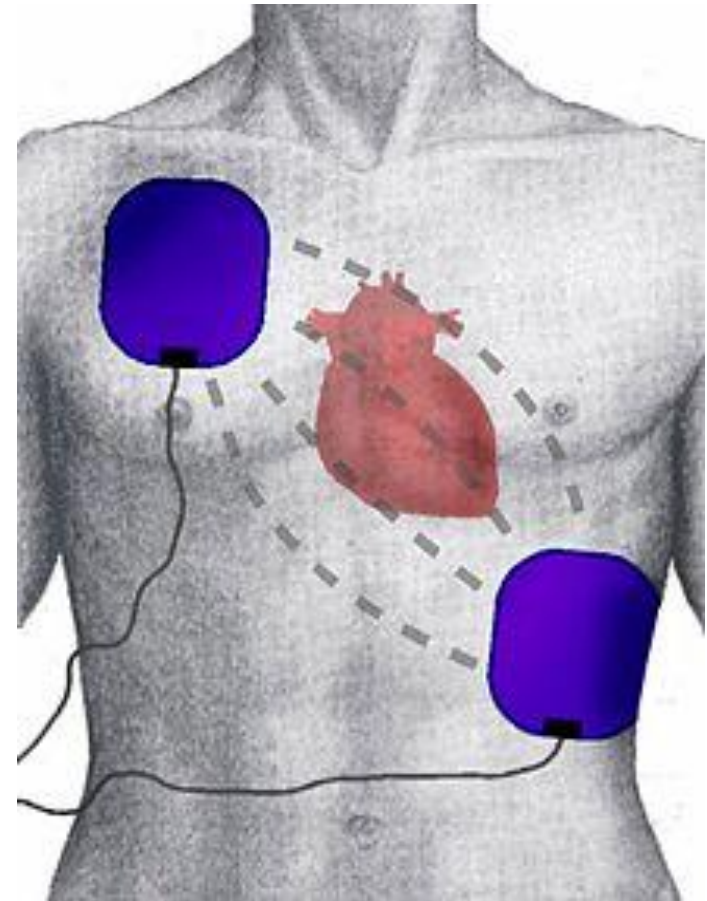


Applying Jidoka in Healthcare

The Automated External Defibrillator or AED

Defibrillation uses a specific machine (defibrillator) to shock a person's heart back into a normal/safe rhythm.

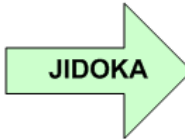
Use of a defibrillator in the wrong situation can cause the patient severe injury or death.



Applying Jidoka in Healthcare: The AED

Open Chest Application

Closed Chest Application



Human work	Machine work
<ul style="list-style-type: none"> • Determine appropriateness of treatment • Bring patient to machine • Perform surgery to expose heart • Adjust machine • Place paddles in correct location • Start machine • Recharge machine 	<ul style="list-style-type: none"> • Delivers charge to heart directly

Human work	Machine work
<ul style="list-style-type: none"> • Determine appropriateness of treatment • Bring patient to machine • Adjust machine • Place paddles in correct location • Start machine • Recharge machine 	<ul style="list-style-type: none"> • Delivers charge to heart indirectly

Surgical expertise is no longer needed.



Applying Jidoka in Healthcare: Any Layperson can use the Machine

Portable Device with Trained Medical Personnel

Human work

- Determine appropriateness of treatment
- Place paddles in correct location
- Start machine

Machine work

- Travels to patient
- Indicates correct paddle location
- Self-adjusts charge
- Delivers charge
- Recharges automatically

