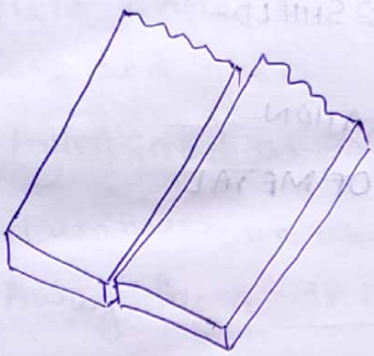
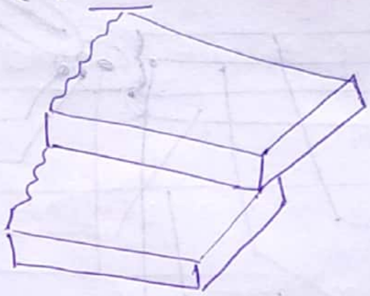
* Types of Welded Joints

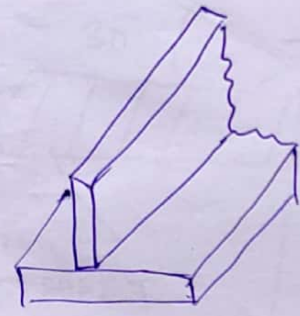
(A) BUTT



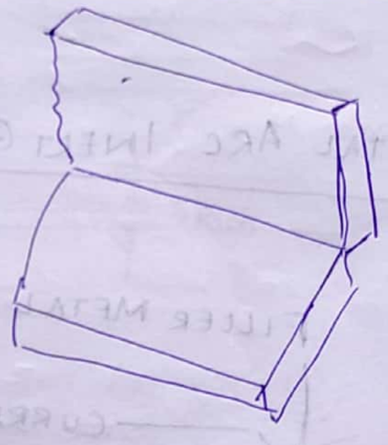
(B) LAP



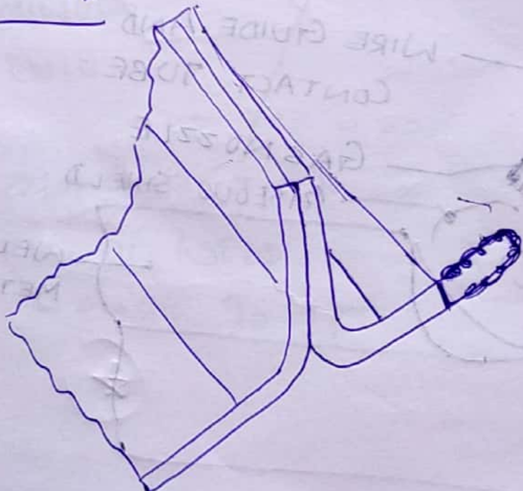
(C) TEE



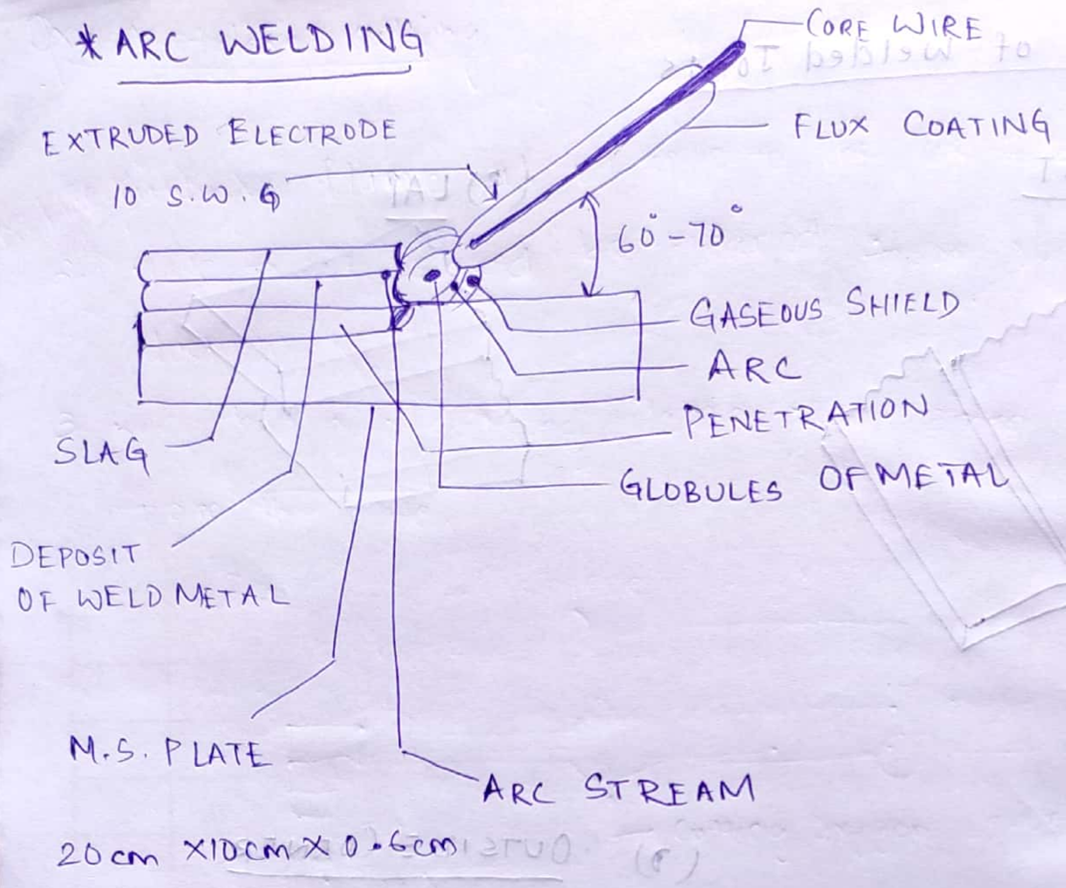
(D) OUTSIDE CORNER



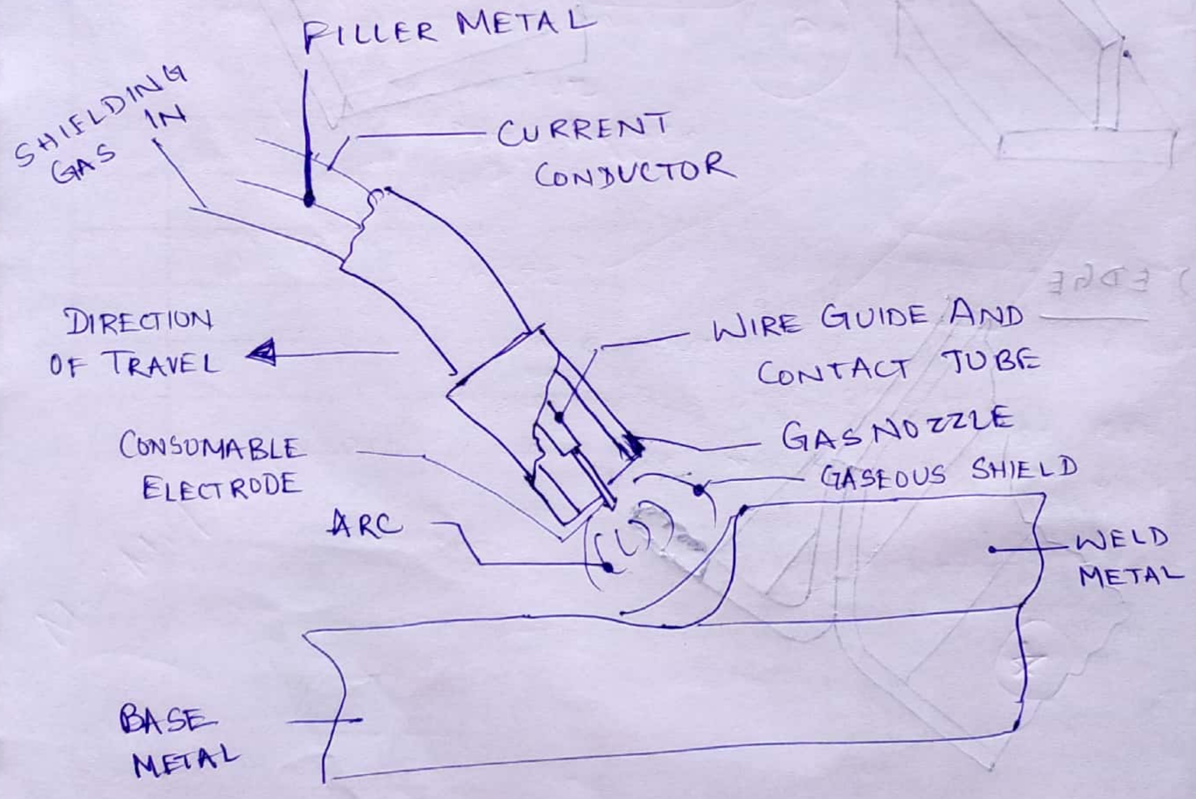
(E) EDGE



* ARC WELDING



* METAL ARC INERT GAS WELDING



Oxy-acetylene welding

Oxy-acetylene cutting

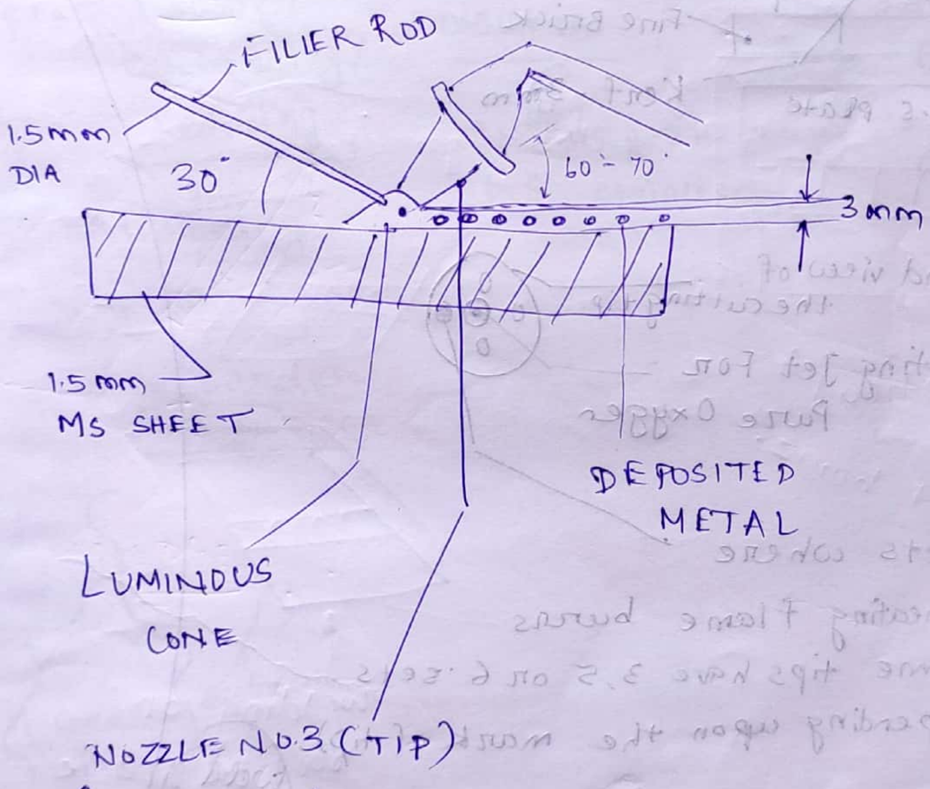
1. welding nozzle at 60° to the plate.

