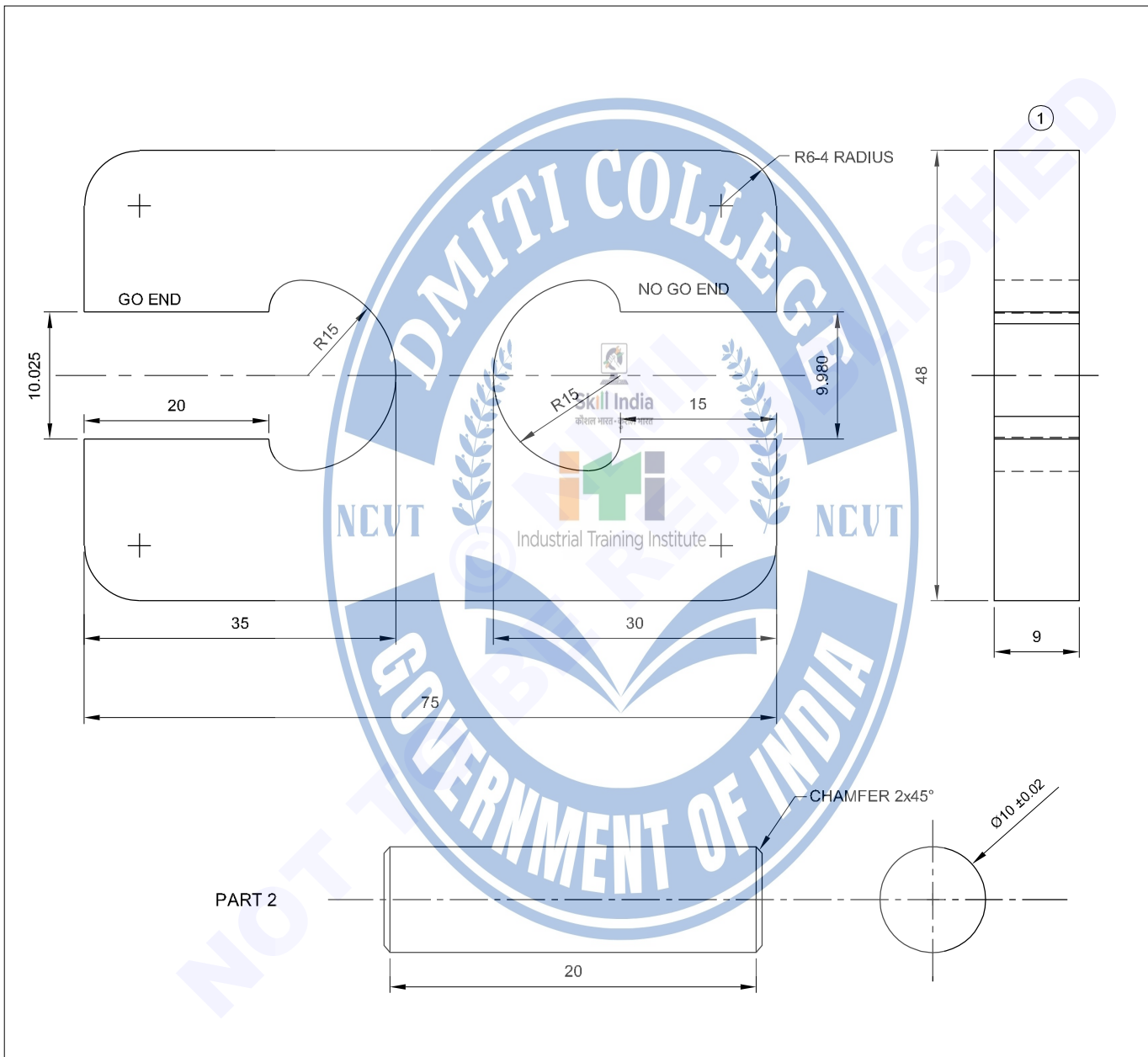
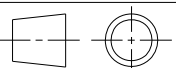


**Making a snap gauge for checking a dia. of  $10 \pm 0.02\text{mm}$**

**Objectives:** At the end of this exercise you shall be able to

- file to overall size as per drawing
- mark the profile as per drawing and punch with measurements
- chain drill chip and file profile as per drawing
- turn a round to size and shape
- check the round rod into GO end and NO GO end.



1	50 ISF 10-80	-	Fe-310	-	1	2.2.139
2	Ø12-25	-	Fe-310	-	2	2.2.139
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE 1:1					TOLERANCE $\pm 0.02$ mm	TIME 20 hrs
 <p style="text-align: center;"><b>MAKING A SNAP GAUGE</b></p>					CODE NO. FI20N22139E1	

## Job Sequence

### Snap Gauge:

- Check the raw material for its size
- File the raw material to size 75 x 48 x 9 mm maintaining flatness and squareness
- Check the flatness and squareness with try square.
- Apply marking medium cellulose lacquer on the surface of the job.
- Mark all the dimension lines as shown in job drawing Part – 1
- Punch witness marks on the marked lines.
- Chain drill and remove excess metal by chipping and sawing.
- File and finish the profile as per given in the job drawing maintaining the dimensional accuracy of  $\pm 0.02$  mm.
- Check the measurement with vernier caliper
- Finish surface and remove burrs in all corners of the job.

### Round Rod:

- Hold the round in a centre lathe with three jaw chuck.
- Turn the round rod to size fit of  $\varnothing 10 \pm 0.02$  x 60 mm long maintaining the dimension between 9.980 mm and 10.020 mm.
- Chamfer both the ends of round in lathe.
- Check the round rod in “snap gauge”.
- Apply thin coat of oil to preserve and for evaluation.

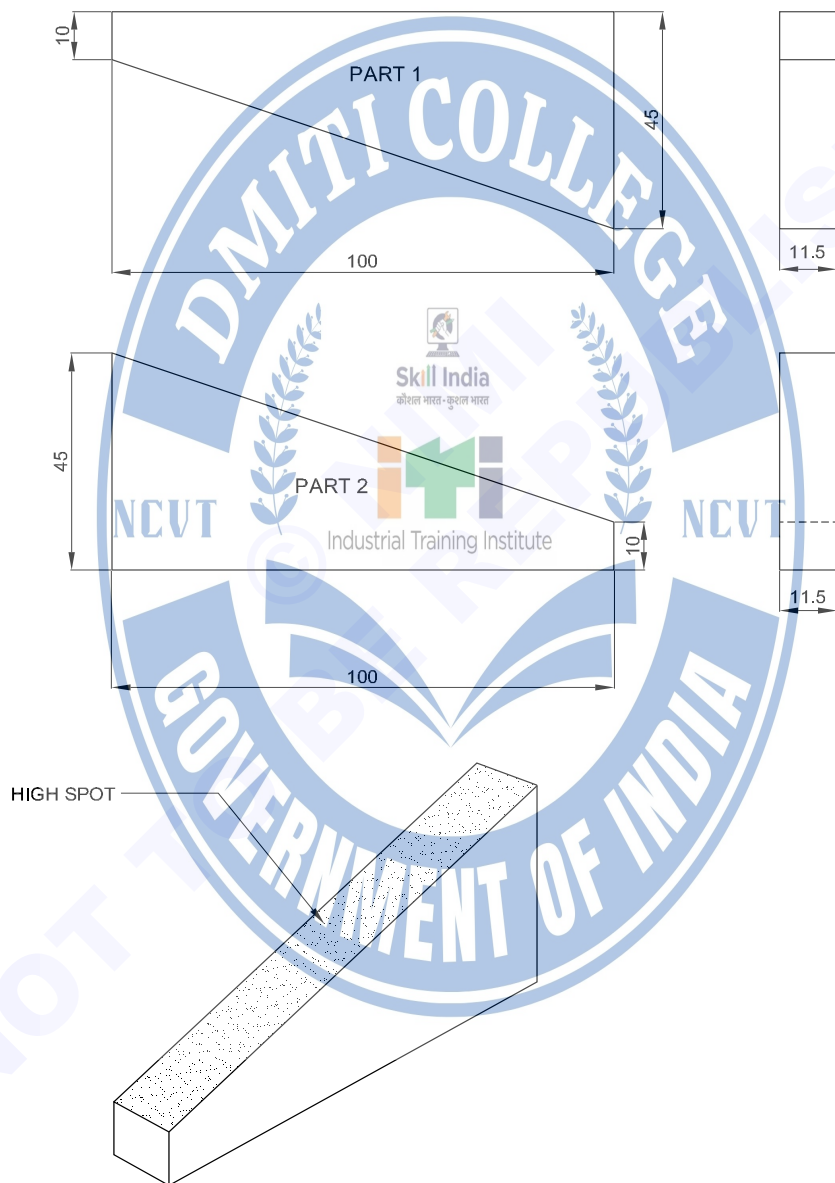
If the round enters into “Go Side” and not enter into “No go side” means, the turned component is equal to minimum permissible dimension, that means the product component is accepted for further process. Instead of that the turned component enters into both “Go” and “No go” end means the turned component is equal to maximum dimensions, that means the product component is not accepted for further process. Simply the maximum permissible dimensions component should be rejected.



