



# Furniture Making

NTQF Level- I

## Learning Guide #4

Unit of Competence: Apply 3S

Module Title: Applying 3S

LG Code: IND-FMK1 - M01 LO 4-01

TTLM Code: IND-FMK1- TTLM 0919v1

LO 4: Set all items in order

<b>Instruction Sheet</b>	<b>Learning Guide #1</b>
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This learning guide is developed to provide you the necessary information regarding the following content coverage and topics –

- The second pillar of 5S – Set in order

This guide will also assist you to attain the learning outcome stated in the cover page. Specifically, upon completion of this Learning Guide, you will be able to –

- Prepare plan for implementing set in order activities.
- Perform general cleaning activities, in parallel with set in order activity.
- Decide location/layout, storage and indication methods for items.
- Prepare and use necessary tools and equipment for setting in order activities.
- Place items in their assigned location.
- Return immediately the items to their assigned location after use.
- Report performance results using appropriate formats.
- Regularly check each item in its assigned location and order.

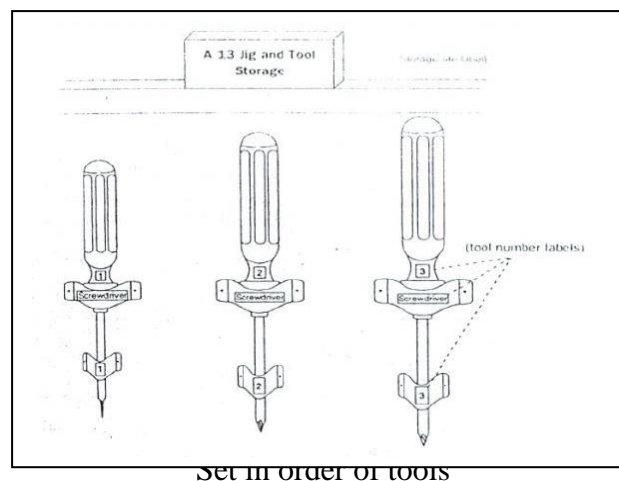
### **Learning Instructions:**

1. Read the specific objectives of this Learning Guide.
2. Follow the instructions described in number 3 to 8.
3. Read the information written in the “Information Sheets 1”. Try to understand what are being discussed. Ask your trainer for assistance if you have hard time understanding them.
4. Accomplish the “Self-check 1” in page 16.
5. Ask from your trainer the key to correction (key answers) or you can request your trainer to correct your work. (You are to get the key answer only after you finished answering the Self-check 1).
6. If you earned a satisfactory evaluation proceed to “Operation Sheet 1” in page 19; However, if your rating is unsatisfactory, see your trainer for further instructions or go back to Information sheet 1.
7. Read the “Operation Sheet 1” and try to understand the procedures discussed.
8. Do the “LAP test” in page 21 (if you are ready). Request your trainer to evaluate your performance and outputs. Your trainer will give you feedback and the evaluation will be either satisfactory or unsatisfactory. If unsatisfactory, your trainer shall advice you on additional work. But if satisfactory you can proceed to Learning outcome #5.

## 1. Explanation of the second pillar of 5S – Set in order

### 1.1 Definition of set in order

Set in order means arranging necessary items so that they are easy to use and labelling them so that anyone can find them and put them away. The key word in this definition is “anyone”. Set in order can be implemented only when the first pillar- sort is done first. No matter how well you arrange items, set in order can have little impact if many of the items are unnecessary and not sorted. Similarly, if sorting is implemented without setting in order, it is much less effective. Where necessary items should be placed should be made clear for anyone to immediately find them and return them easily. Hence, Sort and Set in order work best, when they are implemented together.



### 1.2 Benefits of set in order

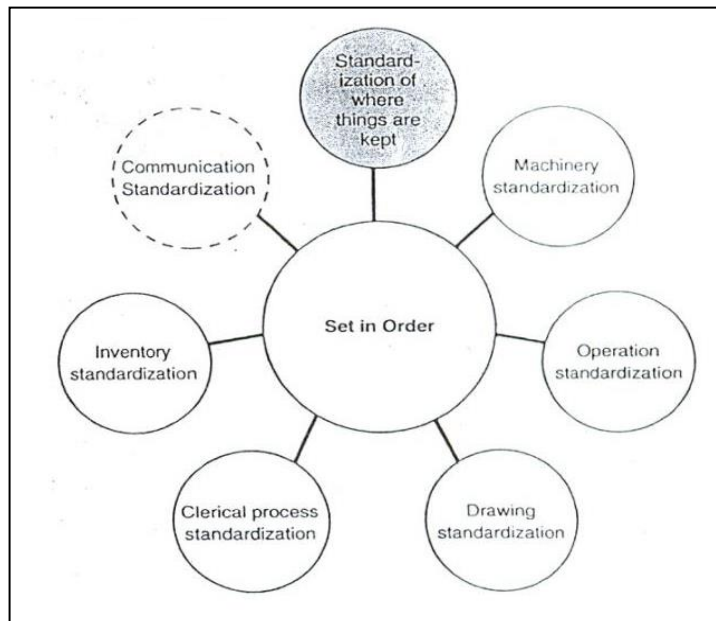
Setting in order is important because it eliminates many kinds of waste from operations in a workplace. These include searching time waste, waste due to difficulty in using items, and waste due to difficulty in returning items. In general, the following problems and wastes are avoided when set in order is well implemented.

