

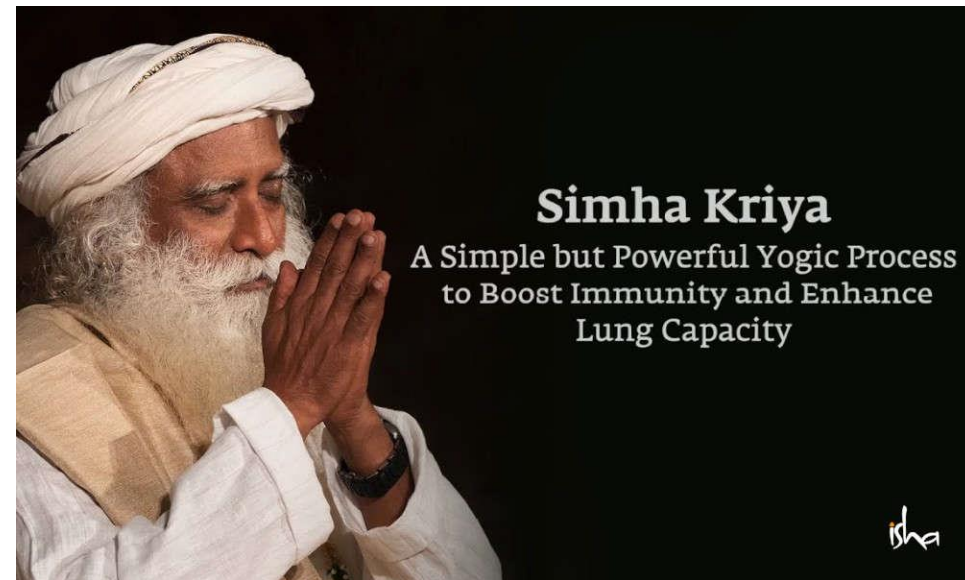
Computer Aided Manufacturing



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Immunity Boosting Breathing



1 min

Topic :

Maintenance and retrofitting

Recap and review of previous class

Let's
Recap



5 mins

Prerequisites Knowledge

- Maintenance of your body
- Technology update at home

Evocation



REGULAR CAR MAINTENANCE

- Safety
- Environmental Benefits
- Performance
- Appearance
- Cost-effectiveness

A cartoon illustration of a doctor in a white coat and glasses, holding a stethoscope, standing next to a red car. The car is shown from a front-three-quarter view. The doctor is looking at the car as if performing a check-up.

2 to 5 mins

General Objective (GO)

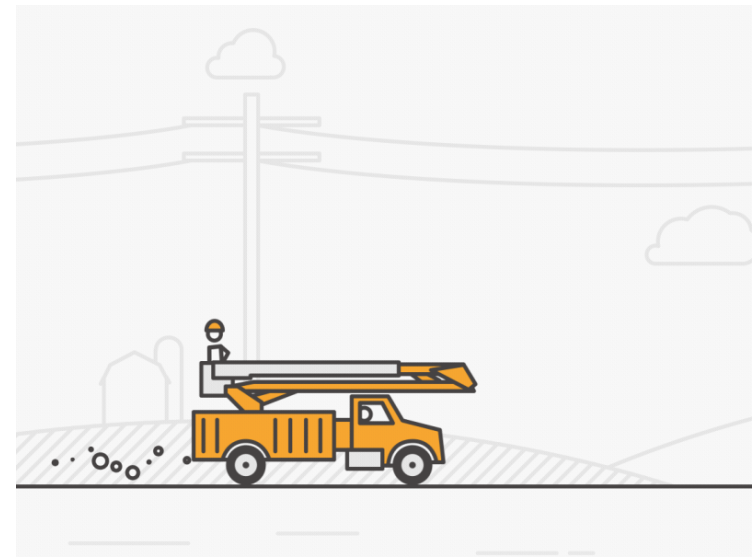
- Students will be able to understand the importance of maintenance and apply the retrofitting concept for real time applications.

