

Multi-Process Operations Module 17

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Multi-Process Operations: Key Points

- ▶ **Multi-process handling:** Tasks or machines of an entire sequence of processes are grouped together to enable a worker to move with the work from process to process.
- ▶ **Multi-process operations** balance the relationship between productivity and humanity.
- ▶ Multi-process operations differ from multi-unit operations: multi-process operations are the **key to one-piece flow**.
- ▶ Review the **eight key points** about multi-process operations and learn the seven new precautions.
- ▶ The **five-step training** procedure emphasizes show them, tell them, have them do it, and praise them.

Horizontal Multi-unit Operations Versus Vertical Multi-process Operations

Multi-unit operations. One worker handles several processing machines or steps, performing the same type of process, or task.

Multi-process operations. One worker handles several processes (arranged according to the processing sequence).

Multi-process operations are the key to one-piece flow production.

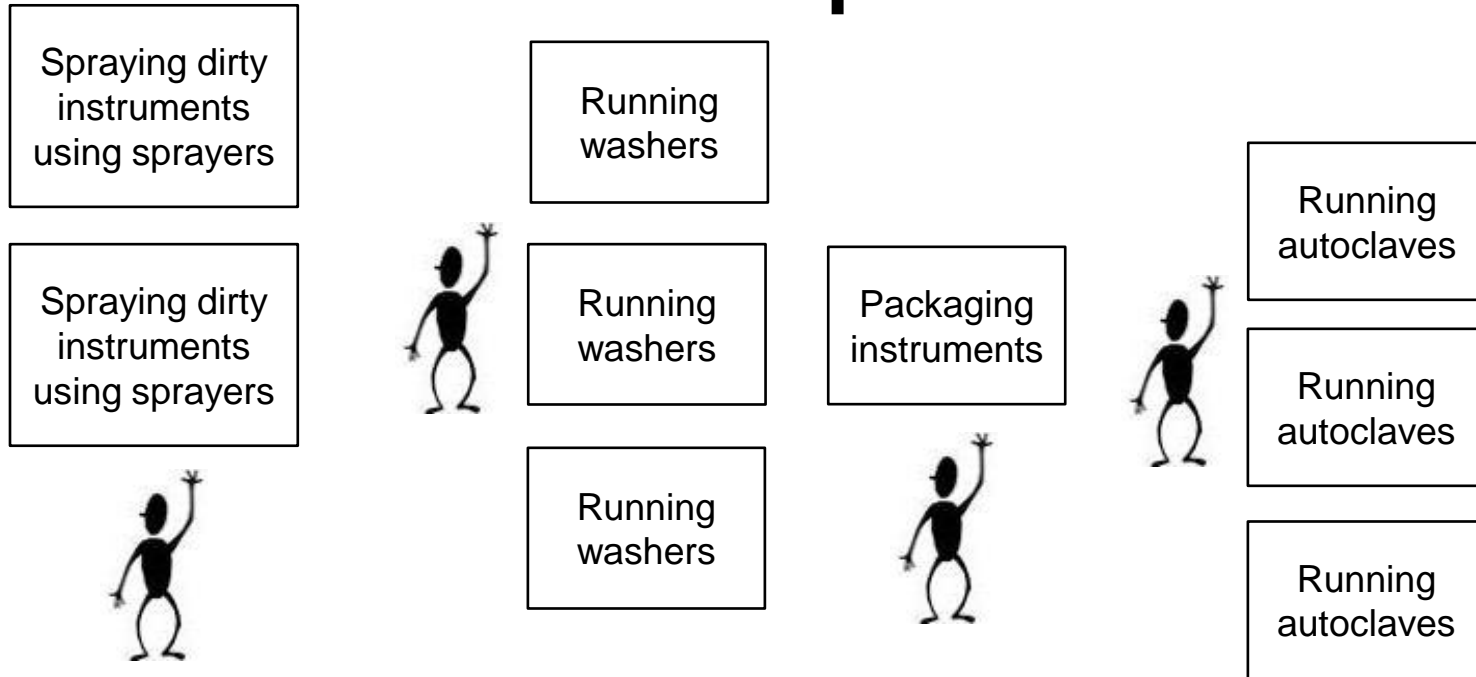
Without multi-process operations, there can be no JIT production system.