1. Motion wastes
2. Searching time wastes
3. The waste of human energy
4. The waste of excess inventory
5. The waste of defective products
6. The waste of unsafe conditions

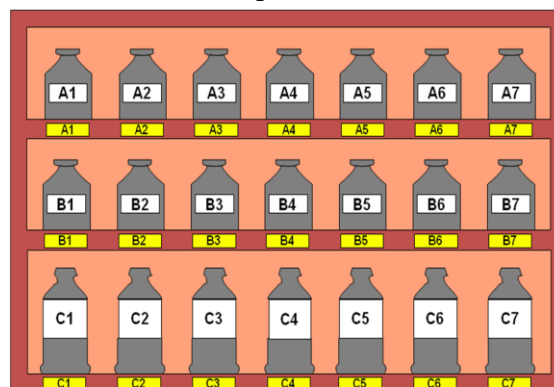
The set in order step is actually at the core of so many important business principles such as safety, ergonomics, quality, inventory control, productivity, standard work, the visual workplace and employee morale. Also it is the core of standardization. This is because the workplace must be organized before any type of standardization can be implemented effectively. Standardization means creating a consistent way of doing or carrying out tasks. When we think of standardization, we have to think about anyone. For example, machinery standardization means anyone can operate the machinery. Also if we have operation

standardization this means anyone can perform the operation. Even for people to get along together, they need to standardize their behaviors, at least to some extent

Set in order is the core of standardization.



In implementing set in order pillar, we use visual controls so that communications became easy and smooth. For example, we can visually know where items are placed and where to return them and so on. A visual control is any communication device used in the workplace that tells us at a glance how work should be done. Through visual controls, information such as where items belong, how many items should be placed there, what the standard procedure is for doing something, the status of work in process etc can be communicated.



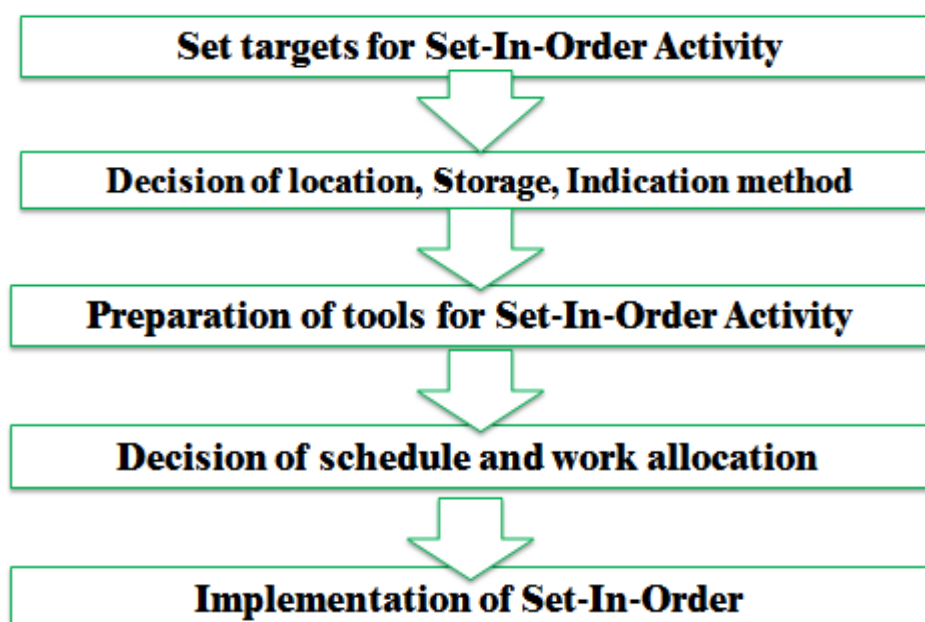
## 2. Implementing the Second Pillar of 5S – Set in order


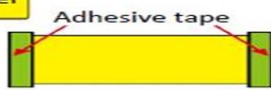

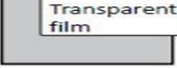




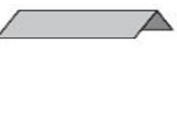
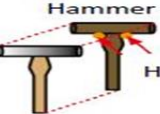

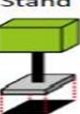





### 2.1 Plan and procedures for set in order

Set in order activity plan sheet (sample)

Basic plan		Seiton																															
Activity items																																	
Preparing tools	Plan																																
	Result																																
Determining storage positions/methods	Plan																																
	Result																																
Determining indication methods	Plan																																
	Result																																
Setting temporary signboards	Plan																																
	Result																																
Signboard operation	Plan																																
	Result																																

Procedures for Set in order



Labels	    
Signs	   
Figures	     
Partition lines	 

There are some principles for deciding best locations for tools and equipments. Jigs, tools and dies differ from materials, equipments, machinery and parts in that they must be put back after each use. Some of the principles for jigs, tools and dies also apply to parts, equipments, and machinery. These are:

- Locate items in the workplace according to their frequency of use. Place frequently used items near the place of use. Store infrequently used items away from the place of use.
- Store items together if they are used together, and store them in sequence in which they are used.

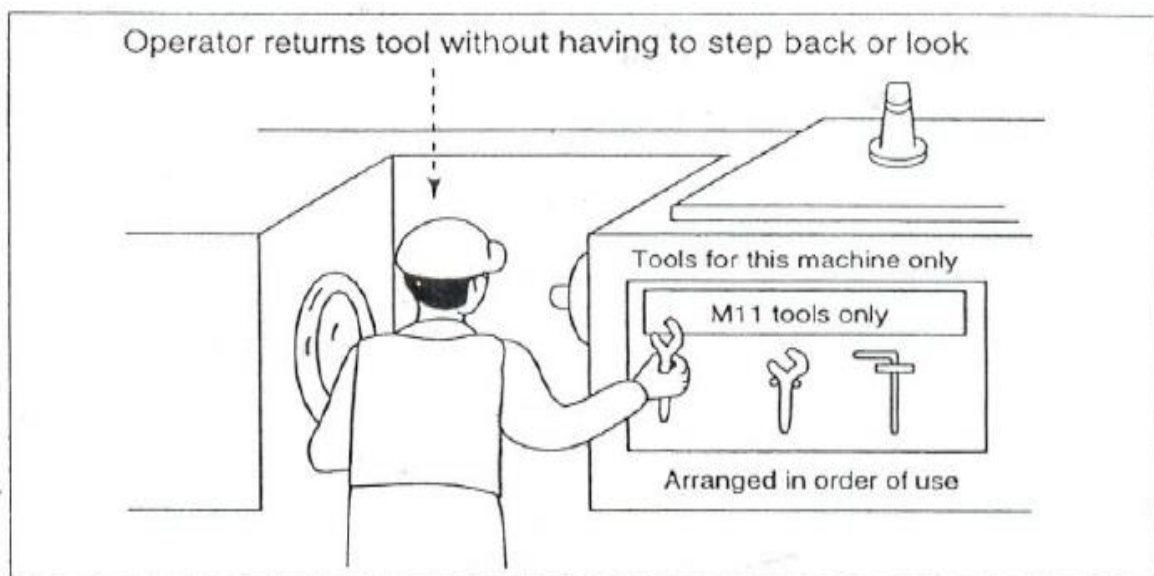


Fig. Tools kept at hand and stored in the order used.