Scrape external angular mating surface and check angle with sine bar

Objectives: At the end of this exercise you shall be able to

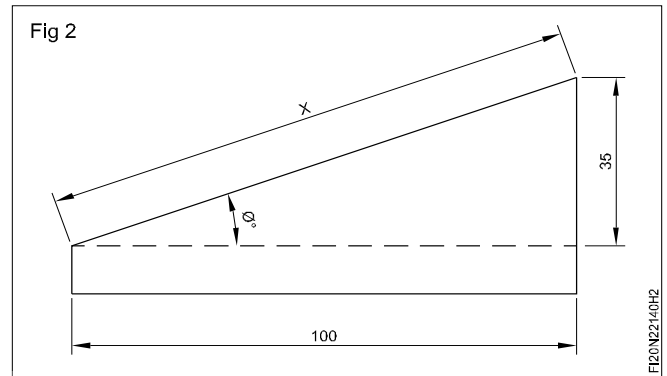
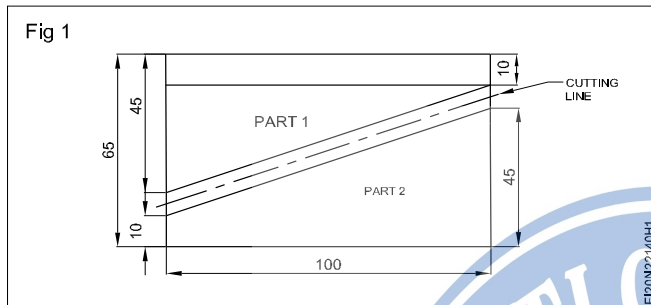
- file to flat and square
- mark as per drawing and punch witness marks
- prepare Part 1 and 2 as per drawing
- check angle with sine bar.



1	65ISF 12-105	-	Fe-310	-	1&2	2.2.140
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE 1:1	<b>SCRAPE EXTERNAL ANGULAR MATING SURFACE AND CHECK ANGLE WITH SINE BAR</b>				TOLERANCE: ±0.02 mm	TIME : 15 hrs
					CODE NO. FI20N22140E1	

## Job Sequence

- Check the raw material for its size.
- File to flatness and squareness to overall size.
- Mark dimensional lines as per drawing and punch witness marks.
- Cut off the material into two pieces (part – 1 and part – 2) by hackwawing as shown in Fig -1



- File part – 1 to size and shape maintaining the dimensional accuracy  $\pm 0.02\text{mm}$
- Check the dimensions with vernier caliper.
- Check the angle  $19^\circ 17'$  with vernier bevel protractor.
- Similarly file part – 2 to size and shape and also to angle  $19^\circ 17'$
- Apply prussian blue evenly on the surface plate to check high spot on angular surfaces.
- Place part – 1 and part - 2 angular surfaces on surface plate and move gently.
- Take the job from the surface plate and notice the high spot (prussian blue spotted marks) on angular surfaces.
- Hold the job in a bench vice, scrap and remove the high spots with a flat scraper.
- Repeat the process until the prussian blue cover the entire angular surfaces of part – 1
- Similarly scrape part – 2 and maintain the angular surface without high spot and angle  $19^\circ 17'$ .
- Clean the surface plate, sine bar and slip gauge with soft cloth.
- Select the slip gauge to the height of 33.024 mm
- Set the part – 1 in sine bar and clamp it properly.
- Fix the dial test indicator in the stand.
- Set the dial test indicator plunger on the angular surface of the job.
- Set the dial test indicator pointer in 'zero' position
- Wring the slip gauges under the sine bar roller.
- Move the dial test indicator from one end to other end and check the parallelism of the angular surface.
- If the dial test indicator pointer does not move plus (or) minus side and stand still in zero position means, there is no deviation in the angular surface of job.
- Instead of that, the dial test indicator pointer moves plus (or) minus side means there is a deviation in the angular surface of the job.
- If you notice any deviation, correct the parallelism of the surface of the job by using suitable slip gauge and calculate the actual angle.
- Dismantle the setting, clean all the instruments and keep it in proper place.
- Make part – 1 and part – 2 angular surface and apply thin coating of oil and preserve it for evaluation.

### Calculation of angle

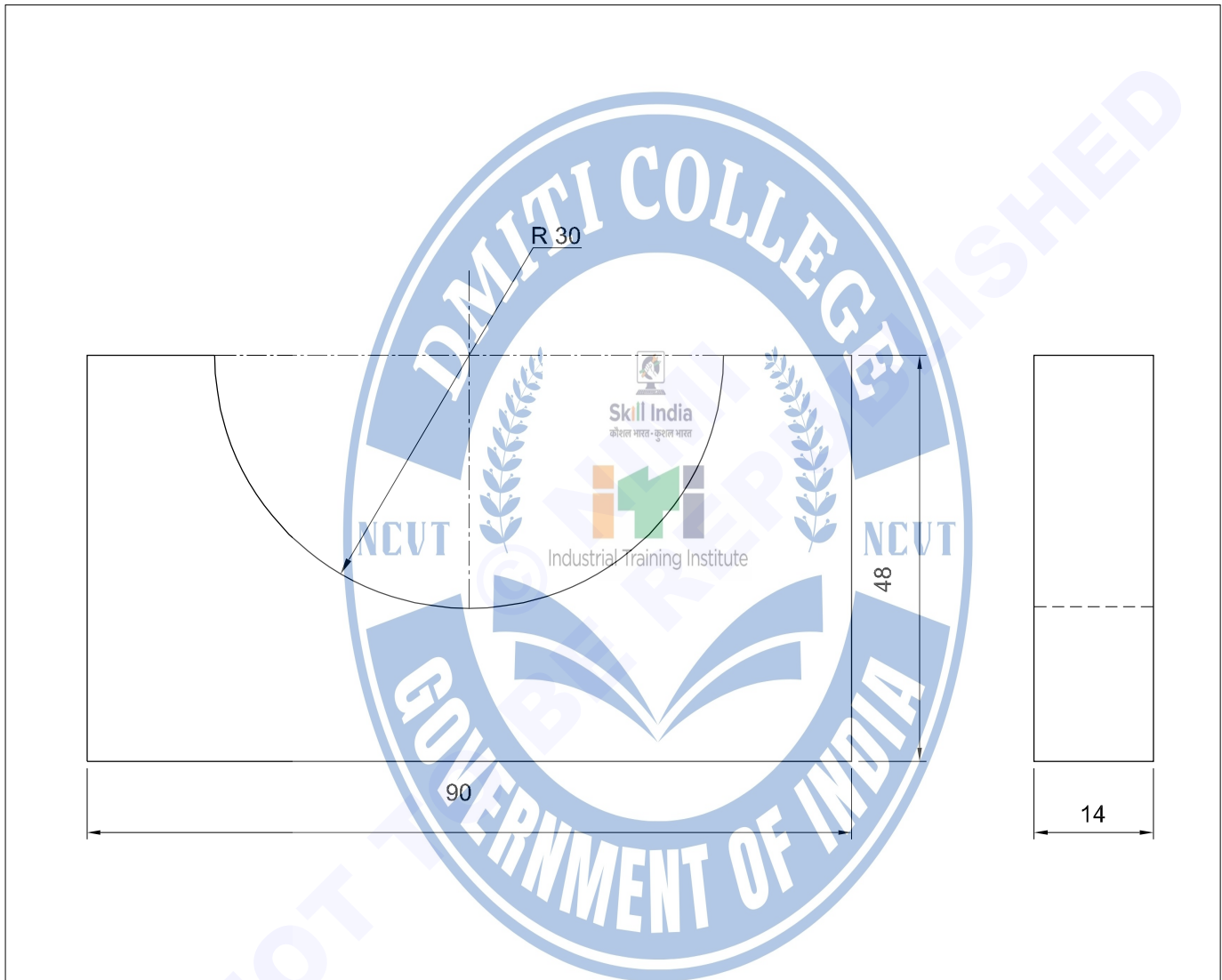
$$\tan \theta = \frac{\text{opposite side}}{\text{adjacent side}} = \frac{35}{100} = 0.3500$$

$\therefore \theta 19^\circ 17' 20''$  ( as per trigonometric table)

Scrape on internal surface and check

**Objectives:** At the end of this exercise you shall be able to

- file to size as per drawing
- mark and punch to the dimensions
- chain drill and chip excess metal
- file profile to shape and size to an accuracy of  $\pm 0.02\text{mm}$
- scrape and remove high spots on internal surface.

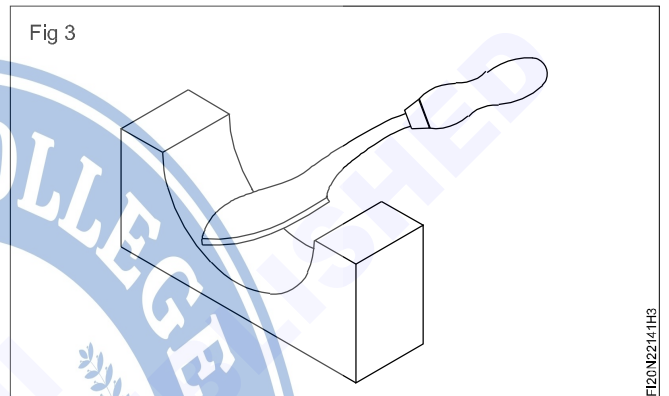
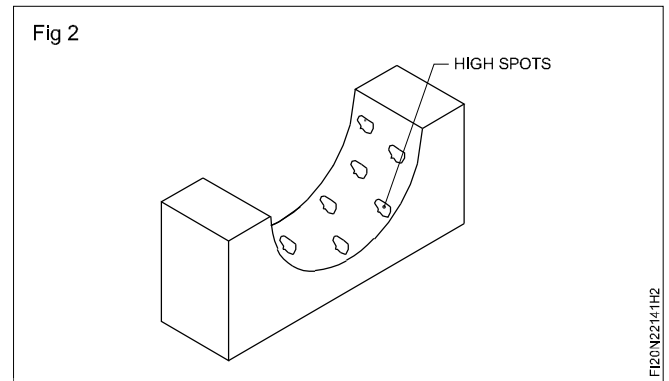
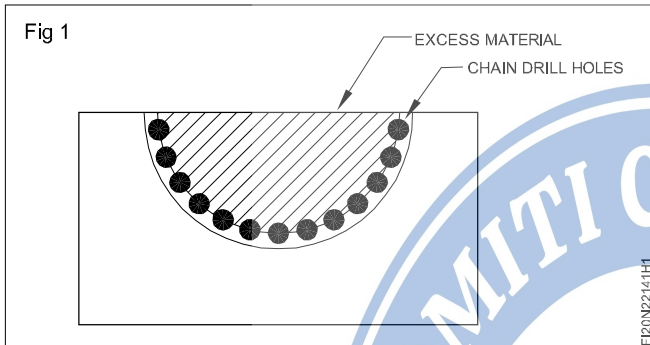