Horizontal Multi-unit Operations Versus Vertical Multi-process Operations

Distinguish between the grouping of tasks or machines that all serve a certain processing function (**multi-unit process stations**) and tasks or machines that provide a sequence of processing functions needed to complete a certain process (**multi-process production line**).

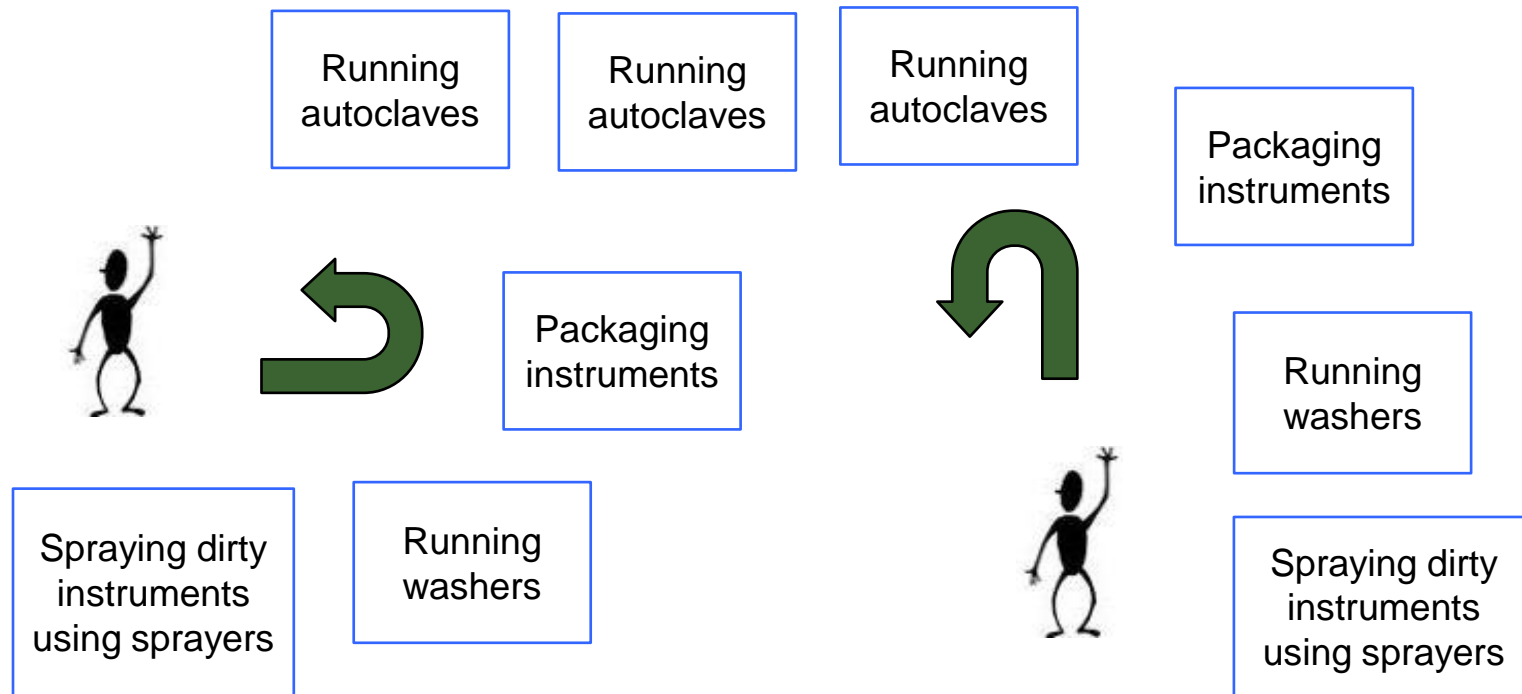
When work is divided into **single-skill tasks**, **more team members are needed** to operate a process or production line and it is more difficult to reduce or redeploy the number of team members when demand changes. Multi-process operations easily determine the minimum number of team members needed for any particular amount of output.

Multi-Unit Operations



- In this process, each team member runs only one type of machine doing one type of task in the process.
- If demand is lower, some team members will be idle because the other members can run only their machines in the process.
- It is difficult to redeploy anyone – who will do their task?