- Device a “just let go” arrangement for tools. This approach involves suspending tools from a retractable cord just within reach so that they will automatically go back in to their correct storage position when released.
- Make storage places larger than the items stored there so that they are physically easy to remove and put back.

- Eliminate the variety of jigs, tools and dies needed by creating a few jigs, tools and dies that serve multiple functions.
- Store tools according to function or product. Function-based storage means storing tools together when they have similar functions. This works best for job-shop production. Product-based storage means storing tools together when they are used on the same product. This works best for repetitive production.

There are principles helpful in deciding the best locations for parts, equipments, and machinery, as well as tools by removing motion wastes. Motion wastes are unnecessary movements created when people move their trunks, feet, arms, and hands more than needed to perform a given operation. These wastes lead to waste of time, energy and effort. These motion wastes can be minimized by locating parts, equipments, and machinery in the best locations possible. More important than removing motion wastes is asking why it occurs. By asking 'why' we can find the methods of manufacturing that work and approach the zero-waste mark. Eliminating the unnecessary motions from existing operations is called *Motion improvement*. And finding ways to eliminate the whole operations to remove the wastes is called *Radical improvement*.

The principles that are helpful to eliminate or reduce motions that operators make are:

- Principle 1: Start and end each motion with both hands moving at once.
- Principle 2: Both arms should move symmetrically and in opposite directions.
- Principle 3: Keep trunk motions to a minimum.
- Principle 4: Use gravity instead of muscle.
- Principle 5: Avoid zigzagging motions and sudden changes in direction.
- Principle 6: Move with a steady rhythm.
- Principle 7: Maintain a comfortable posture with comfortable motions.
- Principle 8: Use the feet to operate on and off switches for machines where practical.
- Principle 9: Keep materials and tools close and in front.

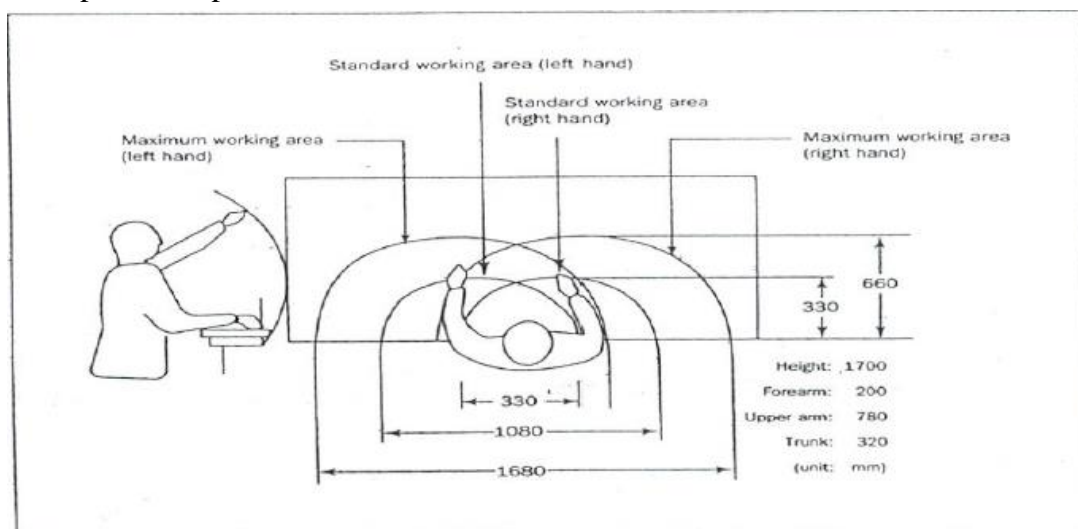


Fig. Guidelines for locating parts, equipments, and machinery to maximize motion efficiency.

Principle 10: Arrange materials and tools in the order of their use.

Principle 11: Use inexpensive methods for feeding in and sending out materials.

Principle 12: Stand at a proper height for the work to be done.



Principle 13: Make materials and parts easy to pick up.

Principle 14: Make handles and grips in efficient, easy-to-use shapes and positions.

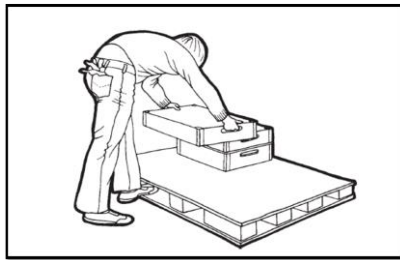


Fig. Motion wastes

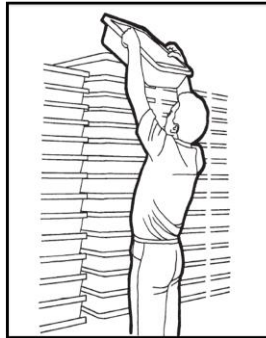
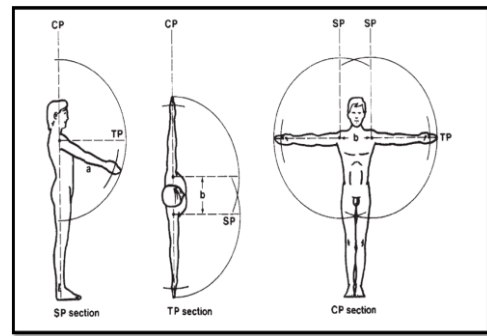