1	50 ISF 15 - 95	-	Fe-310	-	-	2.2.141
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE 1:1	SCRAPE ON INTERNAL SURFACE AND CHECK				TOLERANCE : $\pm 0.02 \text{ mm}$	TIME : 10 hrs
					CODE NO. FI20N22141E1	

## Job Sequence

### Scrape on internal surface and check

- Check the raw material for its size.
- File metal to over all size 90 X 48 X 14mm and check the size with Vernier caliper.
- Check Flatness and squareness with try square.
- Apply marking media and mark as per drawing and punch witness marks.
- Chain drill holes to remove Excess metal



- Cut and remove the chain drilled portion by chipping.
- File the chipped portion to profile and check with radius gauge and size with Vernier Caliper.
- Hold the test material  $\phi$  60mm on bench vice and clean with soft cloth.

#### Use banian cloth / mull cloth for cleaning.

- Apply Prussion blue on the cylindrical surface of material.
- Clean and place the job's curved portion on (bearing surface) on test material and rotate it gently to find high spots. (Fig 2).
- Hold the job in bench vice. Scrape and remove the high spots with half round scraper (Fig 3).

- Similarly, scrape till high spots are spreaded evenly all over the entire curved surface of the job.
- Finish and remove the burrs in all corners of the job.
- Apply little oil and preserve it for evaluation.

#### Caution:

- Always use scraper with handle.
- Protect the cutting edge of a scraper with a rubber cover when not in use.
- Apply oil, grease on the cutting edges when not in use and keep it in safe place.

## Skill Sequence

### Scraping and testing curved surfaces

**Objective:** This shall help you to

- **scrape and test curved surfaces**

A half round scraper is the most suitable scraper for scraping curved surfaces. This method of scraping differs from that of flat scraping.

#### Method

For scraping curved surfaces the handle is held by hand in such a way as to facilitate the movement of the scraper in the required direction Fig 1.

Pressure is exerted with the other hand on the shank for cutting.

Rough scraping will need excessive pressure with longer strokes.

For fine scraping, pressure is reduced and the stroke length also becomes shorter.

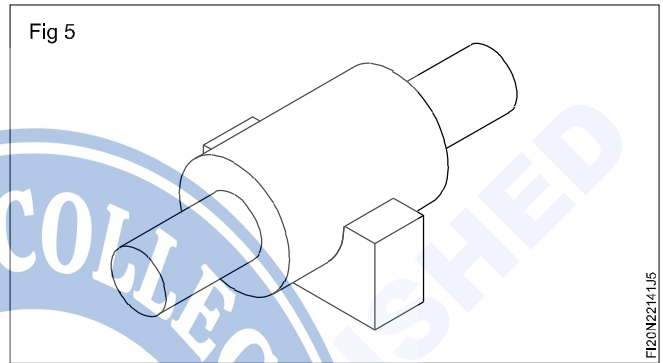
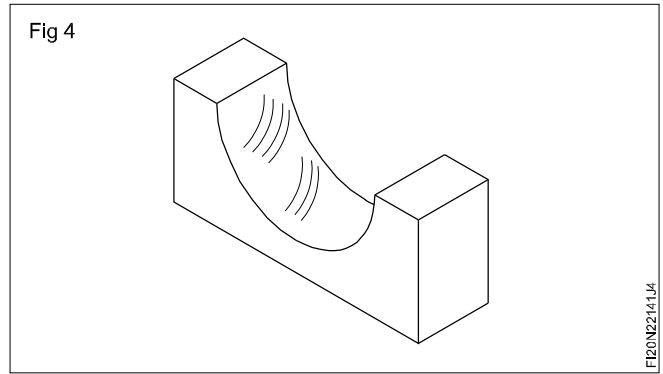
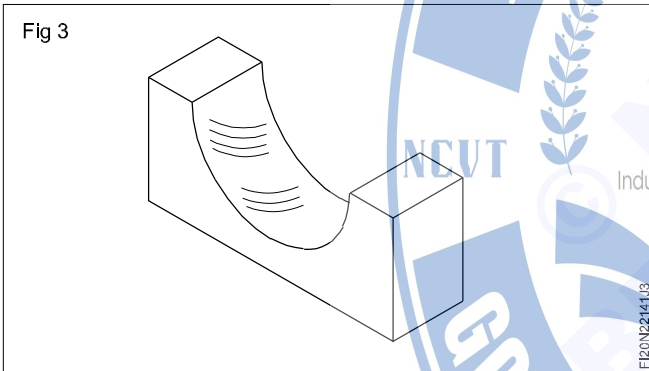
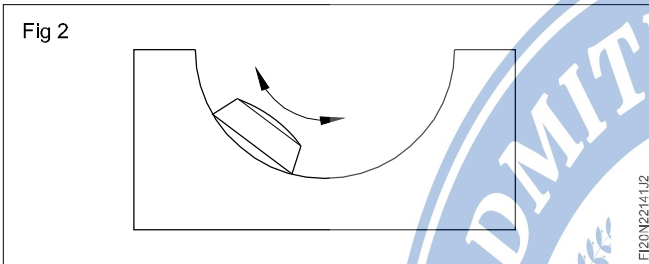
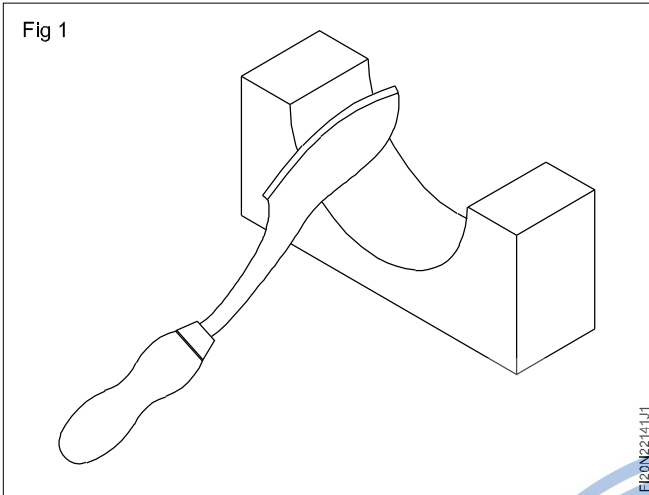
Cutting action takes place both on forward and return strokes Fig 2.

During the forward movement one cutting edge acts, and on the return stroke, the other cutting edge acts.

After each pass, change the direction of cutting. This ensures a uniform surface Figs 3 & 4.

Use a master bar to check the correctness of the surface being scraped Fig 5.

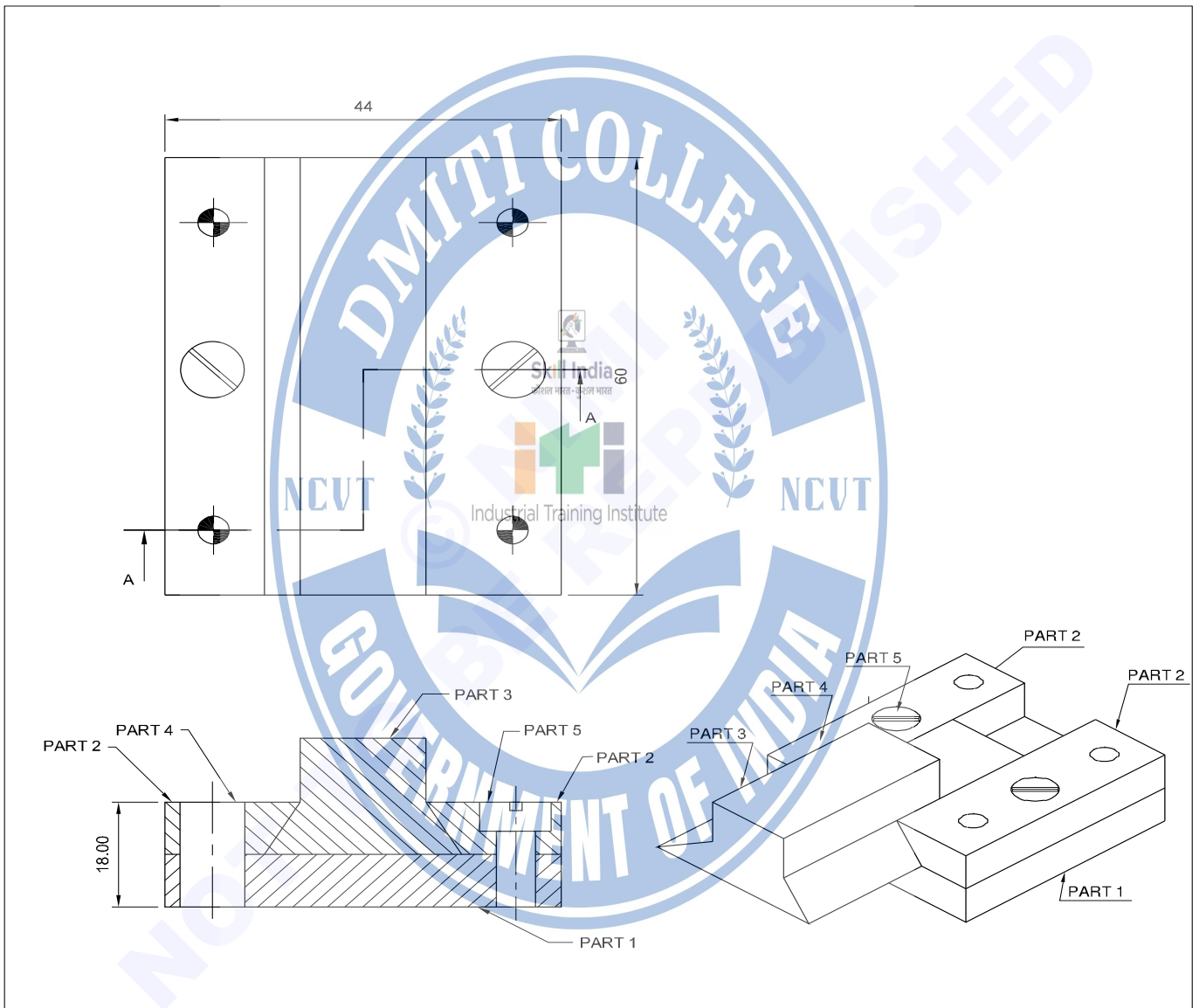
Apply a thin coating of Prussion blue on the master bar to locate the high spots.