2. plate should be clean from dust and rust

3. Filler rod at 30° to the plate

4. Luminous cone about 3mm Away from the plate

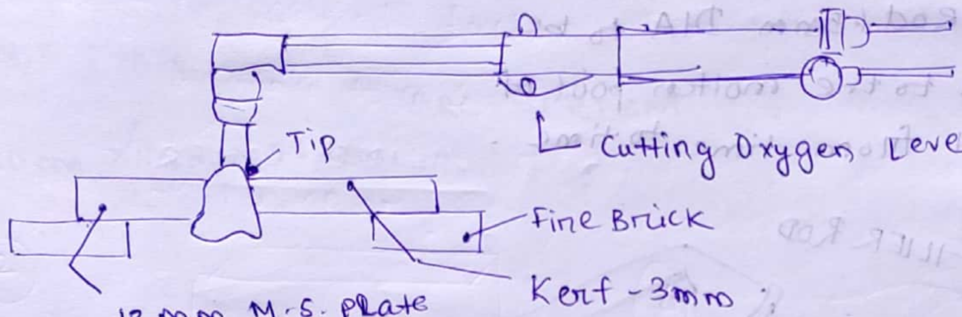
5. Filler Rod 1.5mm DIA to be added to the molten pool of metal from time to time.

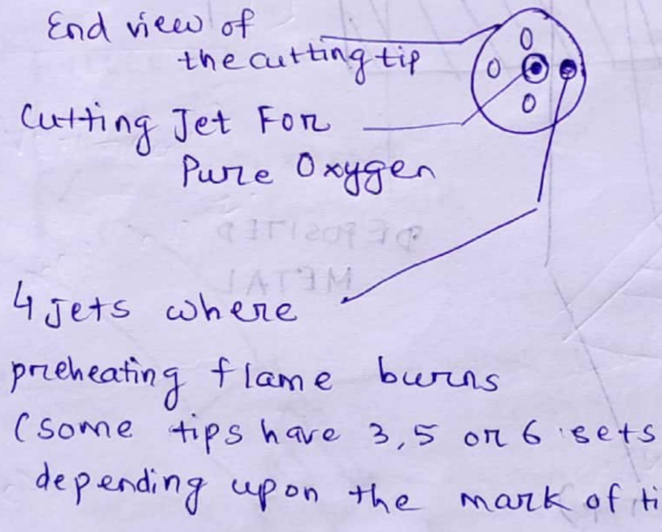


(DIRN. OF WELD - RIGHT TO LEFT

Oxy-Acetylene cutting

1. Cutting flame at rt. angle to the plate to be cut.
2. Plate to cut should be cleaned from rust & dust etc.
3. Keep the tip of cutting flame about 3mm away from the plate.





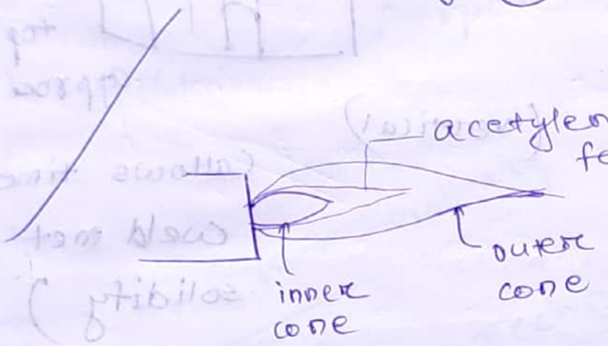
weld met

Welding (Appln.) ★

- Def.
- Types < Gas welding, Arc welding) without press.
  - Advantages ★
  - Disadvantages ★

★ Welded joints (stregth highest)

oxy - fuel

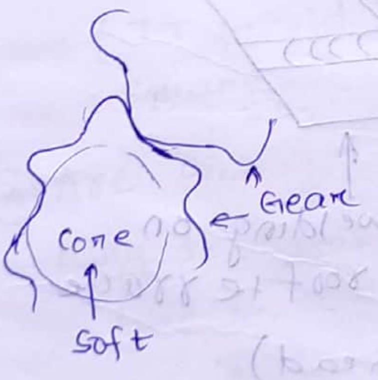


Types of Flame

Fe_3C ← (3000°C) Carborising / Reducing

→ Hardening operation

→ to harder the surface



(3200°C) Neutral

→ welding of MS, stainless steel

Highest (3500°C) Ox. flame

disadv. ★ → oxidise metal surface

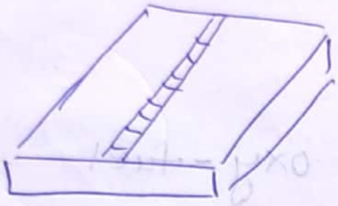
→ cutting metals.

- disadv. of arc welding

1) harmful radiation
2) skilled welders
3) Think of material (base material) whose properties don't change much after welding
4) slag formation

Positions in welding

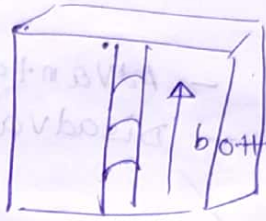
Difficulty
(1) lowest



Plane of workpiece is (horizontal)

weld met vert.

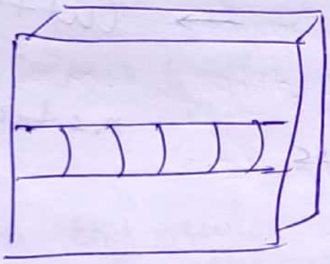
(3)



bottom to top approa. (allows time weld met solidify)

(vertical)

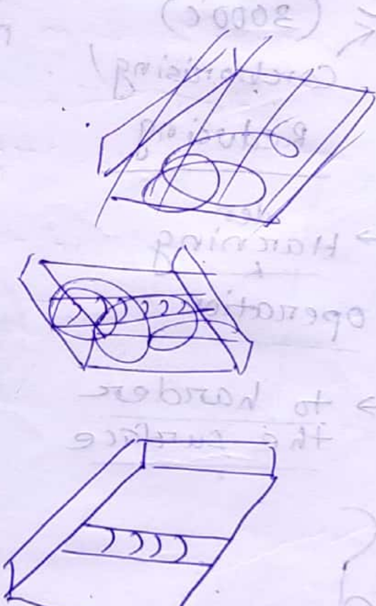
(2)



(vertical)

weld met horiz.

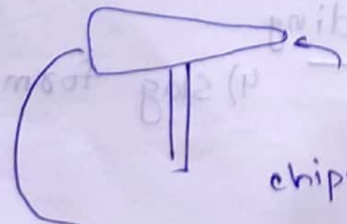
(4)



welding on roof terrace

(overhead)

MS: Mild steel



chipping hammer

* Threaded joints > * Rivet joints

Separate the plate easily

after inserting the rivet; the straight end bends

(Rusting reduces strength)

Appl.

(1) (V-threads - locking porpose)

→ to minimise

for

Hajra & choudhary

workshop Technology (Volume - I)

Reverse polarity

-ve : Table / work piece

+ve : Electrode

for thin metal slabs.

→ Depth of penetration is low; rate of deposition is high.

Straight polarity

(2) Power transmission → screw (bicycle / car)

(Trapezoid / Acme thread) square /

(*) Arc welding

why the slab / base material not melting?

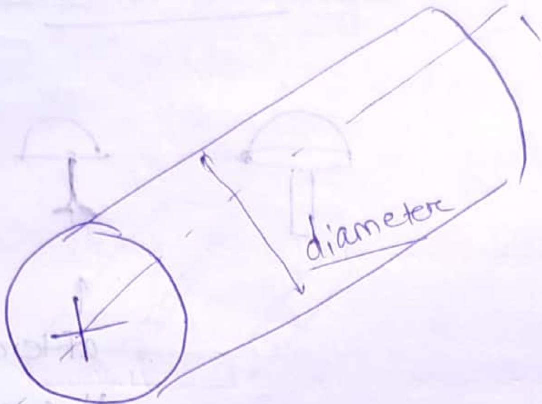
EE Practical ✓

(6) Types of Gas Welding

* Autogeneous - no material

Homogeneous - same material used

Heterogeneous - diff. material used



Weld – A localized fusion of metals produced by heating to a suitable temperatures.

Welding – Fusion or joining of two metals (similar or dissimilar) by application of high temp. & with or without pressure.

WELDING

1. The process of joining metals with the application of heat ; with or without pressure.

2. • Arc - Welding : Use of flux - coated consumable electrode that gives current. when in contact with metal, being welded an electric arc is created at the gap generating high temperatures of up to 6500°F, which melts electrode and metal creating weld.

• Gas - Welding
  - → Metal Inert Gas
  - → Tungsten Inert Gas

3. Gas welding

Metal joining process in which the ends of pieces to be joined are heated at their interface by producing coalescence with one or more gas flames ($O_2 + C_2H_2$), with or without filler metal.

- → Autogenous
- → Homogeneous
- → Heterogeneous

4.
1. O_2 cylinder
2. C_2H_2 cylinder
3. Welding Torch
4. Welding Tip (Nozzle)
5. Pressure regulators
6. Hose and Hose fittings

7. Goggles and Glasses

8. Gloves and Apron

9. Spark-lighter

10. Filler Rod and Flux material.

5) Neutral : equal amount of O_2 and C_2H_2

Oxidizing : More amount of O_2 than C_2H_2

Reducing : More amount of C_2H_2 then O_2.