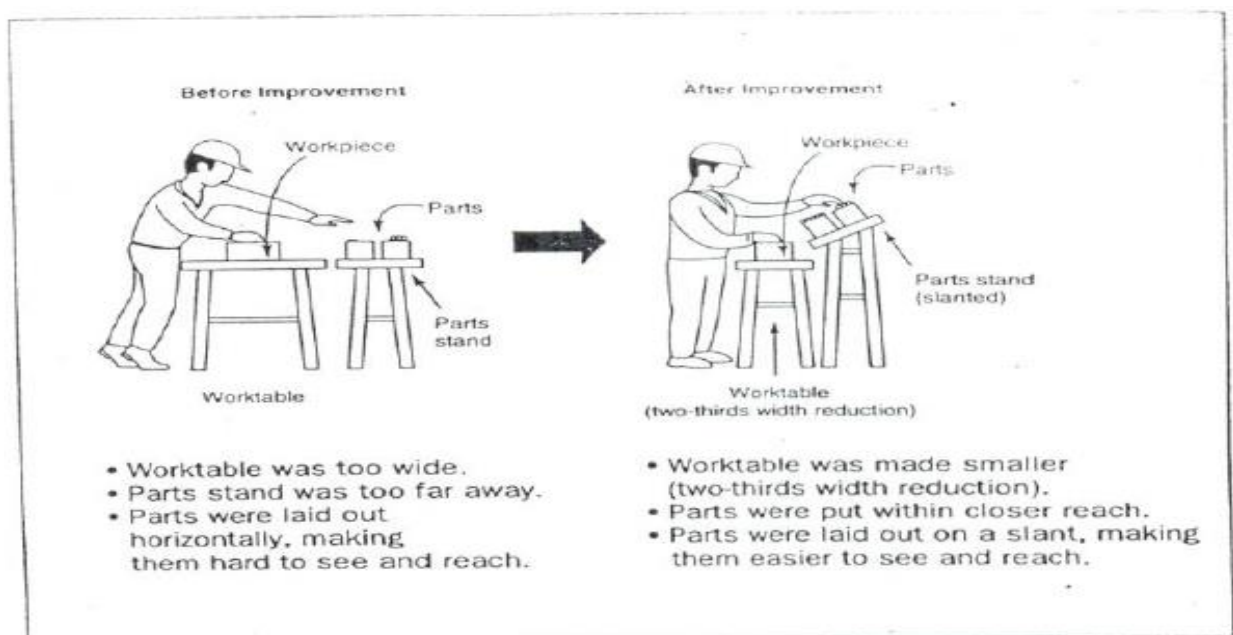
Fig. No waste of motion



### Example of eliminating motion wastes

#### Improving the retrieval of parts

The figure below shows an improvement in picking up parts in an assembly work. Before improvement, the worktable was so large that the assembly worker had to stretch to pick up parts. Also, the parts boxes were laid flat at table level, making it difficult to reach inside them. After improvement, the decreased width of the worktable enabled the assembly worker to reach the parts without stretching his arm too far. Also the parts boxes set on an inclined surface to make their contents more accessible.



Improvements in picking up parts

#### Improving the layout of parts

The following figure shows an improvement in how plastic packaging sheets are used. The sheets are moved from a rack behind the operator to a hook in front of the operator and above the production line. This improvement eliminates four seconds of motion waste from each unit of packing work.



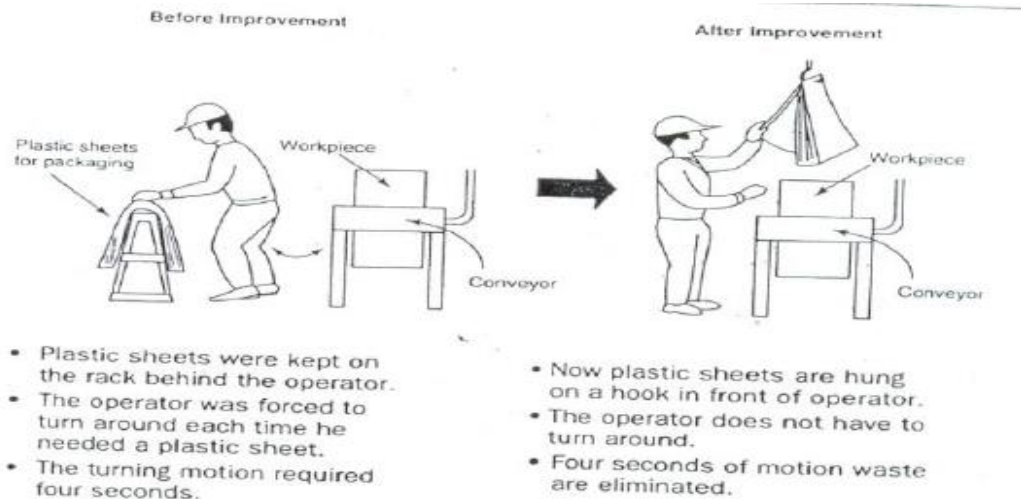


Fig. Improvement in parts layout

### Evaluating current locations and deciding best locations

The 5S Map is a tool that can be used to evaluate current locations of parts, jigs, tools, dies, equipment, and machinery, and to decide best locations. 5S Map involves creating two maps 'before map' and 'after map'. The 'before map' shows the layout of the workplace before implementing set in order. The 'after map' shows the workplace after implementing set in order. The 5S Map can be used to evaluate the locations in a small or large workplaces, like in a single workstations, on a production line, or in a department.

#### The steps of using the 5S Map:

1. Make a floor plan or area diagram of the workplace you wish to study. Show the location of specific parts, inventory, tools, jigs, dies, equipment and machinery.
2. Draw arrows on the plan showing the work flow between items in the workplace. There should be at least one arrow for every operation performed. Draw the arrows in the order that the operations are performed, and number them as you go.