Practice in dovetail fitting assembly and dowel pins and cap screws assembly

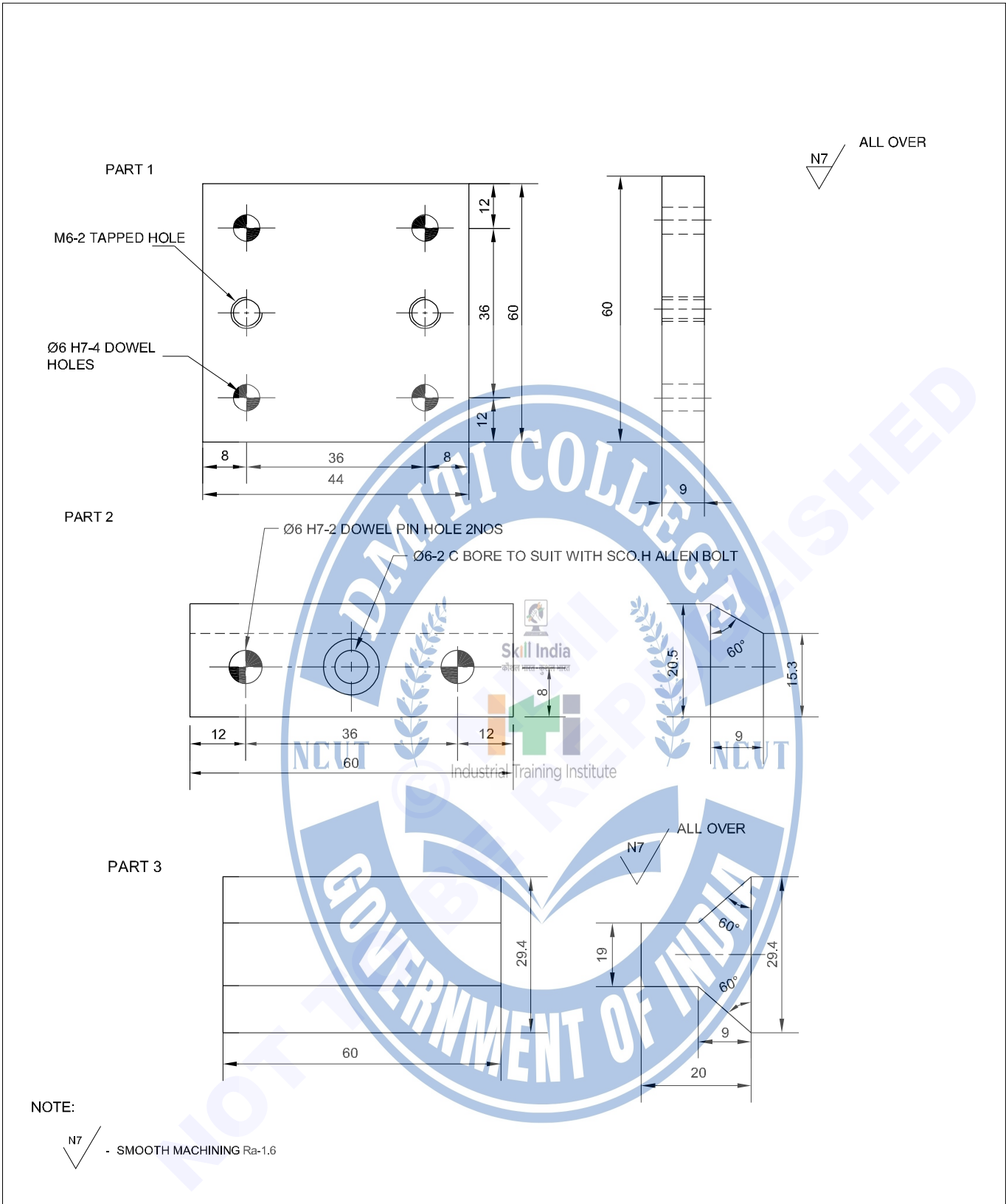
Objectives: At the end of this exercise you shall be able to

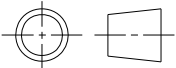
- mark dimensions with a Vernier height gauge
- file the parts 1, 2, and 3 to size
- drill ream and tap at correct locations
- counterbore to required depth
- assemble the parts 1,2 & 3 with dowel pins and cap screws.



2	M6-12	CAP SCREW IS:3406	Fe 310	-	5	2.2.142
4	Ø6-18	DOWEL PINS	Fe 310	-	4	2.2.142
1	35 ISF 25 - 65	DOVE TAIL SLIDE	Fe 310	-	3	2.2.142
2	25 ISF 10-65	TOP PLATES	Fe 310	-	2	2.2.142
1	65 ISF 10 - 65	BASE PLATE	Fe 310	-	1	2.2.142
NO.OFF	STOCK SIZE	SEMI PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

SCALE 1:1	<b>PRACTICE IN DOVETAIL FITTING ASSEMBLY AND DOWEL PINS AND CAP SCREWS ASSEMBLY</b>	DEVIATIONS ±0.02 mm	TIME 16 hrs
		CODE NO. FI20N22142E1	



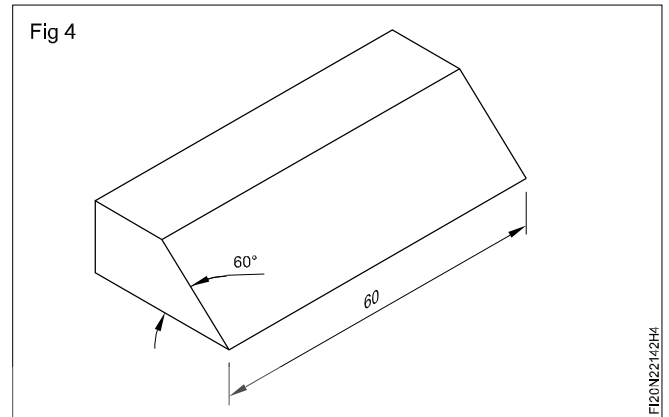
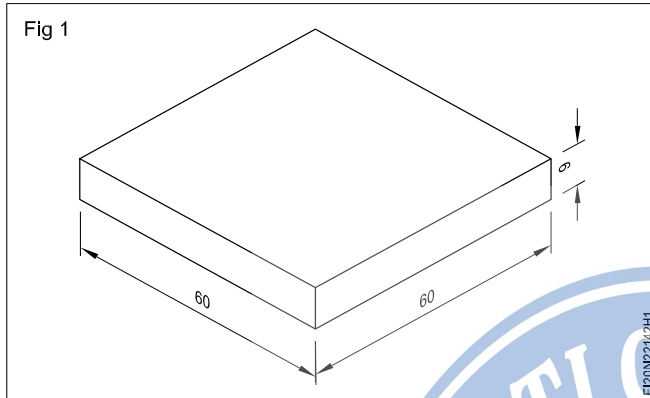
-	-	-	-	-	-	2.2.142
NO.OFF	STOCK SIZE	SEMI PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE 1:1	<b>PRACTICE IN DOVETAIL FITTING ASSEMBLY AND DOWEL PINS AND CAP SCREWS ASSEMBLY</b>				DEVIATIONS ±0.02 mm	TIME
					CODE NO. FI20N22142E2	

## Job Sequence

- Check the raw material for its size, part 1, 2, & 3 as per drawing.