6) AC arc welding – used to weld magnetic materials

1) Down hand heavy plate

2) Fast fill

3) Aluminium TIG welding with high frequency.

DC arc welding – Metal arc welding.

8) → Gives off gases to prevent weld contamination

→ introduces deoxidizers to purify the weld

→ causes weld-protecting slag to form

→ improves arc stability

19) when the impedence of a circuit is removed, the voltage that appears between these two terminals is open-circuit voltage.

16) A pressure regulator's primary function is to match the flow of gas through the regulator to the demand for gas placed upon it, whilst maintaining a constant output pressure.

17) 1. Store acetylene cylinders in an upright position.

2. They must be securely fastened to prevent shifting or falling.

3. Do not lay sides, drop or handle roughly.

14/18) 1. Butt

2. Outside-corner

3. Tee

4. Lap

5. Edge

15) A full acetylene cylinder which has a pressure of 250 psi at 70°F.

A full O_2 cylinder has a pressure of 2200 psi at 70°F

$\boxed{1 \text{ Psi} = 6.98 \text{ KPa}}$

12) → Coated electrodes are specified based on core wire diameter. Commonly used electrode diameters are 2, 2.5, 3.18, 4, 5, 6 mm etc.

FOUNDRY

Content of Report to be submitted

1. Different sections of foundry (Tree diagram)
2. Mould making materials
3. Mould making process
4. Drawing of different tools used in Foundry
5. Drawing of different patterns.
6. Drawing of complete mould (cross-sectional view)
7. Q and A on Foundry.

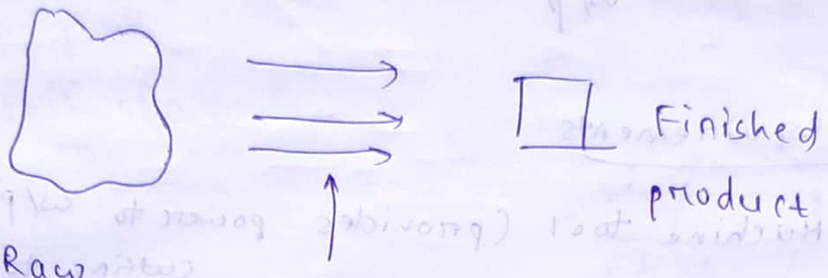
Core print

Riser → to add more molten metal (allowance)

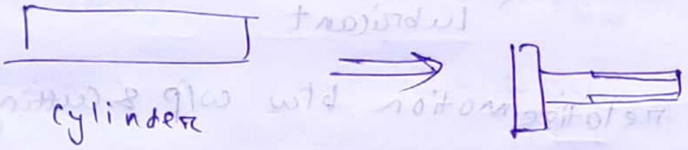
Riser → To check liquid contraction

Core

Manufacturing



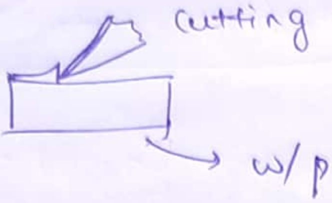
followed = Man. pro.



Man Pro.

- Primary
  - Casting
  - Forming
  - Welding
- Secondary
  - Machining
  - Grinding

Machining - It is one type of Man. pro. in which extra material is removed in the form of chips from a preformed blank using a wedge shaped cutting tool, to get a desired product having proper shape, size and accuracy.



Requirements

→ Machine tool (provides power to w/p or cutting tool)
→ Cutting tool
→ workpiece (w/p)
→ Environment — Dry / Lubricant

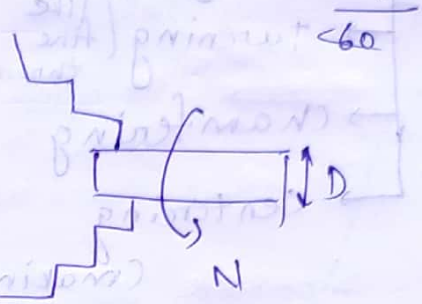
→ provides relative motion b/w w/p & cutting tool which helps in cutting

→ Machine tool – is a non-portable power operated device in which energy is expended to remove extra material from the w/p by providing relative motion b/w w/p & cutting tool to get the desired product

Machine tool
- → Lathe
- → Milling machine
- → Drilling Machine
- → Shaping machine

Parameters of machining

→ Cutting velocity
→ Feed
→ Depth of cut



Cutting

$$\omega = 2\pi N$$

$$V_c = (2\pi N)\left(\frac{D}{2}\right) = \pi \underbrace{D}_{mm} \underbrace{N}_{rpm}$$

(m/min)

$$= \boxed{\frac{\pi D N}{1000} \text{ (m/min)}}$$

✓

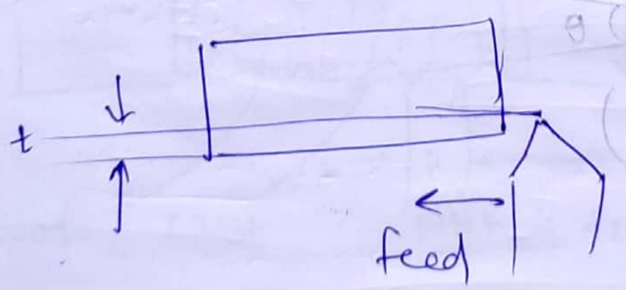
Feed (f)

(mm/rev)

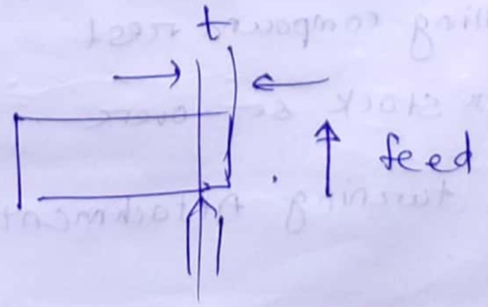
distance moved / rev

Depth of cut (t)

How much amount you are engaging the cutting tool.



(Turning)

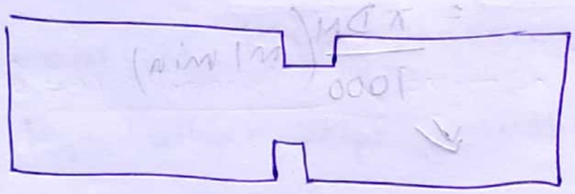


(Facing)

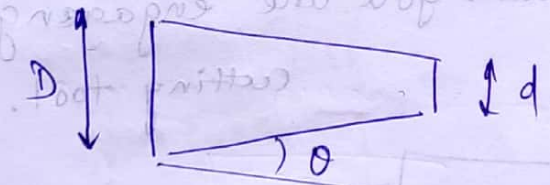
Operations in Lathe

- → facing
- → Turning (like fine threading)
- → chamfering
- → centering (making hole in one edge)
- → Grooving
- → Taper turning
- → Threading

Grooving



Taper turning

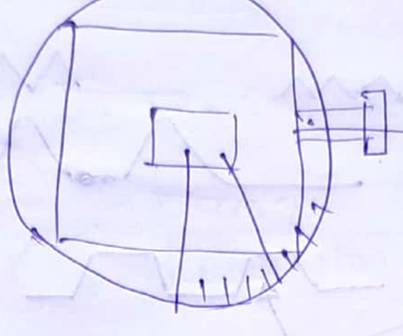


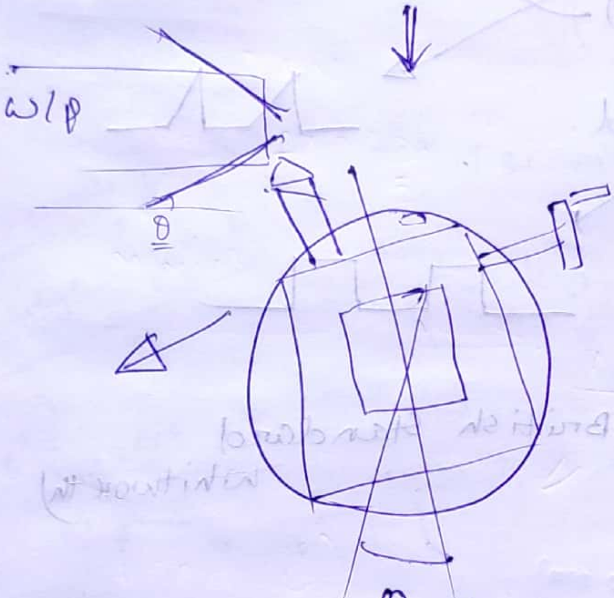
(D > d)

Methods

- → Swivelling compound rest
- → Taper stock set over
- → Taper turning Attachment

Swivelling compound rest



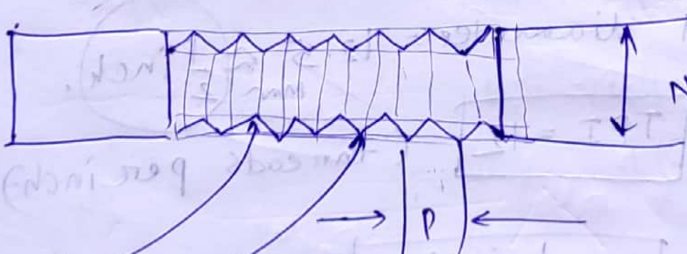


Move both crossslide & taper turning

θ = taper angle

Threading (like in screw)

Circular helical groove (= threads)



pitch = dist. b/w two consecutive root or crest

(lead screw)

Types of Thread

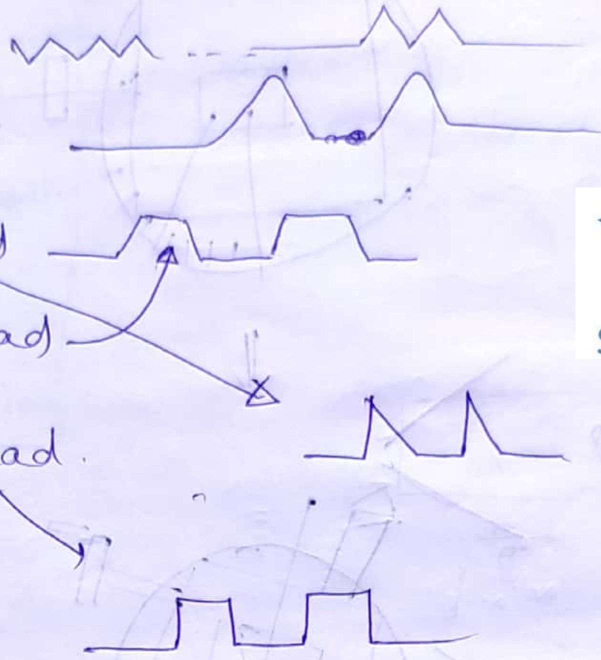
→ V Thread

→ BSW Thread

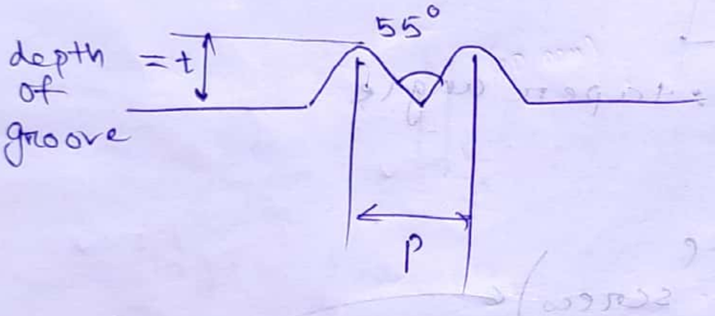
→ ~~Acute~~ Acme Thread

→ Buttress Thread

→ Square thread.