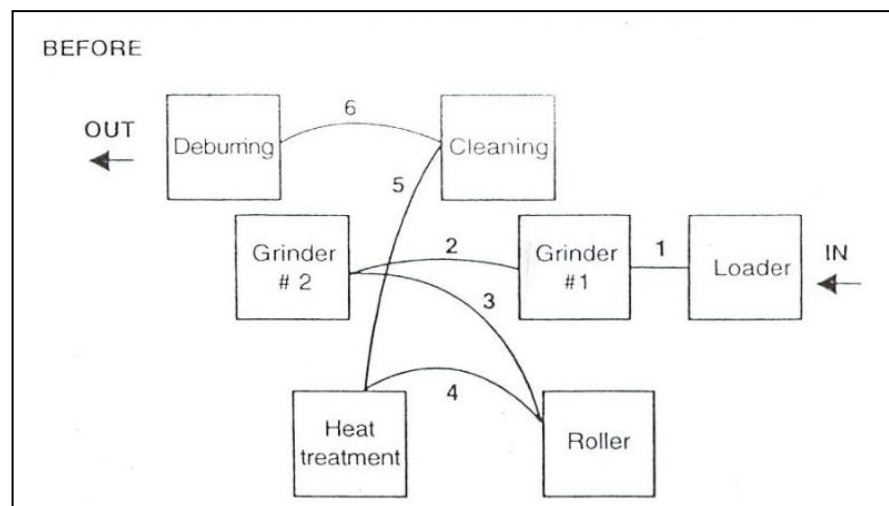


Fig. 5S Map of old layout in machining operations ('before map')

3. Look carefully at the resulting “spaghetti diagram”. Can you see places where there is congestion in the work flow? Can you see ways to eliminate waste?
4. Make a new 5S Map to experiment with a better layout for this work place. Again, draw and number arrows to show the flow of operations performed.
5. Analyze the efficiency of the new layout (the after map), based on the principles explained in the above.
6. Continue to experiment with possible layouts (after maps) using the 5S Map until you find one which you think will work well.

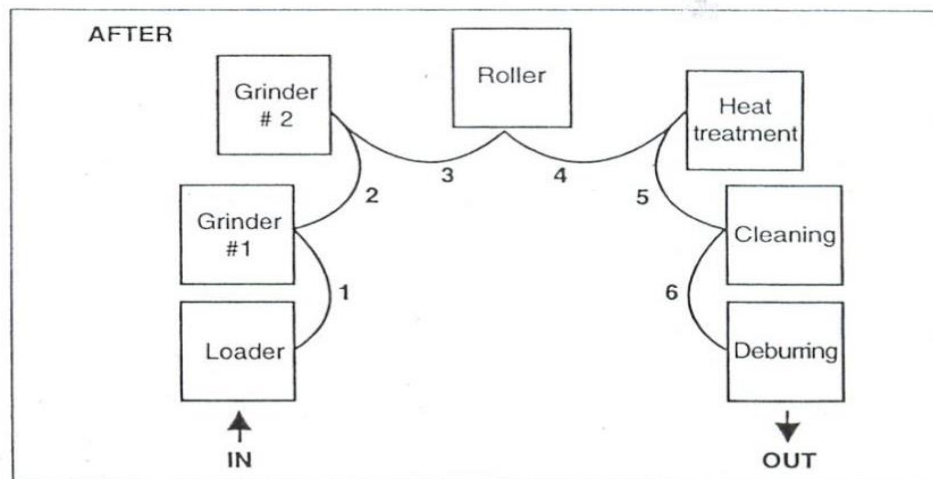


Fig. 5S Map of new layout (the after map) in machining operations.

7. Implement this new layout in the work place by moving parts, tools, jigs, dies, equipment, and machinery to their new locations.
8. Continue to evaluate and improve the layout in the workplace.

## 2.2 Set in order strategies

Once best locations have been decided, it is necessary to mark these locations so that everyone knows what goes where, and how many of each item belongs in each location. There are several strategies for marking or showing what, where and how many.

### 2.2.1 Motion Economy strategy

Following the principles explained in the above, we can remove motion waste from existing operation. By using human body appropriately, by organizing the workplace and by redesigning of tools and equipments, we can minimize motion waste.

### 2.2.2 Visual control Strategy

A visual control is any communication device used in the work environment that tells us at a glance how work should be done. There are several strategies for setting in order items so that to easily identify what, where and how many (visual control). These visual control strategies are discussed in the next contents.

**Signboard strategy:** uses signboards to identify what, where, and how many. The three main types of signboards are:

- Location indicators that show where items go.
- Item indicators that show what specific items go in those places.
- Amount indicators that show how many of these items belong there.