### Part 1

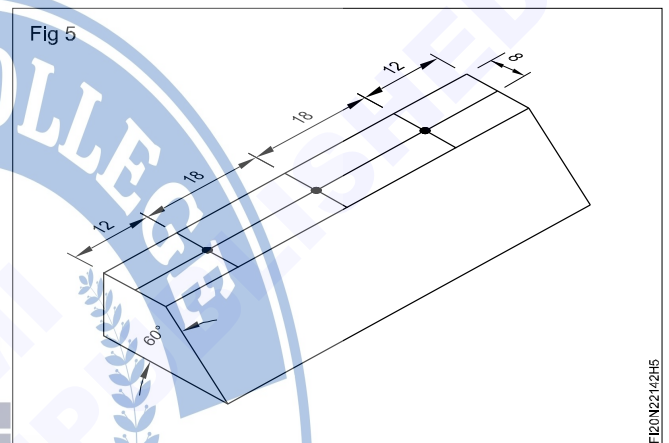
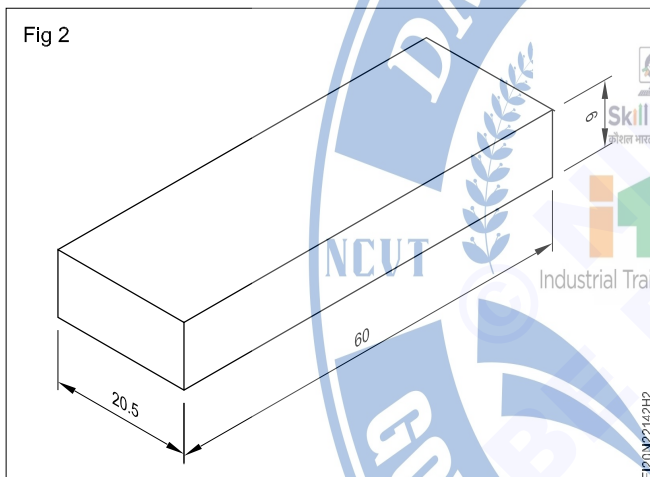
- File to size and square. (Fig 1).



Mark the holes as per drawing in two piece (Fig 5).

### Part 2

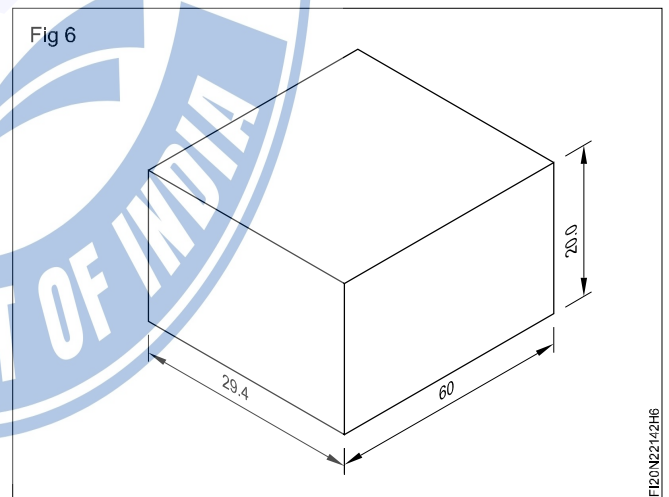
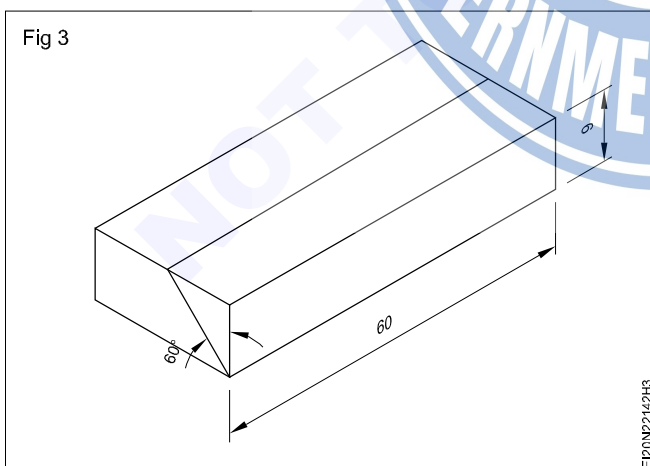
- File to size and square. (Fig 2).



### Part 3

- File to size and square to 29.4x60x20 mm (Fig 6).

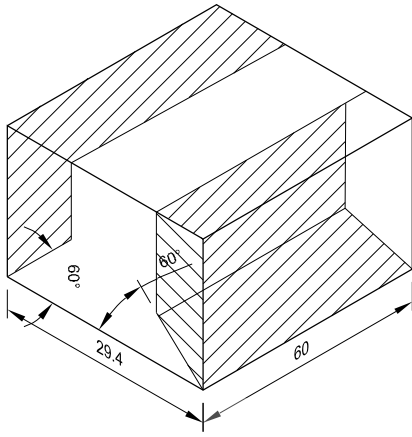
- Mark 60° angle using Vernier bevel protector in two pieces. (Fig 3).



- Cut and file the angular surface to flat and 60° angle and check the angle with Vernier bevel protector. (Fig 4)

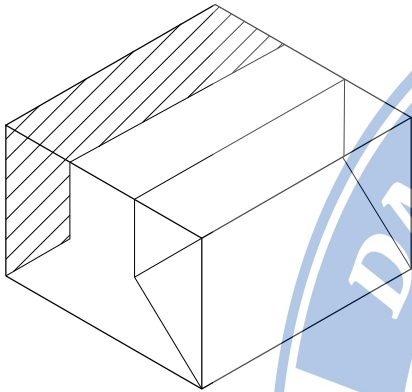
- Mark lines as per drawing with vernier height gauge and angle to 60° with vernier bevel protector. (Fig 7).
- Cut and remove the excess metal of hatched portion in one side by sawing and file to size, shape and angle to 60°. (Fig 8)
- Similarly, repeat the above process in other side of the job.
- Check the size with vernier caliper and angles with vernier bevel protractor (Fig 9).