Specific Objectives

- *Students will be able to*
 - Explain the five types of preventive maintenance in CNC machines. (U / C) (E)
 - Compare preventive maintenance with breakdown maintenance. (U / C) (E)
 - Exemplify the retrofitting technique. (U / C) (E)
 - Select the necessary steps for retrofitting the conventional machines. (Ap / C) (E)

What is Maintenance

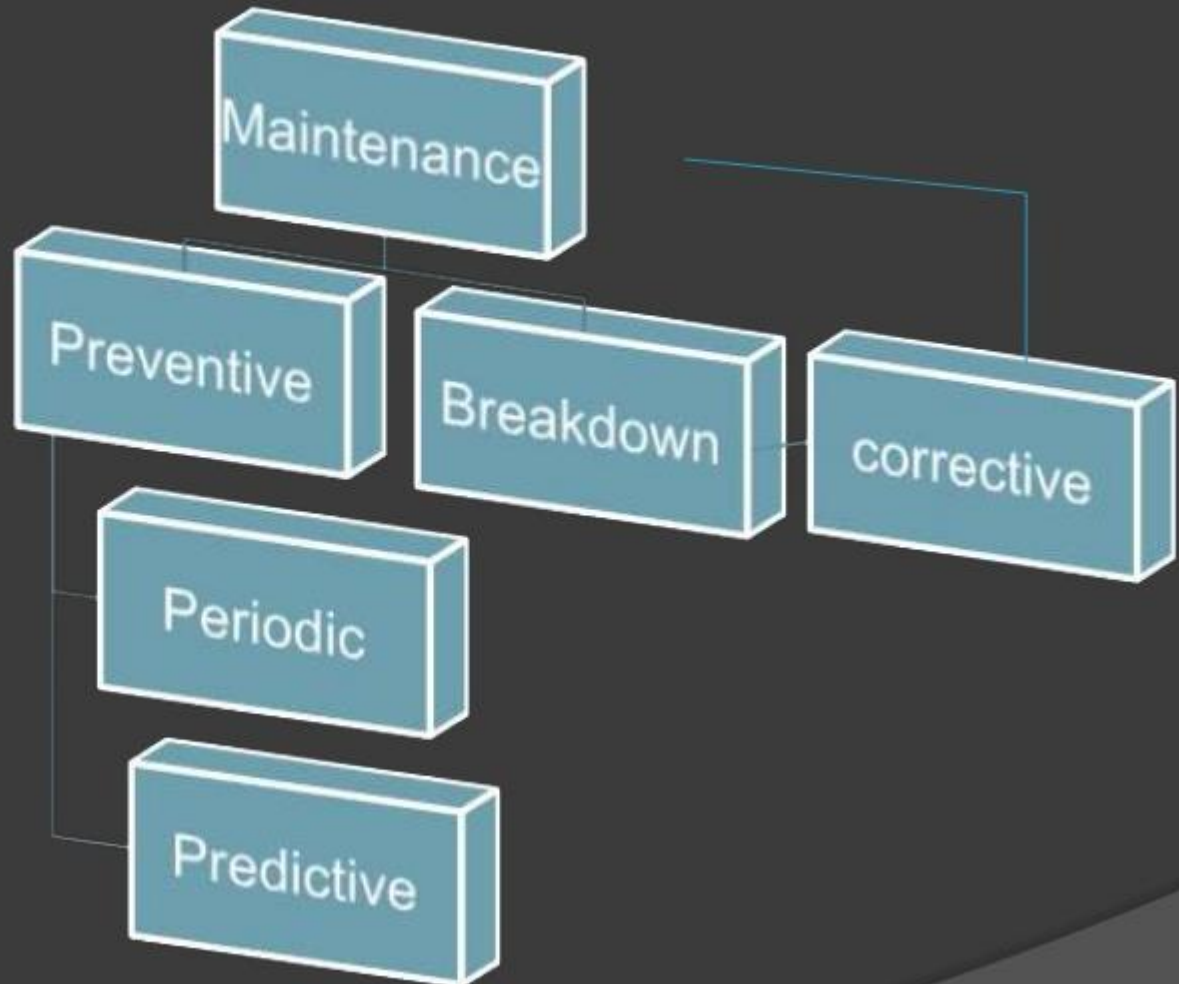
- ❑ The process of **preserving a condition or situation** or the state of being preserved
- Maintaining, repairing, and replacing if necessary devices, equipment, machinery, building infrastructure, and supporting utilities in industrial, business, governmental, and residential installations



