

# CHAPTER 15: Just in Time & Lean Manufacturing



# Just In Time

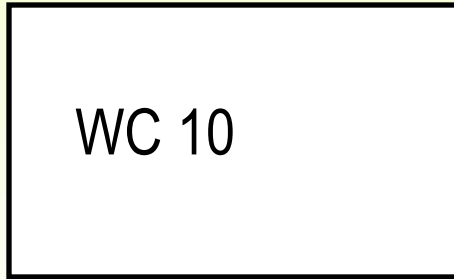
## Just in Time (JIT) – a Business Philosophy

- Production system: manufacturing & movement of materials and goods occur just when they are needed, usually in small batches
- JIT operates with very little “fat” (waste)
- Defines waste in terms of customer value

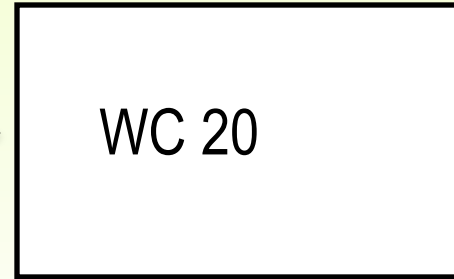
## JIT Goals

- Eliminate disruptions
- Make system flexible by reduce setup and lead times
- Eliminate waste, especially excess inventory

# Sources of Waste: Waiting



Move

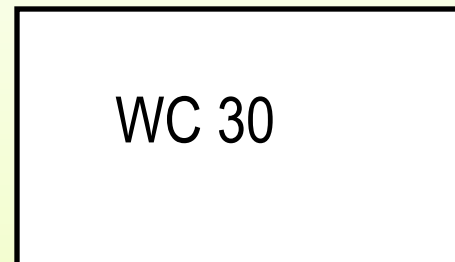


Arrive at WC 20 –wait  
to be worked on

After finished in WC 20  
wait to move out of WC

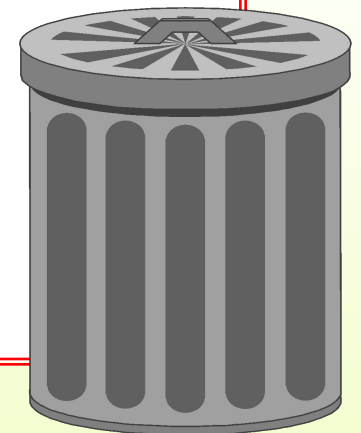
After finished in  
WC 10 wait to  
move out of the  
WC

Large Batch sizes impact Wait times!