Multi-Unit Operations



- Two cells are created with cross-trained staff.
- With a different layout and training, the operations now require fewer team members.
- If demand changes, it is easier to add or redeploy a team member.

Multi-Process Operations Questions

Question: Don't multi-process operations present problems with labor unions?

Most unions are “craft unions” with specialization of the skills of the members. This specialization can make it difficult to introduce multi-process operations.

*It is **critical** to include union representatives in improvement training and events.*

Question: If all workers in our organization needed to learn to handle multi-process operations, wouldn't that incur a tremendous amount of training costs?

Look to create less expensive ways to train workers. Staff could spend one hour each day watching skilled team members do their work.

Create standard work that is simple and easy to understand for every step and train to the standard work. Develop a skills matrix to track each team member's training on the standard work and their skill level.

Think about the costs that are reduced due to reduction in rework, defect, inventory, and overproduction



Multi-process Operations: Eight Key Points

Point 1: Establish U-shaped processing cells.

Abandon the traditional layout of shish-kabob production, and set up a “flow shop” arrangement where process steps/equipment is laid out according to processing sequence.

Various machines are lined up in a closely linked processing cell. In this kind of cell, U-shaped lines are better than straight lines. Straight lines create waste by making the staff walk farther.

The staff learn how to handle all the processes in the cell. As a result, a smaller number of staff could produce the same output.

U-shaped cells in healthcare operations

- Sterile processing
- Laboratory testing
- Surgical case cart picking
- Inpatient units – RNs are assigned to a U-shaped cell consisting of patient rooms
- Surgical services – U-shaped cell is the patient’s journey from prep to recovery

Multi-process Operations: Eight Key Points

Point 2: Abolish processing islands.

Processing islands are full of waste caused by:

- Independent processing rhythms and the resulting idle time for some workers
- Less obvious operating methods that are not standardized
- An isolated “island” operating at its own pitch with workers keeping inventories of supplies to keep the process going

Processing islands in healthcare operations

Think about the journey of a cancer patient getting chemotherapy. Each step of their visit is a “processing island” existing in different locations – registration, exam by the MD or RN, lab work, imaging, infusion – creating long lead times and waste.

Multi-process Operations: Eight Key Points

Point 3: Make the equipment smaller.

Equipment only needs to work fast enough to keep up with the cycle time. We do not need fast, large, and expensive general-purpose equipment when the job can be done using slower, smaller and cheaper machines that perform only specialized tasks. Getting the right kind of equipment is the first step in bringing all equipment into a single line.

Point 4: Standing while working.

Standing while working is a basic requirement for multi-process operations. Workers can more easily help their neighboring workers and eliminate idle time.

Point 5: Multiple skills training.

Multiple skills training is necessary for workers handling multi-process operations. The key to success in multi-process operations is simplifying the processing step/machines so they perform only the essential processing function and do not require frequent fine-tuning.

Multi-process Operations: Eight Key Points

Point 6: Separate human work from machine work (jidoka).

Make a clear distinction between work done by people and work done by machines. Separate people from machines whenever possible.

By distinguishing between human work and machine work, the team member can leave the machine to do its work while he or she goes on to the next task that requires human intelligence and know-how.

Develop devices and techniques that promote “jidoka” (human automation) and “poka-yoke” (mistake proofing).



Separating human work from machine work in healthcare.

- Today's IV pump signals the staff when the IV bag is empty, the line is blocked, or there is air in the line – all work the RN had to do in the past.
- By making the machine more “intelligent” the RN is able to do more patient care that requires nursing expertise.

Multi-process Operations: Eight Key Points

Point 7: Human automation and poka-yoke.

Once the team member can let the machine operate on its own, he or she is free to turn to the next task. But what if the machine starts producing defects without anyone there to notice? Do we have to keep a team member there just to watch for abnormalities? If so, we are not separating human work from machine work.

Human automation and poka-yoke prevent defects by automatically detecting them and stopping.

Point 8: Safety first.

After beginning multi-process operations, pay close attention to safety. Everyone should be aware that “safety takes precedence over everything else.”

One safety point is to keep start buttons separate from the machine so operators will be at a safe distance when machines start working – for example, as is done for x-ray and other imaging equipment. Other useful safety devices include machine covers and electric eyes that shut off the machines when anything or anyone approaches them.