BSW Thread (British Standard Whitworth)



211
64
844
1266
13504

Standard

(2) 1 inch = 25.400 mm

nominal diameter = 12.5 mm ≈ $\frac{1}{2}$ inch.

For $\frac{1}{2}$ inch → $\boxed{TPI = 12}$ (threads per inch)

$$\boxed{P = \frac{1}{12} \text{ inch}}$$

$$P = \frac{1}{12} \times 25.4\,mm = 2.116\,mm$$

$$t = 0.64\,p = 0.64 \times 2.11 = 1.35\,mm$$

→ feed velocity (threading) >> feed velocity (turning)

→ Truing (placing w/p in chuck of headstock)

→ Facing

→ $\boxed{\text{combination centred drill head}}$ (in drill chuck)

Tom's technique

→ Turning (90°)

side-cutting edge angle = 0°

→ Chamfering (65. 75°)

from side base

set 0

turn to 20

65 . 20 = 45°

45° = clearance angle

10–15

→ Grooving

(Grooving tool)

RPM = u × cutting speed / diameter

u × cutting speed / D

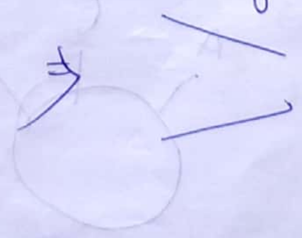
operations changes

≡ Parting tool

(to cut into parts the w/p)

→ Taper turning (90°)

Touches the edge



→ Threading (Automatic)

(BSW)

$\text{diameter} \propto \dfrac{1}{\text{thread number}}$

fo

$\frac{1}{4} \rightarrow 10$

~~0.6043~~ $\times \frac{1}{12} \times 25.4$

$\frac{1}{2}''$ — 12

$1''$ — 20

1.8 = 40

diameter = $0.64 \times \frac{1}{12} \times 25.4$ (in mm)

no. of threads

instead of 13.5

max 14 can be given

as angle not exactly 55°

B

B ~~Half knot~~

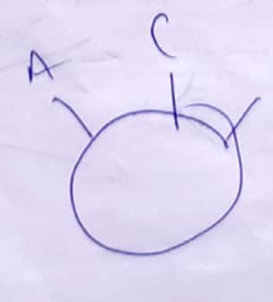
2

1.5 or 2 Half nut

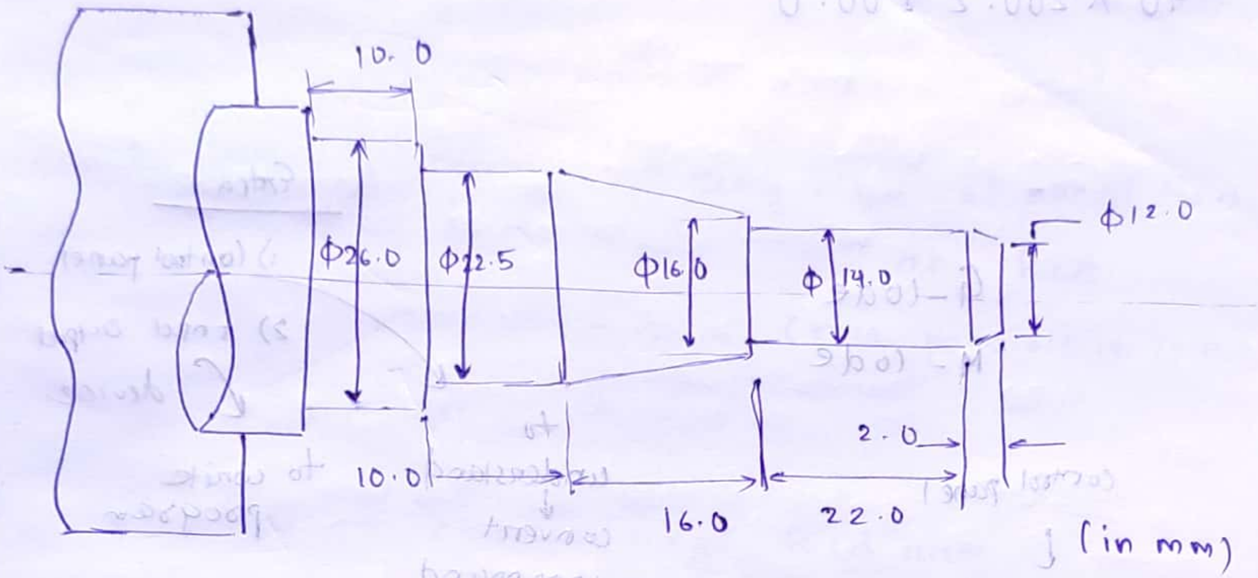
BSW

Right to left

Feed down ←



23/10/18 TURNING



N1 (TURNING) → T 606 → cutting tool number

```
G50 S 2800
G0 T 0606 M42
G96S120 M04
G0 X31.0 Z1
G71 U0.75
G71 P1000 Q1100 U.2 .W.1. F.08
N1000 G0 X12.0
G1 Z0
G1 X14.0 Z-2.0
Z-24.0 ;
X16.0 ;
G1 X22.5 Z-40.0
Z-50.0
X26.0
Z-60.0
N1100 G1 X32.0
G0 X200.0 Z50.0
M05
M01
N2 (PARTING)
G28 U0
G28 W0
G50 S2000
G0 T0707 M42
G96 S80 M04
G0 X32.0
G0 Z-63.0
G1 X-1.0 F0.2
G1 X32.0 F.05
G0 X100.0 Z200.0
M05
M30
```

for cutting the extra part

G0 G42 X200. 0Z1

G70 P1000 Q1100 F.05

G0 X 200. Z 100. 0

Extra

1) Control panel

2) Input output device

G-code

M-code

to understand ↓ convert command to machine language

to write program

control panel ↓ command to motor ↓ rotate w/p ↓ to increase rpm

③ Automatic tool changer

→ Load the cutting tools in sequence on multiple cutting tool holder.

→ You can call respective cutting tool

Idea & time ↓ when no machining is done ↓ tool cutting and setting time

Turning → reduces idle time ↓ increases productivity

→ In Turning centre

↳ more rigid

↳ elliptical movt. of w/p restricted

→ Turning centre → any kind of speed and any feed

(not possible in lathe)

→ TC → choose any feed rate

↓

it would remain uniform

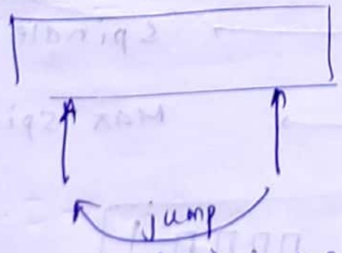
↓

higher quality of final w/p.

→ single - point cutting tool – held by tool shank

$\boxed{\text{G → Preparatory functions}}$

(1)



G00 : rapid position.

(2) G01 : Linear interpolation

(Continuous machining operation on straight path

SSP Notes

(cw) G02 }
(ccw) G03 } tool moves on a circular arc.

G20 : Inch input

G21 : Metric input
(~~value~~ to mention metric unit)

G32 : Thread cutting

G50 : spindle maxm. speed setting.

G70 : Finishing cycle → a bunch of programs.

G71 : stock removal in turning
(Bulk or huge removal like $\phi 30 \rightarrow \phi 10$)

a cycle i.e. a bunch of programs

Speed function : S□□□□

G96 S200 M3 : Cutting speed 200 m/min

G97 ⟶ spindle speed

G50 ⟶ Max spindle speed

Feed function (F□□□. □□□□)

Miscellaneous Fn: M□□

CW M03 → spindle rotation
CCW M04 →

M30 : Program end & rewind

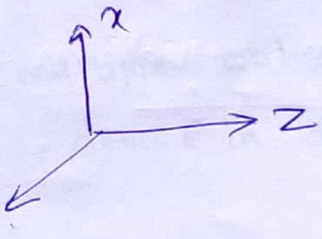
Each line is block

G71 P1000 Q1100

P1000 → starting block no.

Q1100 → Ending block no.

diameter	: X
length	: Z



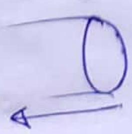
F0.35 → roughing feed 0.35

G2 X160 Z-70. R20.

(end point coordinate)

R20. → radius of circular ar.

→ tangential vel. (facing)
(surface speed ; m/s)



(spindle speed ; rpm)

Facing

$$V = \frac{\pi D N}{1000}$$

Constant velocity

→ D decreases in facing
so
N must increase
as we approach from periphery to centre

Hydraulic → holding insi
→ moving tail stock

Hollow spindle – connected to motor

→ to hold large w/p
→ less stress deformation

CNC → 3 DC motor; 2-axes machine

Gears < 1000 rpm / > 1000 rpm

250 mm job in chuck can be placed

550 mm job max m. in length in machine

$\boxed{\text{Turret}}$ – multiple tool holding device in turning centre

it can rotate

Tool post – in lathe machine

8 → cutting ~~Turning~~ tool } may be
7 → Threading tool

while tool changing { 8 → 7 (not 360°) (but other shortest way)

G0 T0700

07 → Machin tool 7
00 → w.r.t machine origin and then origin = job origin

WC (tungsten carbide) ⟶ cutting tool

In CNC (+ Fe) (4 cutting edges)

Job - M.S.