JIDOKA

Portable Device for Non-Medical Person

Human work

- Start machine
- Place paddles on patient

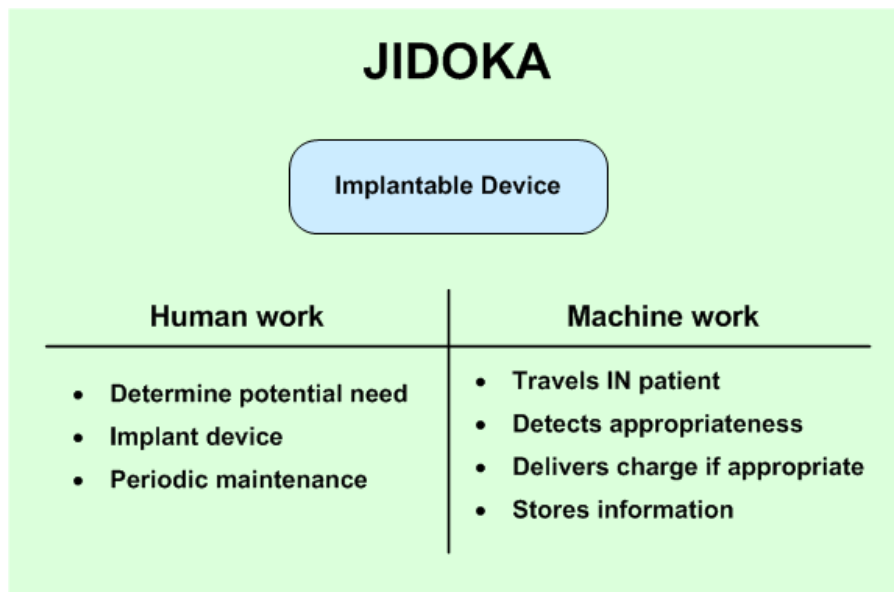
Machine work

- Travels to patient
- Detects appropriateness
- Delivers charge if appropriate
- Recharges automatically

- The machine travels to the patient.
- The machine automatically detects the necessary condition – will not discharge if correct cardiac pattern not detected.
- The placement of paddles is indicated by pictures.
- The machine indicates when it needs maintenance.
- The directions for using the machine are in pictures so literacy in language is not required.



Applying Jidoka in Healthcare – Implantable AED



- Now the device is where it is needed – in **the** patient.
- The device detects when it is needed and discharges.
- Needs periodic maintenance but no human is required to deliver function.
- *Human intelligence is in the machine!*



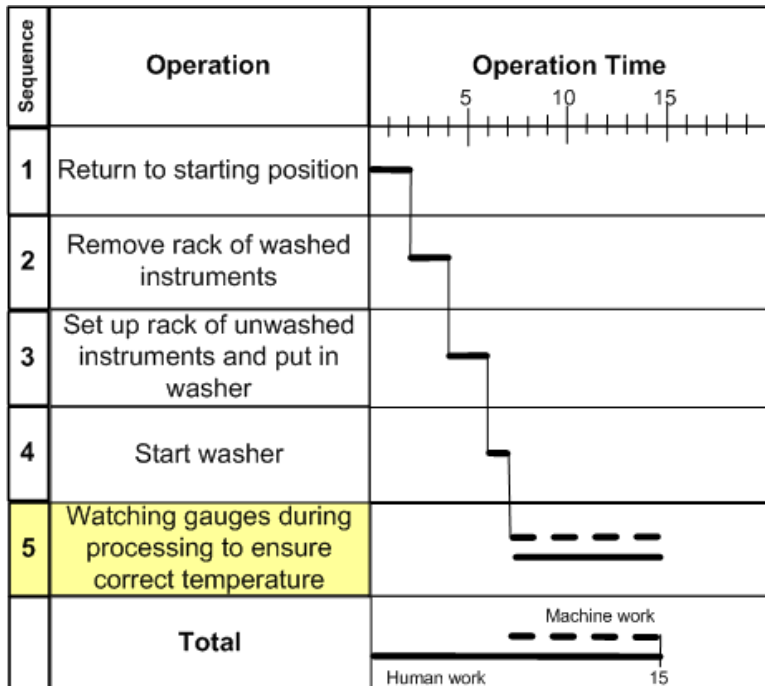
Jidoka Summary

- ▶ There are four key principles to Jidoka.
- ▶ Four steps should be followed when applying Jidoka to a mistake prone process.
- ▶ **Jidoka** brings human intelligence into the automation process to ensure reliability, flexibility, and precision.
- ▶ There are four steps in transitioning to Jidoka – manual labor, mechanization, automation, and jidoka (autonomation).
- ▶ Jidoka enables a process to keep equipment running without human assistance or supervision.
- ▶ Separating team members from machines should be done carefully and thoughtfully.
- ▶ Apply jidoka to prevent defects from being passed downstream and/or to prevent overproduction.

