

SAFETY

Safety:

Safety is a state in which hazards and conditions leading to physical, psychological, or material harm are controlled to preserve the health and well-being of individuals and the community.

Types of safety:



Safety Sign for Industries:



1) IMPORTANT OF SAFETY RULES:

TOP TEN SAFETY RULES



1

Be responsible for your own safety and the safety of others

Most accidents are preventable

2

3

Never take short cuts or bypass safety measures

Only perform tasks for which you are trained

4

5

Use the correct tools and equipment for a job

Consider any risks before you start working

6

7

Never wear loose-fitting clothing or untied shoes

Don't engage in horseplay on the job

8

9

Keep a tidy workplace and clean as you go

Wear the right Personal Protective Equipment (PPE)

10



5S CONCEPT:

5S is a Japanese methodology for workplace organization. In Japanese it stands for seiri(SORT), seiton(SET), seiso(SHINE), seiketsu(STANDARDIZE), and shitsuke(SUSTAIN).



PERSONAL PROTECTIVE EQUIPMENT (PPE):

These injuries and illnesses may result from contact with chemical, radiological, physical, electrical, mechanical, or other workplace hazards. Personal protective equipment may include items such as gloves, safety glasses and shoes, earplugs or muffs, hard hats, respirators, or coveralls, vests, and full body suits.

Personal Protective Equipment (PPE)



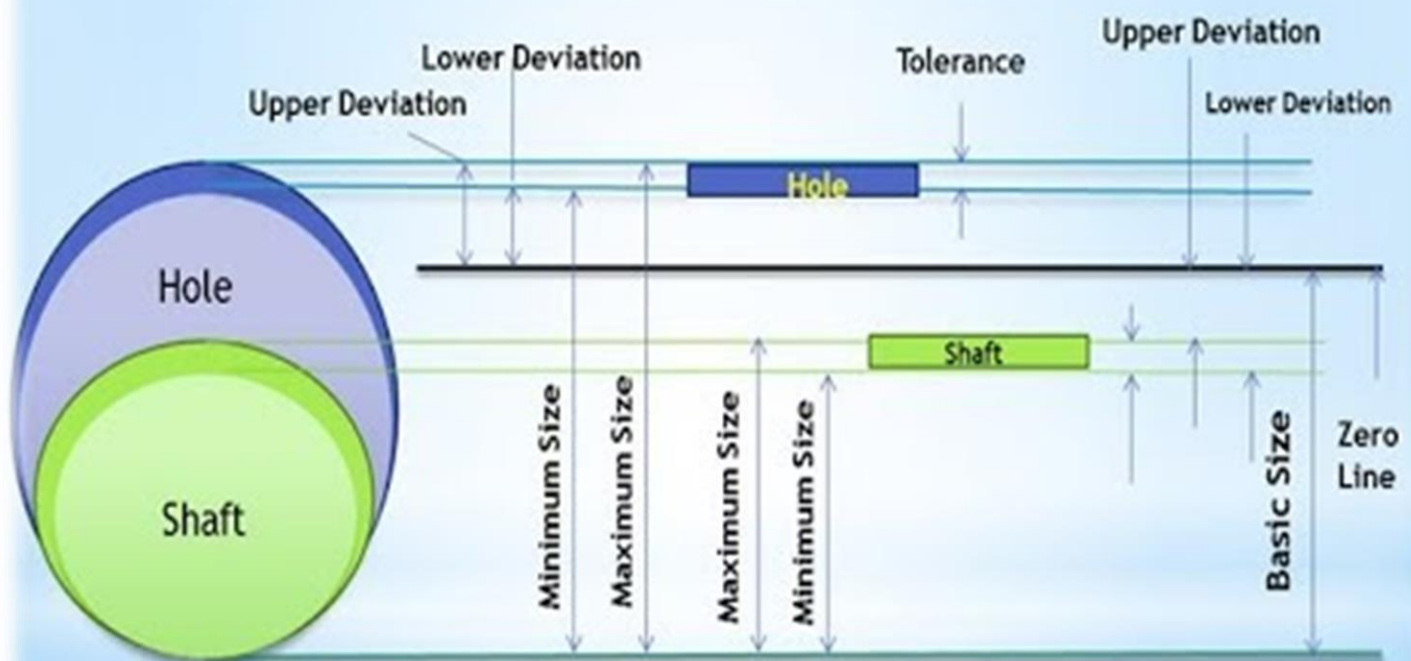
LIMITS FIT & TOLERANCE:

The manufacture of interchangeable parts require precision. Precision is the degree of accuracy to ensure the functioning of a part as intended. However, experience shows that it is impossible to make parts economically to the exact dimensions. This may be due to,

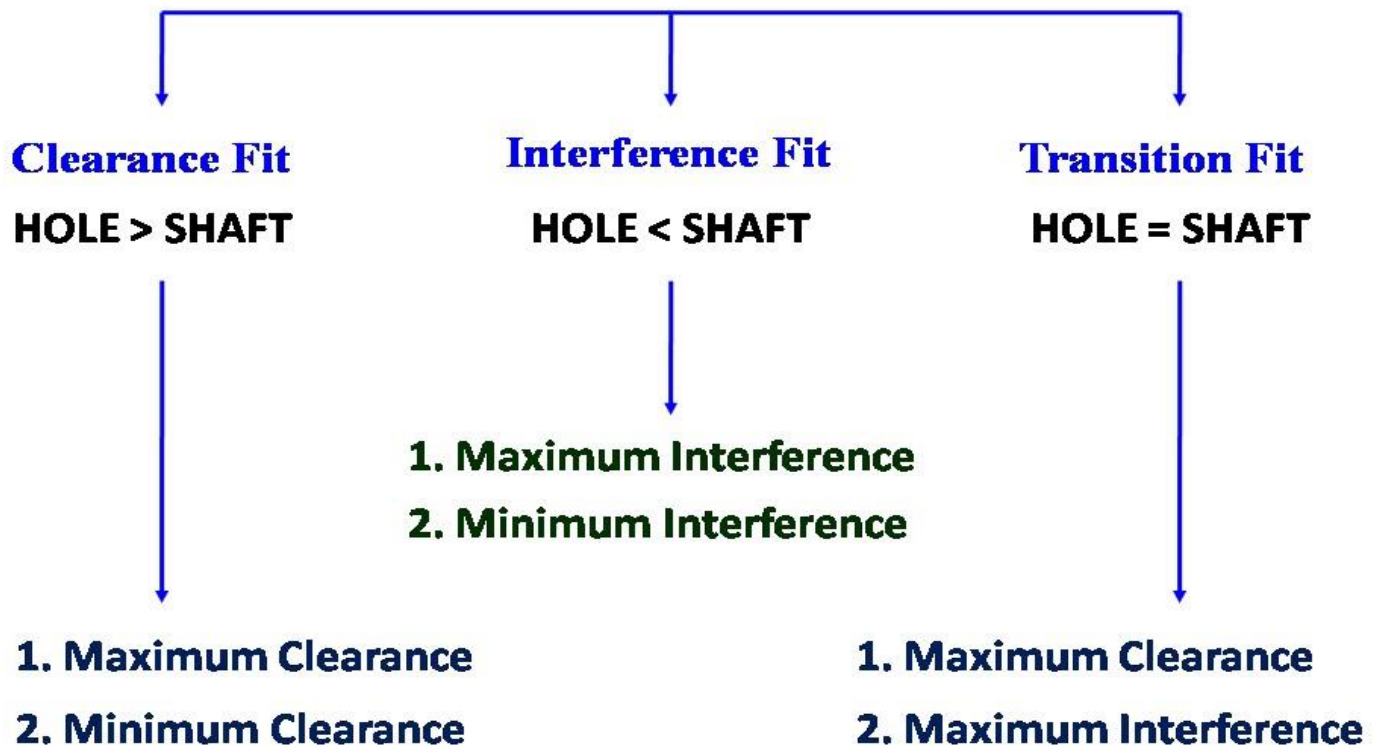
1. In accuracies of machines and tools,
2. In accuracies in setting the work to the tool,
3. Error in measurement, etc.

The workman, therefore, must be given some allowable margin so that he can produce a part, the dimensions of which will lie between two acceptable limits, a maximum and a minimum.

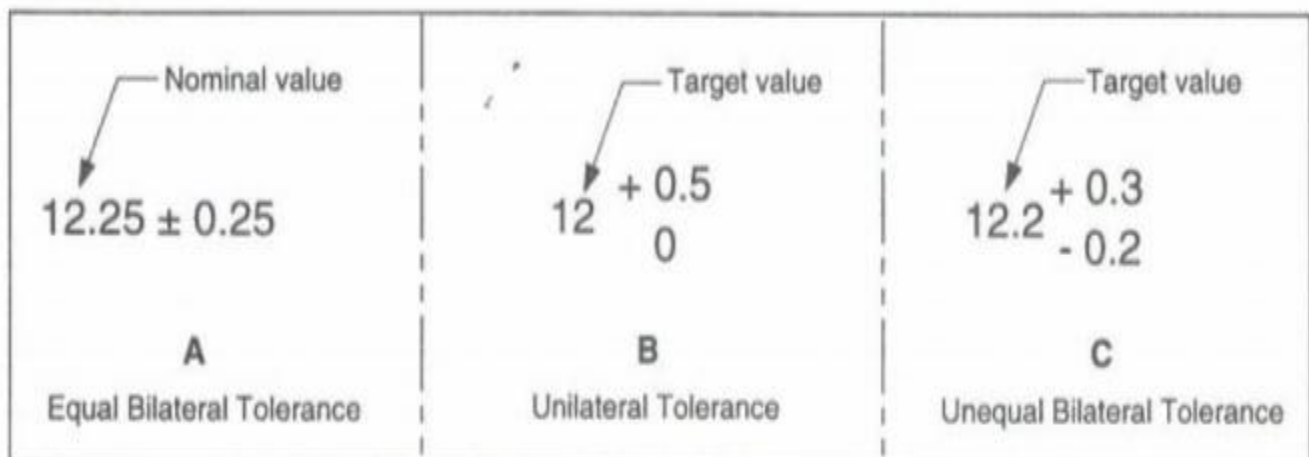
Limits, Fits, and Tolerances



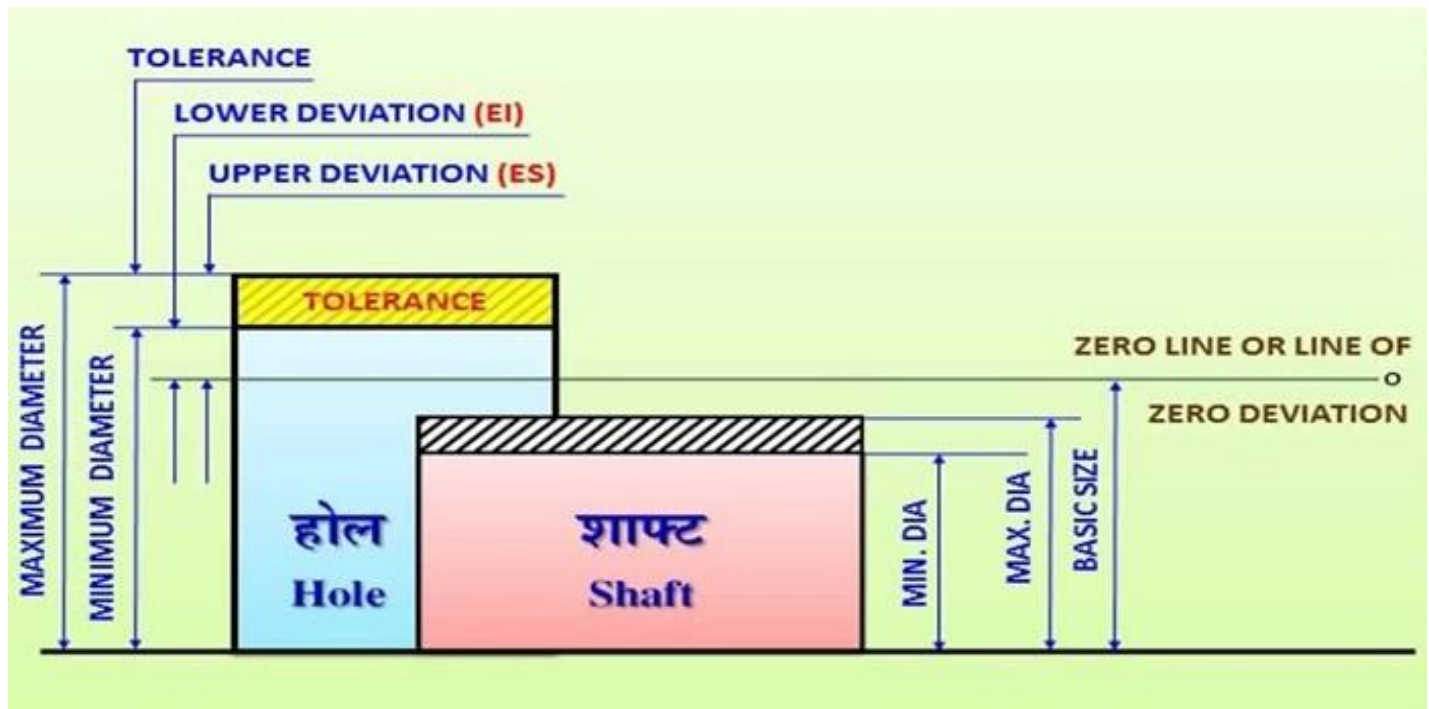
Types Of Fits



TYPES OF TOLERANCE:



TERMINOLOGY OF LIMITS, FITS & TOLERANCE:



General Terminology in Fits

Grade: This is an indication of the tolerance magnitude; the lower the grade, the finer the tolerance.

Deviation: It is the algebraic difference between a size and its corresponding basic size. It may be positive, negative, or zero.

Upper deviation: It is the algebraic difference between the maximum limit of size and its corresponding basic size. This is designated as 'ES' for a hole and as 'es' for a shaft.

Lower deviation: It is the algebraic difference between the minimum limit of size and its corresponding basic size. This is designated as 'EI' for a hole and as 'ei' for a shaft.

Actual deviation: It is the algebraic difference between the actual size and its corresponding basic size.

Fundamental deviation: It is the *minimum difference between the size of a component and its basic size. This is identical to the upper deviation for shafts and lower deviation for holes.*

25

GEARS

GEARS:

Gears is a rotating circular machine part having cut teeth or, in the case of a cogwheel or gearwheel, inserted teeth (called cogs), which mesh with another toothed part to transmit torque.

CLASSIFICATION OF GEARS

- GEARS ARE CLASSIFIED AS FOLLOWS:
 - 1) SPUR GEARS
 - 2) HELICAL GEARS
 - 3) SPIRAL GEARS
 - 4) BEVEL GEARS
 - 5) WORM AND WORM WHEEL
 - 6) RACK AND PINION
 - 7) INTERNAL GEARS