THE TYPES OF MAINTENANCE

what they are & when to use them

Types of Maintenance



Preventive Maintenance

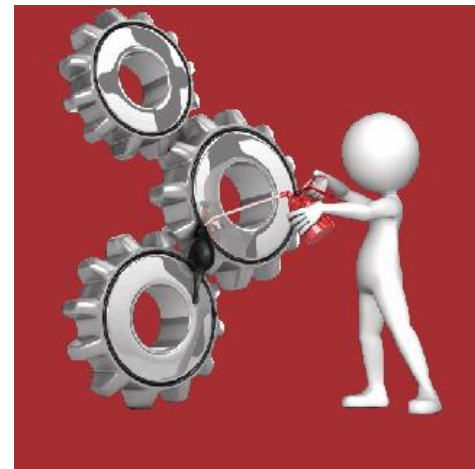
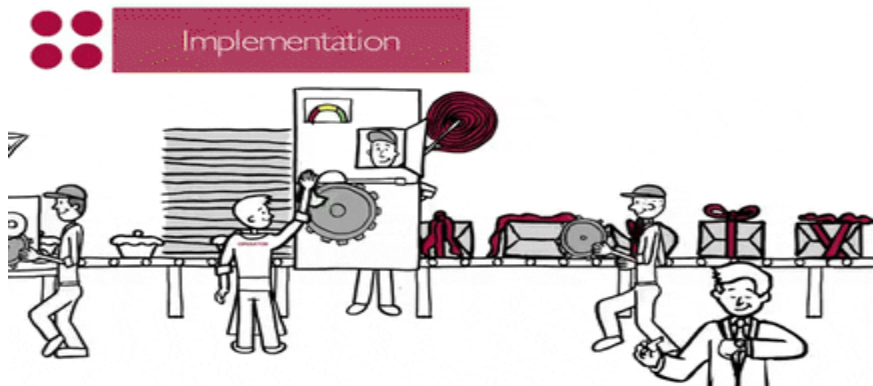
It is a **daily maintenance** (cleaning, inspection, oiling and re-tightening), design to retain the healthy condition of equipment and prevent failure through the prevention of DETE.



Industrial centrifugal pump maintenance



Machine Lubrication



Breakdown maintenance

It means that people wait **until equipment fails and repair it**. Such a thing could be used when the equipment failure does not significantly **affect the operation or production** or generate any significant loss other than repair cost.



Engine maintenance



BREAKDOWN MAINTENANCE

Corrective or Breakdown maintenance implies that repairs are made after the equipment is failed and can not perform its normal function anymore

It occurs when there is a work stoppage due to machine breakdown. **Maintenance becomes repair work.** It seeks to get the equipment back into operation as quickly as possible. To control the investment in **replacement spare machines** are also may required.

Quite justified **in small factories** where:

Down times are non-critical and **repair costs are less** than other type of maintenance