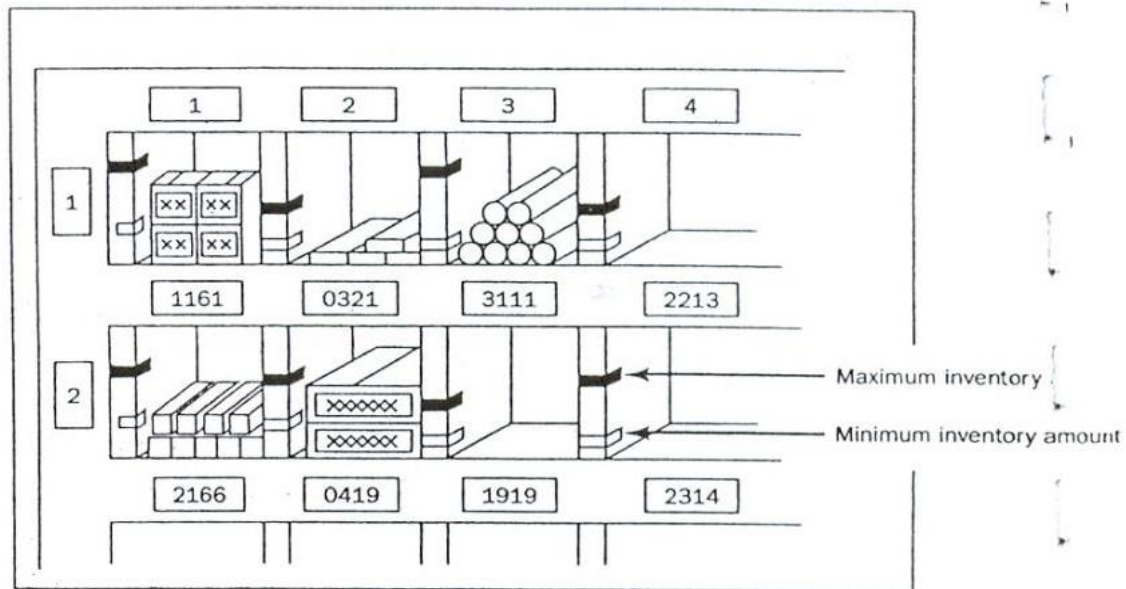


Fig. Amount indicators

Signboards are often used to identify:

- Names of work areas
- Inventory locations
- Equipment storage locations
- Standard procedures
- Machine layout

For example, in order to identify inventory stored on shelves in a warehouse, a whole system of signboards may be used. Every section of shelving may have a signboard identifying the section. Within that section, vertical and horizontal addresses on shelves can be identified with additional signboard. Each item stored on the shelf may also have a signboard showing the “return address” for that item. The “return address” allows the item to be put back in the proper location once it has been removed.

The ‘after 5S Map’ discussed before is a kind of signboard. It shows the location of parts, tools, jigs, dies, equipment, and machinery in a given work area after set in order is implemented. When posted in the work place, it is useful in communicating the standard for where items are located.

**Painting strategy:** is a method for identifying locations on floors and walkways. It is called the Painting strategy because paint is the material generally used. But also plastic tape, cut in to any length, can be used. Plastic tape, although more expensive, shows up just as clearly as paint and can be removed if the layout is changed.

The painting strategy is used to divide the factory’s or workshop’s walking areas (walkways) from the working areas (operation areas). When putting lines to divide walkways from operation areas, the following factors should be considered:

- U-shaped cell designs are generally efficient that straight production lines.
- In-process inventory should be positioned carefully for best production flow.
- Floors should be levelled or repaired before we put lines.

- Walkways should be wide enough to avoid twists and turns and for safety and a smooth flow of goods.
- The dividing lines should be between 2 and 4 inches in width.
- Paint colors should be standardized. For example
  - operation areas are painted by green;
  - walkways are fluorescent orange or red;
  - Lines that divide the walkways from operation areas are yellow in color.

Dividing lines can be used to show:

- Cart storage locations,
- aisle directions,
- door range, to show which way a door swings open,
- for worktables,
- Tiger marks, to show areas where inventory and equipment should not be placed, or to show hazardous areas.

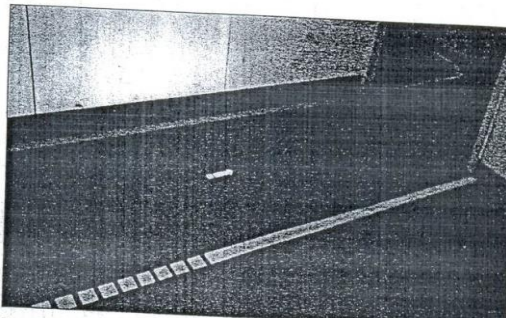


Fig. Aisle direction line

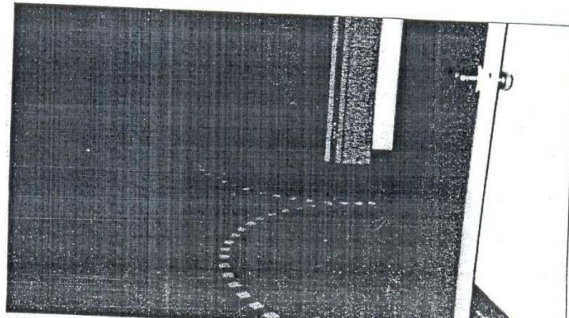


Fig. Door-range line



**Color-code strategy** : is used to show clearly which parts, tools, jigs and dies are to be used for which purpose. For example, if certain parts are to be used to make a particular product, they can all be color-coded with the same color and even stored in a location that is painted with that color. Similarly, as shown the picture in below, if different types of lubricants are to be used on different parts of a machine, the supply containers, oil cans, and machine parts can be color-coded to show what is used where.