Material of cutting tool

WC > M.S (hardness)

cutting velocity

100 - 150 m/min.

If more carbon % ⟶ cutting velocity decrease to

80 - 100 m/min.

(In lathe) H.SS ⟶ 25 to 30 m/min

(W/p = M.S.)

High speed? Steel

Non - ferrous : High speed

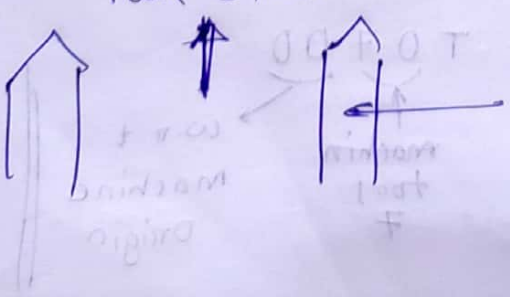
cast iron : harder ⟶ low speed

More carbon (%) ⟶ more brittle

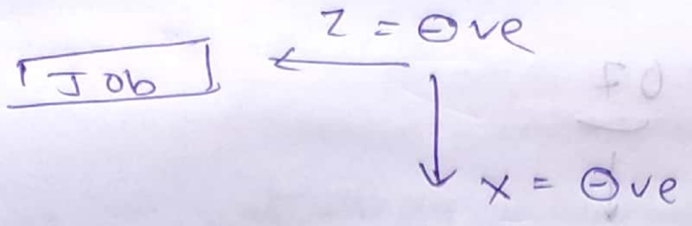
↓

more harder also

Tail stock



Guide - to prevent lateral movt.

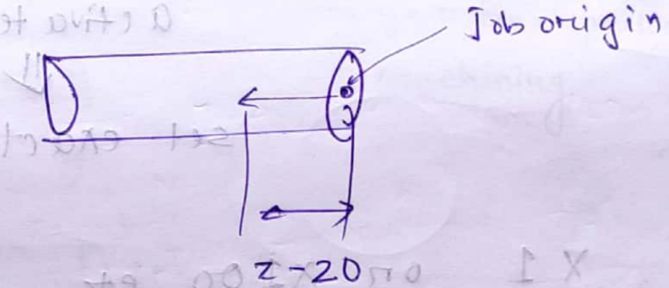


In one rotation of job, how much cutting ~~tool~~ moves = feed

mm/rev.

feed definition reverses | Milling - job moves

cutting tool fixed



Edit key - write program

EOB - End of block (i.e. ';')

Insert - Add block to program

CNC - ACW

Lathe - CW

At address,

you have to save job origin

and then refer it if required

T07 07

tool no. 7

the address

Auto

Auto mode

MDI

Manual mode

T08 11

i.e. no. on turret

address

→ X, MPG → Hand wheel activated

⇓

set exact coordinates

X 1 or X100 etc.

One division on hand wheel = 100 micron

30. 10. 18

Milling

Raw material → Manufacturing → Product
- → size
- → surface finishing
- → shape

Manufacturing
- Primary
  - ~~Primar~~
  - — casting
  - — forming
  - — joining
- Secondary
  - → Remove material to get final product
  - - Machining

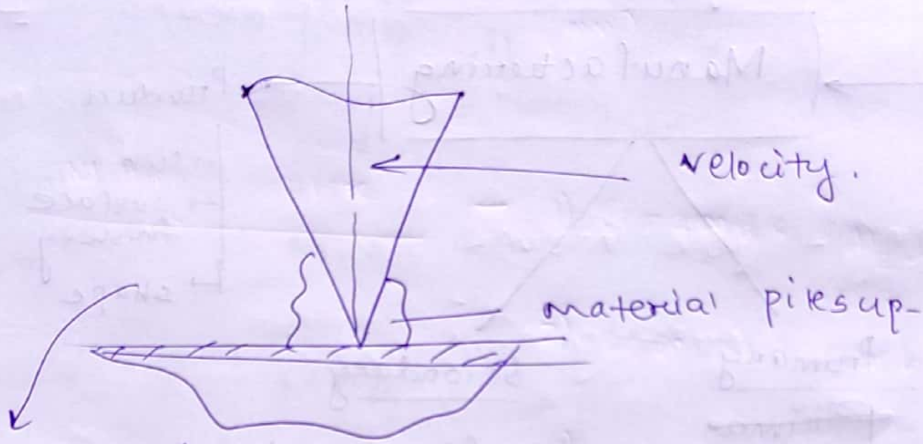
Machining

Conventional M/C — Economical
- → Turning
- → Milling
- → Shaping
- → Grinding
- → Honing
- → Lapping

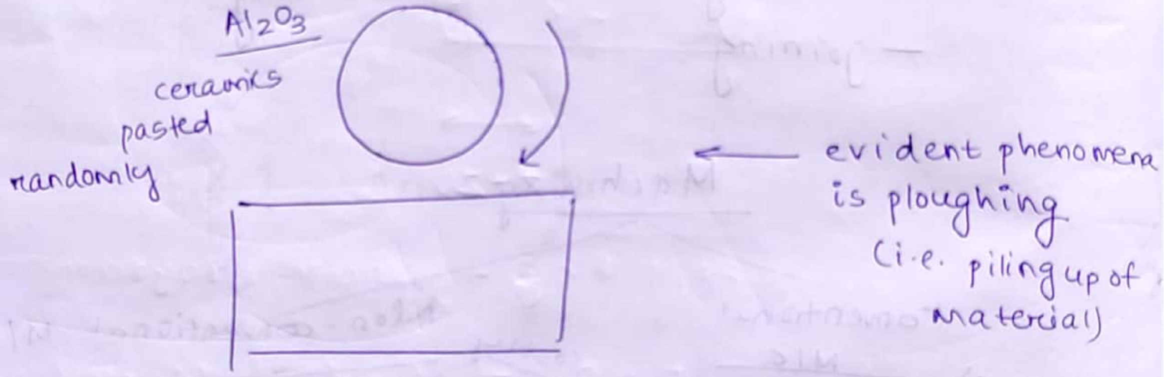
(Grinding, Honing, Lapping) Finishing processes

Non-conventional M/C — Costly, Better productivity
- → EDM (Electron-discharge machine)
- → LBM (Laser beam)
- → ECM (Electro-chemical)
- → CHM (Chemical)
- → AJM (Abrasive Jet)
- → WGM (water-gate)

Machining : Removal of extra material to obtain a product of exact specification with a wedge-shaped cutting tool. The material will be removed in the form of chips.



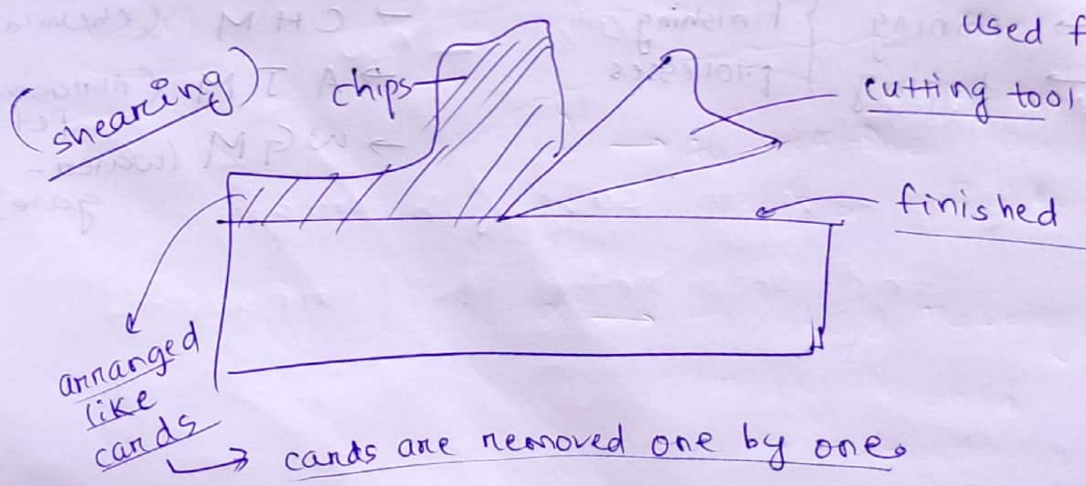
(Ploughing) → leads to reduction of MRR



(Grinding) → as ploughing – MRR reduction

↓

therefore used for finishing



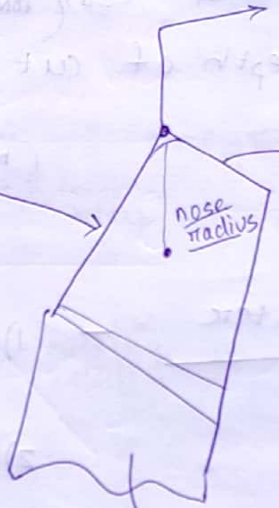
→ cards are removed one by one.

// cutting tool harder than w/p. in conventional machining always.

generally blunt (nose)

Tool Tip.

(PPC) primary or principle cutting edge (bigger) length



Auxilliary cutting edge (ACE)

shank

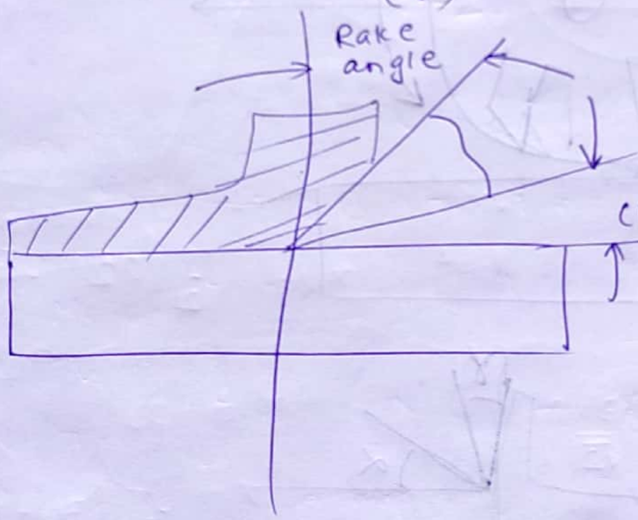
Rake surface - chip interacts

Primary flank surface ← below PPC

Auxillary flank ← Below ACE

(*)// if sharp tool tip, then it might break due to stress concentration

(γ) Rake angle



Clearance angle (α)

→ Blunt nose ⇐ smooth

(surface of product)

(*)// if tool tip

(surface of product)

* Parameters of machining

mm (d

rel.vel. b/w → cutting velocity (V_c) (m/min). $= \frac{\pi D N}{1000}$

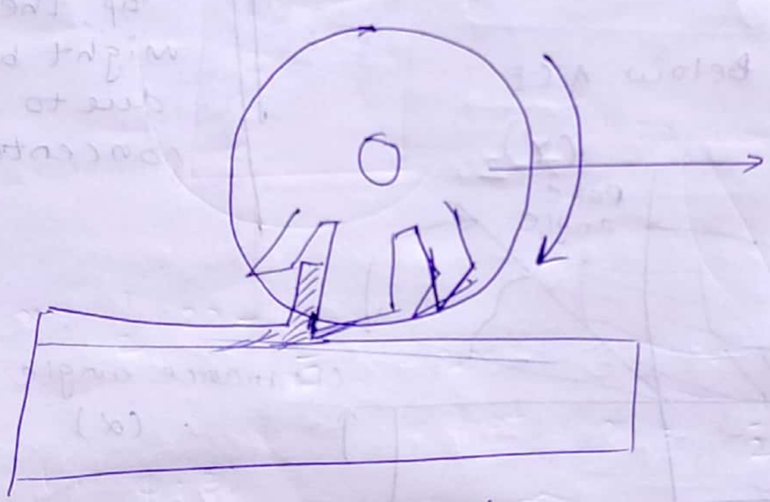
→ Feed (S_0) (mm/rev.)