Precautions and Procedures for Developing Multi-Process Operations

1. Make work procedures as simple as possible.

- In some cases staff will need to learn certain procedures that take a long time to master or involve special skills.
- Simplify work procedures for easy comprehension. In addition to simplification, thorough standardization makes multiple skills for multi-process operations easier to learn.

2. Leaders should provide proper guidance.

- Effective leadership from managers and leads is essential in multiple skills training.
- Managers, leads, and other supervisors should understand the processes and put that knowledge to use in helping staff learn multiple skills for multi-process operations.

Precautions and Procedures for Developing Multi-Process Operations

3. Transparent operations.

- When teaching new work operations, explain the operations and steps as clearly and fully as possible. This is called “transparent operations.”
- Uncover and elucidate all the details considered “givens.” These “transparent operations” ensure that even an unskilled worker has all the information he or she needs to perform the job correctly.
- Avoid “oral tradition” of know-how that gets passed from person to person. Information must be explicit. Job guidelines and standard work must contain clear descriptions of thoroughly standardized operations.

4. Implement mult-process operations.

- Implement multi-process operations throughout the clinical area or department.
- Multiple skills deteriorate if only taught for certain processes or isolated areas.
- Put the full authority of leadership into promoting organization-wide multiple skills training. Use whatever vehicles of communication are available (such as in-house newsletters and presentations) to issue progress reports on multiple skills training.
- Hold “multiple skills contests” to present awards of recognition to the best trainees.

Precautions and Procedures for Developing Multi-Process Operations

5. Promote perseverance and set successive goals.

- Multiple skills training requires perseverance.
- Trainees have to be constantly encouraged to “hang in there” no matter what problems they encounter.
- There is no rush—the key is to take all the time you need to accomplish the training.
- Be systematic by clearly scheduling the various steps in multiple skills training.
- Create reference charts, such as a multiple skills training schedule or a multiple skills score sheet, for an at-a-glance display of each trainee’s progress.

6. Make prompt equipment modifications.

- Modify equipment to make it easier to use or to enable the separation of human work from machine work.
- Sometimes production engineers or equipment maintenance staff refuse to make equipment improvements.
- If equipment improvements are simple enough, equipment operators or supervisors may be able to make the improvements themselves.

Precautions and Procedures for Developing Multi-Process Operations

7. Absolute Safety.

- Since multiple skills training requires novices to learn new processing steps or to operate new types of processing equipment, make sure the training is not hazardous to the team member or the patient.
- If even one accident or injury occurs during the training, it will likely have an adverse impact on morale and willingness to learn.
- Avoid all possible hazards.

Ensure absolute safety: perform safety checks during the design and operation of new process steps or equipment and adopt a safety-minded discipline.

Five Steps to Setup for Multi-Process Training

Step 1: Create multiple skills training teams.

If the department or unit has a small-group staff programs or meetings, simply set up multiple skills training as a new agenda item within the meeting or program. Help put trainees at ease and set the stage for the challenge of developing multi-process operations.

Step 2: Clarify what the trainees' current skills are for each process.

- Before beginning multiple skills training, find out what skills and strengths the operator trainees already have and describe them.
- Enter the trainees' names on a chart and mark "skilled" or "unskilled" next to each process to indicate whether each trainee has the skills required for each process.
- Make separate current ability marks when special skills are required in the process.

If possible, evaluate current skills using multiple levels.

A five-level skills evaluation might be organized as:

- Level 1: Unable to do the operation.
- Level 2: Able to do the operation is someone else does the setup.
- Level 3: Can generally do the operation, but needs minor guidance.
- Level 4: Can do the operation well, except under unusual conditions.
- Level 5: Can do the entire operation well.

Five Steps to Setup for Multi-Process Training

Step 3: Use a multiple skills training schedule.

- Set separate targets for each trainee whose current skills were just evaluated in step 2.
- Keep it simple by displaying person-specific lists of current conditions and targets, rather than process- or skill-specific lists.
- Avoid numerical indicators if more easily understood graphic ones can be used. Popular graphic display formats for this include multiple skills score sheets and multiple skills maps.