Using the standard work
combination sheet to
apply Jidoka.



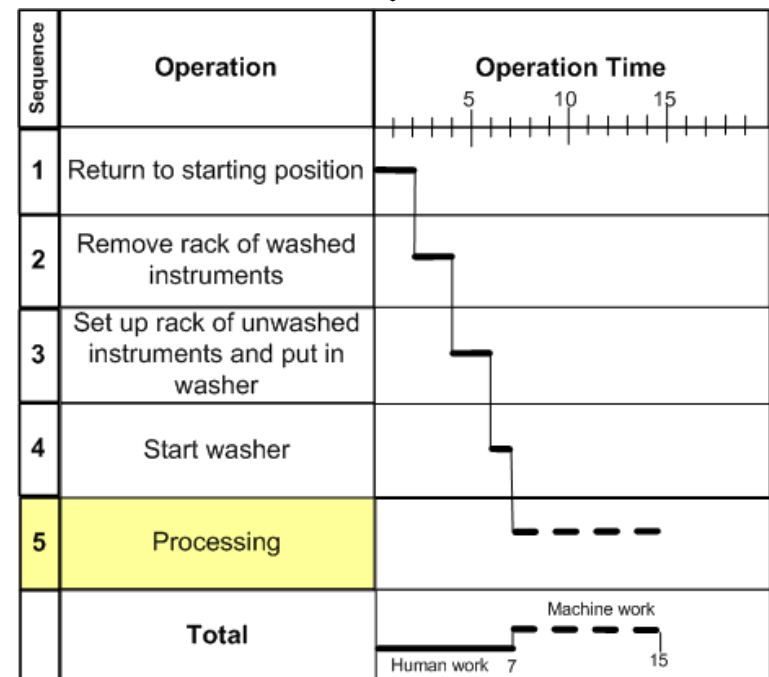
Separating Human Work from Machine Work



The above five operations can be expressed in a Standard Work Combination Sheet to help distinguish human work from machine work.

As long as operations proceed as described above, the team member cannot be completely separated from the machine. The machine must be customized to enable the team member's separation. The following describes a procedure for separating the team member.

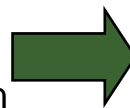
Step 1: Apply jidoka to the processing step. Do not worry about automating the processing step, since it is nearly always automated already. Start by considering this step and noting it on a Standard Work Combination Sheet.



Separating Human Work from Machine Work

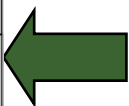
Step 2: Apply *jidoka* to the step requiring the team member to stay connected to the machine. For the washer, this means automating the task of watching the gauges to ensure the correct temperature by adding an automatic alarm.

Once the processing and the gauge watching have been automated, separate the team member from the machine, at least during the processing. This takes us to the first stage *in jidoka*: separating the team member.



Sequence	Operation	Operation Time
		5 10 15
1	Return to starting position	
2	Remove rack of washed instruments	
3	Set up rack of unwashed instruments and put in washer	
4	Start washer	
5	Processing	
	Total	Human work 7 Machine work 15

Sequence	Operation	Operation Time
		5 10 15
1	Return to starting position	
2	Remove rack of washed instruments	
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4	Start washer	
5	Processing	
	Total	Human work 7 Machine work 15



At this stage, the team member still has to extract the rack of clean items from the washer and set up the next rack for processing before starting the machine. This pair of manual operations is called the “output/input” procedure or the “detach/attach” procedure.

Step 3: Apply *jidoka* to the task of returning to starting position. For a washer to handle processing all by itself, it must be able to fully stop when the processing is completed. Next, it should be able to return the rack holding the clean items to the position it occupied before processing, such as opening the door and extending the rack. This is the next step for *jidoka*, which is expressed in the Standard Work Combination Sheet shown.