Financial justification for scheduling **are not felt.**

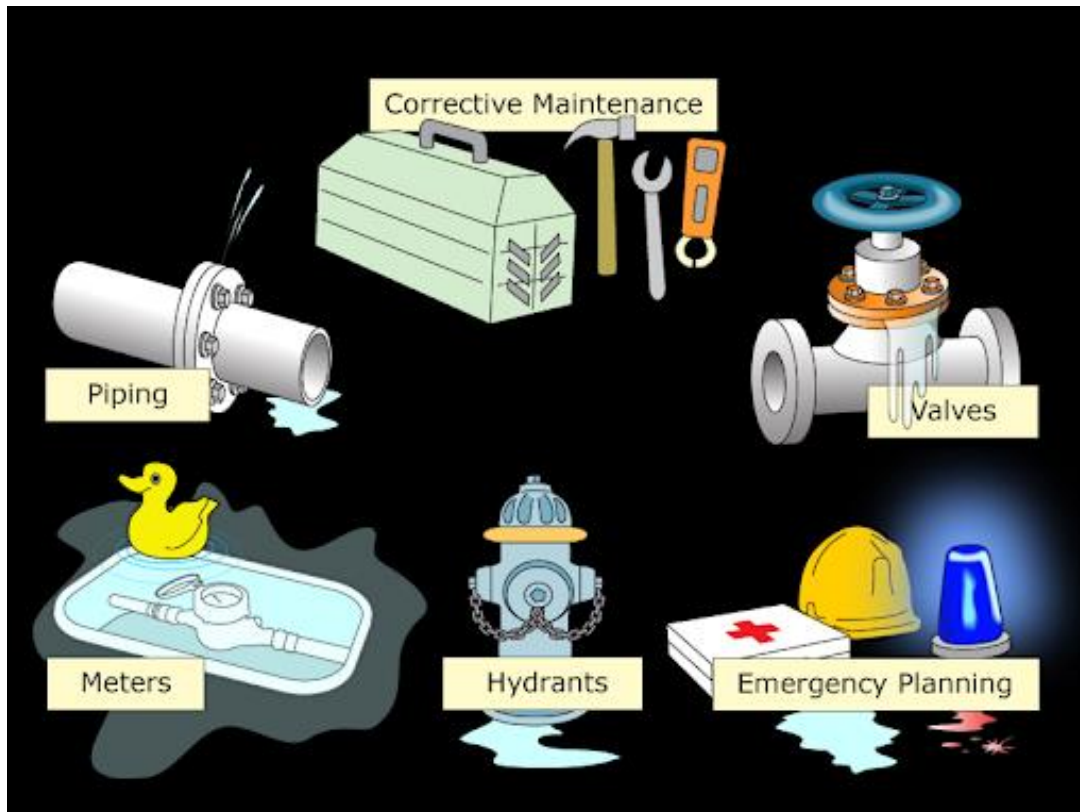
Disadvantages of Corrective Maintenance

- ❖ Breakdown generally occurs in inappropriate times leading to poor and hurried maintenance
- ❖ Excessive delay in production & reduces output
- ❖ Faster plant deterioration
- ❖ Increases chances of accidents and less safety for both workers and machines
- ❖ More spoilt materials
- ❖ Direct loss of profit
- ❖ Can not be employed for equipment regulated by statutory provisions e.g. cranes, lift and hoists etc.



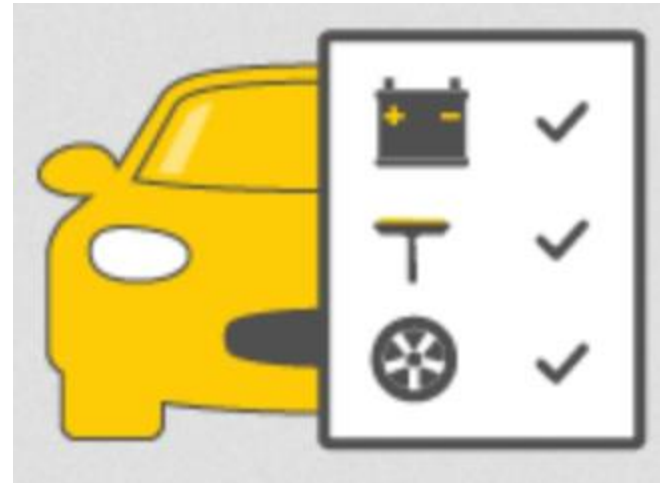
Corrective Maintenance

It **improves equipment and its components** so that preventive maintenance can be carried out reliably. Equipment with **design weakness** must be **redesigned** to improve reliability or improving maintainability.