Types of Gears



Spur Gear



Helical Gear



Herringbone Gear



Worm & Worm Wheel



Rack & Pinion Gear



Bevel Gear



Mitre Gear

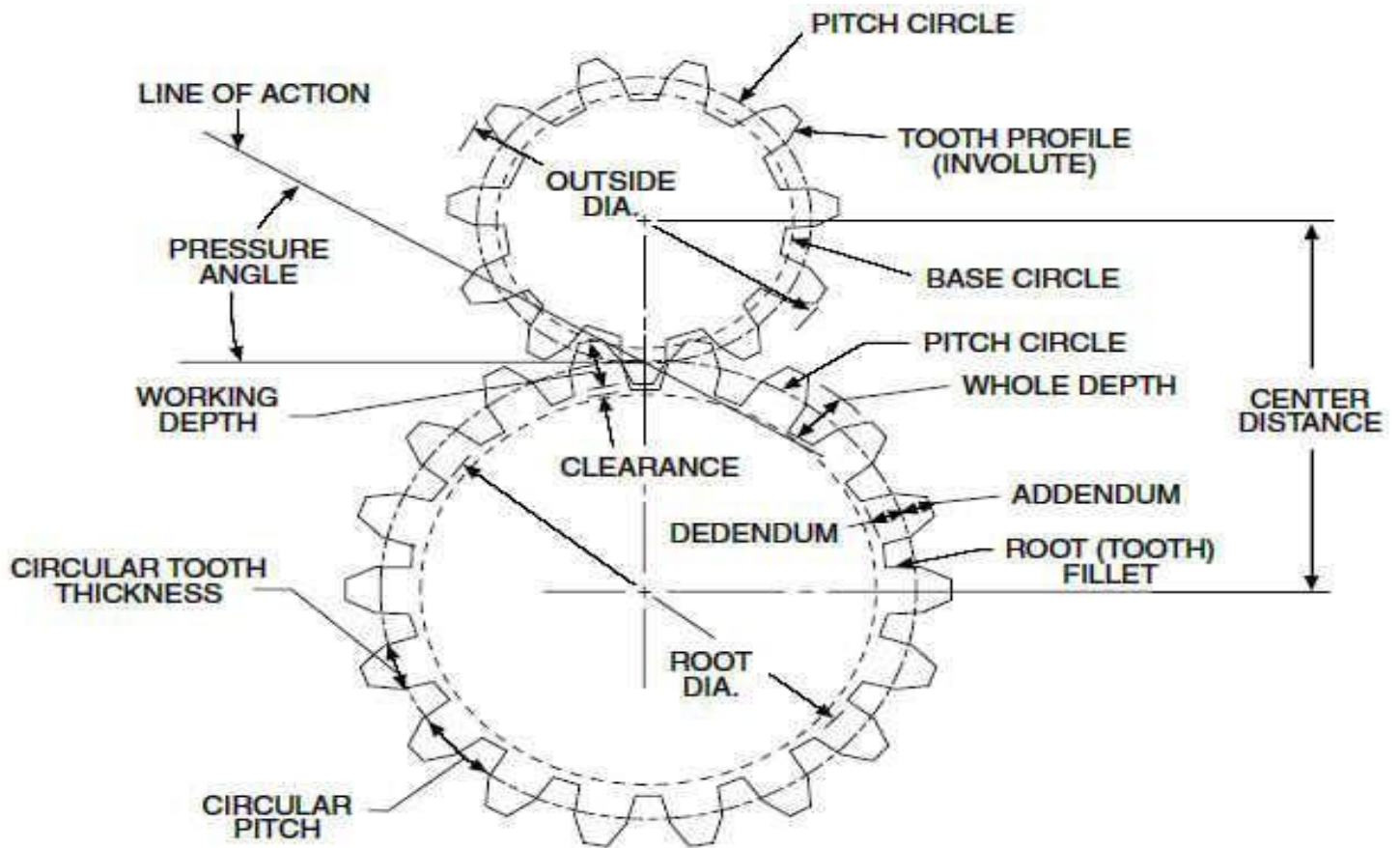
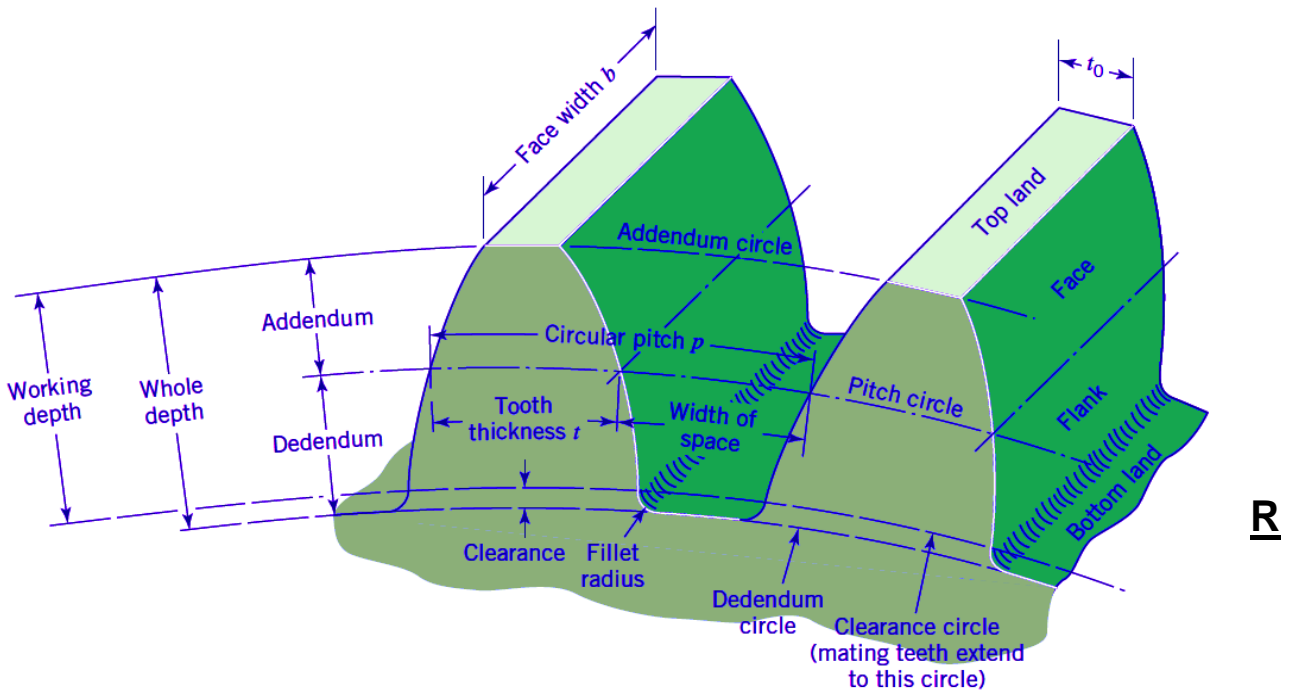


Spiral Bevel Gear



Internal Gear

GEAR TERMINOLOGY:



REPAIR OF BROKEN GEAR TOOTH BY METHOD

REPAIR OF BROKEN GEAR TOOTH:

The repair of broken gear tooth by the two methods...

- 1) Welding Method
- 2) Dovetail Blank Method

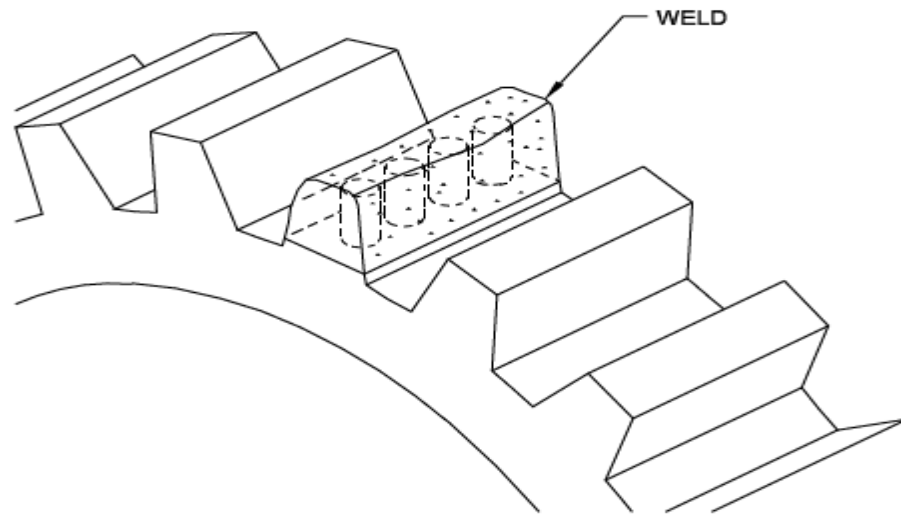


Fig. 1 Welding Method

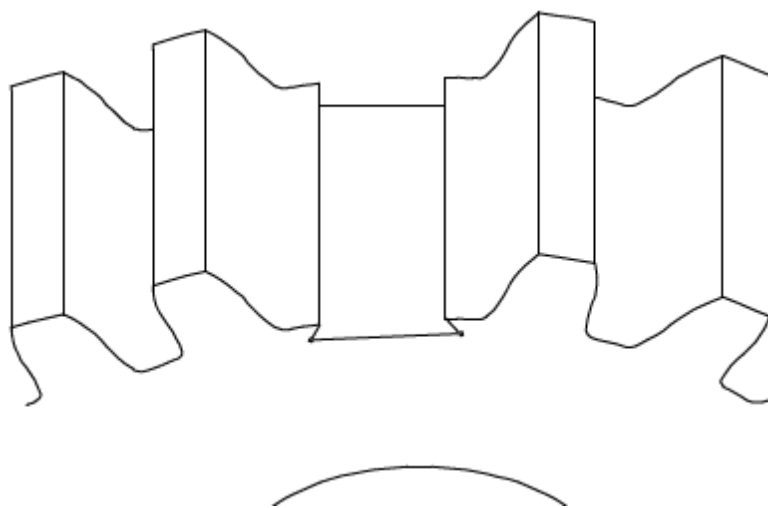


Fig. 2 Dovetail Blank Method

INSTALLATION OF MACHINES

INSTALLATION OF MACHINE:

The sequence of installation methods are as follows.

- 1) foundations
- 2) fitting and moving
- 3) levelling
- 4) testing

Types of Machine Foundations

- A suitable foundation is selected depending on the type of machine
- For compressors and reciprocating machines, a **block foundation** is generally provided
- Such a foundation consist of a pedestal/pier supported by a thick footing
- If two or more similar machines are to be installed, a single mat may be preferred. Such a foundation is also known as **combined block-type foundation**
- Block foundations are **normally modelled as rigid foundations** for analysis

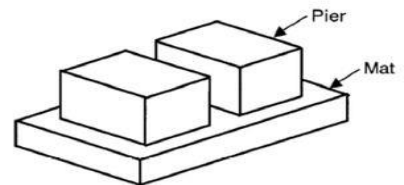
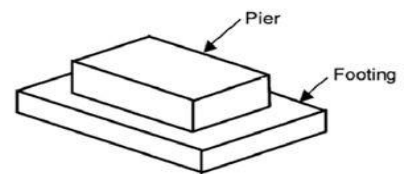


Fig. 1 Levelling Equipment for Machines



Fig 2 Tensile Testing Equipment for Machines

MAINTENANCE

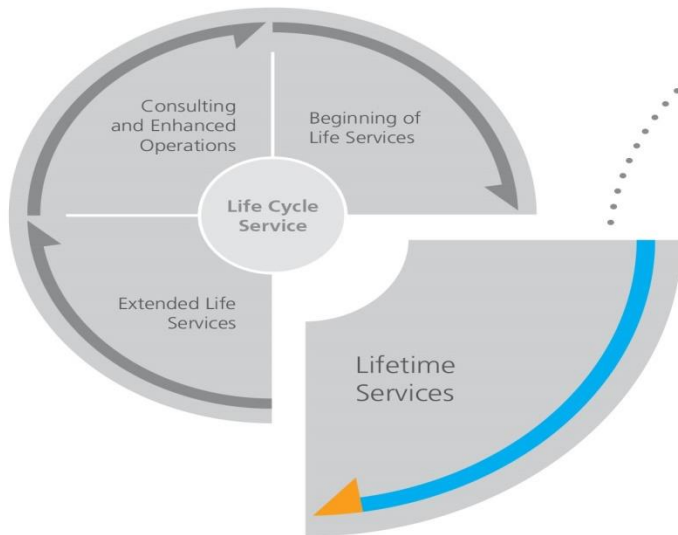
MAINTENANCE:

Maintenance is the process of maintaining something or somebody. It may mean the state of being maintained.

TYPES OF MAINTENANCE:



GEA SERVICE



The cost efficient way of ensuring safety and reliability

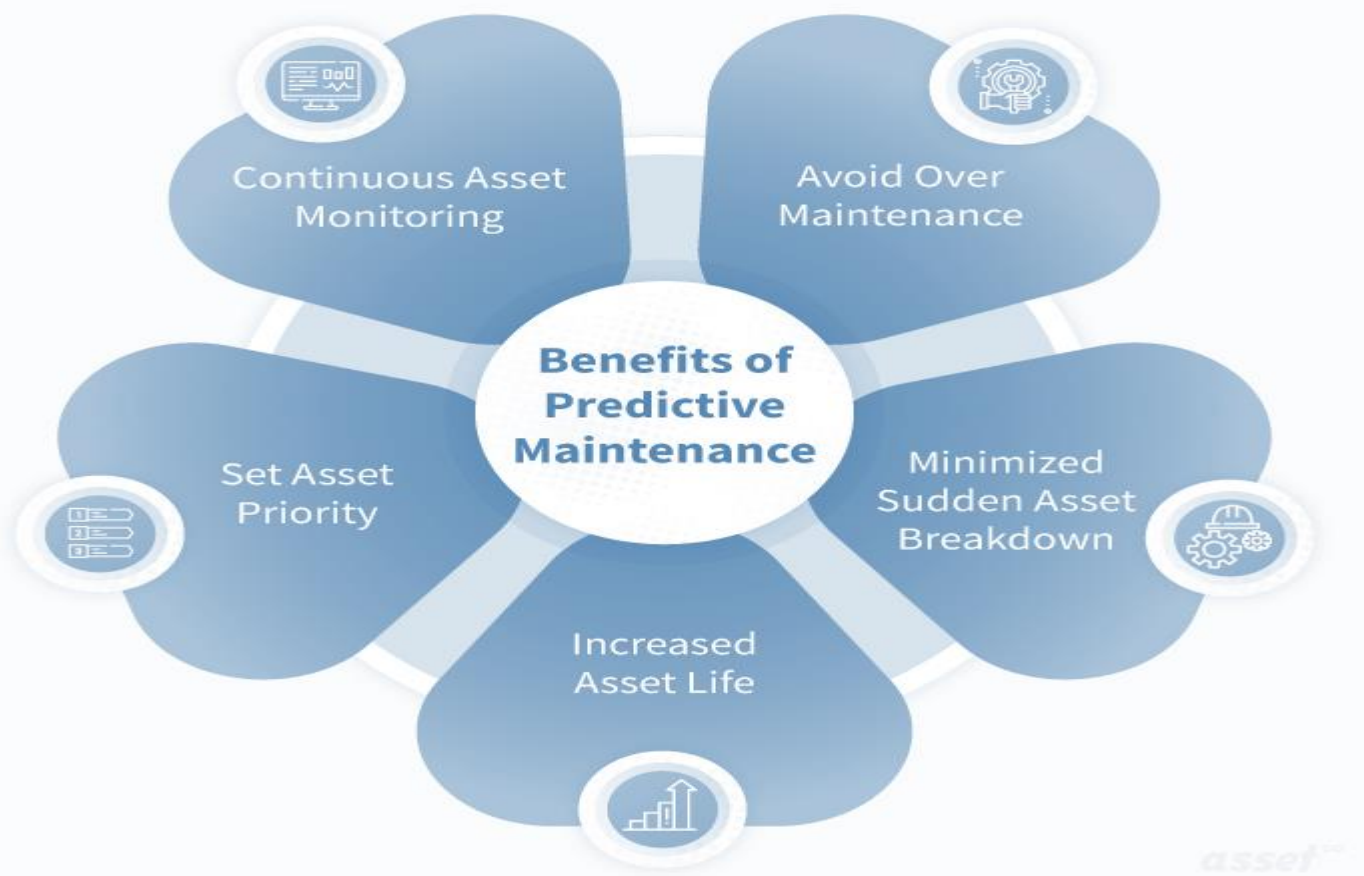
CORRECTIVE MAINTENANCE

24/7 responsiveness,
100 % efficiency

Fig.1 Corrective Scheduled Maintenance

ELEMENTS OF PREVENTIVE MAINTENANCE

- ✓ Inspections or Check ups
- ✓ Lubrication
- ✓ Planning and Analysis
- ✓ Training to maintenance staff
- ✓ Storage of spare parts
- ✓ Records and Analysis



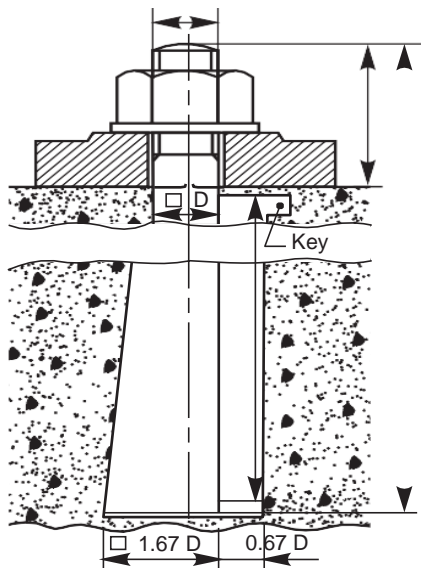
FOUNDATION BOLTS

FOUNDATION BOLTS:

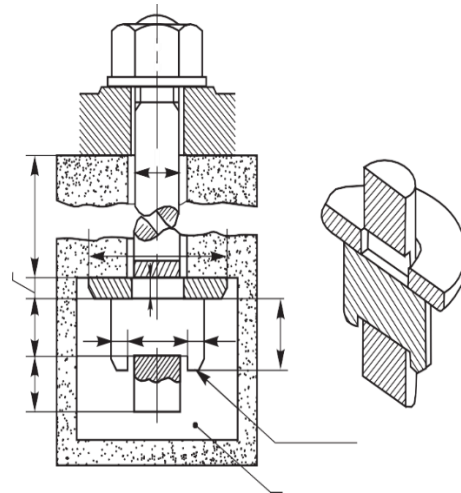
Foundation bolts are used for fixing machines to their foundations. Foundation bolts are made by forging from mild steel or wrought iron rods. The bolt size depends upon the size of the machine and the magnitude of the forces that act on them when the machine is in operation.