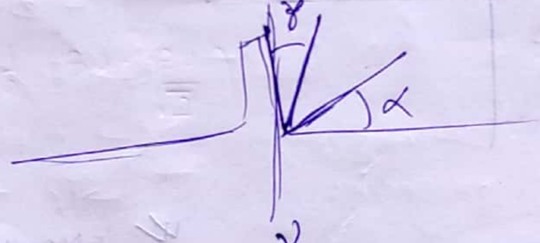
→ Depth of cut (t) (mm)

Milling cutter – 1) Ceramics (Al_2O_3, CrO_3 etc.)

2) cemented carbide

3) HSS (~ 750°C tolerance)





γ → to ease the flow of chip

α → To avoid rubbing of already finished surfaces.

of w/p)

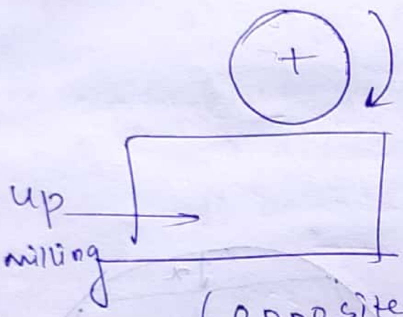
rpm

diff.

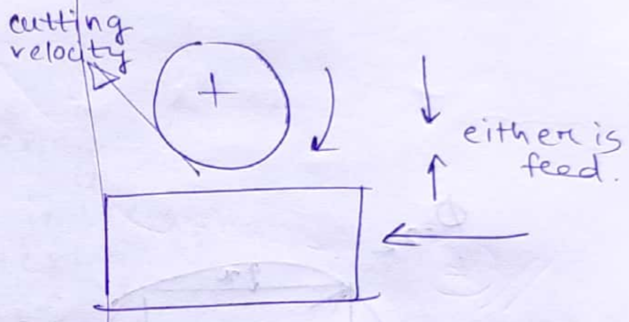
① Multipoint cutting tool; all teeth particip-ate.

② MRR is high

③ Intermittent cutting operation
(time lag b/w tooth engagement).

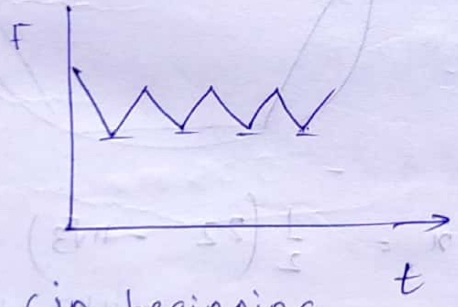


(opposite)
conventional/up

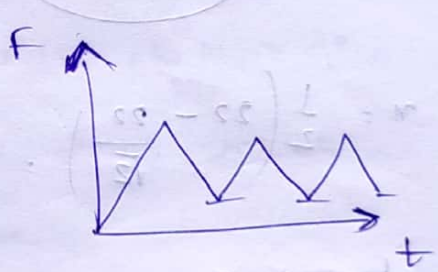


down milling

(same)
climb / down.



(in beginning, large force is applied
Thrust force
↓
vibration → surface cutting
↓
roughness on the w/p



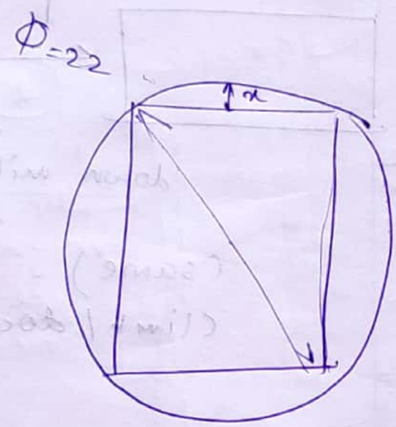
(better for thin w/p and fragile)

costly

(as material to be removed from table)

↳ so more holding apparatus.

<u>Chip thickness</u>



$x = \frac{1}{2}\left(22 - \frac{22}{\sqrt{2}}\right) = 3.222$

1.64

for $\phi = 30$

$x = \frac{1}{2}\left(30 - \frac{30}{\sqrt{2}}\right)$

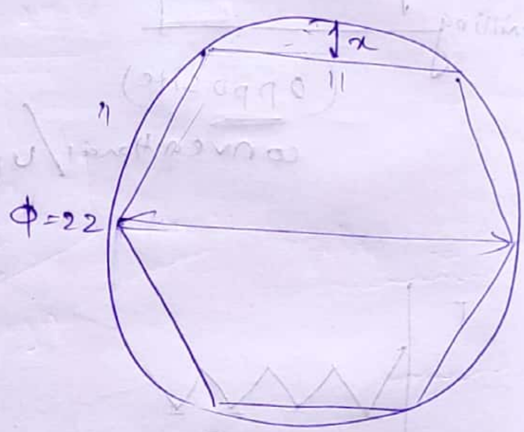
21.213

8.787

4.394

economical

<u>Chip thickness</u>



$x = \frac{1}{2}\left(22 - 11\sqrt{3}\right)$

$\frac{2.947}{2} = \boxed{1.4735}$

for $\phi = 30$

$x = \frac{1}{2}\left(30 - 15\sqrt{3}\right)$

4.019

2.010

* Indexing Mechanism — give rotational motion to w/p

(contains ~~moder~~ gears for vel. transfer)

for 

not for 

* $\boxed{\text{Worm gear}}$ — made of brass
  - indexing attachment
  - for efficient velocity transformation

a) simple indexing
b) compound indexing
c) differential indexing
d) angular indexing

40 ~~times~~ rotation of index plate = 1 rev. of the w/p.

= 360° of w/p.

1 rotation of index plate = 9° of w/p.

→ 6 rotation of index plate + 6° more

$$6\left(\frac{2}{3}\right) = 6\left(\frac{2\times5}{3\times5}\right)$$

$$= 6\left(\frac{10}{15}\right)$$

10th hole of 15th hole system

→ diff collars – diff tool for cutting

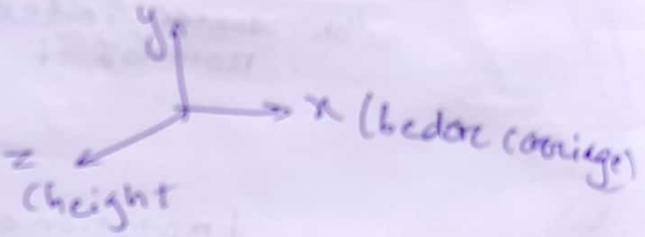
→ indexing is an ext. arrangement
can be removed

Brown & Sharpe - index plate

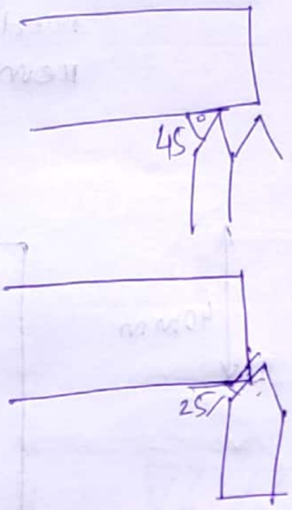
Cincinnati - index plate

→ Horizontal universal - column type
milling type

<u>Redany</u>



LC 0 05 mm



20 division — forward.

6.11.18

Machining

Conventional | Non-conventional

Conventional

- → Turning
- → Milling
- → Drilling
- → Shaping

→ A physical tool is required

→ Physical contact b/w cutting tool & w/p.

→ Cutting force is present.

→ Deflection of w/p or tool.

Non-conventional

Characteristics

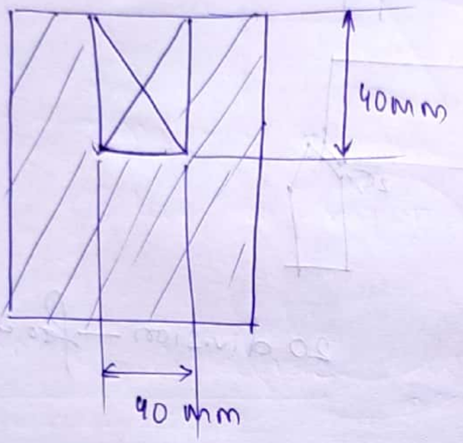
→ There may not be any physical tool.
⇓
→ There may not be any contact between tool & w/p.
⇓
→ There is no cutting force
⇓
→ Deflection less / not present

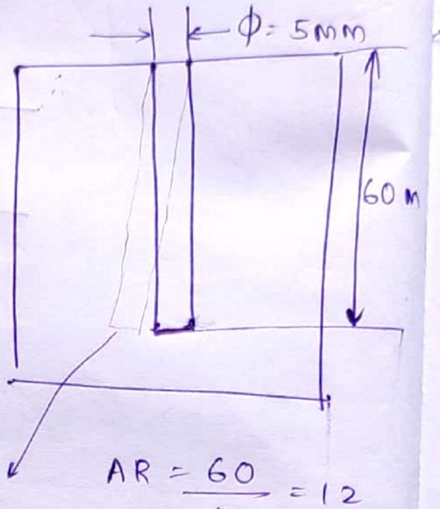
(*) → Material removal with or without chip formation.