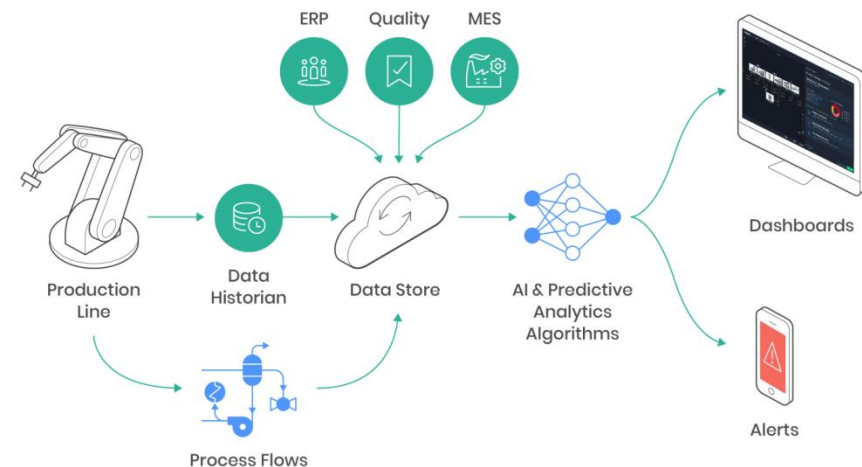
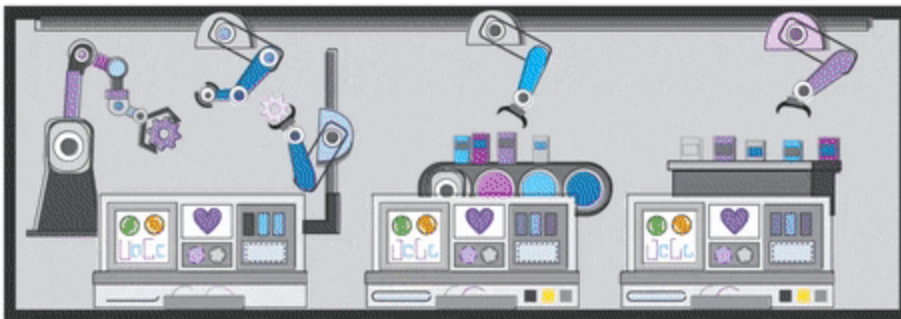
Periodic maintenance:

Maintenance carried out according to **predetermined schedule**. It may be quarterly, half yearly etc.



Predictive Maintenance

This is a method in which the **service life** of important part **is predicted based on inspection or diagnosis**, in order to use the parts to the limit of their service life. Compared to periodic maintenance, predictive maintenance is **condition based maintenance**. It manages trend values, by measuring and **analyzing data** about deterioration and employs a surveillance system, designed to monitor conditions through an **on-line system**.



Other Considerations

When designing the **Maintenance Plan** should be taken into account **two important** considerations affecting some equipment in particular.

- ❖ Firstly, some equipment are subjected to **legal rules** that regulate their maintenance, forcing them to perform certain activities with an established frequency.
- ❖ Secondly, some of the maintenance activities can not be performed with the regular maintenance equipment (either their own or **hired**) because **it requires knowledge and / or specific resources** that are only up to the manufacturer, distributor or a specialist team.

Some equipment are subjected to **rules or regulations by the Administration**. Above all, there are equipment that are **hazardous to people or the environment**. The Administration requires the completion of a series of tasks, tests and inspections, and some of them must be performed by companies duly authorized to carry them out. These tasks must necessarily be incorporated into the Maintenance Plan of the equipment, whatever model you decide to apply.

Some of the equipment subjected to this type of maintenance are:

- Equipment and devices under pressure
- Installation of High and Medium Voltage
- Cooling Towers
- Certain lifts: service or people
- Vehicles
- Fire Prevention Facilities
- Storage tanks of certain chemicals

Benefits of Maintenance

- Prolonged life of company equipment
- Less unplanned downtime caused by equipment failure
- Less unnecessary maintenance and inspections
- Fewer errors in day-to-day operations
- Improved reliability of equipment
- Fewer expensive repairs caused by unexpected equipment failure that must be fixed quickly
- Reduced risk of injury

A) Daily Maintenance

Perform these maintenance tasks
at the beginning and at the end of
work.