TYPES OF FOUNDATION BOLTS

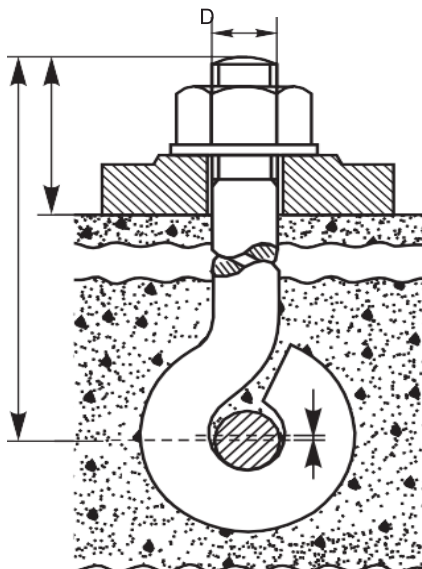
LEWIS FOUNDATION BOLT



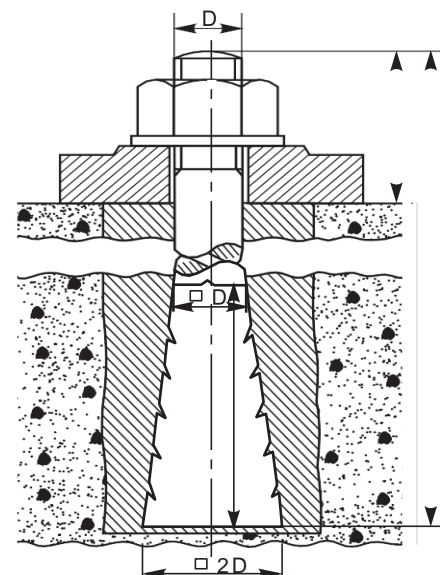
COTTER FOUNDATION BOLT



EYE FOUNDATION BOLT



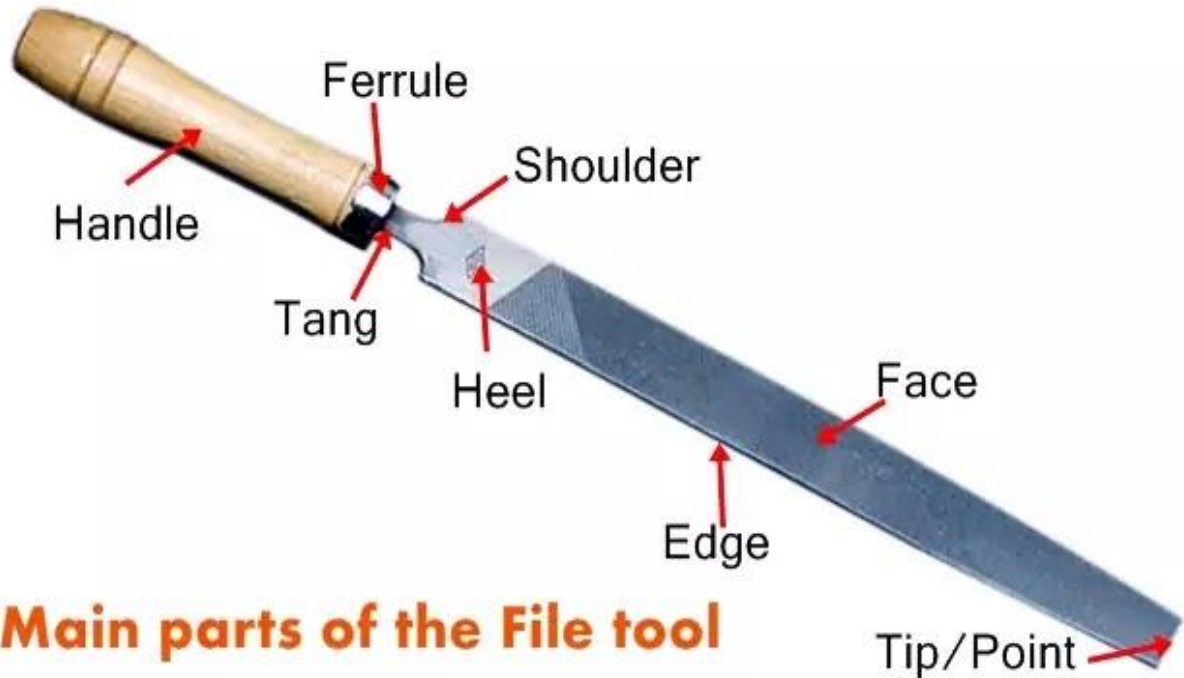
RAG FOUNDATION BOLT



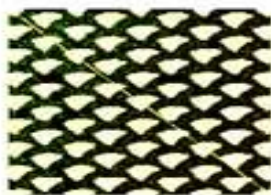
FILES

FILES:

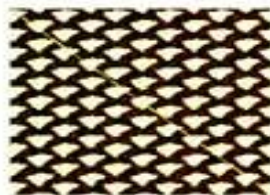
File is a tool used to remove fine amounts of material from a work piece. It is common in woodworking, metalworking, and other similar trade and hobby tasks. Most are hand tools, made of a case-hardened steel bar of rectangular, square, triangular, or round cross-section, with one or more surfaces cut with sharp, generally parallel teeth.



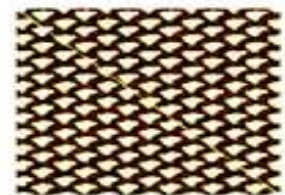
Main parts of the File tool



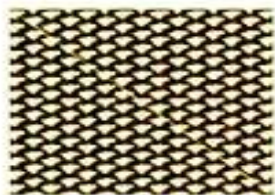
Rough



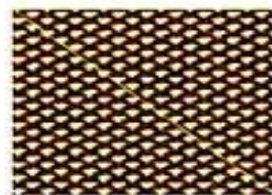
Bastard



Second Cut

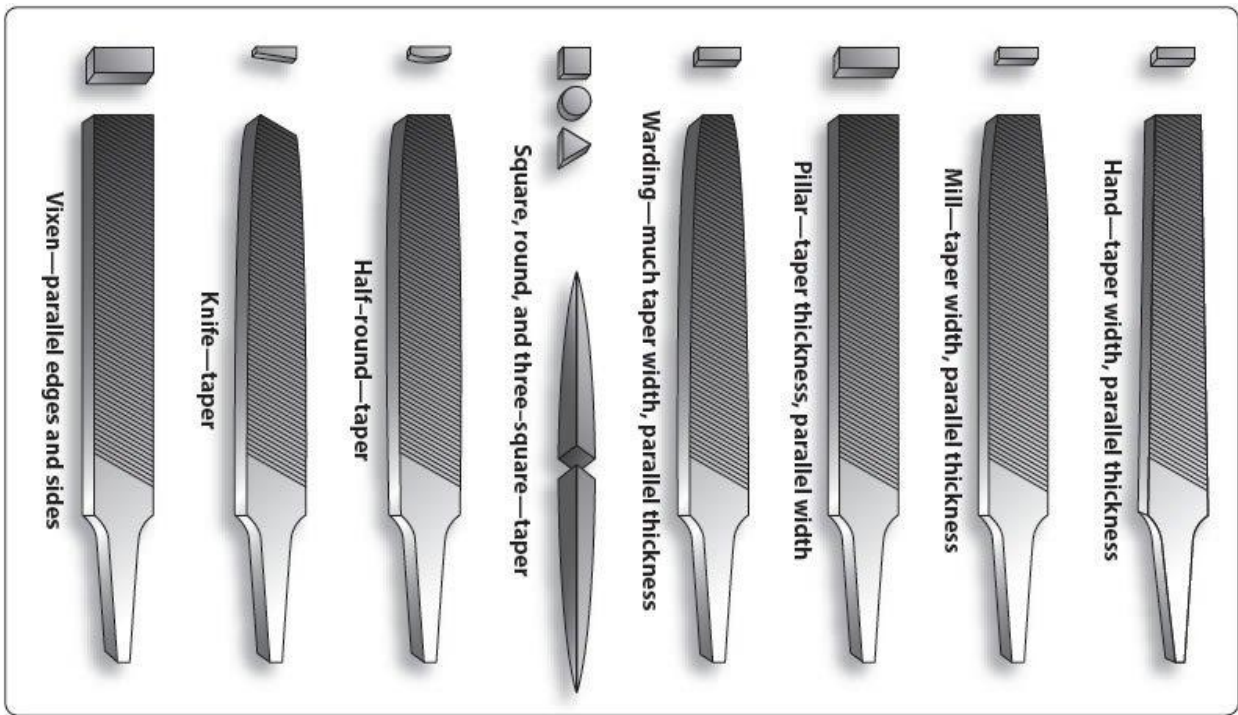


Smooth



Drad Smooth

Grade of Files



Files

In AHS each work station is equipped 4 files

- 1 Rough cut Rectangular File
- 1 Smooth cut Rectangular file
- 1 Half Round File
- 1 Round File

Files are made from **High Carbon Steel**

One edge of the file has no teeth. This is called the **Safe Edge**

Remember never use a file with a broken or missing handle.

The part of the file inside the handle is called the **Tang**

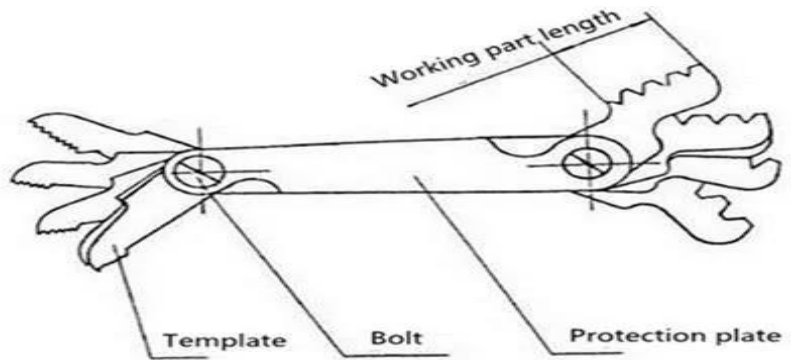
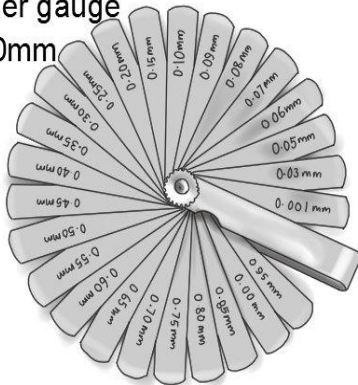


GAUGES

GAUGES:

A gauge is an important measuring device in the field of design engineering. It is a device used to provide certain dimensional information, according to a specified standard or system. Some gauges are meant to measure the size of the object.

Metric feeler gauge
0.04 - 1.00mm



Types of Gauges

Plug Gauge



Ring Gauge



Snap Gauge



Telescopic Gauge



Wire Gauge



Dial Gauge



Bore Gauge



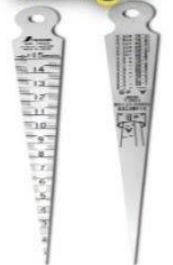
Slip Gauge



Drill Gauge



Taper Gauge



Drill angle Gauge

BELT DRIVE

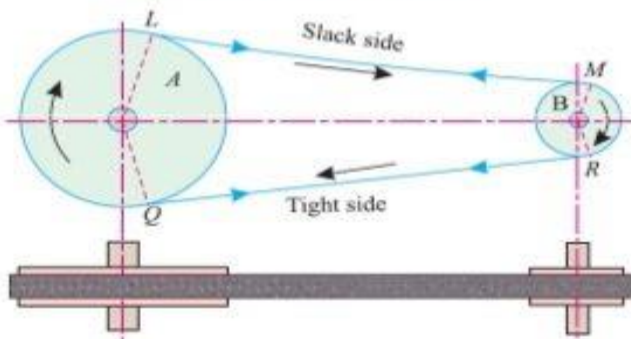
BELT DRIVE:

A belt drive is a frictional drive that transmits power between two or more shafts using pulleys and an elastic belt.

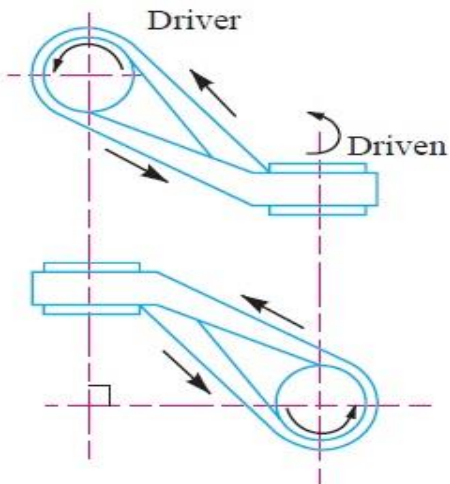
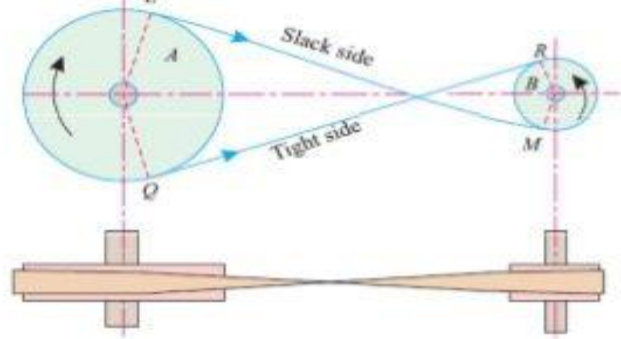
Classification of Belt Drive:

- 1) Open belt drive.
- 2) Crossed belt drive.
- 3) Compound belt drive.
- 4) Quarter turn belt drive
- 5) Stepped cone pulley.
- 6) Fast and loose cone pulley.
- 7) Jockey pulley drive.

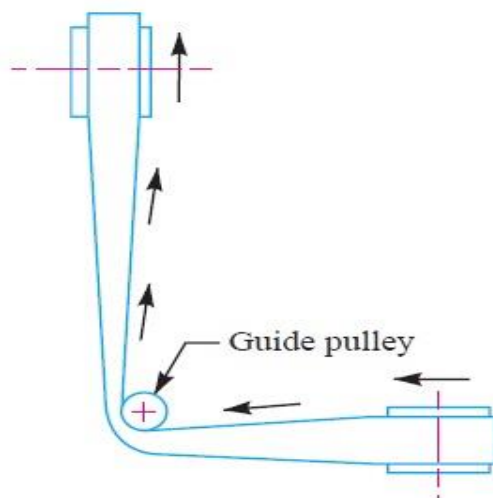
Open Belt Drive



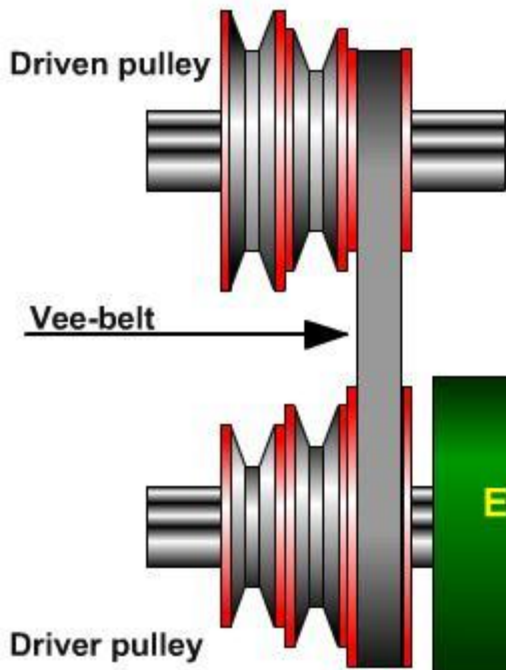
Cross Belt Drive



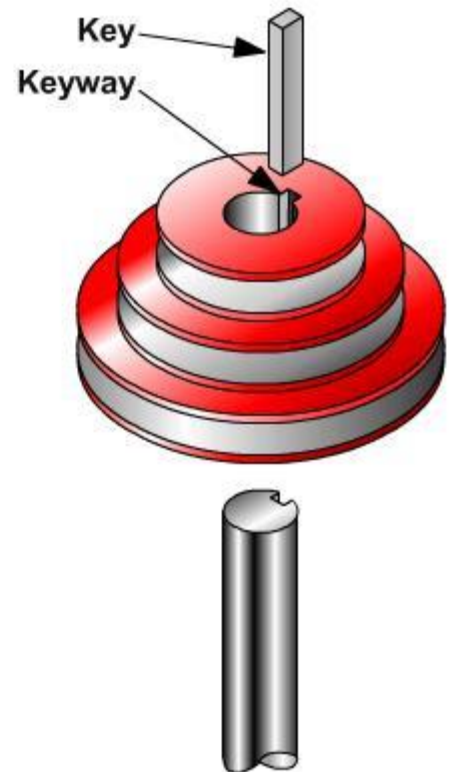
(a) Quarter turn belt drive.