→ cutting tool may not be harder than w/p.

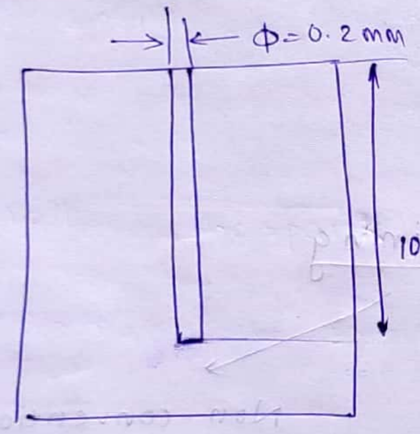
aspect ratio = $\frac{\text{length}}{\phi}$

→ uses non-traditional media for material removal.





$AR = \frac{60}{5} = 12$



by drilling there would be deflection.

$AR = \frac{100}{0.2} = \underline{500}$ very high.

Different Non-Conventional Machining Process

- → Abrasive Jet Machining (AJM)
- → Ultrasonic machining (USM)
- → Water Jet Machining (WJM)
- → Abrasive Water Jet Machining (AWJM)

} → For Material Removal Uses Mechanical Energy

- → Laser beam machining (LBM)
- → Electron Beam Machining (EBM)
- → Electrical discharge Machining (EDM)
- → Plasma Arc Machining (PAM)

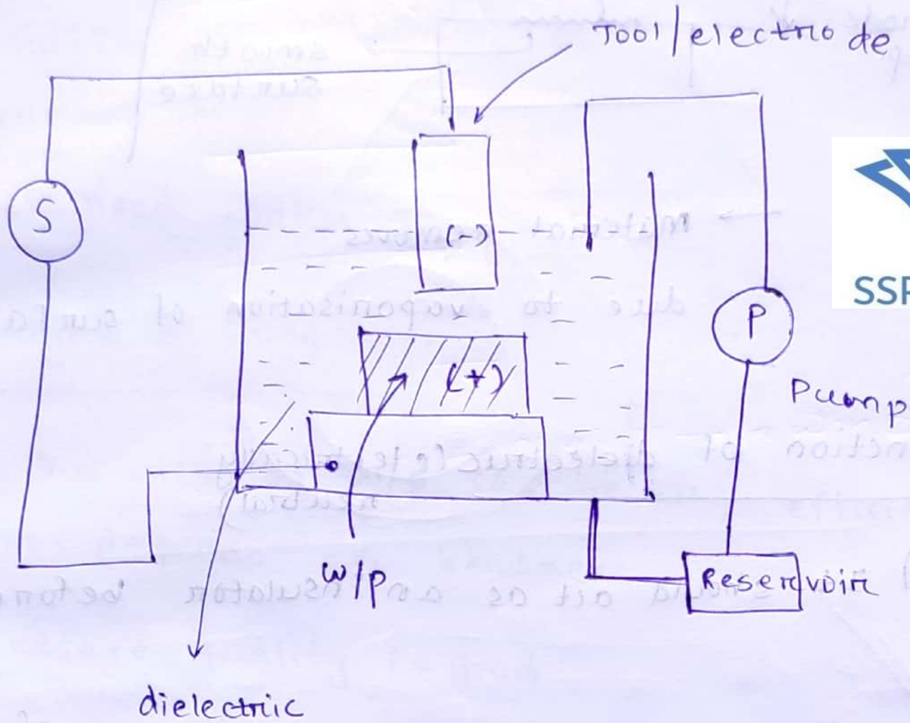
} → Uses Thermal Energy

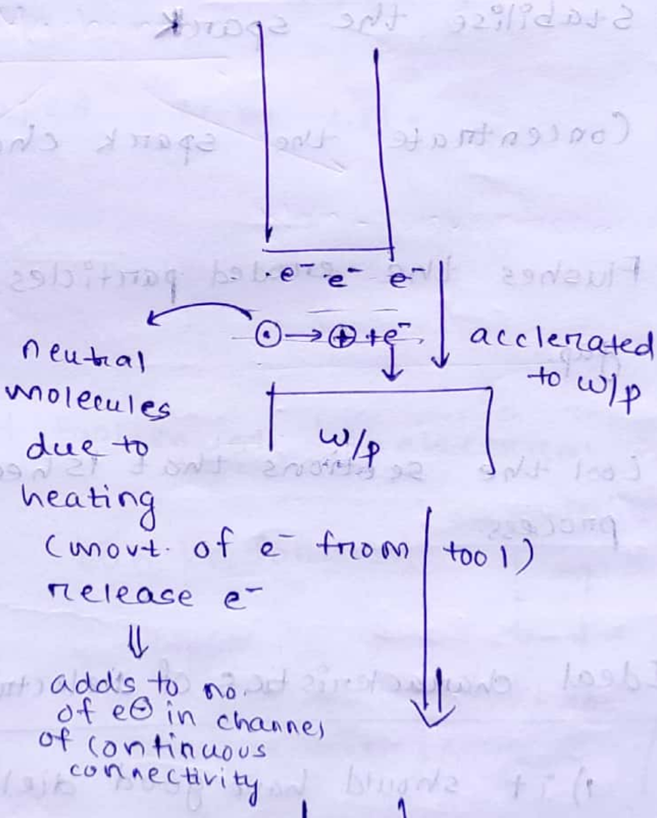
- → Electrochemical Machining (ECM)
- → chemical Machining (CHM)

} → Uses chemical Energy

- → Ion-Beam Machining (IBM) } → Uses Kinetic energy of ions.

Electric Discharge Machining (EDM)





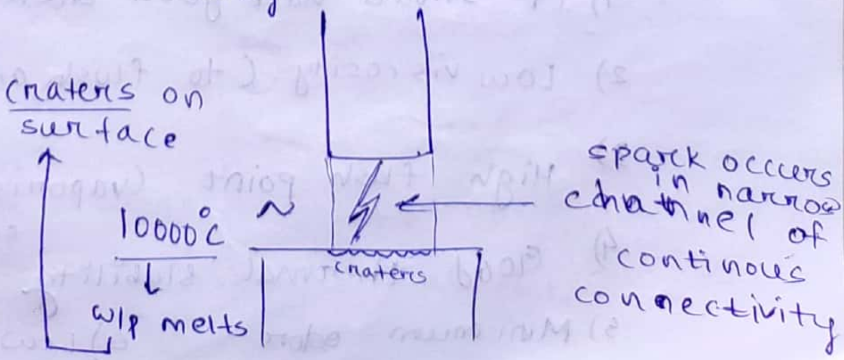
For Material Removal

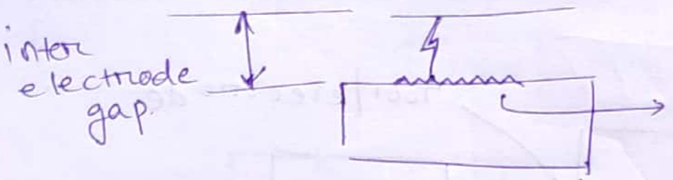
→ Uses Mechanical Energy

→ Uses Thermal Energy

→ Uses chemical Energy

→ Uses Kinetic energy of ions.





→ w/p and tool material is conducting

→ material removes due to vaporisation of surface metal

- Function of dielectric (electrically neutral)

1) It should act as an insulator before break-down (ionisation of dielectric)

2) Stabilise the spark

3) Concentrate the spark channel.

4) Flushes the eroded particles from inter electrode gap.

5) Cool the sections that is heated by machining process.

- Ideal characteristics of dielectric

1) It should have good dielectric strength.

2) Low viscosity (to flush away debris)

3) High flash point (vaporisation point of dielectric → so that at 10000°C it is not degraded).

4) Good thermal stability

5) Minimum odor   6) Low cost

Common dielectrics

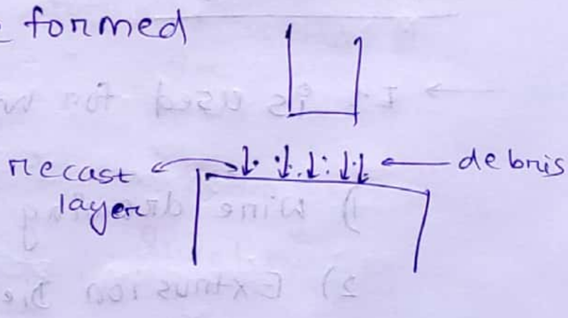
1. Transformer Oil
2. Paraffin
3. Kerosene
4. Deionized water

Advantages of EDM

1) Any hardness of w/p can be cut; efficiency doesnot depends on hardness.
2) The surface quality is good
3) Process can be mechanized easily
4) Complex shapes can be cut.

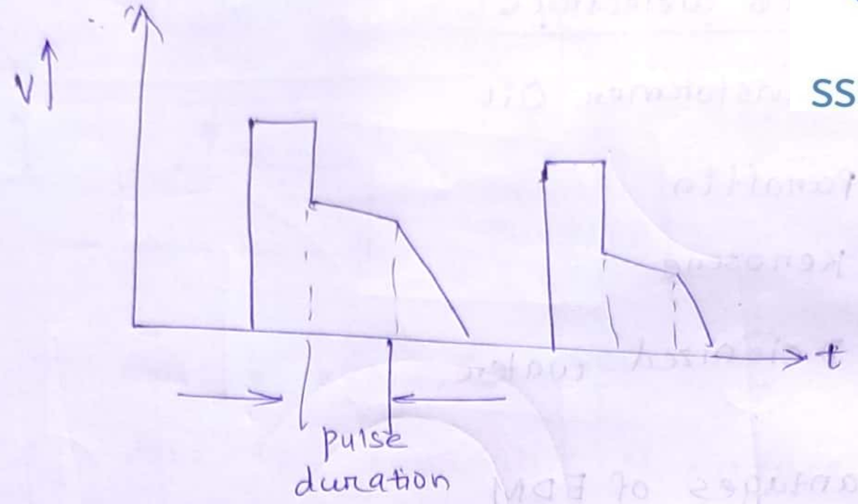
Limitations

i) Machining Time is high
IMP. ii) Both w/p and tool must be electrical conductive
iii) Recast layer can be formed



* Parameters

1) Current
2) Gap voltage
3) Pulse on time (when pulse is present)
4) Pulse off time (when pulse is absent)
5) Duty factor

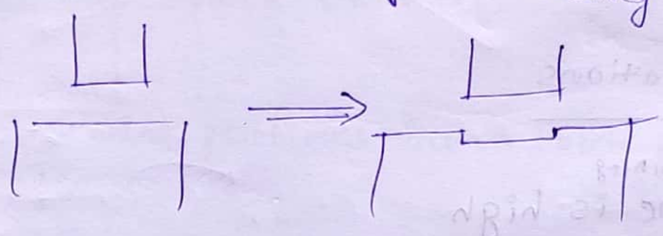


$$\boxed{\text{duty factor} = \frac{\text{on time}}{\text{on + off time}}}$$

The inter electrode gap (IEG) is to remain same, so servo system is used.