Fig 7



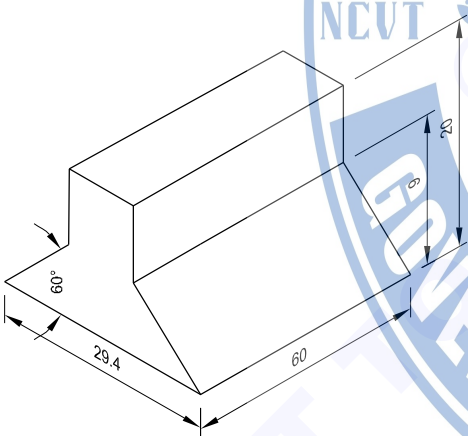
FI20N22142HT

Fig 8



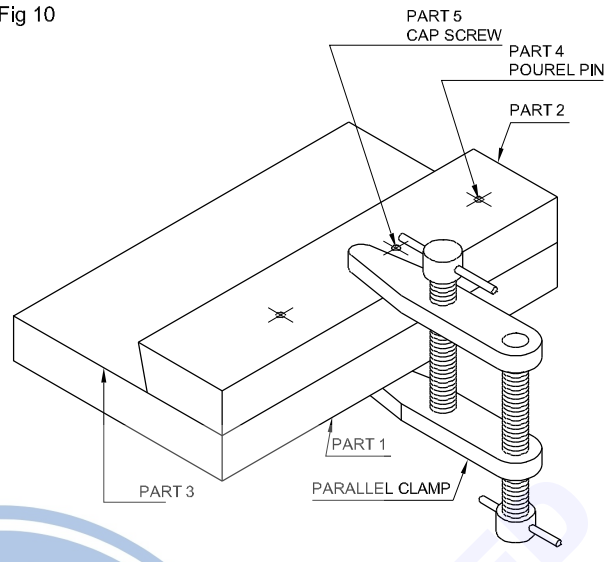
FI20N22142HB

Fig 9



FI20N22142HS

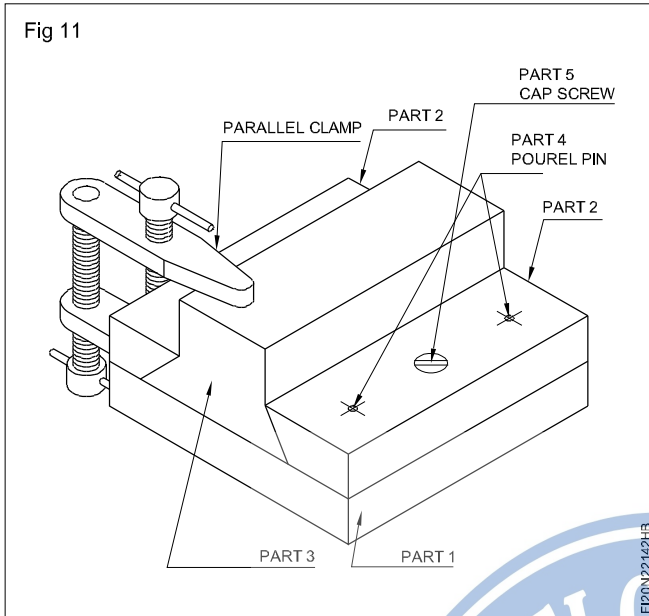
Fig 10



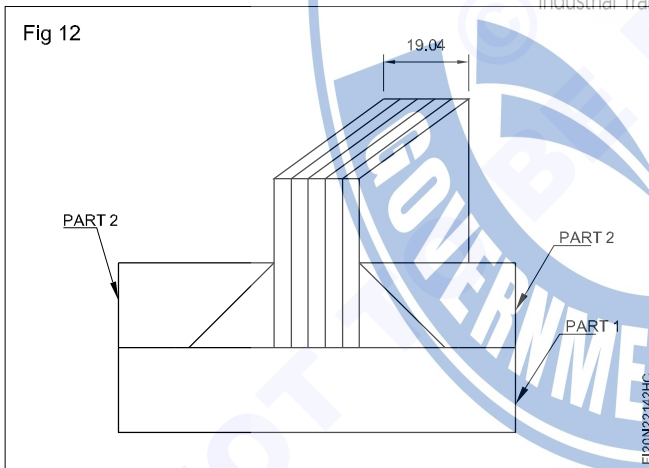
FI20N22142HA

- Remove centre drill and fix  $\varnothing 5.8\text{mm}$  drill in drilling machine and drill a through hole in the place of dowel pin assembly.
- Fix  $\varnothing 6\text{mm}$  reamer in tap wrench and ream the drilled hole without disturbing the assembly (use plenty of oil while reaming).
- Fix a dowel pin  $\varnothing 6 \times 18\text{mm}$  in the reamed hole of dowel pin assembly.
- Similarly, repeat the above drilling and reaming procedures in the other end of the same job without disturbing the assembly and fix another dowel pin in the reamed hole.
- Fix  $\varnothing 6\text{mm}$  drill in drilling machine and drill a through hole in the place of cap screw assembly.
- Remove  $\varnothing 6\text{mm}$  drill and fix  $\varnothing 10 \times 6\text{mm}$  counter bore tool in drilling machine and counter bore to the depth of cap screw head thickness in part 2.
- Dismantle the setting.
- Hold counter sink tool in drilling machine and chamfer the cap screw assembly tapping hole ends in both sides in part 1.
- Cut, four M6 internal thread in part 1.
- Clean burrs from threaded hole.
- Reassemble the dismantled setting and fix dowel pins in reamed holes and fix M6  $\times 18\text{mm}$  cap screw in a threaded hole in part 1 and 2 assembly.
- Place and assemble other two pieces of part 2 and part 3 on part 1 and clamp them with parallel clamp and check the squareness of assembled parts. (Fig 11).

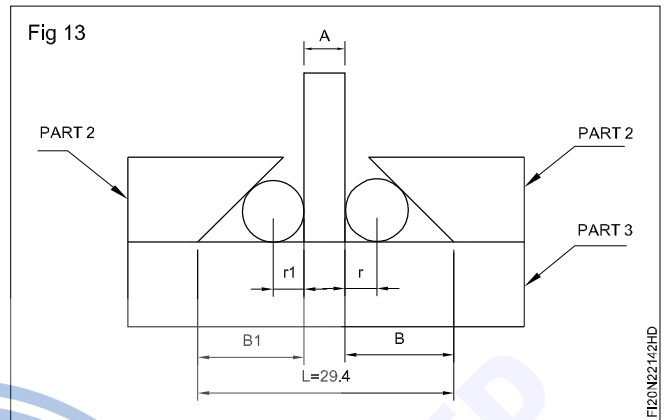
- Place part 2 on part 1, assemble together and clamp the parts with parallel clamp and check the squareness of assembled parts with try square. (Fig 10).
- Hold the assembly in a drilling machine table with machine vice.
- Keep parallel blocks under the assembly, while holding in machine vice for proper seating and levelling the job.
- Fix a centre drill in drilling machine and drill 2 to 3 mm depth, centre drilling on part 2 in the place of dowel pin and cap screw assembly.



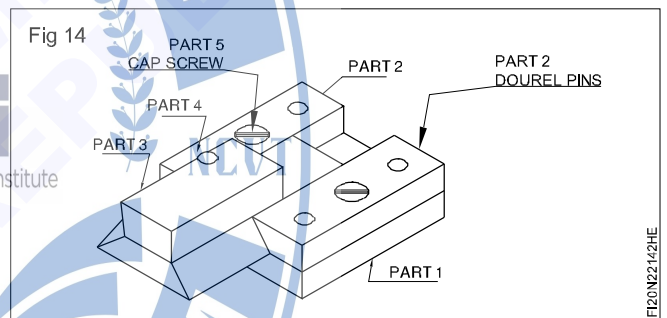
- Follow the above working steps, given in the previous assembly of part 1 and 2 and complete the different operations and fix another two dowel pins and another to cap screws.
- Dismantle the setting of assembly and separate all the parts.
- Re assemble the parts 1 and 2 along with dowel pins and cap screws. Check the dove tail slot gap size with slip gauge. If dovetail slot gap size is not correct, correct the gap size by filing in part 2. (Fig 12). While filing in part 2. Dismantle the assembly and file to size.



- Place  $\varnothing 10\text{mm}$  two precision rollers in dovetail slot and calculate the dovetail slot length. If dovetail slot length is not correct, correct the length size by filing in part 2. (Fig 13).



- Fix part 3 in dovetail slot and slide it. (Fig 14).
- Dismantle and separate all the parts and finish all the surfaces and remove burrs on all the corners of the assembly.
- Reassemble all the parts and fit part 3 in dovetail slot and slide it.
- Apply a little oil and preserve it for evaluation.



## Skill Sequence

### Determine internal dovetail angle using rollers and slip gauges

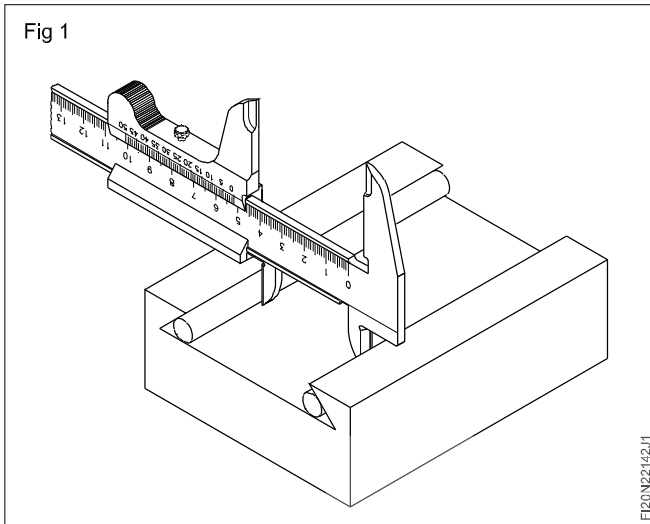
**Objectives:** This shall help you to

- use of precision balls and rollers.
- calculate internal dovetail angle using rollers and slip gauges.

#### Use of precision balls and rollers

There are situations where measurements of components cannot be taken directly. A typical example of this is a dovetail (internal and external).

In such cases it is possible to calculate the size and taper accurately from the measurement taken over the balls or rollers placed between standard measuring instruments and the component. (Fig 1)



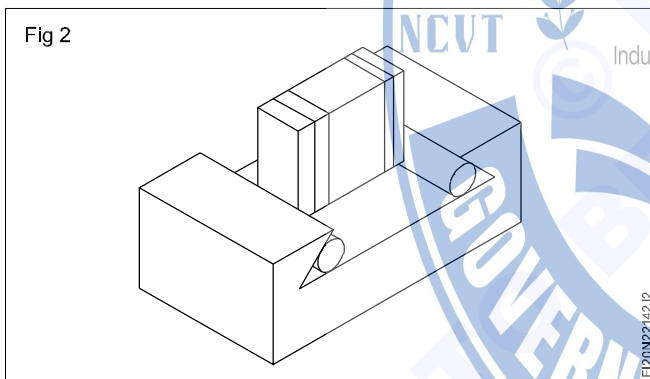
The purpose of the balls or rollers is to provide point or line contact in a known position.

Gap between the rollers can be measured using vernier caliper.

Fig 1 shows how the distance between the rollers is measured with a vernier caliper. It also shows that the point of contact does not lie in the plane of measurement.

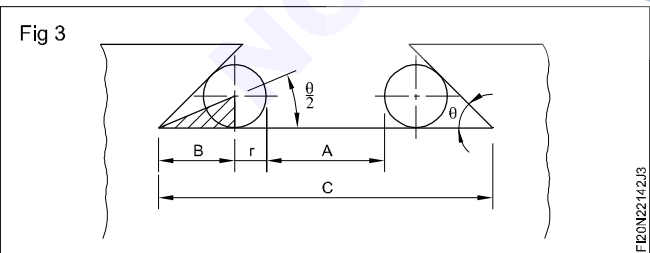
### Calculating taper angle of internal parallel dovetail

After cleaning the dovetail and the matched pair of precision rollers, the rollers are positioned in such a way that the rollers will contact the angular faces as shown in Fig 2.



The gap between the rollers can be measured using a slip gauge or vernier caliper.

In the triangle (shaded) (Fig 3)



$$\tan \frac{\theta}{2} = \frac{r}{B}$$

$$C = A + 2r = 2B$$

$$2B = C - A - 2r$$

$$B = \frac{C - A - 2r}{2}$$

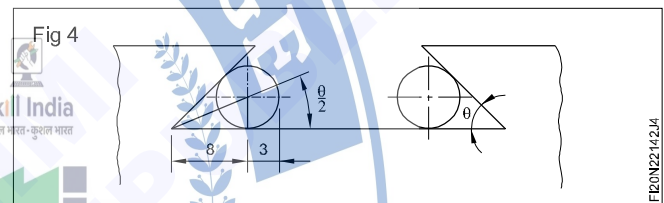
$$\begin{aligned} \tan \frac{\theta}{2} &= \frac{r}{B} = \frac{r}{\frac{C - A - 2r}{2}} \\ &= \frac{2r}{C - A - 2r} \end{aligned}$$

(The value of C,A,r, are known. Hence the angle  $\frac{\theta}{2}$  can be calculated.)

This is the half angle of the dovetail.