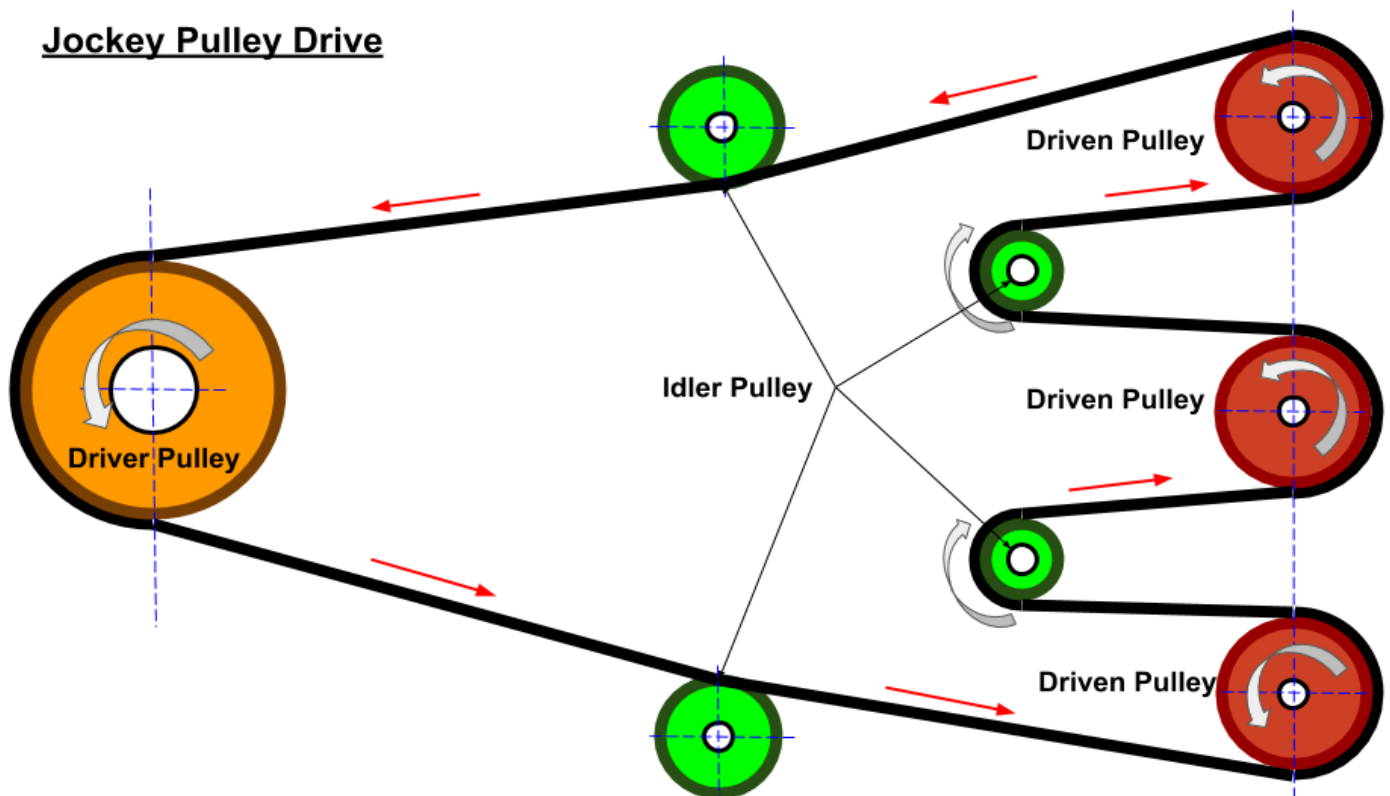
(b) Quarter turn belt drive with guide pulley.



A stepped cone pulley is a single pulley made up of 2,3,4 or more steps. Each step has a groove for a belt.



Jockey Pulley Drive



PIPE FITTING

PIPE FITTING:

Pipe Fittings are defined as the piping components that help in pipe routing for directional changes, size changes, and branch connections.

TYPES OF FITTINGS IN PVC AND METAL:



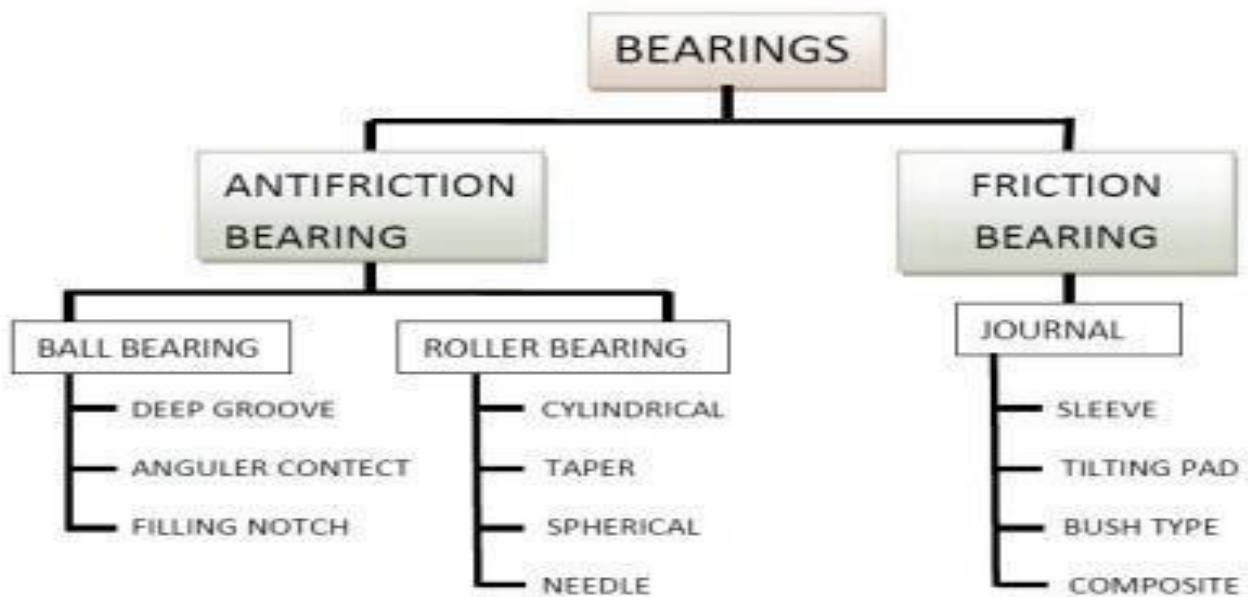
90 deg elbow	Tee fitting	Red tee fitting	M/F elbow	Cross fitting
				
45 deg elbow	Union fitting	Hex head cap	Reducer fitting	Y-way fitting
				
Reducer nipple	Square plug fig	Hex plug fitting	Hex nipple	Lock nut
				
Hose Nipple fitting	Full coupling	Half coupling	single nipple	socket plain fig
				

BEARINGS

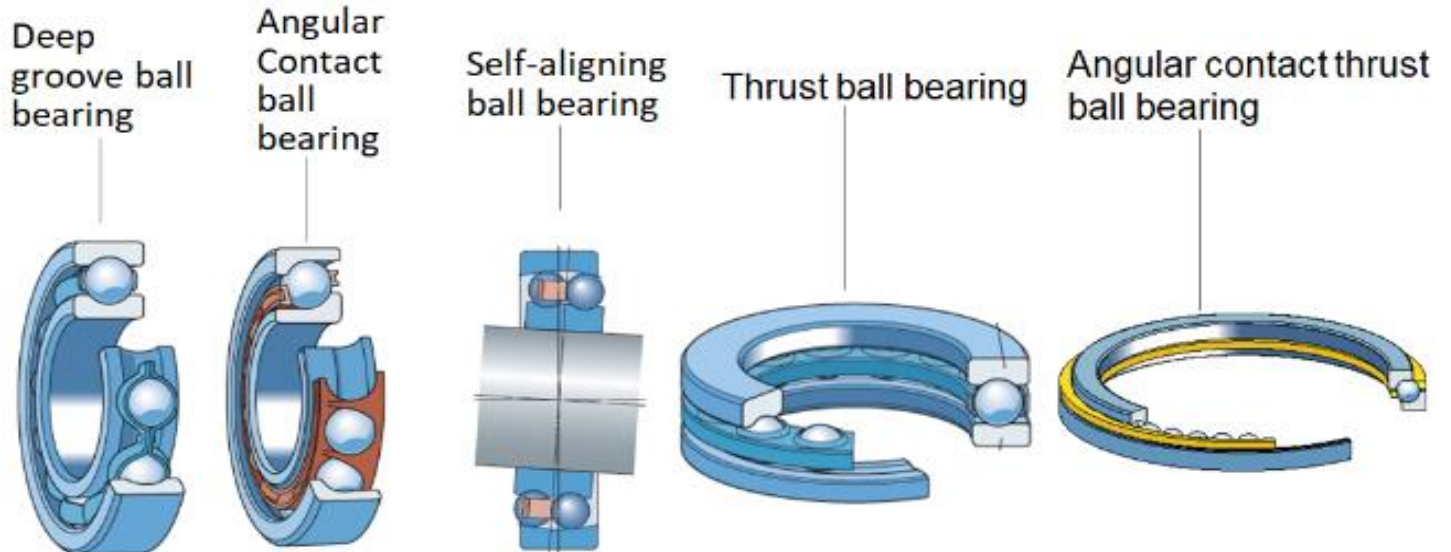
BEARING:

The term "bearing" is derived from the verb "to bear" a bearing being a machine element that allows one part to bear (i.e., to support) another. A bearing is a machine element that constrains relative motion to only the desired motion, and reduces friction between moving parts.

TYPES OF BEARINGS



Ball bearings Types

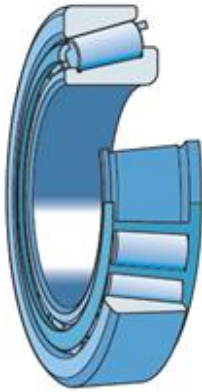


Roller bearings types

Cylindrical roller bearing



Taper roller bearing



Spherical roller bearing



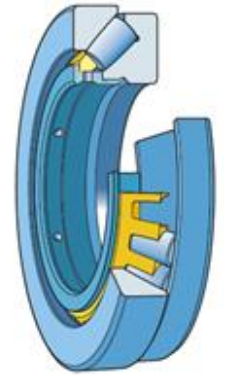
Needle roller bearing



CARB Bearing



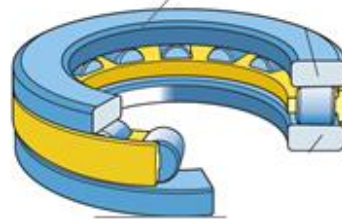
Spherical Roller thrust bearing



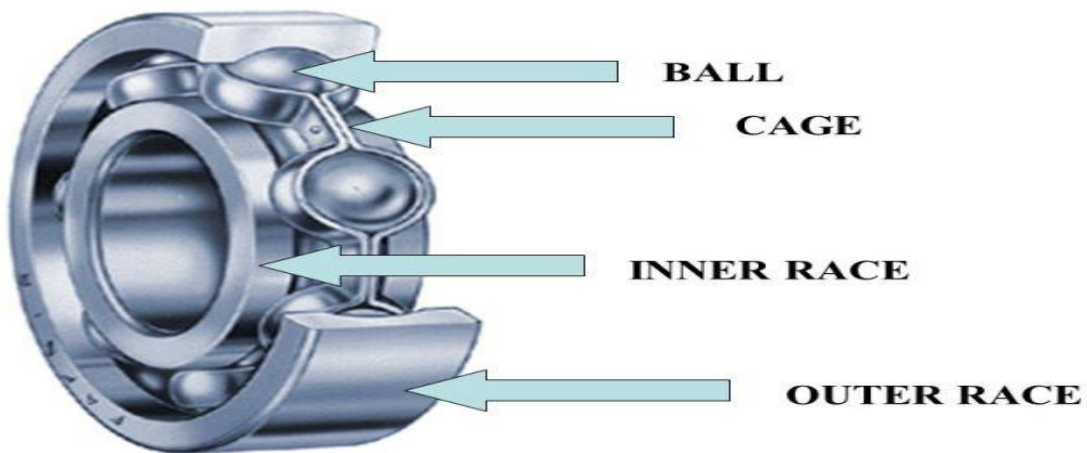
Needle roller thrust bearing



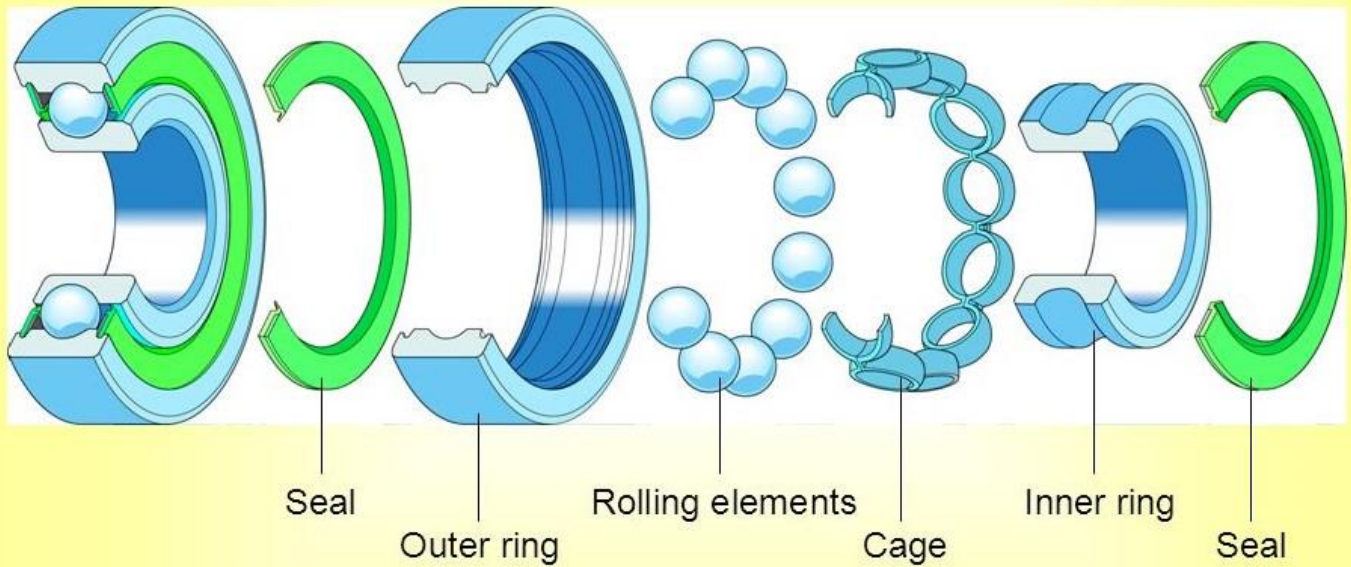
Cylindrical roller thrust bearing



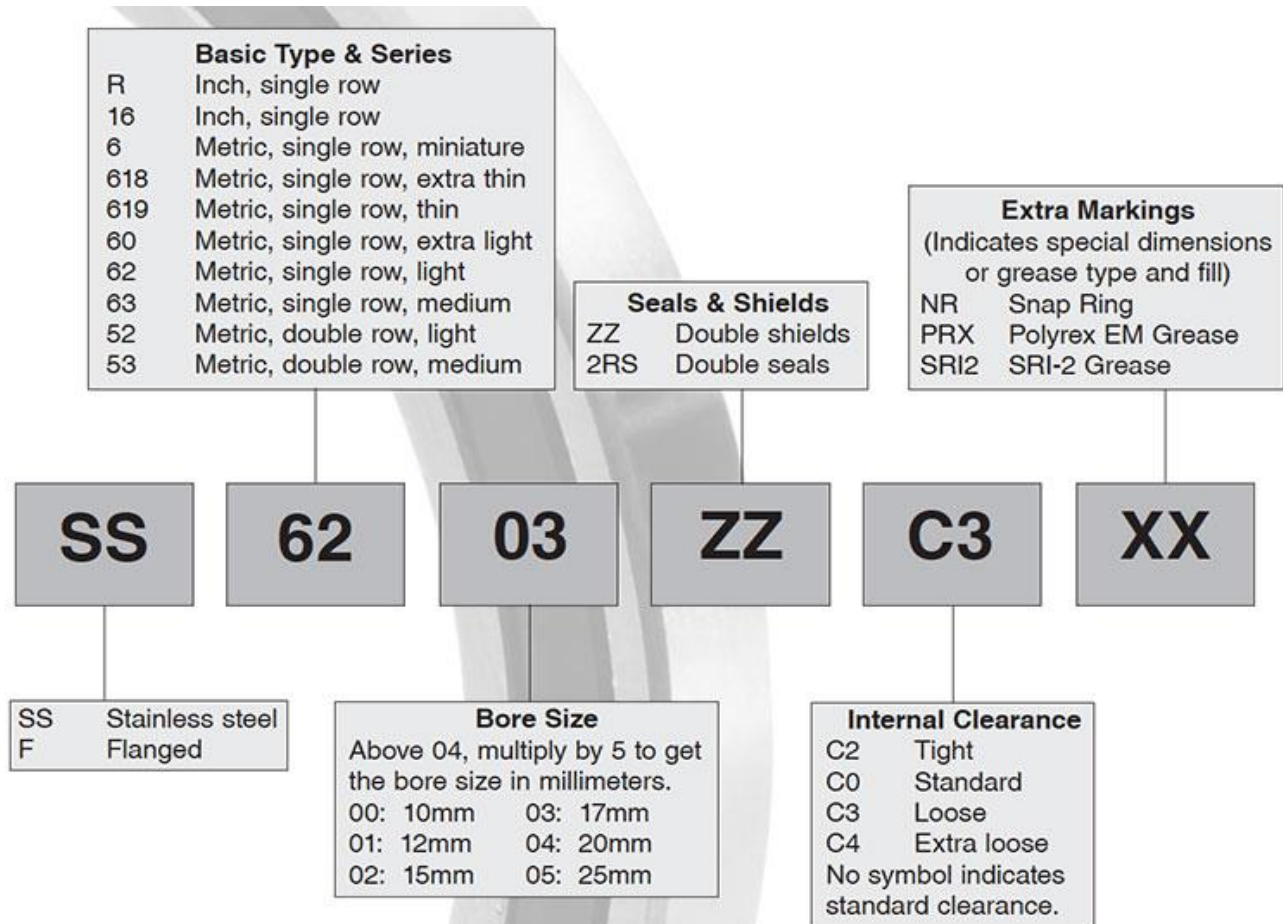
Parts of a Ball Bearing











Component parts of a ball bearing



NOMENCLATURE OF BEARINGS:



The table compares the performance of different bearing types with regard to load, accuracy, speed, noise and friction.