1. Lubrication System

- Check for oil level
- Pressure build up during and pumping
- Check for distribution film of oil on all sliding surfaces
- Check for leaks
- Verify lube/pump operation

2. Cutting Tools & Tool Holders

- Tighten the drawbar
- Tighten work holder devices
- Replace worn tool pump and motor

3. Coolant Level (Optional)

- Remove/Check pump and motor

4. External wiring & cables

- Check fit of cable connections
- Check for damage cables

5. Spindle

- Clean the spindle taper
- Test run the spindle

6. Machine-General Condition

- Check entire machine for loose or missing fasteners.
- All of the oily matter, chips, etc, on the machine should be removed completely and put a thin lubricating oil on the sliding surface of machine to prevent the corrosion.

Mechanical

- Tool holders /Drawbar
- Check for breakage and Thread damage
- Inspect drive belts
- Inspect way covers and wipers
- Check draw bar height

Electrical

- Motor
- Check for condition and testing
- Check voltages
- Check limit switches/safety locks

B) Every Three Months

Electrical

1. Electrical Cabinets

- Check for cleanliness
- Check and secure any loose connections
- Inspect connections/terminals

2. Electrical Elements

- Check for proper working of Push button switches or Rotary Switches

3. Proximity Switches

- Check for proper operation

C) Every Six Months

Mechanical

1. Axes Backlash

- Check and compensate if necessary per the directions after consulting with the factory.

2. Ball Screw Guards

- Check Condition

3. Drive Belt

- Check Condition
- Check Tension

4. Gib Adjustments

- Check table motion for fishtailing movement and adjust as per the directions on page

5. Machine base / Table

- Check for level and mounting bolt loosening

Sample Check Sheet for Maintenance

RECOMMENDATION	DAILY	WEEKLY	MONTHLY	QUARTERLY
Check Oil Level	X			
Drain Moisture from Tank(s)	X			
Inspect Air Filter(s)	X			
Check for Unusual Noise or Vibration	X			
Inspect Belt Guard	X			
Check for Air or Oil Leaks	X			
Clean Exterior of Air Compressor		X		
Check Condition of Vibration Pads		X		
Tighten/Retorque Bolts		X		
Check Belt Tension		X		
Check Operation of Safety Valve			X	
Change Compressor Oil			X	
Clean/Change Air Filter			X	
Perform Pump Up Time Test			X	
Check Operation of System Controls				X
Check Air Tanks for Dents/Leaks				X

Comparison of Maintenance Types

Maintenance Type	Preventive Maintenance					Corrective Maintenance	
	Time Based Maintenance	Failure Finding Maintenance	Condition Based Maintenance	Predictive Maintenance	Risk Based Maintenance	Deferred Maintenance	Emergency Maintenance
Task Type	Scheduled Overhaul / Replacement	Functional Test	Measurement of condition	Calculation and extrapolation of parameters	Inspection or Test	Repair / Replace	Repair / Replace
Objective	Restore or replace regardless of condition	Determine if hidden failure has occurred	Restore or replace based on a measured condition compared to a defined standard	Determine if failure is imminent and intervention is required	Determine condition and conduct risk assessment to determine when next inspection, test or intervention is required.	Restore or replace following failure. Result of a Run to Failure Strategy or an unplanned failure.	Restore or replace following unplanned failure.
Interval	Fixed time or usage interval e.g. 1 month, 1,000hrs or 10,000 km	Fixed time interval (can be set based on risk assessment e.g. SIL)	Fixed time interval for condition measurements / inspections	Continuous online monitoring of parameters, intervention as required	Time based interval between tasks and scope of task is based on risk assessment	Not applicable, but intervention is deferred to allow for proper planning & scheduling.	Immediate intervention required.

RETROFITTING TECHNIQUE

Retrofitting refers to the **addition of new technology or features to older systems-**
power plant retrofit, improving power plant efficiency / increasing output /
reducing emissions

home energy retrofit, the improving of existing buildings with energy efficiency
equipment

seismic retrofit, the process of strengthening older buildings in order to make them
earthquake resistant

Naval vessels often undergo retrofitting in dry dock to incorporate new
technologies, change their operational designation, or compensate for perceived
weaknesses in their design or gun plan.