Multiple Skill Training Schedule

Multiple Skill Training Schedule															Department: <u>ER</u> Manager: <u>Lilah</u>				
○ Unable to do process ◐ Can generally do process ● Can do process well															By: <u>Katherine</u> Date: <u>March 29/12</u>				
Process No.	Process Name														Current Date	Target Date			
No.	Employee Name	Creation of reg's for important	Creation of reg's for important	Creation of reg's for important															
1.	Stacy C	●	○	●	○	○	○	○	○	○	○	○	○	○	○	○	○	Mar 30	04/6
2.	Melody L.	●	○	●	○	○	○	○	○	○	○	○	○	○	○	○	○	Mar 30	04/6
3.	Anne B	●	○	●	○	○	○	○	○	○	○	○	○	○	○	○	○	Mar 29	04/6
4.	Lisa B	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		04/6
5.	Laurie B	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		04/6
6.	Kelly U	●	○	●	○	○	○	○	○	○	○	○	○	○	○	○	○	Mar 29	04/6
7.	Bonnie N	●	○	●	○	○	○	○	○	○	○	○	○	○	○	○	○	Mar 30	04/6
8.	Lisa L.	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		04/6
9.	Kristin B	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		04/6
10.	Amanda E.	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○		04/6

Five Steps to Setup for Multi-Process Training

Step 4: Create a multiple skills training schedule to make effective use of overtime hours and other opportunities.

- After setting specific targets for every worker, set up a multiple skills training schedule tailored to each worker's objectives.
- Avoid using the noon hour or lunchtimes. It is better to use evening overtime hours.
- For training in U-shaped cells, pair up trainees with experienced workers until they keep pace with the cycle time.

Five Steps to Setup for Multi-Process Training

Step 5: Periodically announce score sheet standings to raise worker awareness.

- Once or twice a month, announce the trainees' current score sheet standings to increase awareness of recent progress and identify cases of delayed progress in need of special attention.
- Report multiple skills progress of trained teams rather than individual trainees.
- Training should be within the flow production system which puts more pressure on performance.
- If trainees are just a little too slow, it causes problems for the next process. This keeps the trainees on their toes and aware of what is going on in the line.
- This method of training is called “**multiple skills flow training.**”

Four Steps to do Multi-Process Training

Step 1: Have leaders do the job first.

People learn quickly by watching others do the job first. Start by having them watch an experienced leader do the job.

Step 2: Explain the operation points.

Seeing is not enough. Explain the procedures and main purposes of each job, and make sure the trainees understand them thoroughly. Explain the particular cycle time, operation sequence, standard operations, quality check points, and safety points.

Step 3: Hands-on practice.

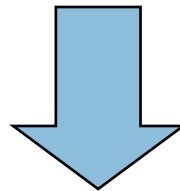
Once the trainee has seen and heard what he or she needs to know, it is time for hands-on practice. The trainee attempts the entire set of operations for the process. If he or she starts lagging behind the cycle time, the trainer steps in to help. After repeated practice, the trainee will be able to perform the job according to the particular standard operations.

For example, suppose a certain job includes five processes. The worker starts at the first process, and then moves on to the other four. If, at the third process, the trainee starts lagging behind the cycle time, the trainer should step in to help with processes 4 and 5.

Four Steps to do Multi-Process Training

Step 4: Review the training immediately.

- Reserve time after each training session to review the session.
- Take another look at the key points in the operation and resolve any confusion over what has been covered in that session.
- The trainer should always remember to praise the trainee. Beginners naturally feel uncomfortable around veteran operators, and the trainee's self-confidence is easily damaged.
- The trainer's responsibility is to bolster the trainee's confidence and enthusiasm. Harsh criticism is counterproductive.



Advice to trainers of multiple skills for flow production is: show them, tell them, have them do it, then praise them. You need all four steps to get multiple skills trained workers.

Multi-process Operations Summary

- ▶ In multi-process operations, one worker handles several processes.
- ▶ Without multi-process operations, there can be no JIT production system.
- ▶ There are eight key points about multi-process operations.
- ▶ There are seven precautions and procedures for developing multi-process operations.
- ▶ Multi-process training is a four-step process.

Appendix

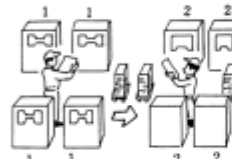
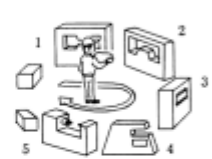
Horizontal Multi-unit Operations Versus Vertical Multi-process Operations

Distinguish between the grouping of machines that all serve a certain processing function (multi-unit process stations) and the grouping of machines that provide a sequence of processing functions needed to build a certain product (multi-process production line).