Bearing type		Radial load	Axial load	Compensation of misalignment	Accuracy	High speed	Low noise	Low friction
Deep groove ball bearing		Good	Normal	Normal	Normal	Very good	Very good	Very good
Single row angular contact ball bearing		Good	Good (in one direction)	Unsuitable	Normal	Very good	Good	Good
Spindle bearing		Good	Good (in one direction)	Unsuitable	Very good	Very good	Very good	Very good
Cylindrical roller bearing with cage		Very good	Unsuitable ... (in one direction)	Sufficient	Good	Good	Sufficient	Good
Tapered roller bearing		Very good	Very good (in one direction)	Sufficient	Sufficient	Normal	Good	Good
Spherical roller bearing		Very good	Good	Very good	Unsuitable	Normal	Sufficient	Good
Axial spherical roller bearing		Sufficient	Very good (in one direction)	Very good	Unsuitable	Good	Sufficient	Unsuitable
Plain bearing		Very good	Sufficient	Normal	Sufficient	Good	Normal	Sufficient



PHYSICAL & MECHANICAL PROPERTIES

PHYSICAL PROPERTY:

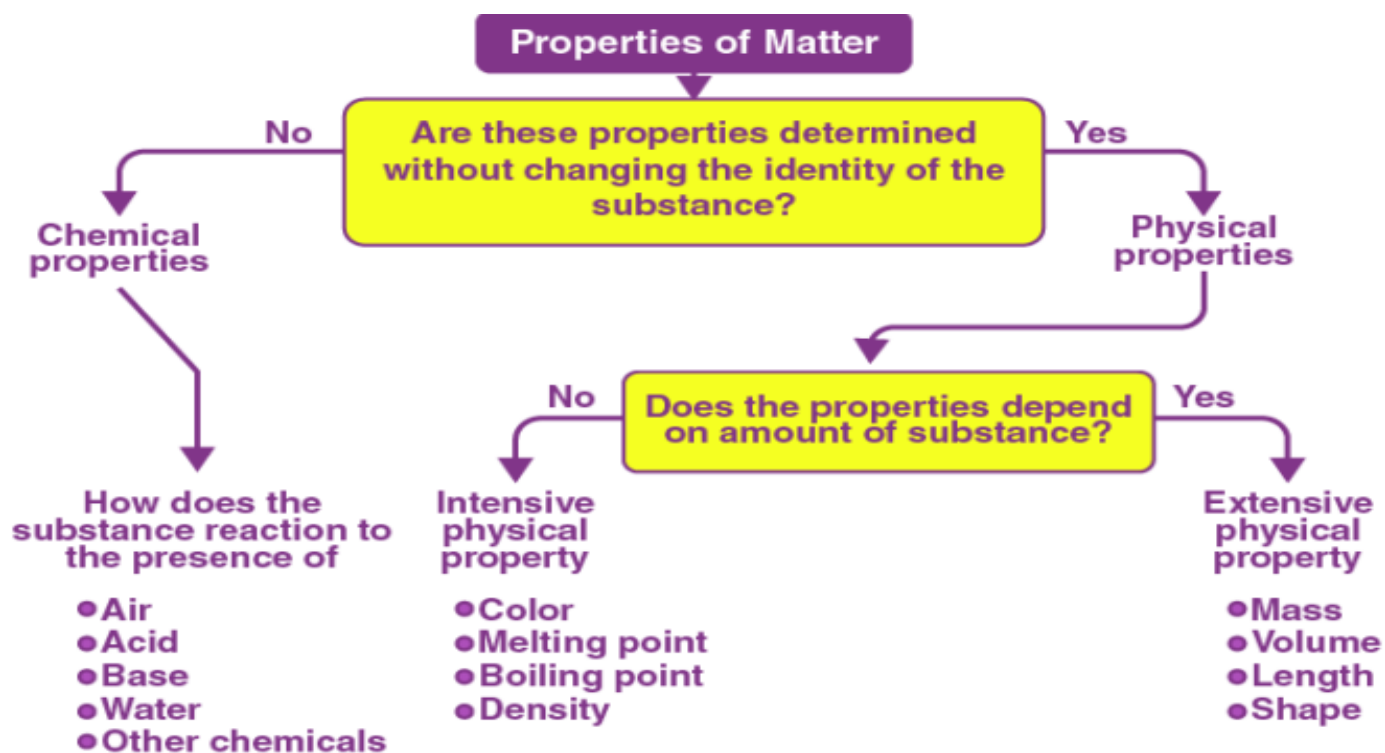
A physical property is a characteristic of matter that is not associated with a change in its chemical composition.

e.g. of physical properties include density, colour, hardness, melting and boiling points, and electrical conductivity.

A physical property is a **characteristic of matter that is not associated with a change in its chemical composition**. Familiar examples of physical properties include density, color, hardness, melting and boiling points, and electrical conductivity.

Physical Properties of Matter

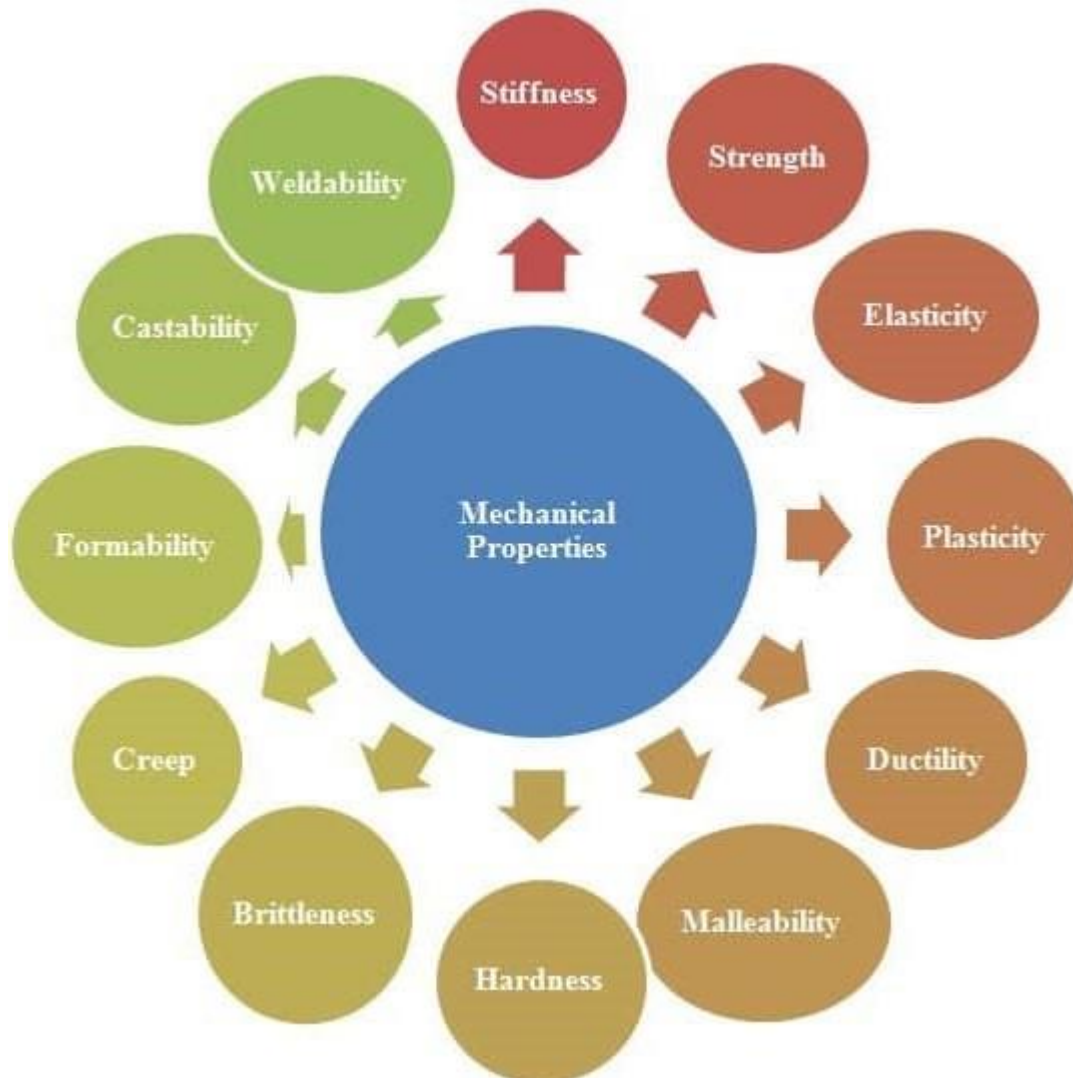
- allows us to identify the substance without causing a change in the composition of the substance
1. State
 - solid, liquid, gas
 2. Colour
 - different for some materials
 3. Lustre
 - metallic shine
 4. Conductivity
 - ability to transmit electricity
 5. Malleability (ductile)
 - bendable



MECHANICAL PROPERTY:

The Mechanical properties of a material are those which affect the mechanical strength and ability of a material to be molded in suitable shape.

TYPES OF MECHANICAL PROPERTIES:



LATHE MACHINES

LATHE MACHINE:

Lathe machine is a machine tool that is used to remove metals from a work piece to give a desired shape and size. Lathe Machines are used in metalworking, woodturning, metal spinning, thermal spraying, glass working, and parts reclamation.

TYPES OF LATHE MACHINES:



Turret Lathe Machine



Speed Lathe Machine



Engine Lathe Machine



CNC Lathe Machine



Tool Room Lathe Machine



Bench Lathe Machine

TYPES OF LATHE OPERATIONS:



Turning

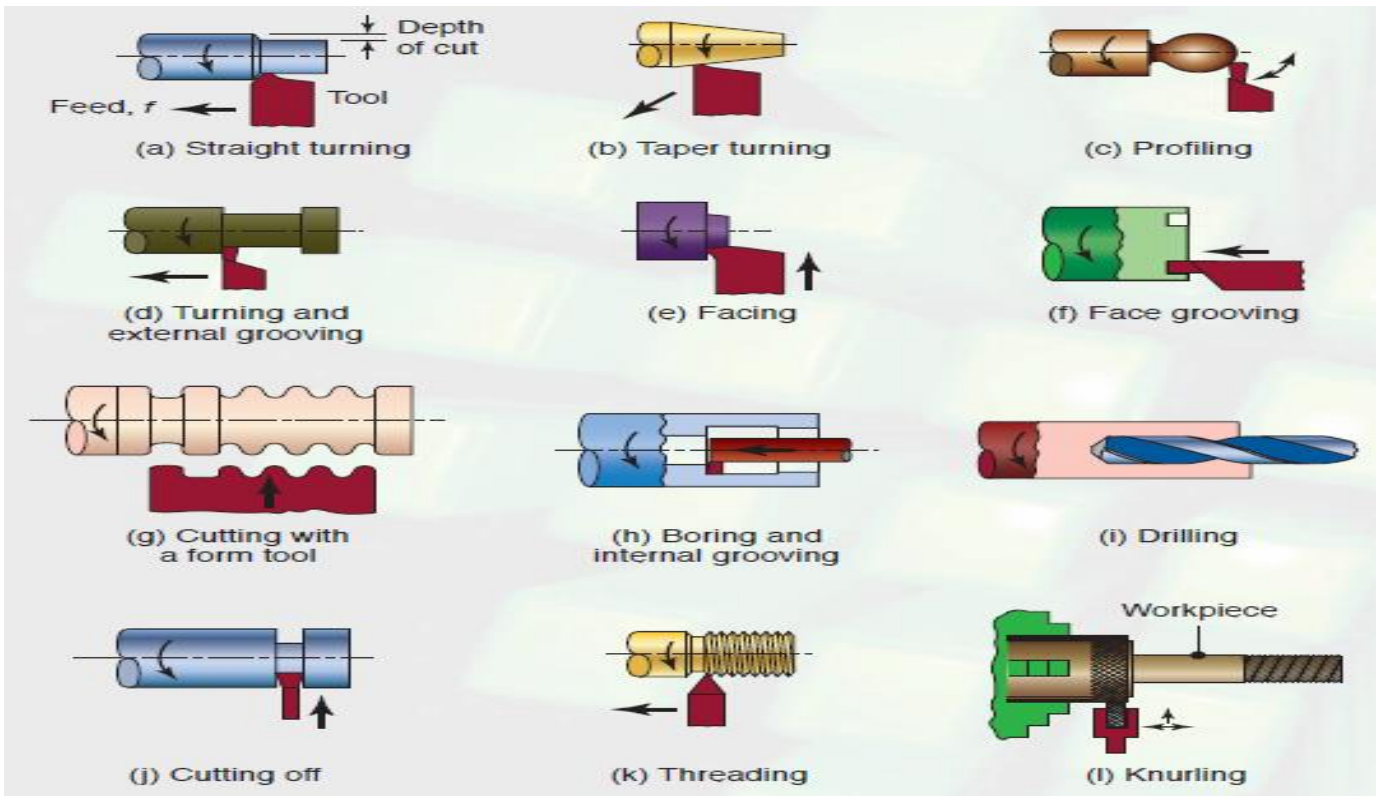
Facing

Grooving

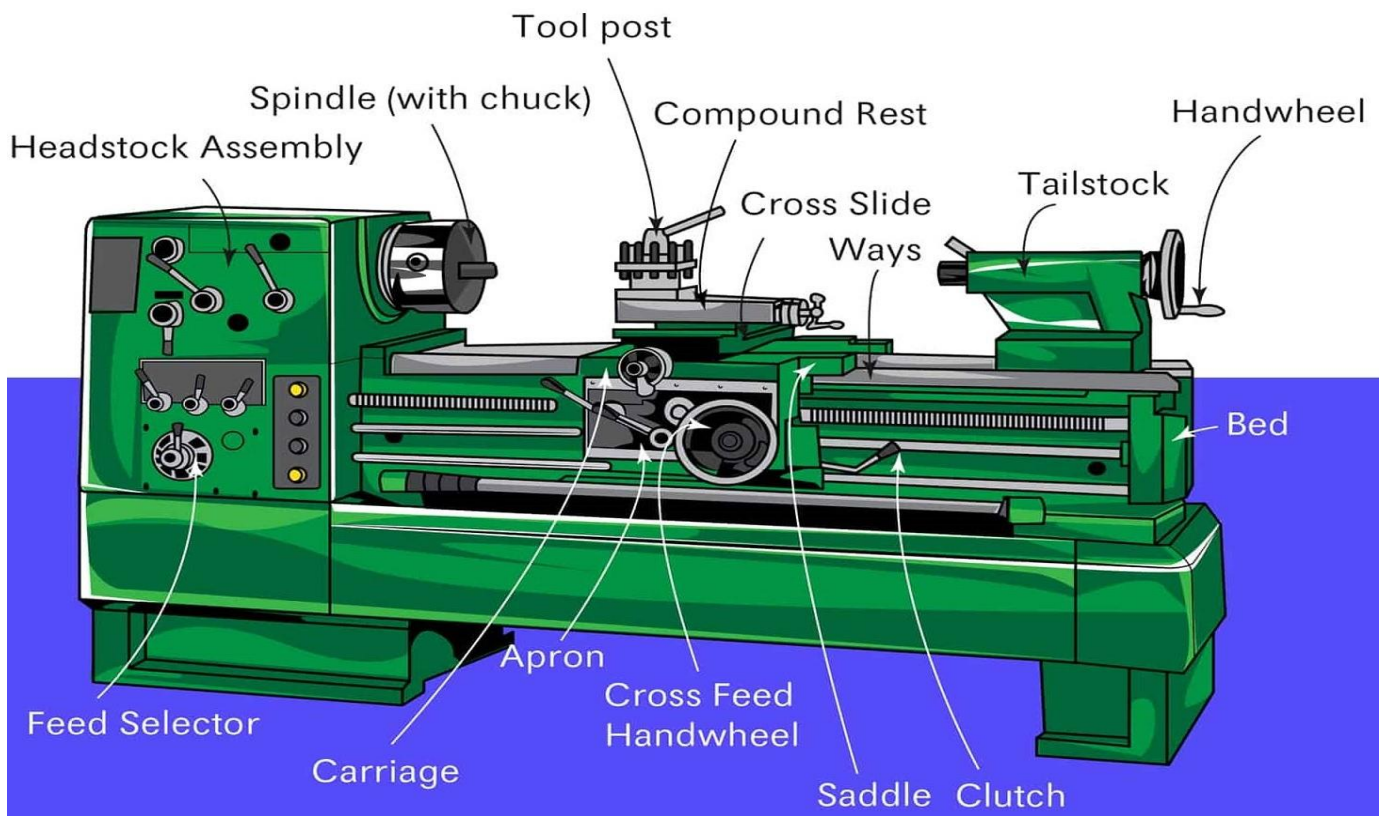


Boring

Drilling



PARTS OF A LATHE MACHINE:



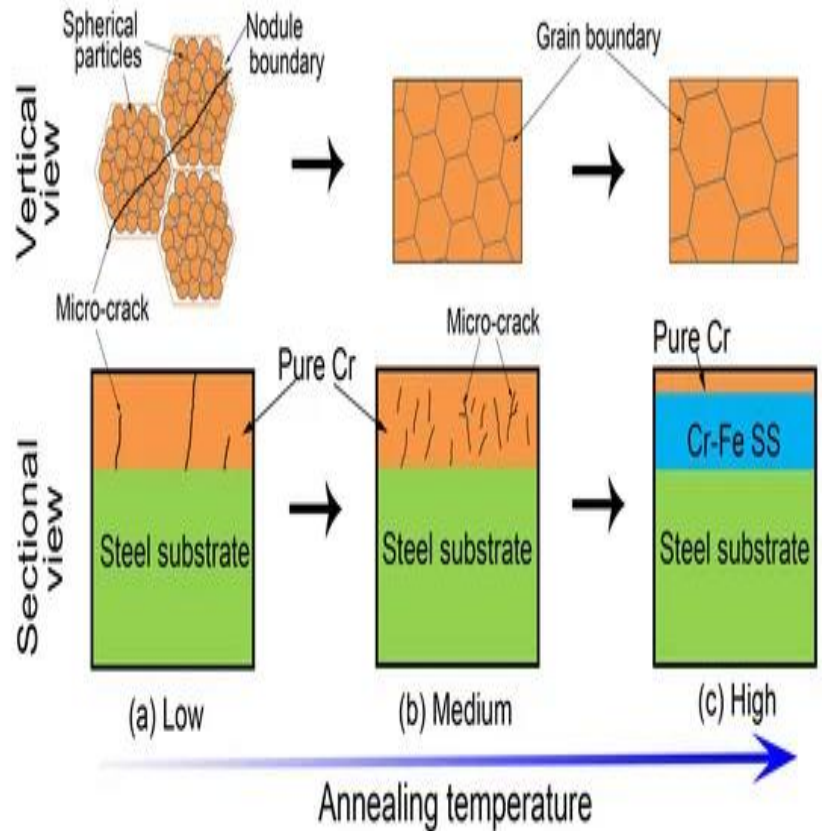
HEAT TREATMENT

HEAT TREATMENT:

The process of changing the structure and thus changing the properties of steel, by heating and cooling, is called '**Heat Treatment of steel**'.