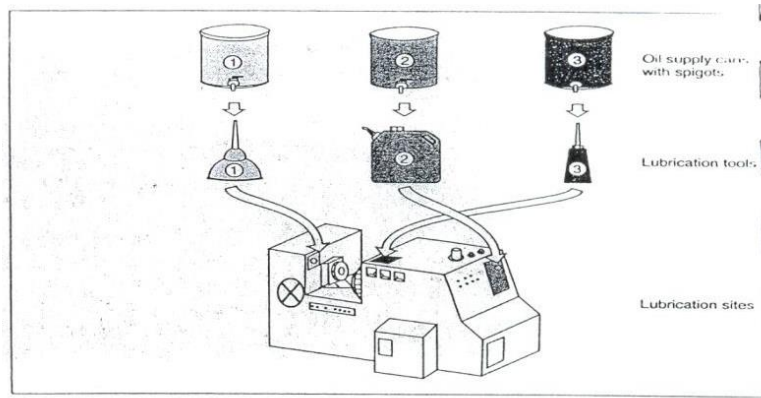
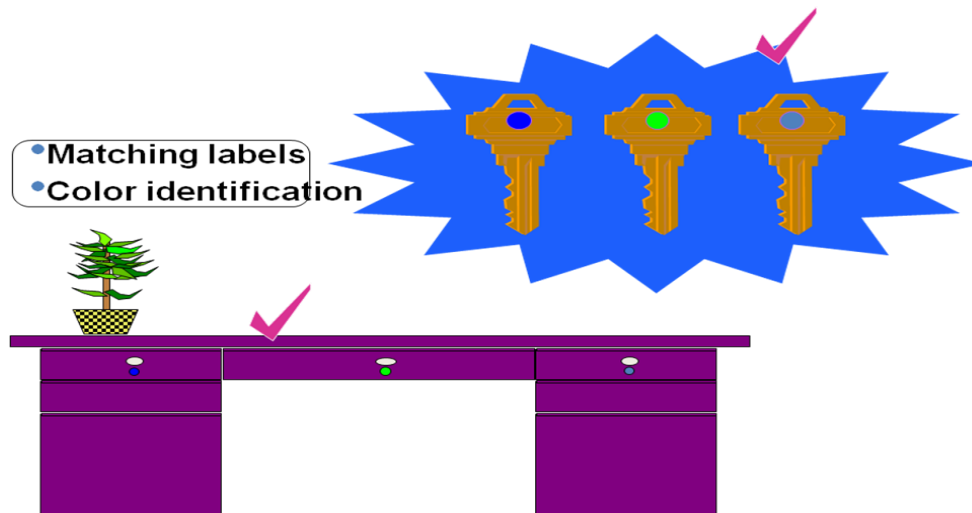
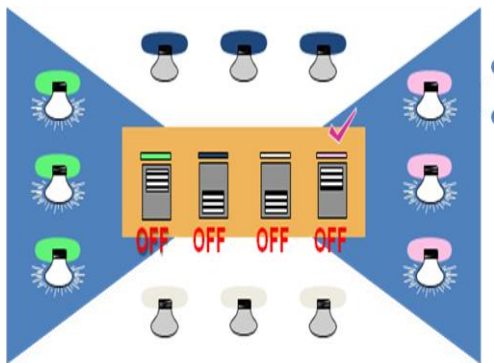
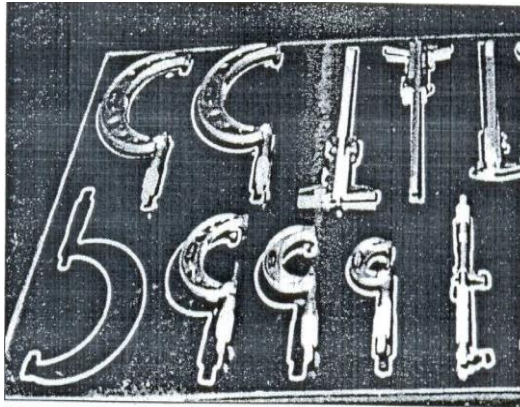


Fig. Color-coding for lubrication

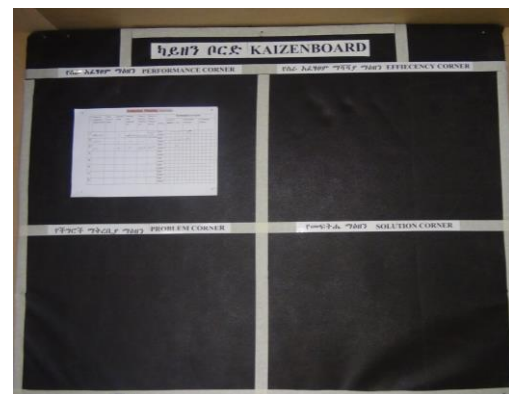
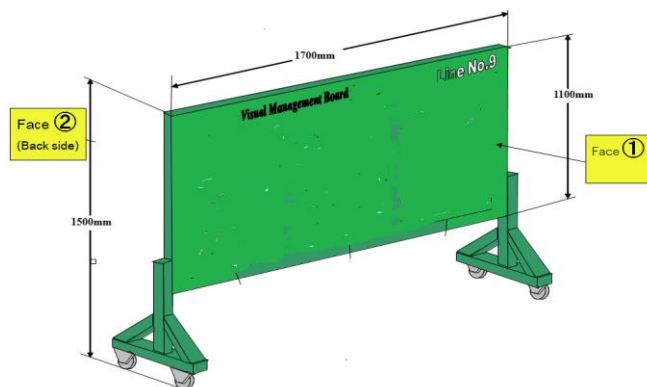


**Outlining strategy:** is used to show which jigs and tools are stored where. Outlining simply means drawing outlines of jigs and tools in their proper storage positions. When you want to return a tool, the outline provides an additional indication of where it belongs.





### Visual Management Board (Kaizen board) Strategy



<b>Self-Check 1</b>	<b>Written Test</b>
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**Instructions:** Answer all the questions listed below. Illustrations may be necessary to aid some explanations/answers. Write your answers in the sheet provided in the next page.

1. Give definition of the second pillar of 5S – Set in order. (3 points)
2. What are the benefits of implementing set in order? (4 points)
3. What are the procedures for set in order? (5 points)
4. What are the principles for deciding best locations of tools and equipments? (6 points)
5. What is 5S Map? (2 points)
6. List the steps of using the 5S Map? (4 points)
7. What are the strategies for implementing set in order? (3 points)
8. What factors should we follow when applying the painting strategy? (6 points)
9. What are the three standardized colors used for dividing and marking walkways and operation areas? (3 points)

**Note: Satisfactory rating - 9 points**

**Unsatisfactory - below 8 points**

You can ask you teacher for the copy of the correct answers.