When work is divided into single-skill tasks, more workers are needed to operate a production line. As client orders shrink, however, it is more difficult to reduce the number of workers. Multi-process operations easily determine the minimum number of workers needed for any particular amount of output.

Horizontal operations

Process \ Product	A	B	C	D
1	○	○	○	○
2	○	○	○	○
3	○	○	○	○
4	○	○	○	○
5	○	○	○	○

	Multi-unit operations (horizontal)	Multi-process operations (vertical)
	 <p>One worker handles four similar machines.</p>	 <p>One worker handles five different processes.</p>
Quality (Q)	<ul style="list-style-type: none"> • Dented, damaged, or missing items • Defective lots • Causes of defects remain a mystery • "I make the products, you inspect them." • Inspectors are responsible for sorting out all the defective products. 	<ul style="list-style-type: none"> • Zero dented, damaged, or missing items • Zero defective lots • Causes of defects are tracked down and arrested. • Production workers do their own inspecting. • Quality is built in at each process.
Cost (C)	<ul style="list-style-type: none"> • Creates lots of waste related to in-process inventory, space, manpower, and conveyance • Costs vary depending upon volume. • Workshops try to save labor. 	<ul style="list-style-type: none"> • Zero waste • Costs are steady regardless of volume fluctuation. • Workshops try to reduce manpower.
Delivery (D)	<ul style="list-style-type: none"> • Long lead-times • Chronically late deliveries • Not very adaptive to schedule revisions 	<ul style="list-style-type: none"> • Short lead-times • Zero late deliveries • Adaptive to schedule revisions

Eight Key Points About Multi-process Operations

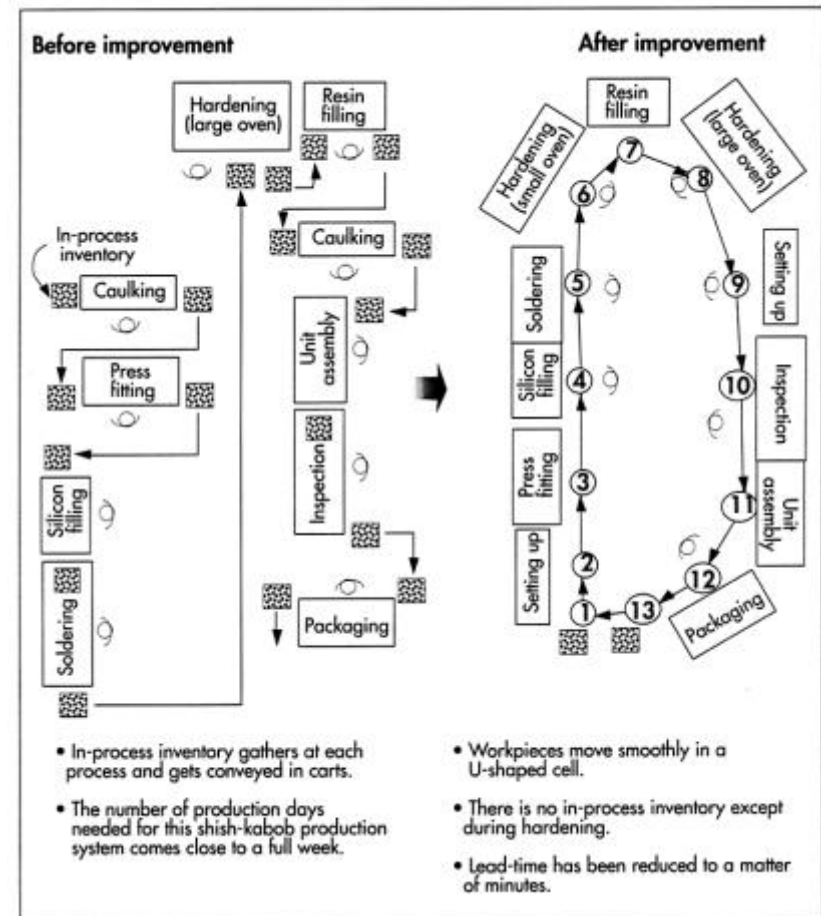
Point 1: Establish U-shaped manufacturing cells.