(voltage sensor → servo system → electrode)

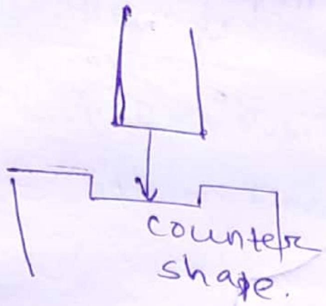
IEG is always decreasing



- Applications

→ It is used for making.

1) Wire drawing die
2) Extrusion Die
3) Forging Die
4) Moulds



→ Electrode erodes at a lesser rate, because heat generation near w/p.

Materials of electrode

1. Copper (soft material)
2. Graphite
3. Brass
4. Cu-tungsten
5. Tungsten

Quiell Quiel

more time 5A, 12A less time

Blocks (horizontal)

peak c. on time

I_p, T_{on},

S → Start } Hottle
E → End }

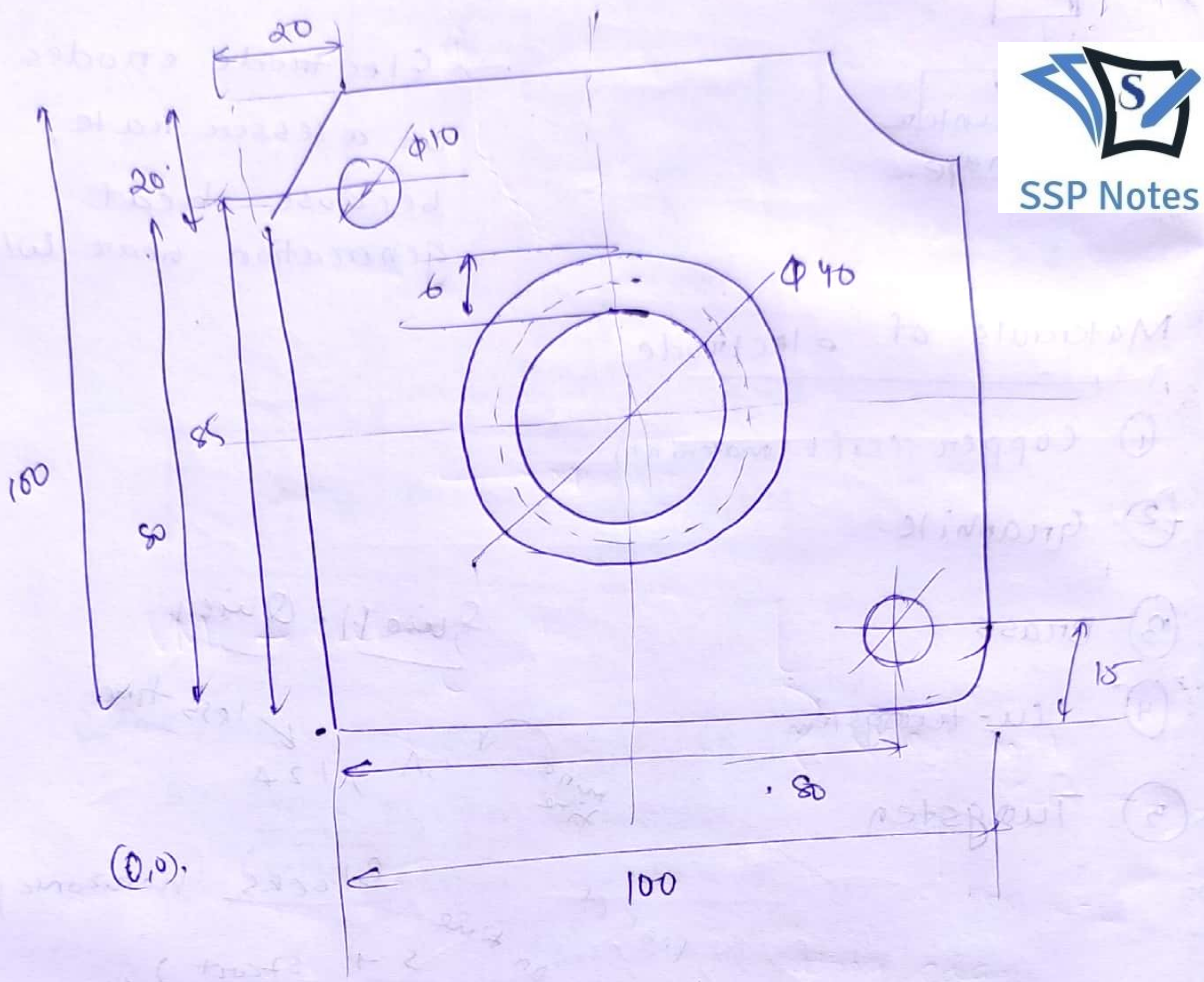
t_r, V_g, SEN α (speed of m/c)

ASEN (scattering control)

TW → total pulse ~~(...)~~ miller time

Black unburnt carbon

R_d → job completion how much Quiel rises.



M01 - Optional stop

M03 - Cutter Rotation CCW.

M04 - Cutter Rot. CW.

M05 - Spindle stop.

M06 - Tool change

M08 - Coolant on.

M09 - Coolant off

M30 - Program stop.

G-code

G00 - Positioning (Rapid)
G01 - Linear interpolation

Machine tool
↑
Machine control unit
↕
I/O device
(comp.)

→ Ball-screw devices
rotates on circumference of helical screw
= transfers power from spindle to work table

→ more rigid - CNC as no vibration in higher speeds also.

- Idle time
- Any speed can be acquired in this M/C.

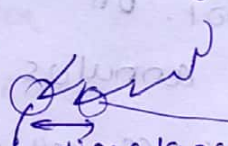
Absolute

i) coordinating system : Reference as the assumed origin

ii) Incremental coordinating system : The last point as origin for the next ~~poi~~ job/work.

→ Continous : on lathe

Intermittent : Milling machine



engages → time lapse → then this engages.

→ Point to point movt. -

Moving from one pt to other pt.

(like drilling holes in houses)

no operations.

→ Circular interpolation

↳ Make circular arc.

VMC - cutting tool:

(End-mill cutter)

at the end cutting edges are there.

→ Codes are written wrt centre of cutting tool tip

G43 $\boxed{\text{Cutter - radius compensation}}$ (CRC)

G49 $\boxed{\text{Cutter - length compensation}}$ (CLC)

We want to move centre of cutting tool. on the centre of annulus

so G40: cancellation of CRC

cutting tool → tip will not be taken into account

→ a conical hole would be formed, so CLC to give flat surface touch of cutting tool.

→ ① End mill cutter

② Drill - bead cutter

→ otherwise length would be considered from tip (conical of cutt...

→ (ca

→ First circumfer...

then middle

then outer 2 c...

(Perform in a b...

H 18 : Height of cu...

D 18 : Diameter of too...

S: spindle speed

F: feed rate.

→ Top surface as ...

X 70 Y 90 → final position

R 20 → radius

→ circula...

→ Point to point movt -

Moving from one pt to other pt

o ↑ o (Like drilling holes in house)

no operations

→ Circular interpolation

↳ Make circular arc.

VMC - cutting tool:

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G49 | $\boxed{\text{Cutter - length compensation (CLC)}}$

We want to move centre of cutting tool on the centre of annulus

so G40: cancellation of CRC

Cutting tool →

tip will not be taken into account

→ CNC: Every axes can be coupled/synchronised

Conventional: 3-D not possible.

SSP Notes

→ canned cycle: Repetitive cycle.

(like after point to point movt.)

↓

after movt.

same fn. is to be done

↓

perform repeated job.

→ First circumference

then middle hole

then outer 2 corner holes

(Perform in absolute origin).

R15:

↓

• 15mm Retract

⇓

pt. to pt. movt.

⇓

to new location

H18: Height of cutting tool T18.

D18: Diameter of tool 18 (CRC)

S: spindle speed

F: feed rate.

Top surface as Z=0

X 70 Y 90 (R 20) → circular interpolation

final position

radius

→ a conical hole would be formed, so

e.g.

↓

→ ① End mill cutter

to give ② Drill-bead cutter

flat surface

touch of cutting tool.

→ otherwise length would be considered from tip (conical) of cutter.

→ Point to point movt.
Moving from one pt to other pt.
(like drilling holes in house)
no operations.

→ Circular interpolation
↳ Make circular arc.

VMC – cutting tool:
(End-mill cutter)
at the end cutting edges are there.

→ Codes are written wrt centre of cutting tool tip

G43 | Cutter-radius compensation (CRC)

G49 | Cutter-length compensation (CLC)

We want to move Centre of cutting tool on the centre of annulus
so G40: Cancellation of CRC.

(cutting tool) – tip will not be taken into account

→ CNC: Every axes can be coupled/synchronised
Conventional: 3-D not possible.

→ Canned cycle: Repetitive cycle.
(like after point to point movt.)
↓
after movt.
same fn. is to be done
↓
perform repeated job.

→ First circumference
Then middle hole
Then outer 2 corner holes
(Perform in absolute origin).

R15: • 15mm Retract pt. to pt movt. to new location

H18: Height of cutting tool T18.
D18: Diameter of tool 18 (CRC)
S: spindle speed
F: feed Rate.

Top surface as Z=0

X70 Y90 (R20) → circular interpolation
final position, radius

→ a conical hole would be formed, so CLC
↓
to give
→ ① End mill cutter
② Drill-bead cutter
flat surface touch of cutting tool.
→ otherwise length would be considered from tip (conical) of cutter.

~~x~~ y z
G00 x400 x 500

xyz (A) Angle

ATC : Automatic Tool changer.

G00 (Rapid posn.)

100% - 15 m/min by default

Simulation : Check the program

1000 to 10000

20000 increase (2011)

4 DC Motor (XYZ, rotation of cutter)