### Example

Calculate the internal dovetail angle of a workpiece as per data given in the Fig 4.



$$\tan \theta = \frac{\text{Opposite side}}{\text{Adjacent side}}$$

$$\tan \frac{\theta}{2} = \frac{r}{B} = \frac{3}{8}$$

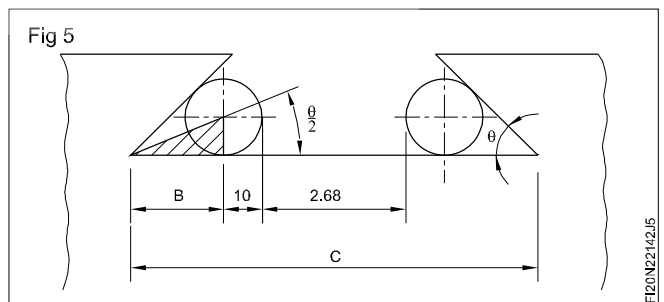
$$\frac{3}{8} = 0.375$$

$$\tan \frac{\theta}{2} = 20^{\circ}30'$$

Tan  $\theta$  or dovetail included angle =  $41^{\circ}$ ...Ans

### Classroom Assignment (Fig 5)

Calculate the distance C of the dovetail if the diameter of the roller is 20 mm, angle is  $60^{\circ}$  and the distance between the rollers is 2.68 mm.



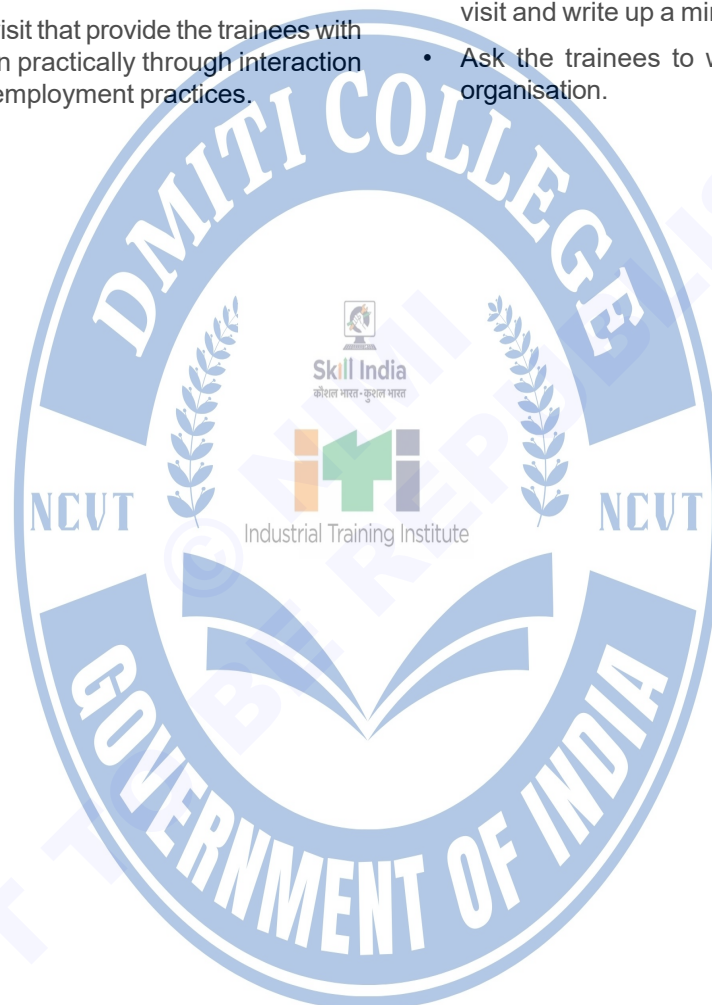
## Industrial Visit

**Objectives:** At the end of this exercise you shall be able to

- gain industries exposure and its function.

**Note:** Instructor shall arrange industrial visit. Following are the general guideline shall be given to trainees.

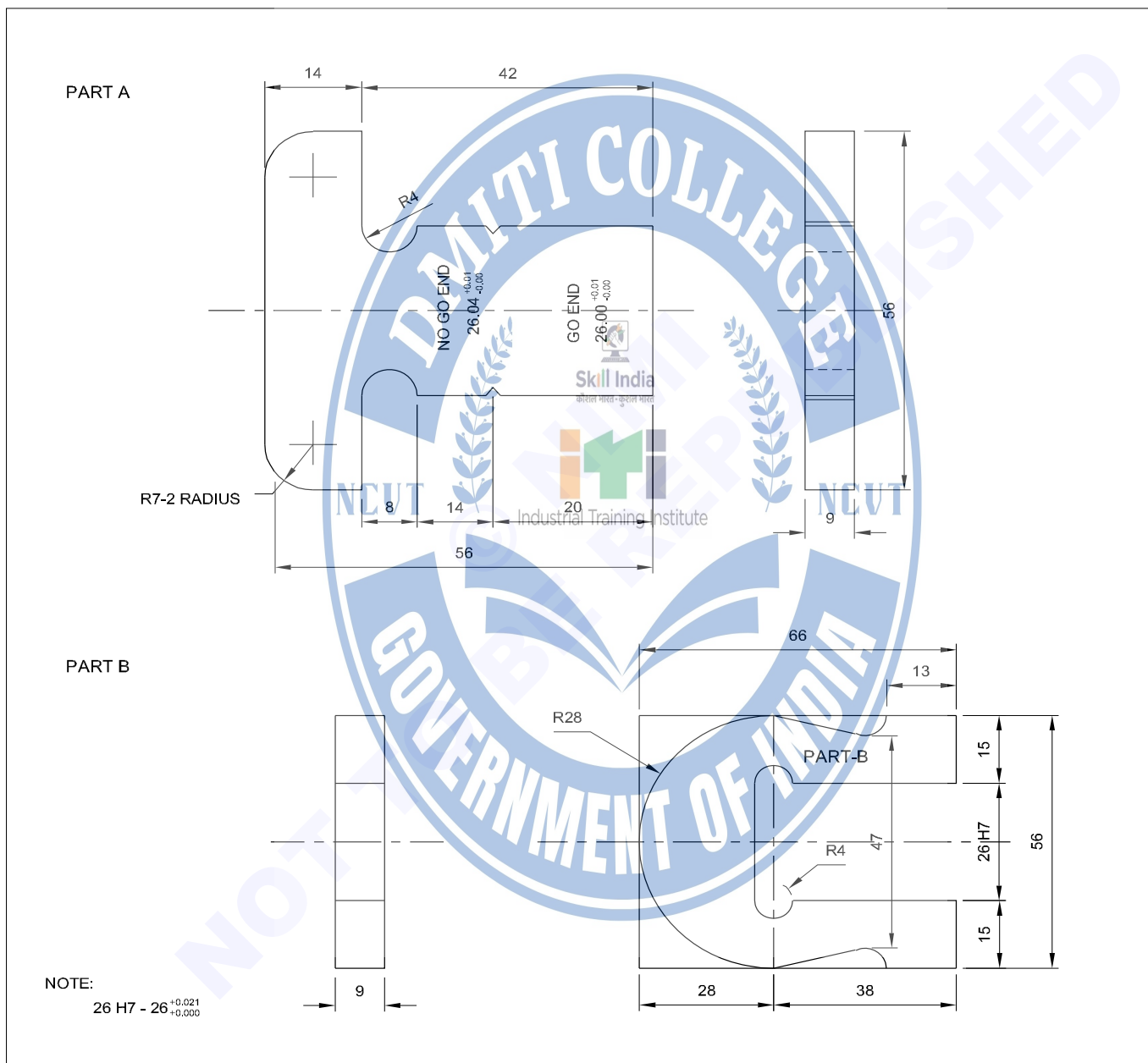
- Ask trainees to get permission letter from parents or guardians for industrial visit.
- Brief to the trainees about industries health and safety procedure and behaviour expected of them.
- Brief about industrial visit that provide the trainees with an opportunity to learn practically through interaction working method and employment practices.
- Ask trainees to interact with the staff of the industry to get more exposure towards the current working conditions of the industry.
- Ask the trainees to assess the benefits of the industrial visit and write up a mini report.
- Ask the trainees to write a thank you letter to the organisation.




Preparation of gap gauges

Objectives: At the end of this exercise you shall be able to

- file flat and square
- mark the profile as per drawing
- drill relief holes, chain drilling and hacksawing
- chip, file to size and profile as per drawing
- file GO end and NO GO end to size
- check the gap GO end and NO GO end with slip gauge.