Classification of heat treatment process

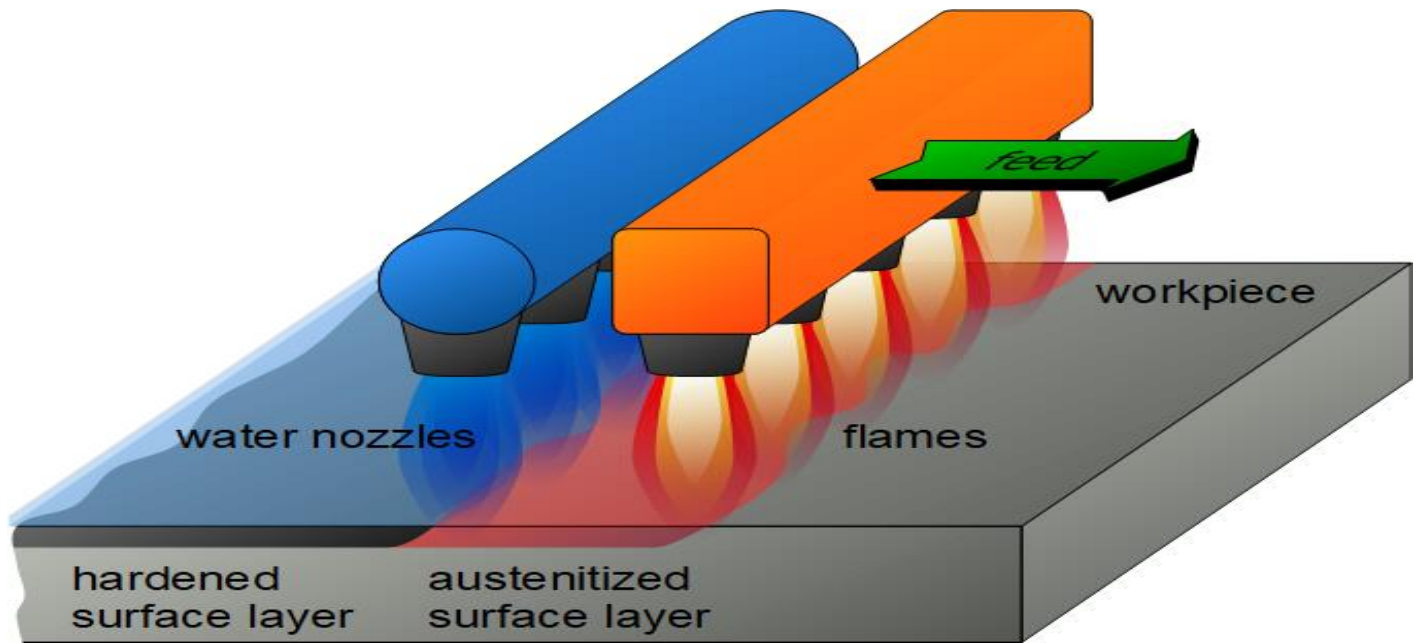
1. Annealing
2. Normalising
3. Hardening
4. Tempering
5. Martempering
6. Austempering



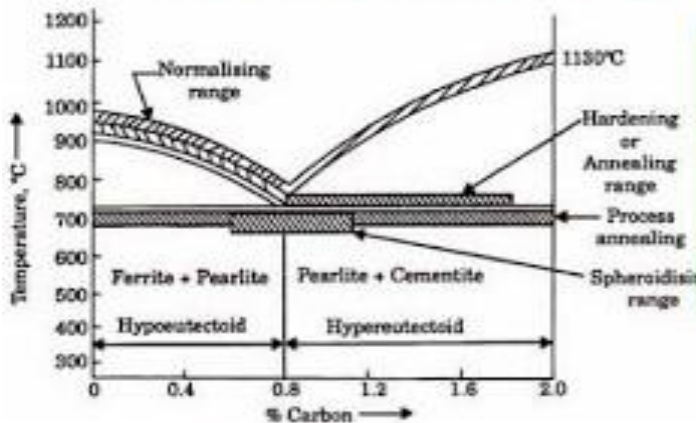
NORMALIZING

Normalizing is a process in which a metal is cooled in air after being heated in order to relieve stress .





Heat Treatment Process



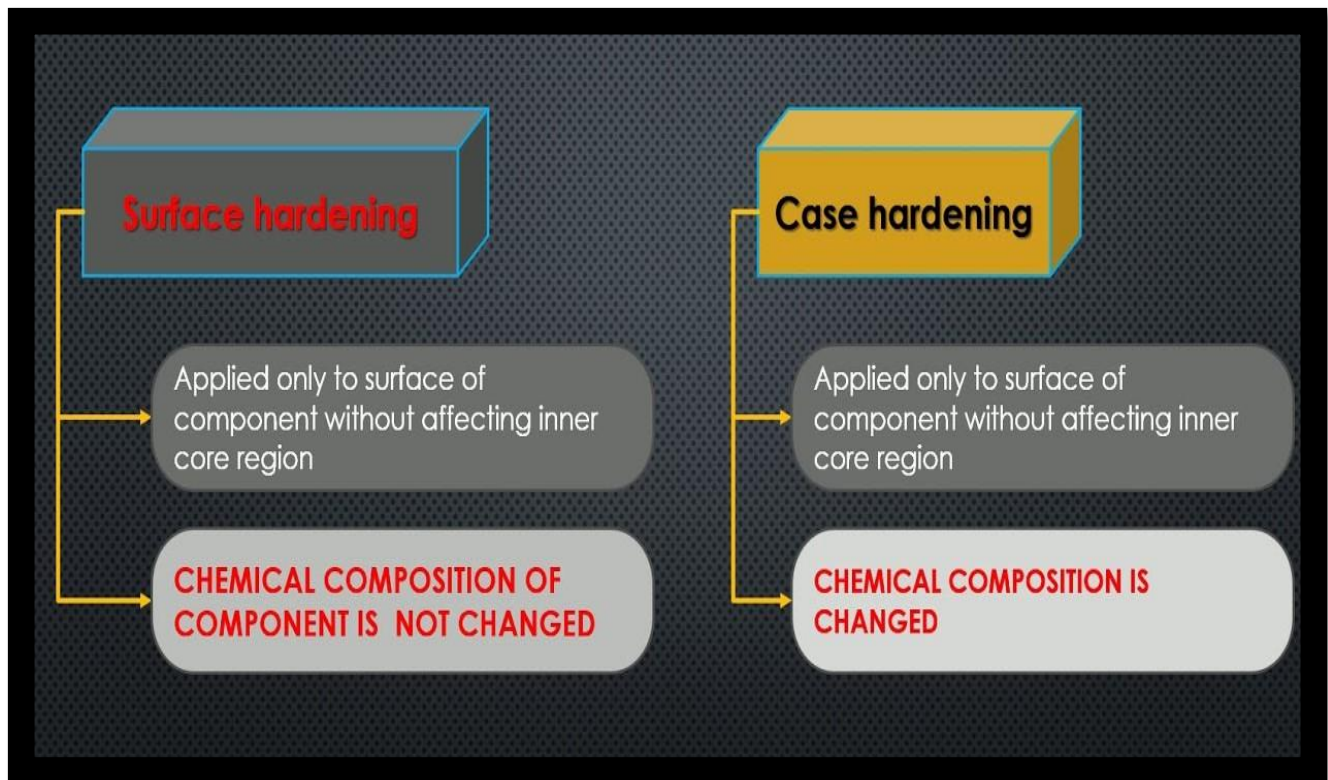
Tempering Process

Austempering

- Consists of cooling with a rate exceeding the critical cooling rate betn. The nose of TTT diagram & M_s temp.
- Held for a sufficient period for the completion of bainitic transformation cooling to room temp. at any rate
- The product may be upper or lower bainte.

Martempering Process

- Martempering is a metallurgical production process intended to **control martensite** characteristics in ductile iron and alloys.
- **Martensite** is **hard and brittle** and require a reduction of the martensite characteristics to usable levels.
- The **process** of martempering is used to manipulating martensite levels and consists of **heating** and a sequential series of **cooling cycles** which gradually reduce the extent of martensite characteristics in the metal.
- It is **beneficial** to begin the process with a high level of martensite formation and to reduce the level gradually because the process **minimizes distortion and cracking** of the metal.



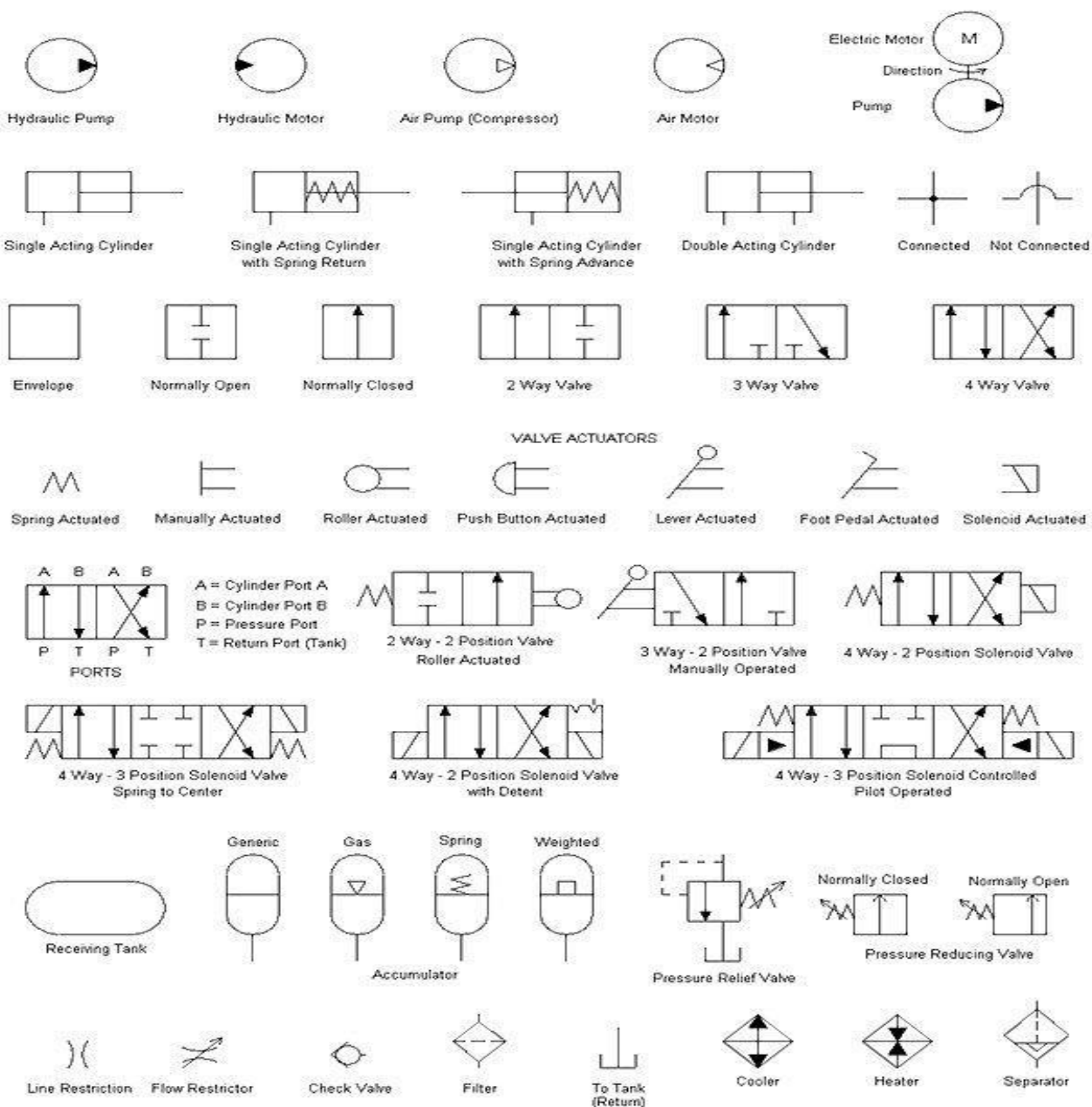
HYDRAULIC SYSTEM

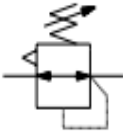
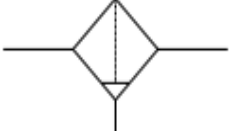
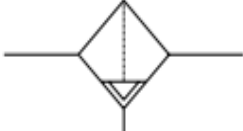
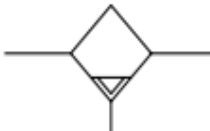
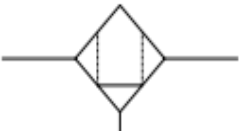

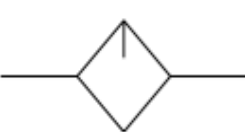

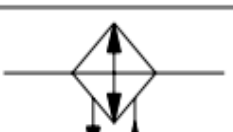

HYDRAULIC SYSTEM:

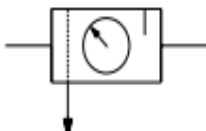
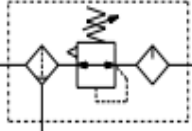
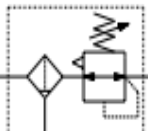
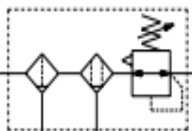
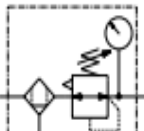

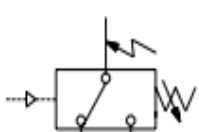


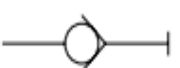
The word hydraulic is derived from Greek words "hydra" meaning water and "aulic" meaning pipe. Hydraulics is a **mechanical function that operates through the force of liquid pressure.**

In hydraulics-based systems, mechanical movement is produced by contained, pumped liquid, typically through hydraulic cylinders moving pistons.