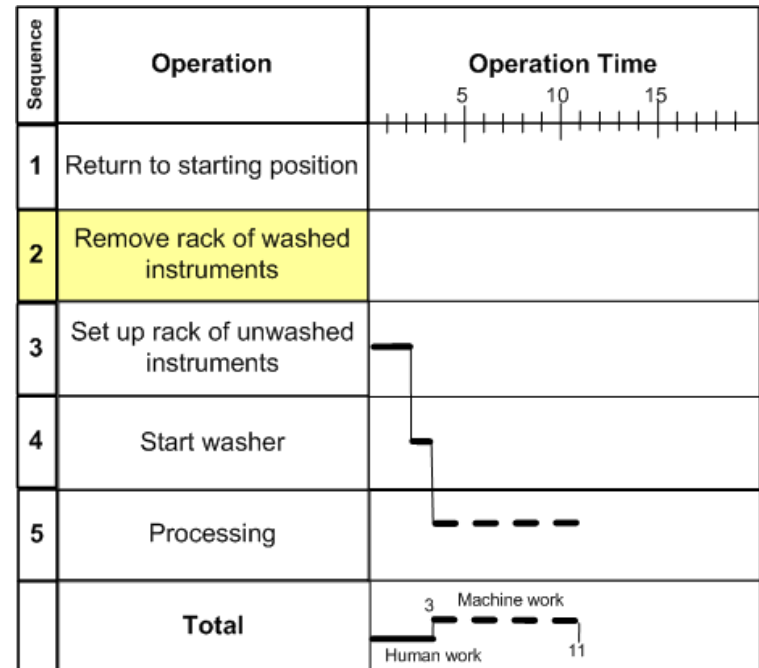
Separating Human Work from Machine Work

Step 4: Apply *jidoka* to removing the processed work – the clean instruments. Removing and setting up work pieces are two of the operations encompassed by machine-centered material handling. In JIT production, consider applying *jidoka* to both of these operations. In deciding whether or not to automate them, the main criterion is the amount of equipment cost incurred. The more complicated automating the material handling operation becomes and the more precision required of it, the more expensive it will be.

It usually entails a lot more complexity and precision to set up work. Instead, setup tasks usually require the precision and versatility of industrial robots. For the washer, it could be a simplified form of a robot – mechanizing the loading dirty racks from delivery carts and unloading of clean ones onto delivery carts.

Therefore, it makes more sense to avoid trying to automate the setup procedure if it turns out that doing it by manual labor is cheaper than buying industrial robots to do the job or mechanizing the step. Instead, channel *jidoka* efforts toward the less demanding procedure of removing work pieces.

This means that the team member’s job (for a series of two work cycles) changes from “remove/setup/ remove/setup” to simply “setup/setup.”



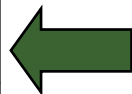
Separating Human Work from Machine Work

Step 5: Apply jidoka to setting up the unprocessed item and starting the machine. At this point, the only remaining manual operation is setting up the rack and hitting the start button. Often, the same device that is able to set up the work automatically and precisely is also able to activate the machine automatically.

When a lot of precision is needed for the setup procedure, automation may require expensive mechanisms, such as industrial robots. Therefore, make a careful study of costs: Which is cheaper in the long run – manual setup or automated setup?

- To summarize**, the key points in automating processes are:
- Team members must be completely separated from the machines.
 - The machines must be equipped with defect - detection devices.
 - Automation must be developed one step at a time.
 - Continual attention must be paid to comparing manual labor costs with equipment investment costs.

Sequence	Operation	Operation Time	
		Manual	Machine
1	Return to starting position	0-5	
2	Remove rack of washed instruments	5-10	
3	Set up rack of unwashed instruments	10-15	
4	Start washer	15-18	
5	Processing		18-22
	Total		22



How the Standard Work Combination Sheet would look if we manage to automate both the setup procedure and the machine activation procedure.