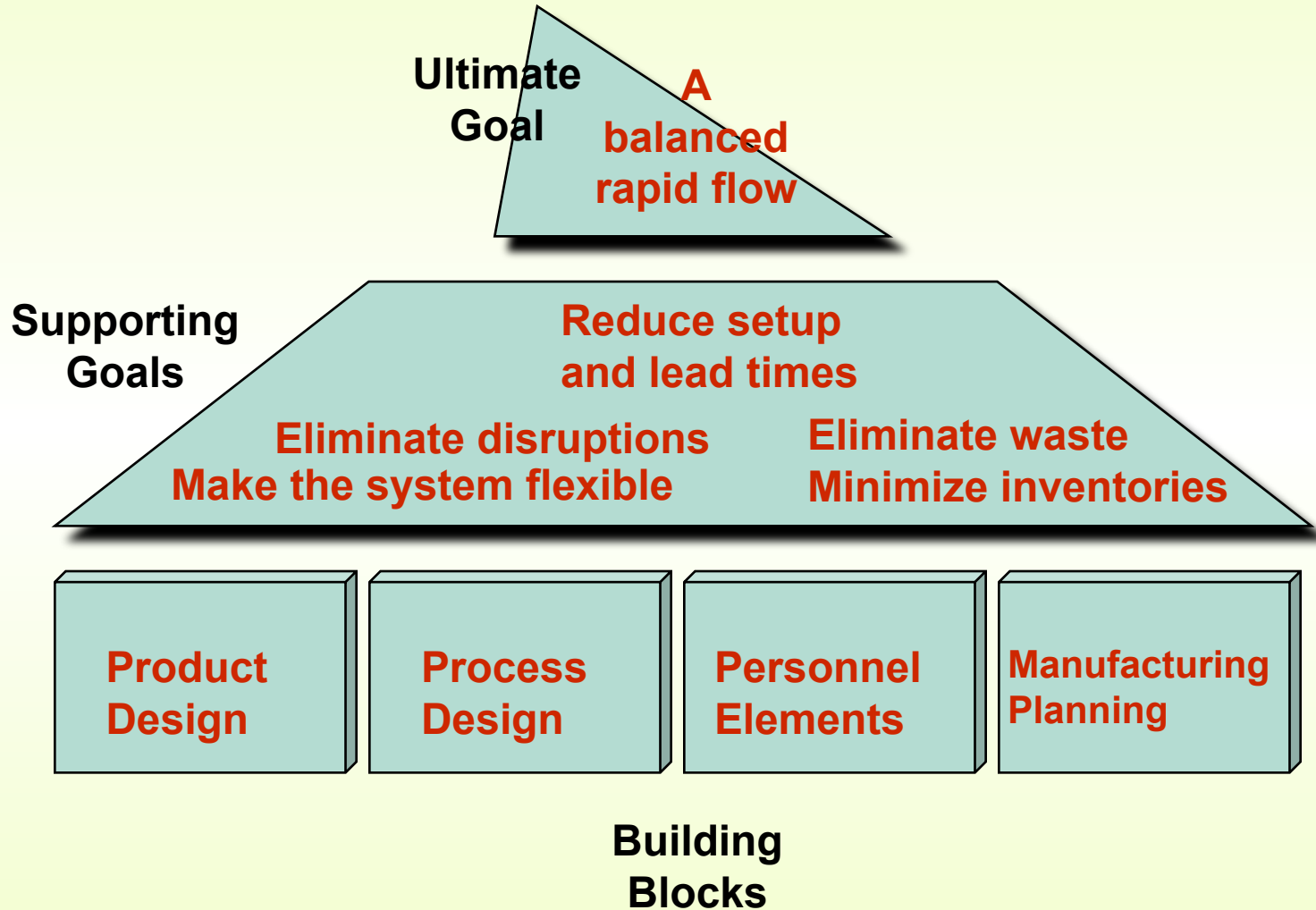


# JIT Wastes

- Overproduction – making more than we can sell now
- Waiting time – for the next process
- Unnecessary handling & transportation
- Processing waste
- Inefficient work methods
- Product defects – producing bad quality items