Abandon the “job shop” layout of shish-kabob production, and set up a “flow shop” arrangement where equipment is laid out according to processing sequence.

Various machines are lined up in a closely linked processing cell. In this kind of cell, U-shaped lines are better than straight lines. Straight lines create waste by making the operators walk farther when getting another work piece at the end of each set of processes.

This new layout eliminates cart conveyance and enables a smooth, one-piece flow of work pieces. The operators learned how to handle all 11 processes in the cell. As a result, a smaller number of workers could produce the same output.

Creation of a U-shaped Manufacturing Cell for Automotive Electronic Parts Assembly



Eight Key Points About Multi-process Operations

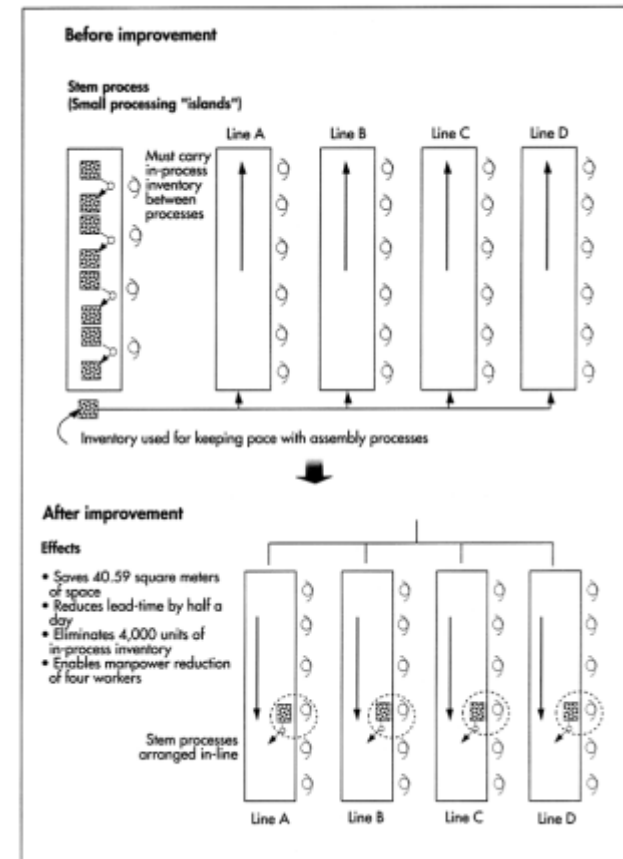
Point 2: Abolish processing islands.

Little islands are full of waste-waste caused by their independent rhythms, by the resulting idle time for workers, and by their less obvious operating methods.

Before this improvement, the stem gear process was an isolated “island” operated at its own pitch by four workers carrying armfuls of inventory. They kept the little island well-stocked with work pieces to keep pace with the assembly lines.

After the improvement, they were able to balance this line with the assembly lines by including a stem process in each assembly line. As a result, they freed up 40.59 square meters of floor space, cut lead time by half a day, eliminated the 4,000 unit stem inventory, and reduces the number of workers by four.

In-line Arrangement of Watch Stem Processes (Eliminate Processing “Islands”)



Eight Key Points About Multi-process Operations

Point 3: Make the equipment smaller.

Equipment only needs to work fast enough to keep up with the cycle time. We do not need fast, large, and expensive general-purpose equipment when the job can be done using slower, smaller and cheaper machines that perform only specialized tasks. Getting the right kind of equipment is the first step in bringing all equipment into a single line.

Point 4: Standing while working.

Standing while working is a basic requirement for multi-process operations. Workers can more easily help their neighboring workers and eliminate idle time.

Point 5: Multiple skills training.

Multiple skills training is necessary for workers handling multi-process operations.

The key to success in multi-process operations is simplifying the machines so they perform only the essential processing function and do not require frequent fine-tuning. After that, workers learn how to systematically and confidently use their skills needed to operate those machines.