SYMBOLS OF HYDRAULIC SYSTEM:

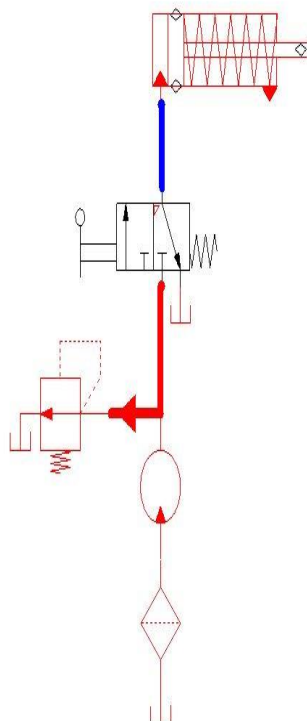


Symbol	Description
	Pressure control valve, relieving pressure regulator, adjustable
	Filter with water trap
	Filter with water trap, automatic
	Water trap with automatic drain
	Mist separator
	Micro mist separator
	Lubricator
	Dryer
	Cooler
	Pneumatic pressure gauge

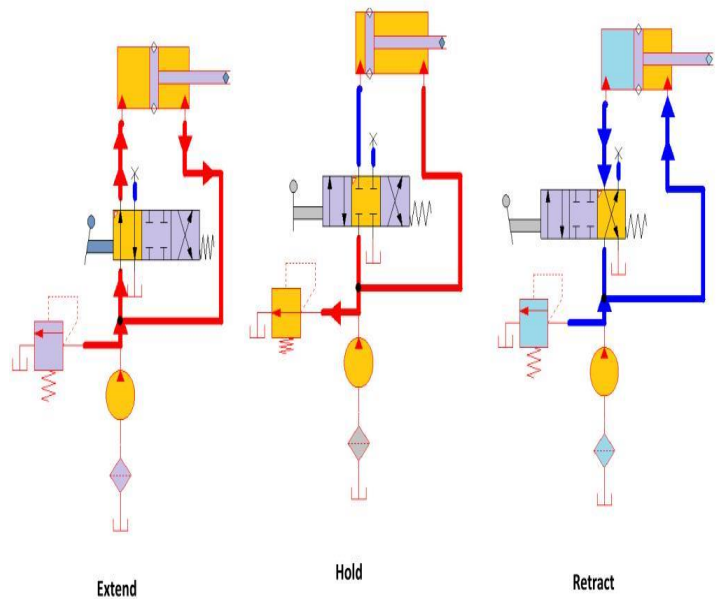
Symbol	Description
	Air preparator, Service unit (simplified graph)
	Air combination, Air filter, regulator and Lubricator
	Air combination, Air filter and regulator
	Air combination, Air filter, mist separator and regulator
	Air combination, Mist separator, regulator and pressure gauge
	Pneumatic booster regulator, handle operated
	Adjustable pressure switch
	Non adjustable pressure switch
	Pneumatic capacitor
	Non-return valve, without spring

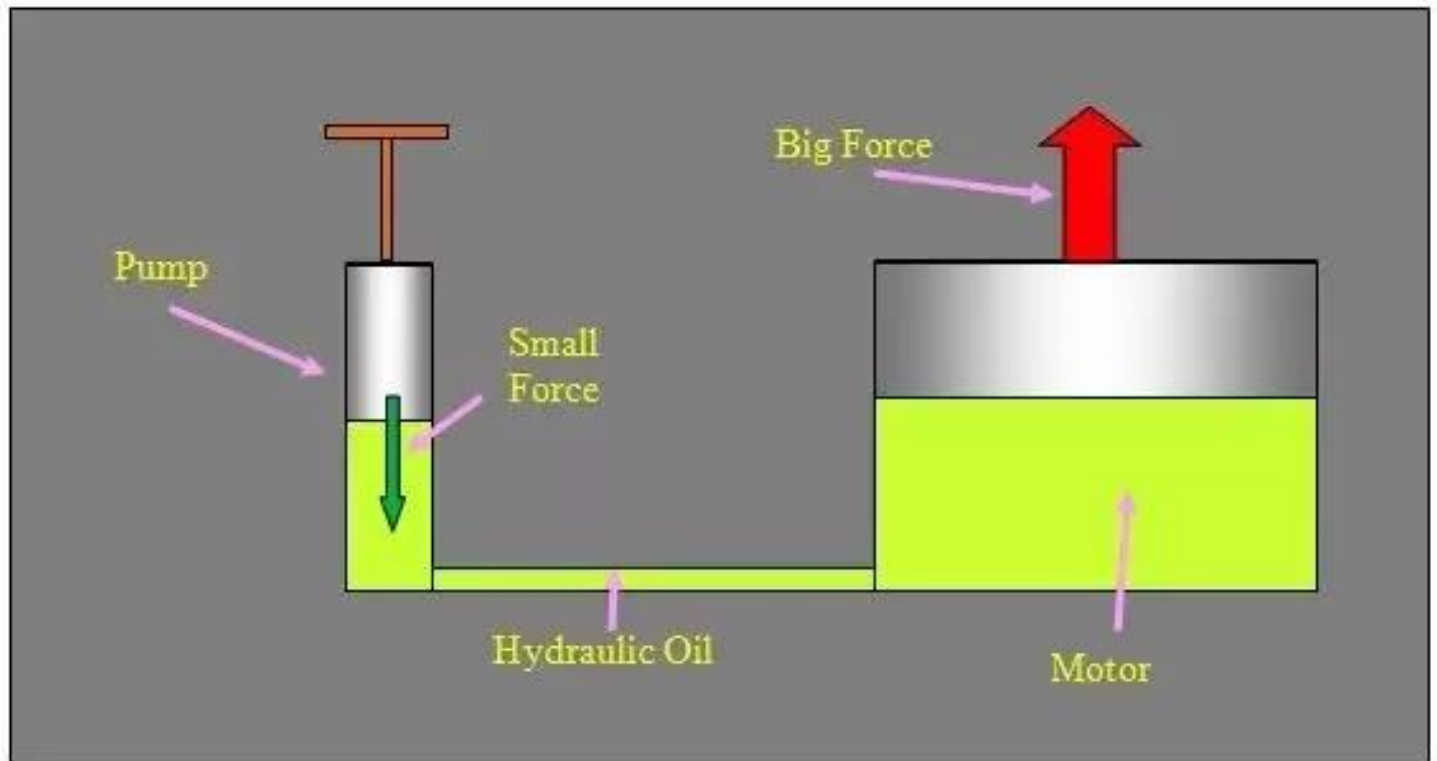
VALVE, CHECK		VALVE, SINGLE FLOW PATH, NORMALLY OPEN (ARROWS DENOTE DIRECTION OF FLOW)	
VALVE, MANUAL SHUTOFF		VALVE, MULTIPLE FLOW PATHS, BLOCKED	
VALVE, MAXIMUM PRESSURE (RELIEF)		VALVE, MULTIPLE FLOW PATHS, OPEN (ARROWS DENOTE DIRECTION OF FLOW)	
VALVE, BASIC SYMBOL SINGLE FLOW PATH IS MODIFIED		VALVE, DIRECTIONAL, 2 POSITION 3 CONNECTIONS	
VALVE, BASIC SYMBOL MULTIPLE FLOW PATHS ARE CHANGED		VALVE, DIRECTIONAL, 3 POSITION 4 CONNECTIONS OPEN CENTER	
VALVE, SINGLE FLOW PATH, NORMALLY CLOSED (ARROWS DENOTE DIRECTION OF FLOW)		VALVE, DIRECTIONAL, 3 POSITION 4 CONNECTIONS CLOSED CENTER	

Single Acting Hydraulic Cylinder Control Circuit



Double Acting Cylinder Control Circuit





Uses of Hydraulics

Hydraulic systems are used where large, precise forces are required.

Common examples include:

- Vehicle power steering
- Dump trucks
- Flight simulators
- Hydraulic jacks
- Heavy earth moving equipment
- Vehicle brake systems

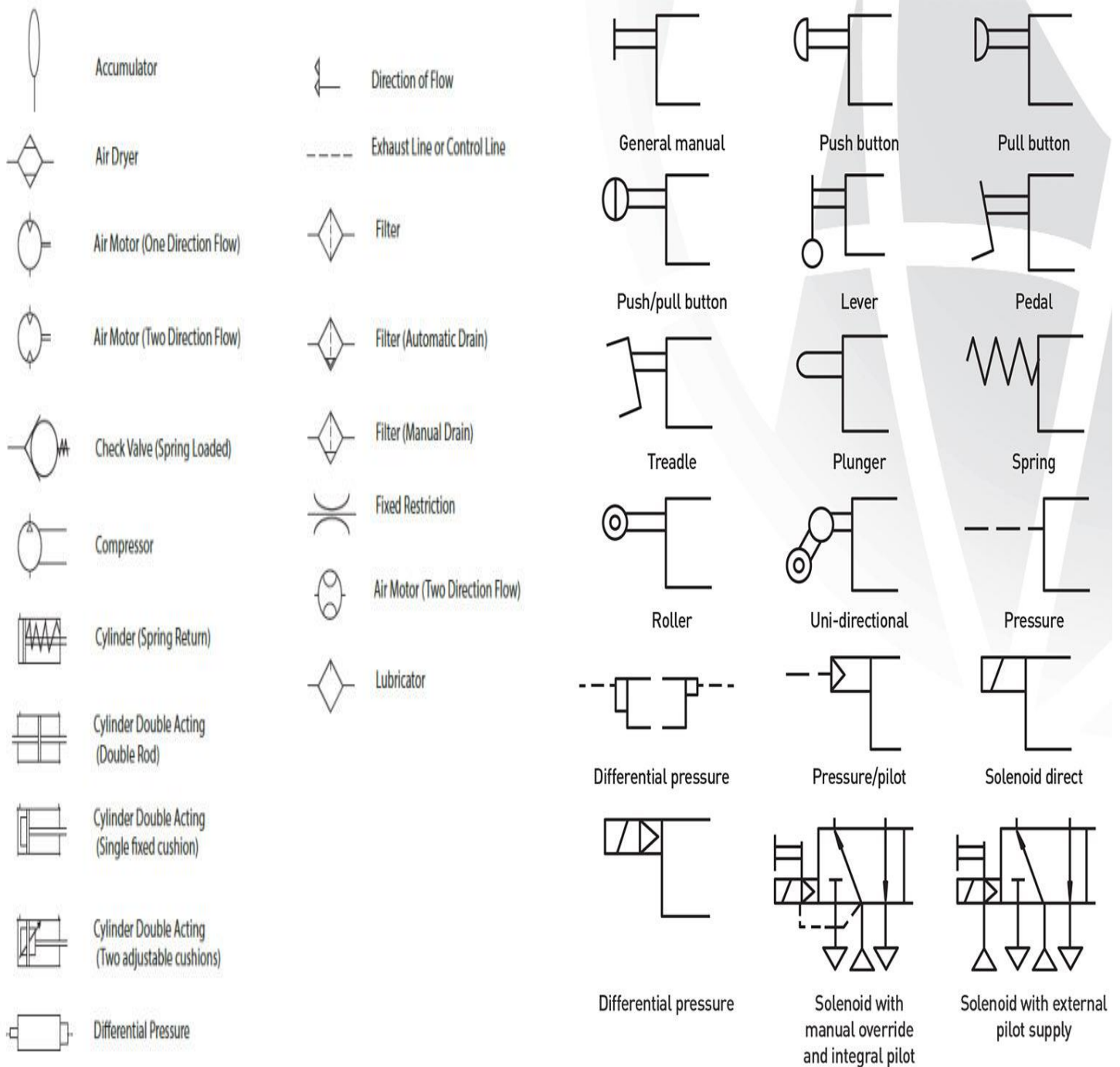


PNEUMATIC SYSTEM

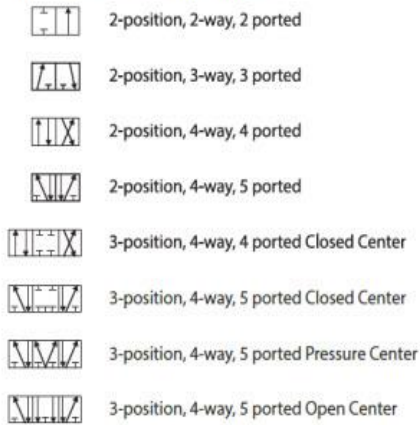
PNEUMATIC SYSTEM:

A pneumatic system is a system that uses compressed air to transmit power. Usually, a centrally located compressor provides power to cylinders, rotary actuators, and other pneumatic devices through a system of tanks, pipes, and valves.

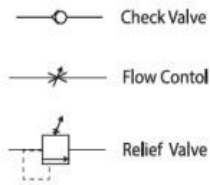
SYMBOLS OF PNEUMATIC SYSTEM:



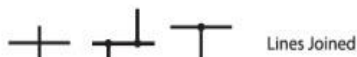
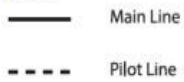
Directional Control Valve Symbols



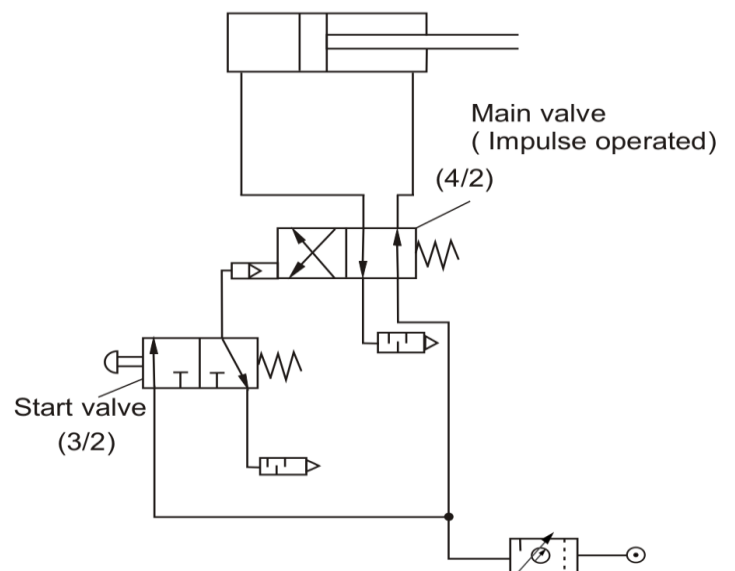
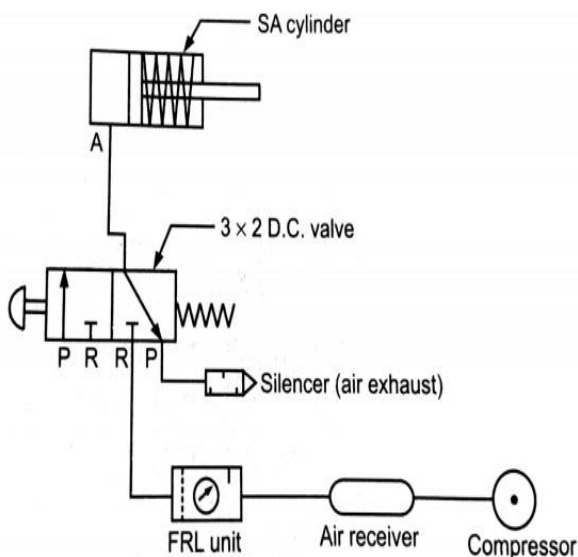
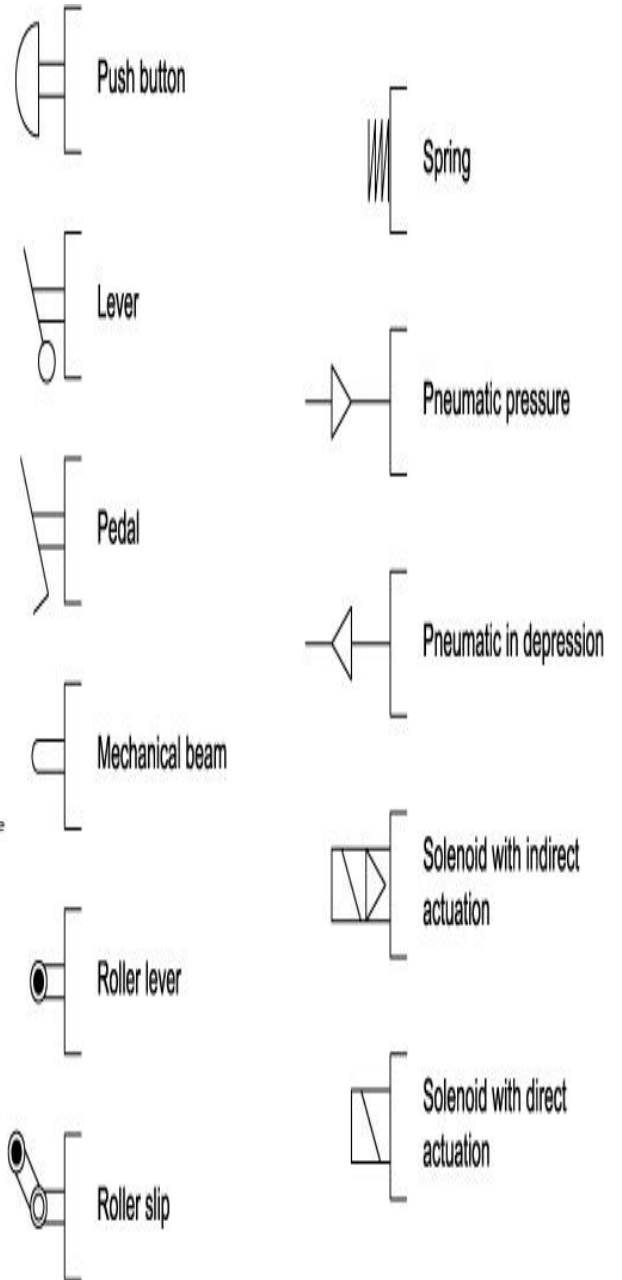
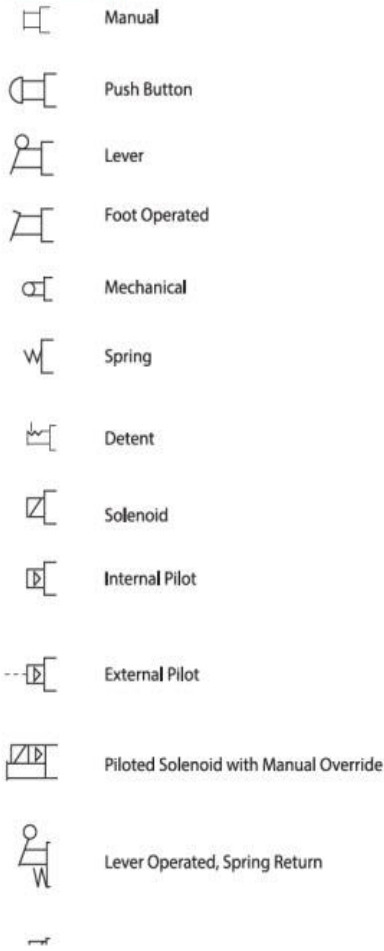
Simple Pneumatic Valves