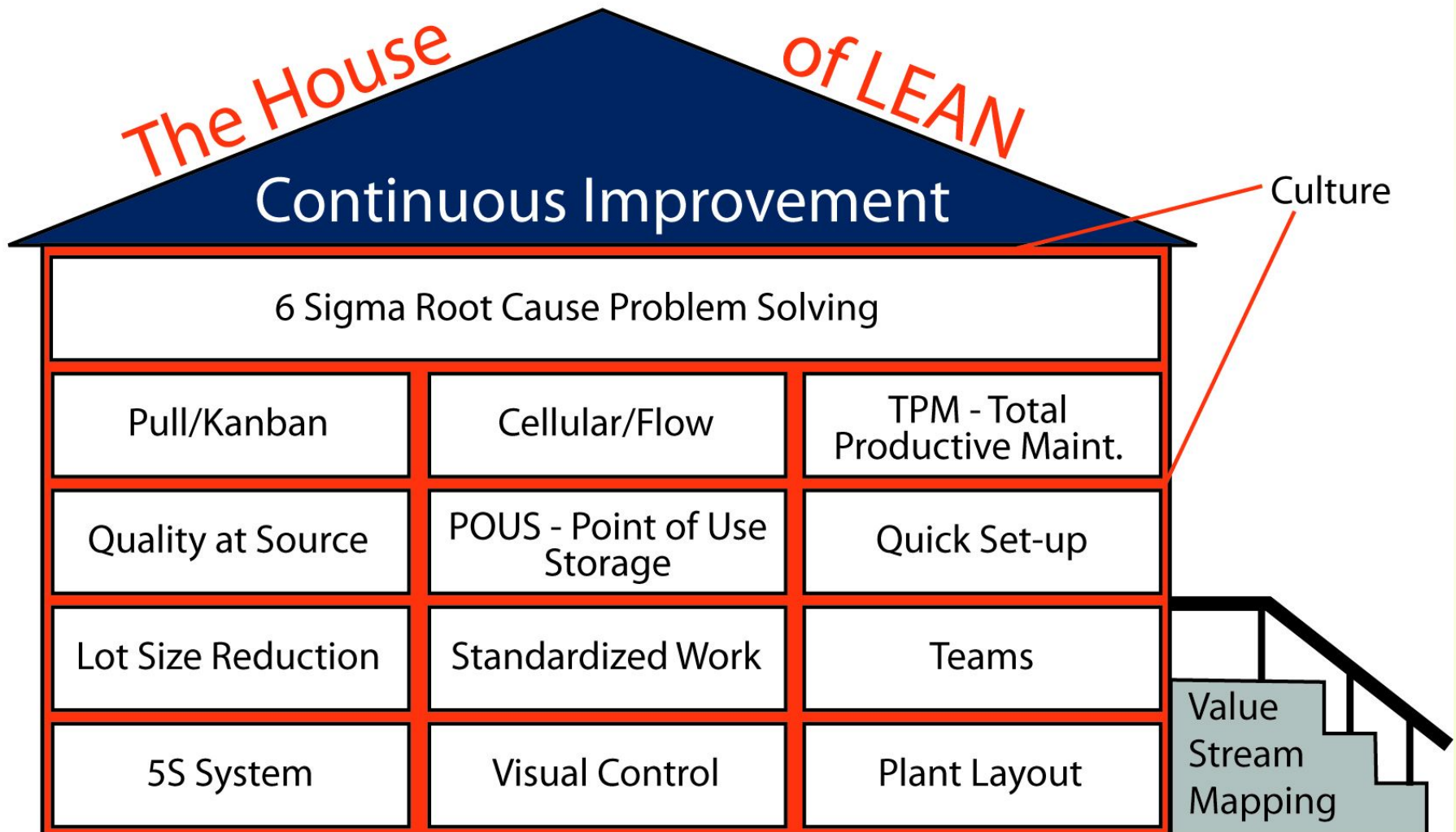
# JIT Goals and Building Blocks



# Production Flexibility

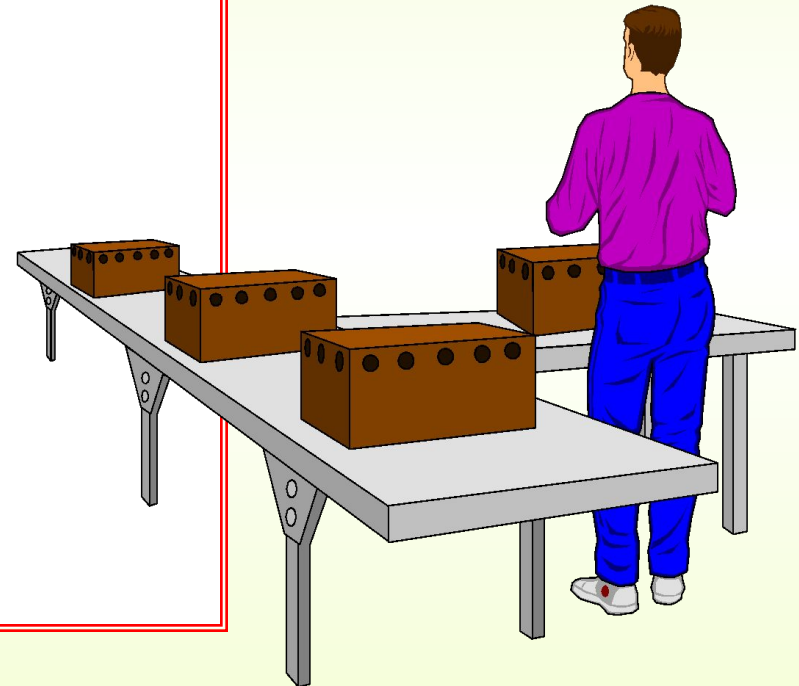
- Reduce downtime by reducing change-over time
- Use preventive maintenance to reduce unexpected breakdowns
- Cross-train workers to help clear bottlenecks – workers skilled in many different work processes
- Reserve capacity for important customers Ex. Operate at 90-95% capacity – **is this a good strategy?**