BENEFITS OF A RETROFIT

Saving on capex while benefiting from new technologies

Optimization of existing plant components

Adaptation of the plant for new or changed products

Increase in piece number and cycle time

Guaranteed spare parts availability

Reduced maintenance costs and increased reliability

CNC RETROFIT

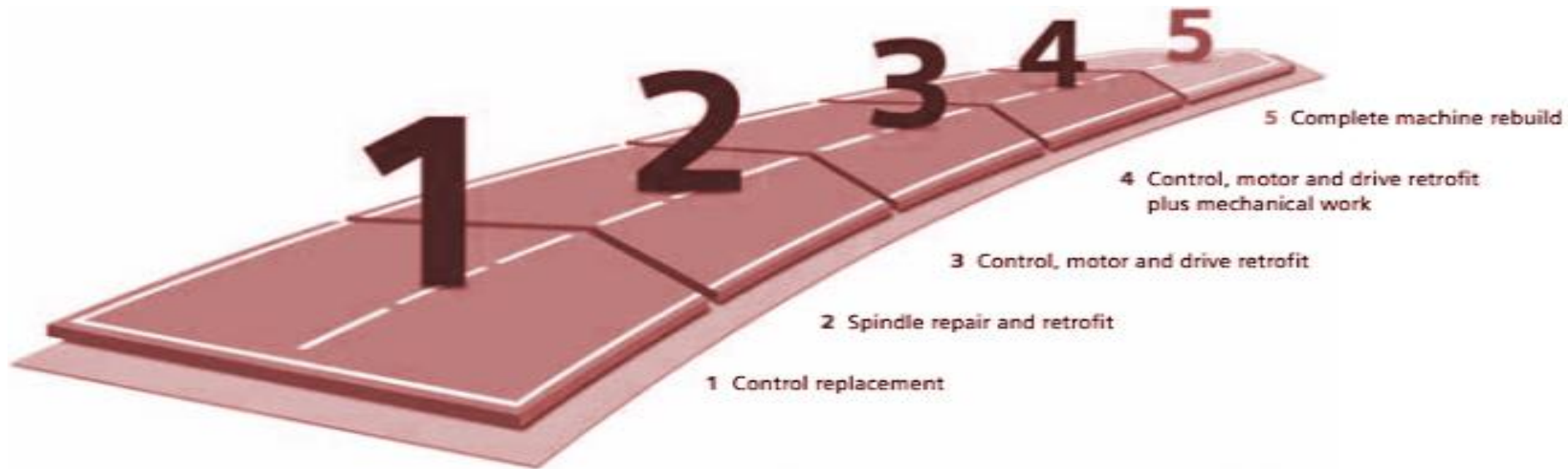
A CNC retrofit typically upgrades the CNC, the **axes servo motors and drives**, the spindle motor and drives, and a portion of the **associated wiring and related electromechanical components**. Unlike rebuilding and remanufacturing, a CNC retrofit **does not include any major repairs** to the machine mechanics. A CNC retrofit should not be confused with a CNC conversion, where **a manual machine is converted into a CNC machine**. Assuming the machine tool is generally in good shape mechanically, CNC retrofitting is typically the **lowest cost solution** to improve the overall performance of an older machine tool.

BENEFITS OF A CNC RETROFITTING

There have been advances in machine tool and CNC technologies in the last twenty years. However, the machine tools advances may not be relevant to a particular machine's application in your business, yet you would still like to take advantage of the CNC advance for performance, reliability and other innovative features. **Not all machine tools are good candidates for a retrofit based on simple economics.** Small commodity machines benefit from an economy of scale in production and in the price of the procured components. **Since a retrofit can require one-time engineering charges, it is often cheaper to purchase a new replacement commodity machine.**