**Answer Sheet**

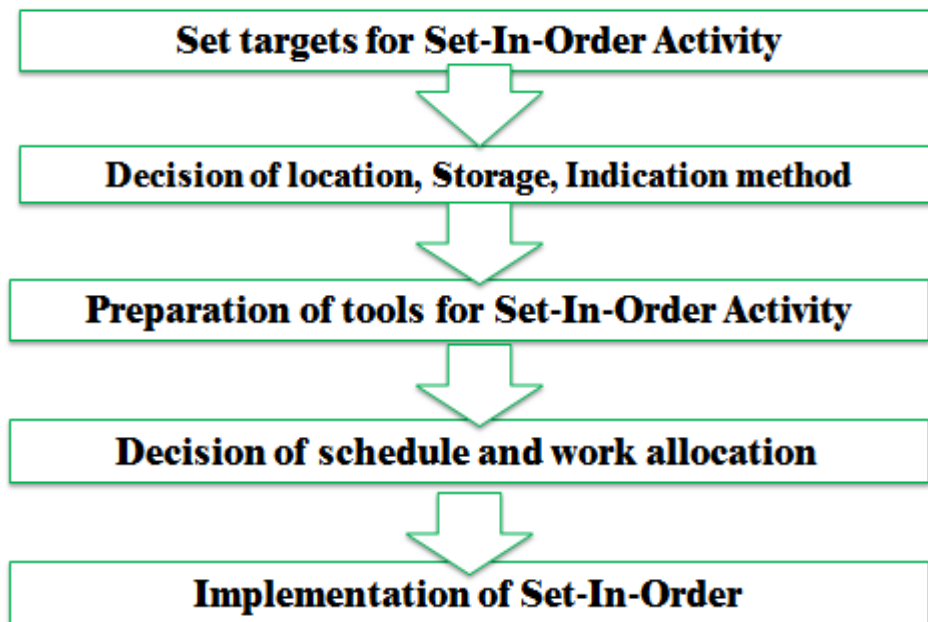
Score = \_\_\_\_\_  
Rating: \_\_\_\_\_

<b>Operation Sheet 1</b>	<b>Implementing Set in order</b>
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**1) Sample plan sheet for implementing set in order**

**2) Procedures for implementing set in order**





### 3) Steps for using 5S Map

1. Make a floor plan or area diagram of the workplace you wish to study. Show the location of specific parts, inventory, tools, jigs, dies, equipment and machinery.
2. Draw arrows on the plan showing the work flow between items in the workplace. There should be at least one arrow for every operation performed. Draw the arrows in the order that the operations are performed, and number them as you go.

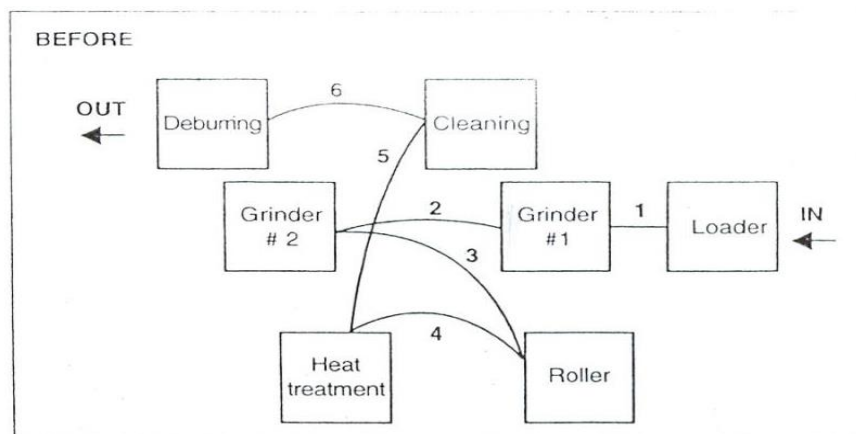


Fig. 5S Map of old layout in machining operations ('before map')

3. Look carefully at the resulting "spaghetti diagram". Can you see places where there is congestion in the work flow? Can you see ways to eliminate waste?
4. Make a new 5S Map to experiment with a better layout for this work place. Again, draw and number arrows to show the flow of operations performed.
5. Analyze the efficiency of the new layout (the after map), based on the principles explained in the above.
6. Continue to experiment with possible layouts (after maps) using the 5S Map until you find one which you think will work well.

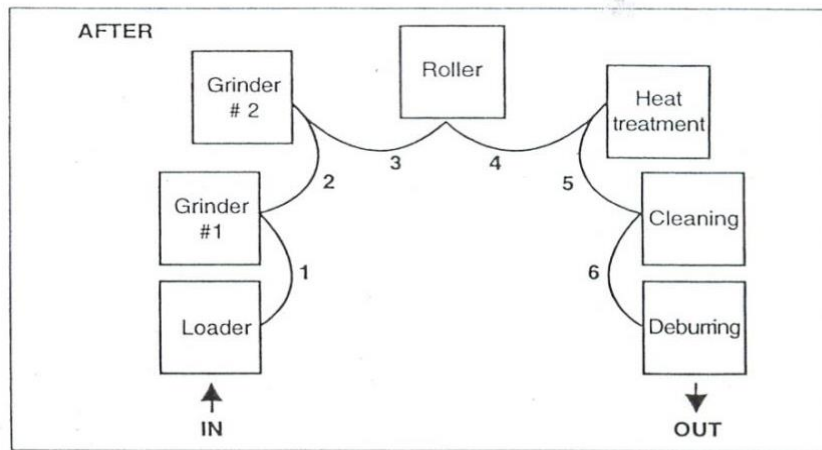


Fig. 5S Map of new layout (the after map) in machining operations

7. Implement this new layout in the work place by moving parts, tools, jigs, dies, equipment, and machinery to their new locations.
8. Continue to evaluate and improve the layout in the workplace.

LAP Test	Practical Demonstration
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Name: \_\_\_\_\_ Date: \_\_\_\_\_

Time started: \_\_\_\_\_ Time finished: \_\_\_\_\_

**Instructions:** Given necessary templates, workshop, tools and materials you are required to perform the following tasks.

Task 1: Using the given template, prepare a plan for set in order activity in your workshop.

Task 2: Following the steps for using 5S Map, draw before and after map/ layout of your work shop.

Task 3: Following the procedures of set in order, perform set in order in the assigned workshop.

<b>List of Reference Materials</b>
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- 1) 5S for operators (1995)
- 2) Ethiopia Kaizen Manual (2011)
- 3) Journals/publications/magazine