# LEAN Manufacturing



# Product Design

1. Standardized parts
2. Modular design
3. Quality
4. DFM (Design for Manufacturing)
5. Mistake-proofing design



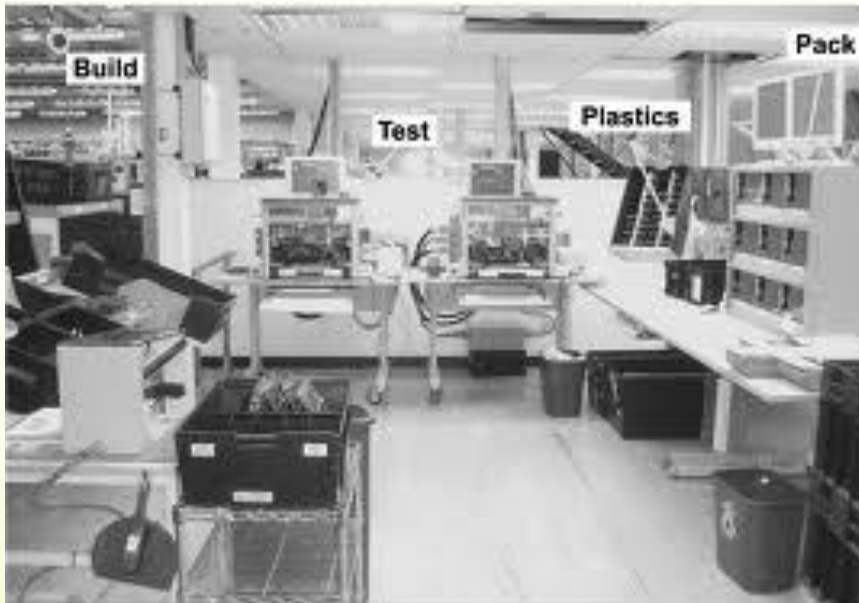


# Process Design

- Smaller production lot sizes
- Setup time reduction
- Manufacturing cells
- Quality improvements –preventive actions
- Reduced inventory



# Work Cells



Examples

# Benefits of Small Lot Sizes

- Reduces on-hand inventory - raw materials
- Less rework – due to quality issues
- Less storage space (warehouse) needed
- Problems become more apparent
- Increase production flexibility
- Easier to balance operations to changing customer demand

# Setup Time Reductions

- Small batch sizes and changing product mixes require frequent machine setups
- Workers are trained to do their own setups
- Do as much of the set-up external from the manufacturing process
- Group Technology may be used to reduce cost and setup time (group similarly-made products)

# Quality Improvement

## Prevent Defects from occurring using:

- Six Sigma to reduce process variability
- Poka Yoke to mistake-proof

## Automation:

- Automatic detection of defects during production  
Ex. Laser beams to check fill amounts of bottles

# Personnel/Organizational Elements

- Workers as assets
- Cross-trained workers
- Train workers in problem-solving
- Form work cell teams



# Manufacturing Planning and Control

- Level loading – keep consistent amount of production  
Example – always produce batches of 5 pieces
- Use Pull Systems and Kanban (card signal system) – automate production control
- Close supplier relationships with key suppliers
- Visual systems – easy to see problems. Example – green light when machine running, red light when broken down
- Preventive maintenance – to reduce unexpected machine breakdowns

# Visual Controls





# Pull/Push Systems and Kanban

## Pull system:

- System for moving work where a workstation pulls output from the preceding station as needed. (e.g. Kanban)

## Push system:

- System for moving work where output is pushed to the next station as it is completed

## Kanban:

- Card or other device that communicates demand for work or materials to the preceding station
- Kanban: Japanese word meaning “signal” or “visible record”
- Paperless production control system
- Authority to pull, or produce comes from a downstream process.

# Push vs. Pull

Because of Wastes inherent in a PUSH system we tend to produce more to offset waste (including quality)