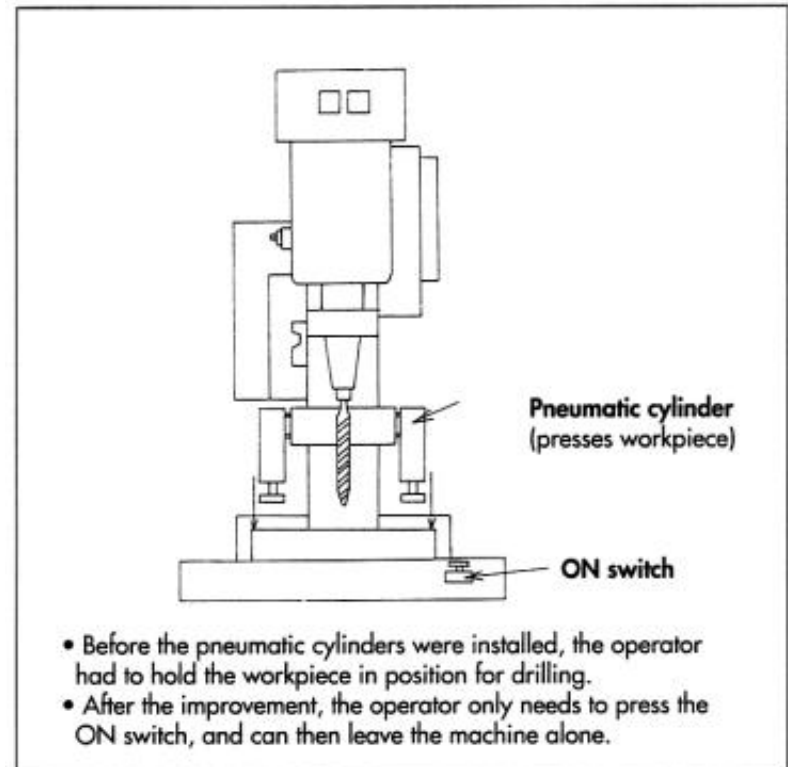
Eight Key Points About Multi-process Operations

Point 6: Separate human work from machine work.

Make a clear distinction between work done by people and work done by machines. Then, separate people from machines whenever possible.

Usually, equipment operators stay close to machines while in operation. The worker and machine, however, each have separate tasks. The company must pay both labor costs and equipment costs.

By distinguishing between human work and machine work, the worker can leave the machine to do its work while he or she goes on to the next task. To make this possible, develop devices and techniques that fall under the categories of “human automation” and “*poka-yoke*.”

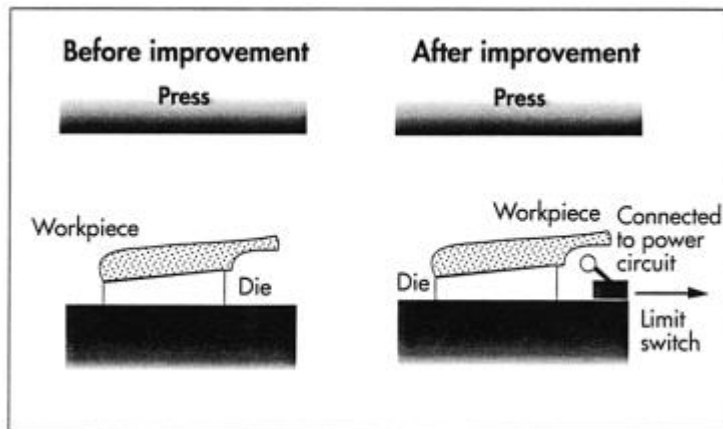


Eight Key Points About Multi-process Operations

Point 7: Human automation and *poka-yoke*.

Once the operator lets the machine operate on its own, he or she is free to turn to the next task. But what if the machine starts producing defects without anyone there to notice? Do we have to keep an operator there just to watch for abnormalities? If so, we are not separating human work from machine work.

Human automation and *poka-yoke* prevent defects by machines automatically detecting them and stopping.



After the improvement, a limit switch prevents the machine from operating until the work piece is set exactly right. This enables the operator to leave the machine without it producing defective goods.

Point 8: Safety first.

After beginning multi-process operations, pay more attention than ever to safety matters. Everyone should remain mindful that “safety takes precedence over everything else.”

One safety point is to keep start buttons separate from the machine so operators will be at a safe distance when machines start working. Other useful safety devices include machine covers and electric eyes that shut off the machines when anything or anyone approaches them.