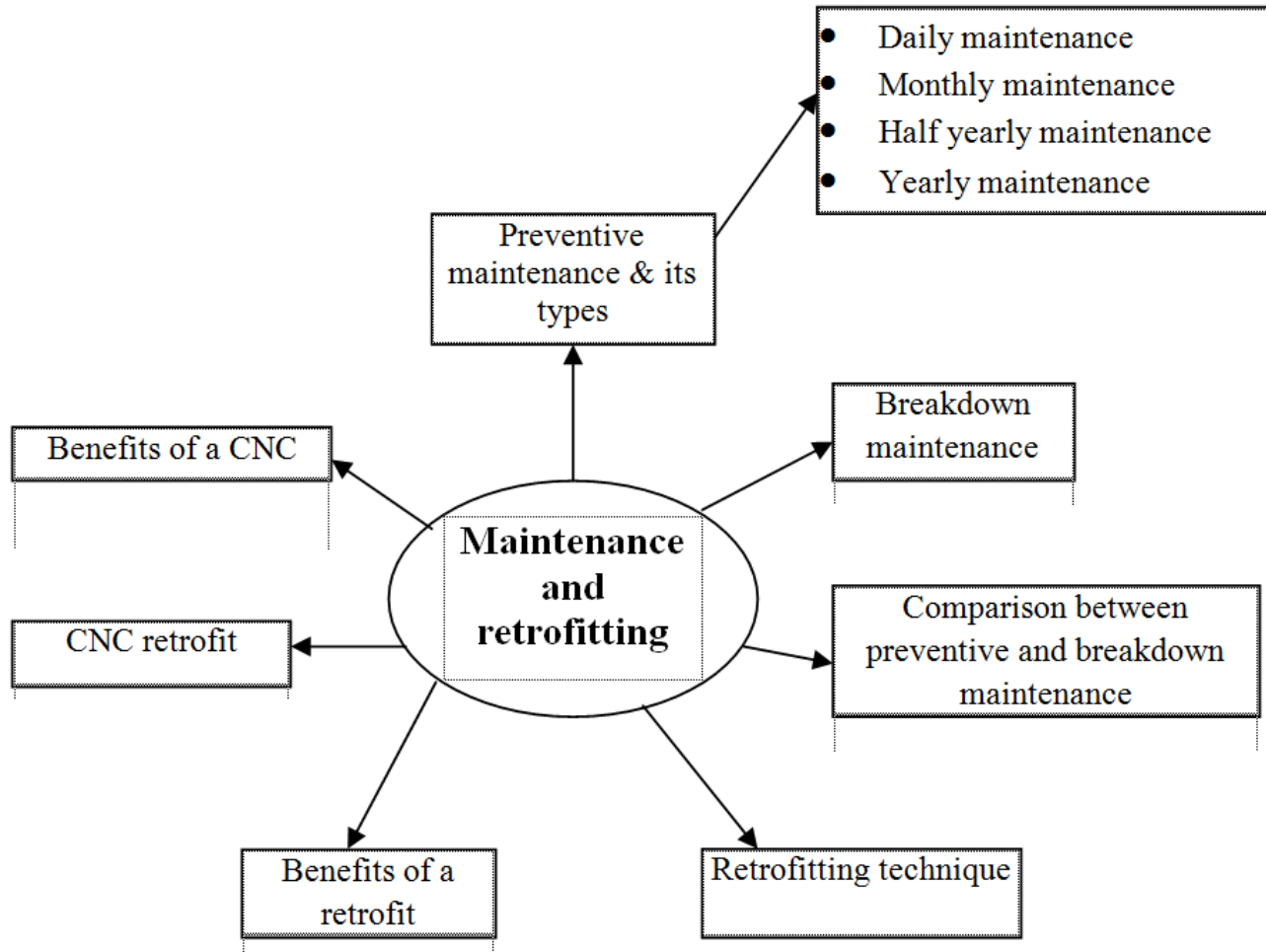
- Far superior repeatability.
- Reduced machine downtime.
- Increased productivity.
- Improved control of machine.
- Fast machining cycles.
- High accuracy, high feed-rate
- Increased accuracy and part finished due to new Digital Servo drives.

Stages of Retrofitting in CNC machines



Specialized in CNC retrofit with complete electrical, electronics and mechanical revamping

Concept Map



Discussion



10 mins