## Kanban Thinking

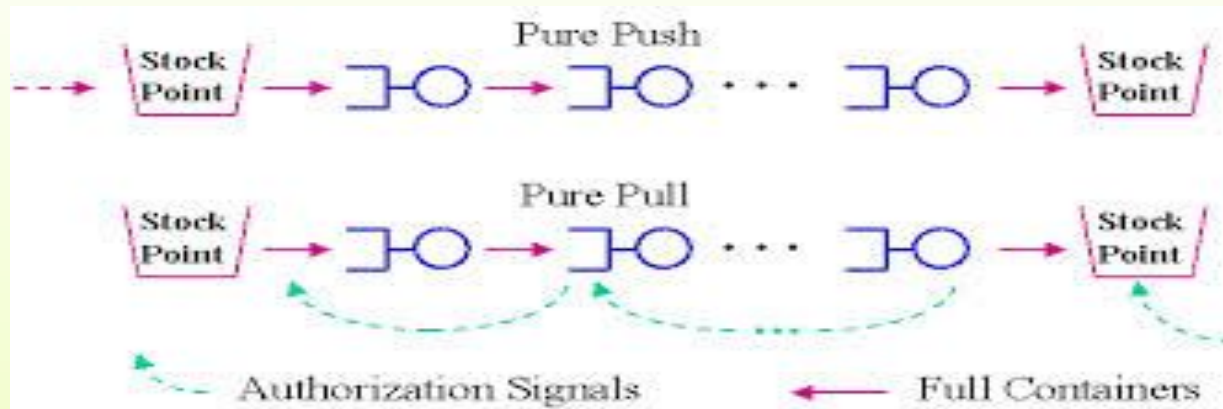
### ► Push vs Pull System

#### Push vs. Pull



- Production Approximation
- Anticipated Usage's
- Large Lots
- High Inventories
- Waste
- Management by Firefighting
- Poor Communication

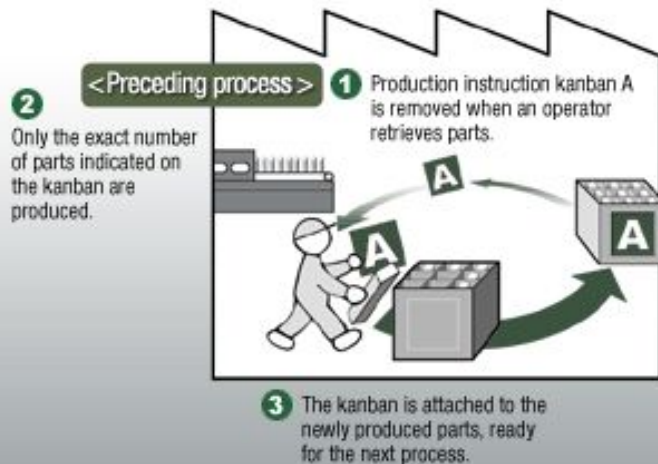
- Production Precision
- Actual Consumption
- Small Lots
- Low Inventories
- Waste Reduction
- Management by Sight
- Better Communication



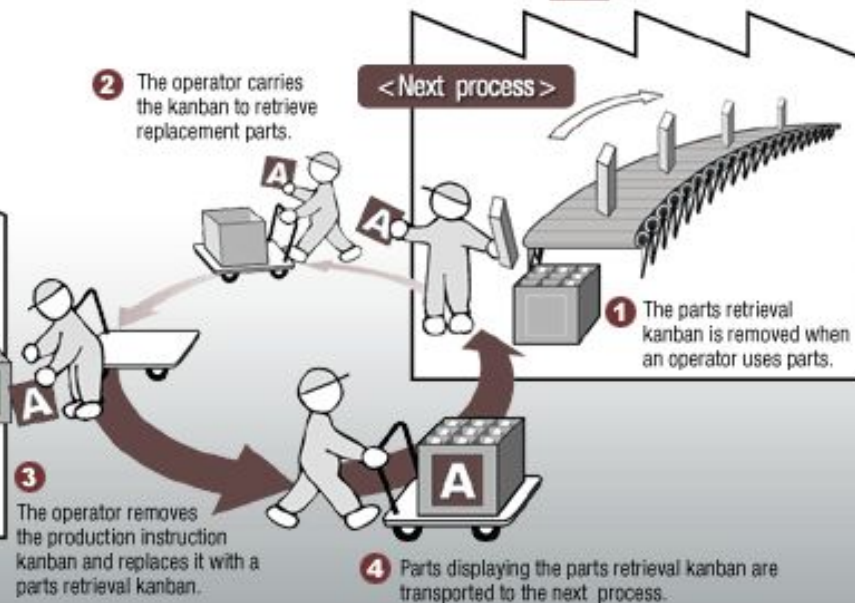
# Kanban Example

Conceptual diagram of the Kanban System

## Operational Flow of Production Instruction Kanban **A**



## Operational Flow of Parts Retrieval Kanban **A**



# Kanban Examples



Two bin system – **RED** means empty – Stores to replenish

Empty means – bring another!