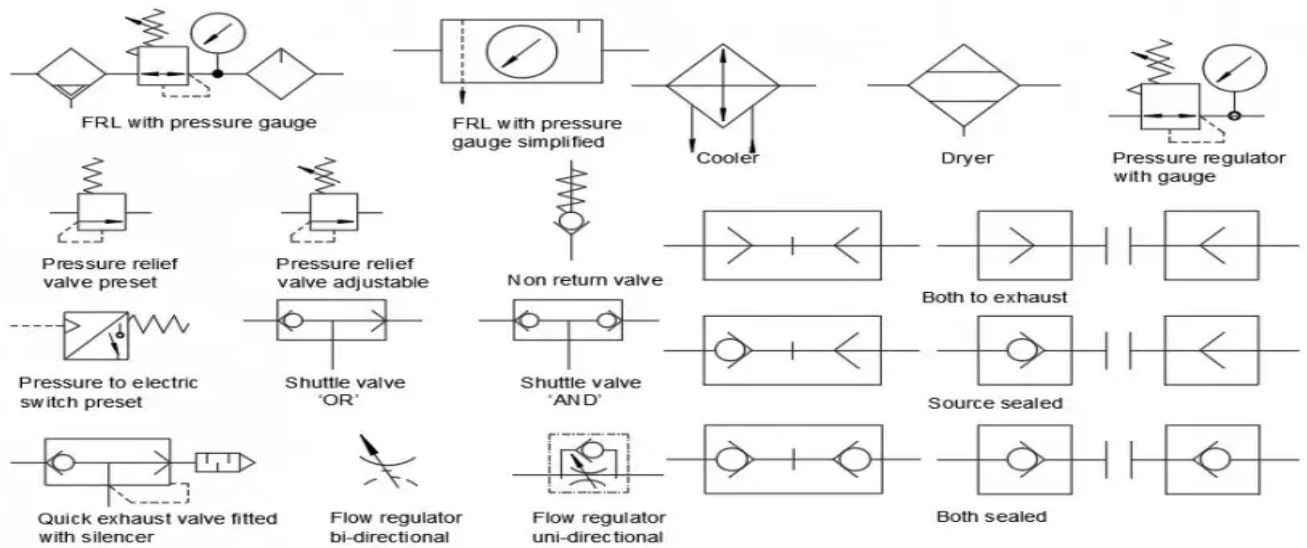
Lines



Actuator Symbols



Air Line Equipment & Accessories Pneumatic Symbols



APPLICATION OF PNEUMATIC SYSTEM:

- General applications:

- Packaging
- Filling
- Metering
- Locking
- Driving of axes
- Door or chute control
- Transfer of materials
- Turning and inverting of parts
- Sorting of parts
- Stacking of components
- Stamping and embossing of components

COMPARISON BETWEEN HYDRAULIC & PNEUMATIC SYSTEM :

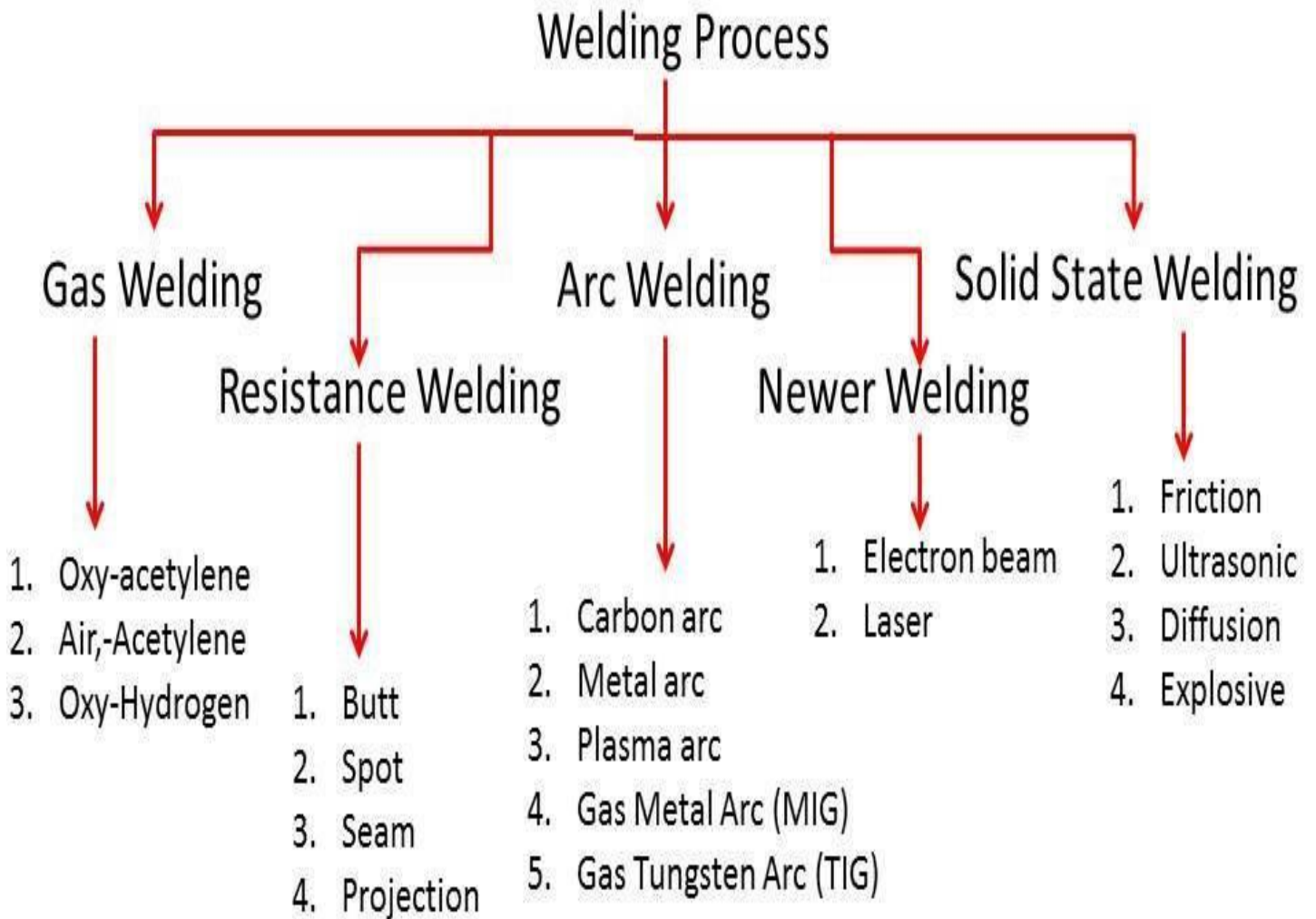
Hydraulic System	Pneumatic System
A hydraulic system is a closed-loop system.	Pneumatic System is an open-loop system.
It is robust in construction and maintenance cost is high.	It is simple in construction and maintenance cost is less.
The working fluid is hydraulic oil.	The working fluid is air.
As oil is incompressible, it can be pressurized to very high pressure.	Air is compressible and hence air can be pressurized to lesser pressure.
The system is bulky due to high pressure.	The system is less bulky as compared to a hydraulic system.
The accuracy of the system is high.	The accuracy of the system is not high.
Hydraulic oil is flammable.	Air is inflammable.
To protect against rust, the system needs special attention.	This system does not require any special attention.
Contamination control is required in this system.	Contamination control is not required in this system.
The power to size ratio is more.	The power to size ratio is small.

WELDING

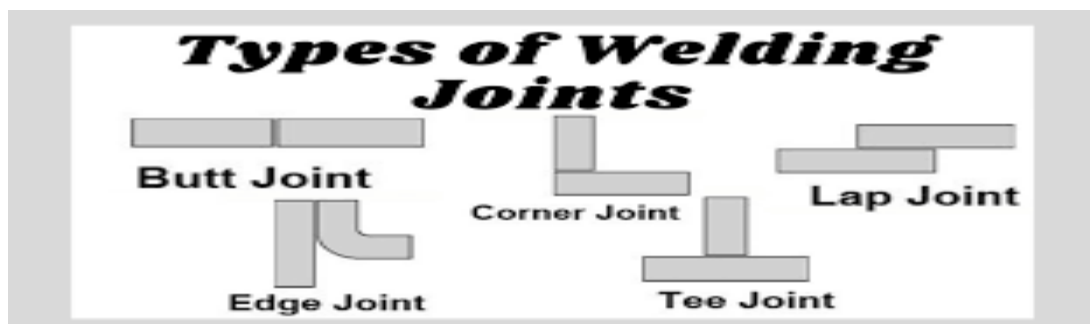
WELDING:

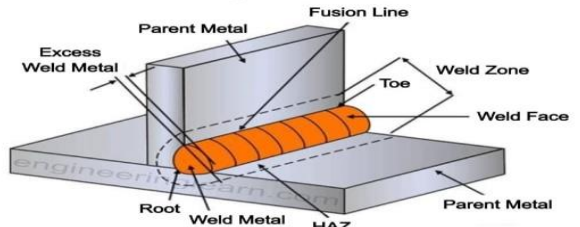
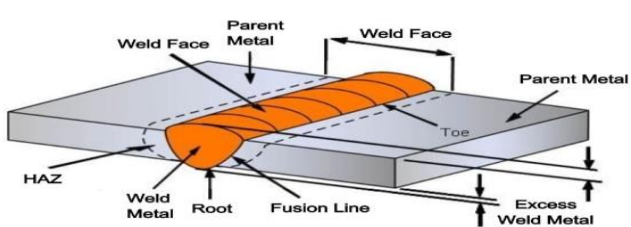
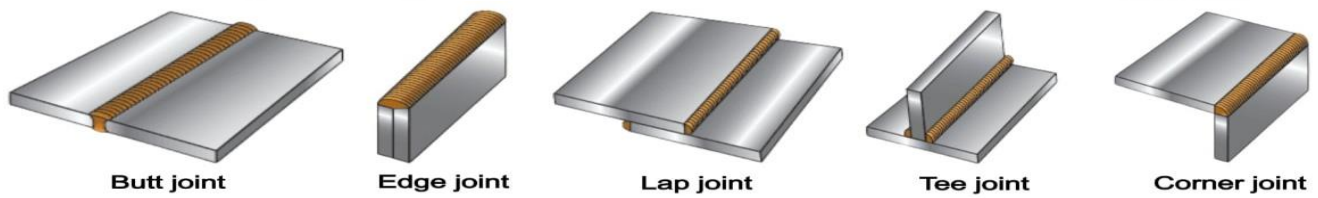
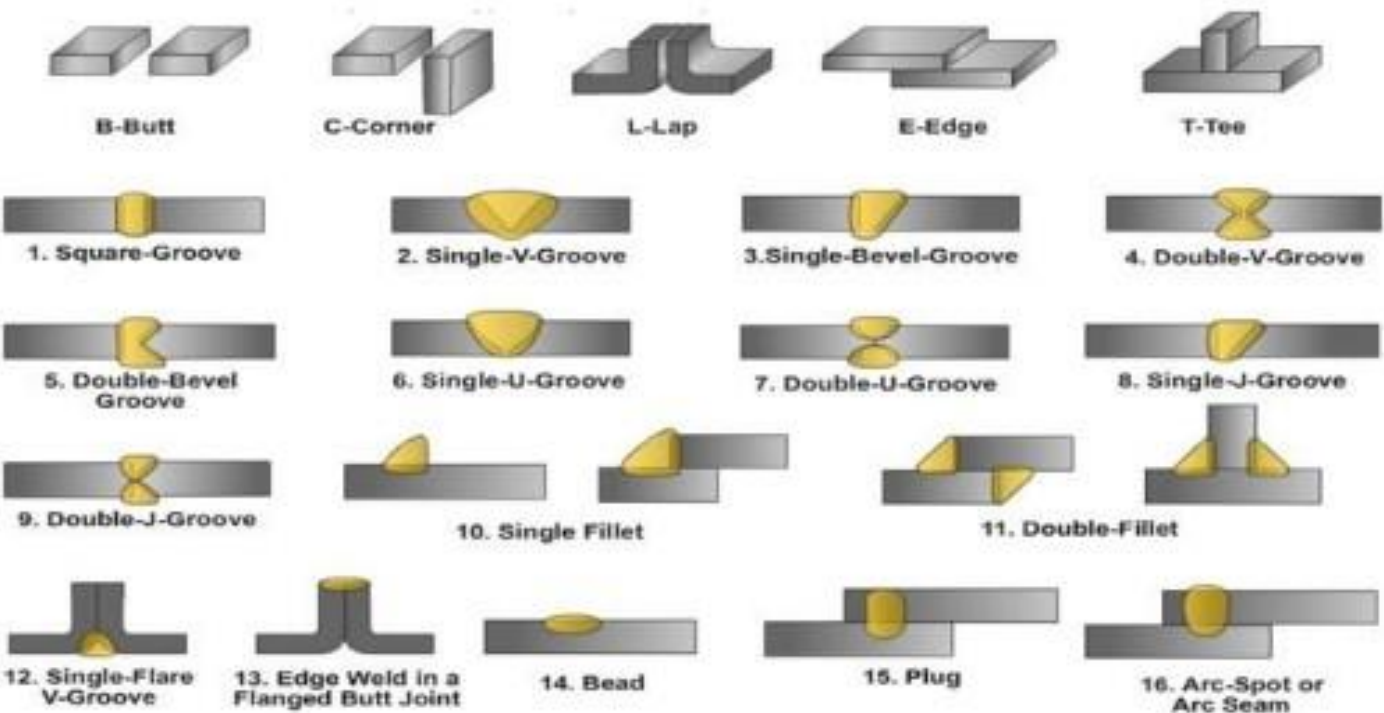
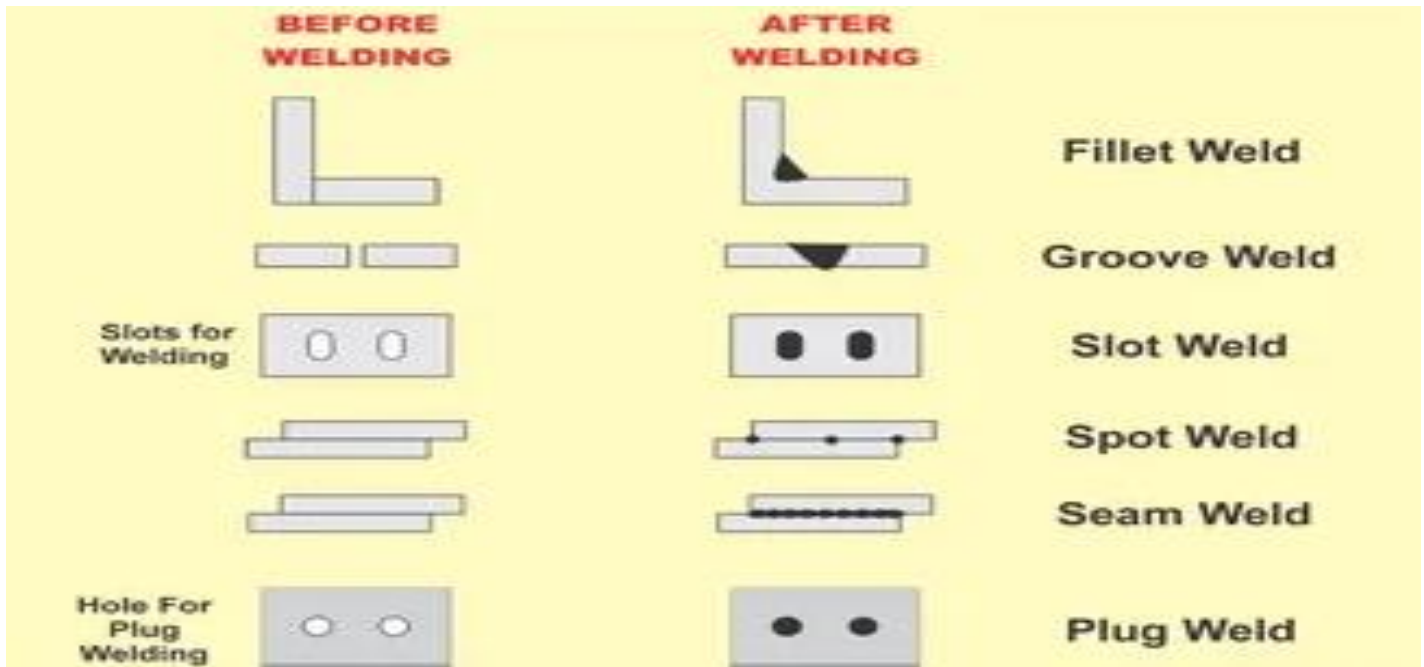
Welding is a fabrication process whereby two or more parts are fused together by means of heat, pressure or both forming a join as the parts cool.

TYPES OF WELDING:



WELDING JOINTS:





THANK YOU