# Preventive Maintenance and Housekeeping

## Preventive maintenance

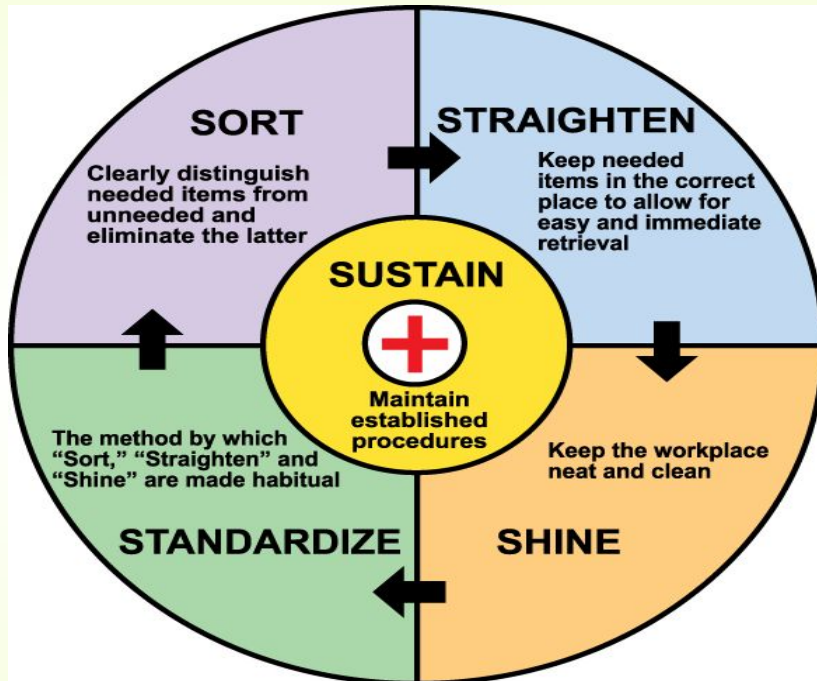
- Maintaining equipment in good operating condition and replacing parts that have a tendency to fail before they actually do fail

## Housekeeping

- Maintaining a workplace that is clean and free of unnecessary materials (**5S program**)
  - Sort
  - Straighten
  - Shine
  - Standardize
  - Sustain



# Housekeeping: 5S Program



## The 5 S



### **SORT / CLEARING**

Throw away unnecessary and unrelated materials in your workplace.



### **SET / ORGANIZE**

Set everything in proper place for quick retrieval and storage



### **SHINE & SWEEP**

Clean the workplace; everyone should be a janitor



### **STANDARDIZE**

Standardize the way of maintaining order and cleanliness

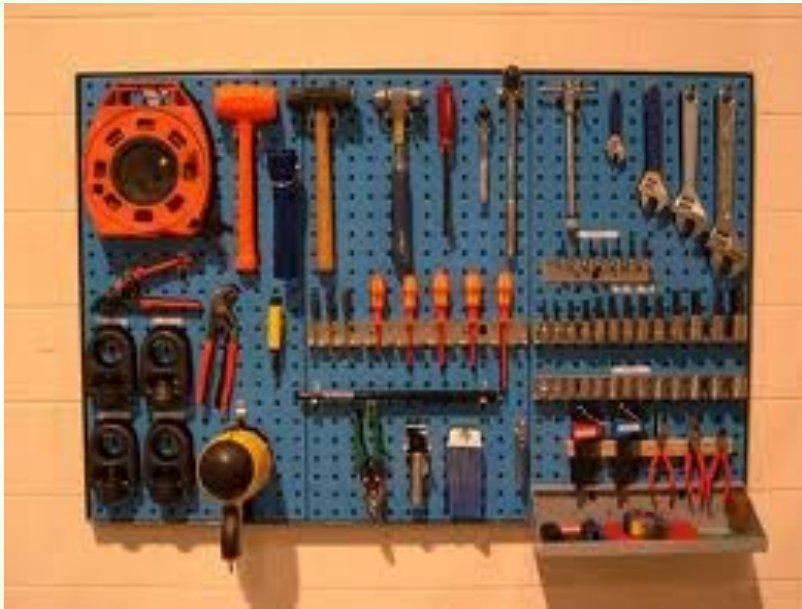


### **SUSTAIN**

Practice '5 S' daily - make it a way of life; this also means 'commitment'



# Housekeeping – 5S Program



Tool Board



Set in  
order  
example

Work Station