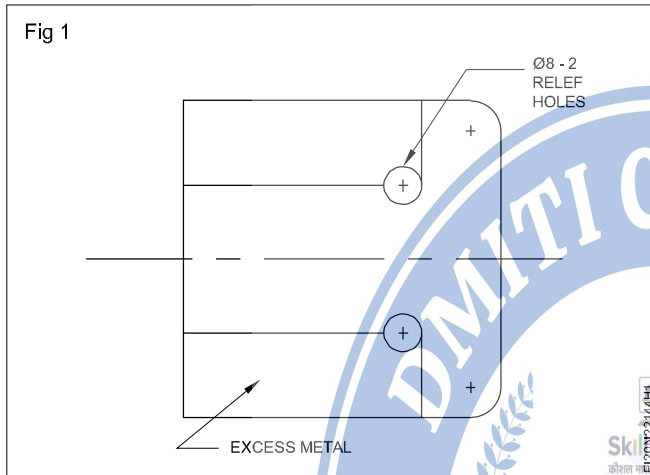
1	70 ISF 10-60	-	Fe 310	-	B	2.2.144
1	60 ISF 10-60	-	Fe 310	-	A	2.2.144
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE 1:1					TOLERANCE : ±0.02 mm	TIME 12 hrs
 <p style="text-align: center;"><b>PREPARATION OF GAP GAUGES</b></p>					CODE NO. FI20N22144E1	

## Job Sequence

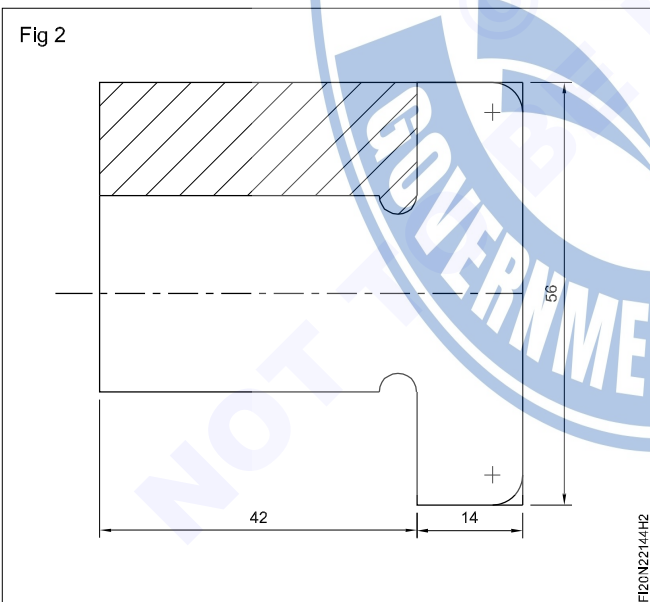
- Check the raw material for its size.
- File metal to size as per drawing.
- Apply marking media on part A and B as per drawing.
- Mark the profile and punch witness marks.

### Part A

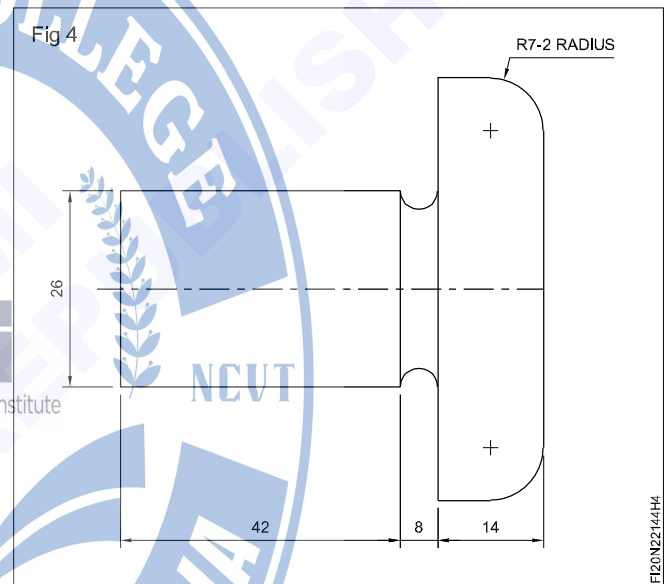
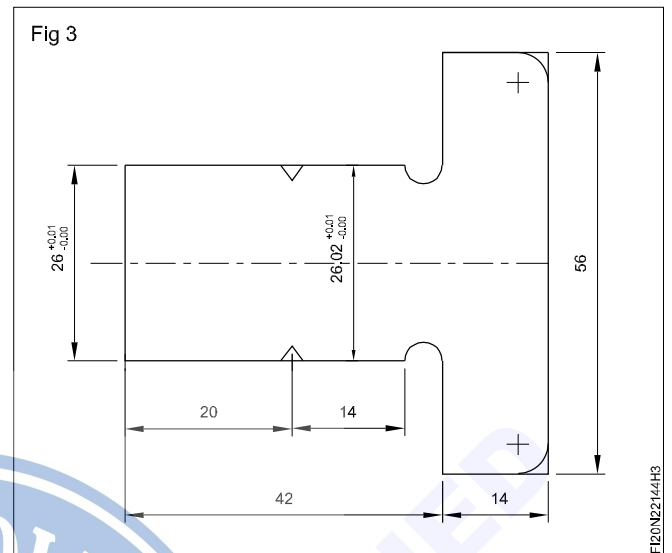
- Hold part A in drilling machine table.
- Fix  $\varnothing 8$  mm in drilling machine spindle and drill two relief holes as shown in Fig 1.



- Hold part A in bench vice, cut and remove the hatched portion of excess metal on one side and file the same portion to size maintaining the accuracy as mentioned in the drawing

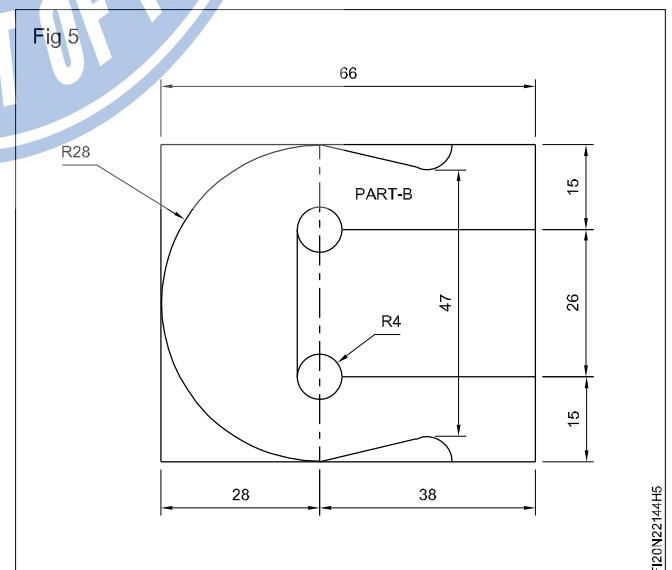


- Similarly, following the above job sequences on the other side of the job, cut and remove the excess metal and file to size Fig 3.
- File radius 7mm as per drawing and check with radius gauge Fig 4.

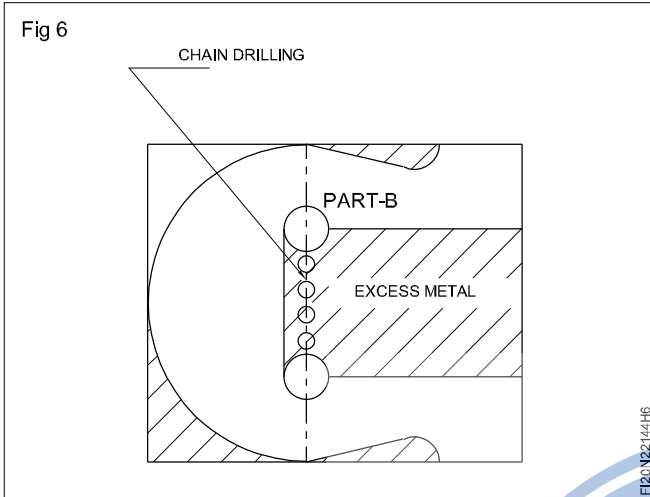


### Part B

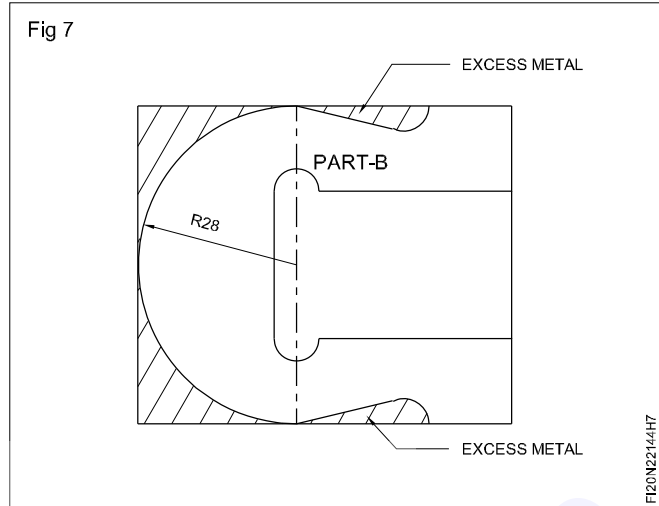
- Hold part B in drilling machine table and drill  $\varnothing 8$  mm relief holes as shown in Fig 5.



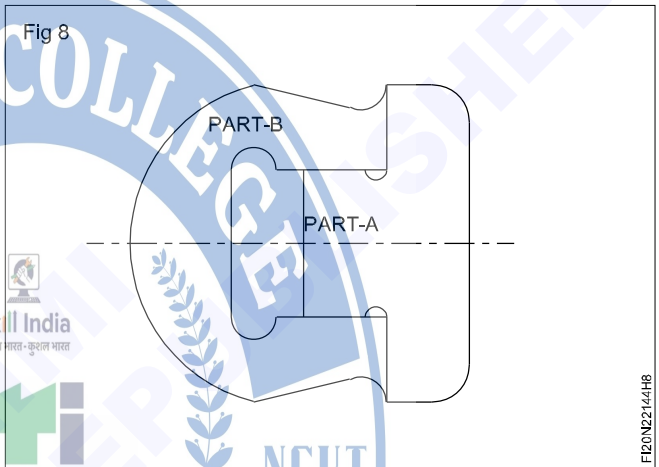
- Chain drill, hacksaw, chip and remove the excess metal in part B as shown in Fig 6.



- File the excess metal in internal portion of part B to size and shape and check the size with vernier caliper.
- Cut and remove the excess metal in outer surface of the part B and file to size and shape as shown in Fig 7.



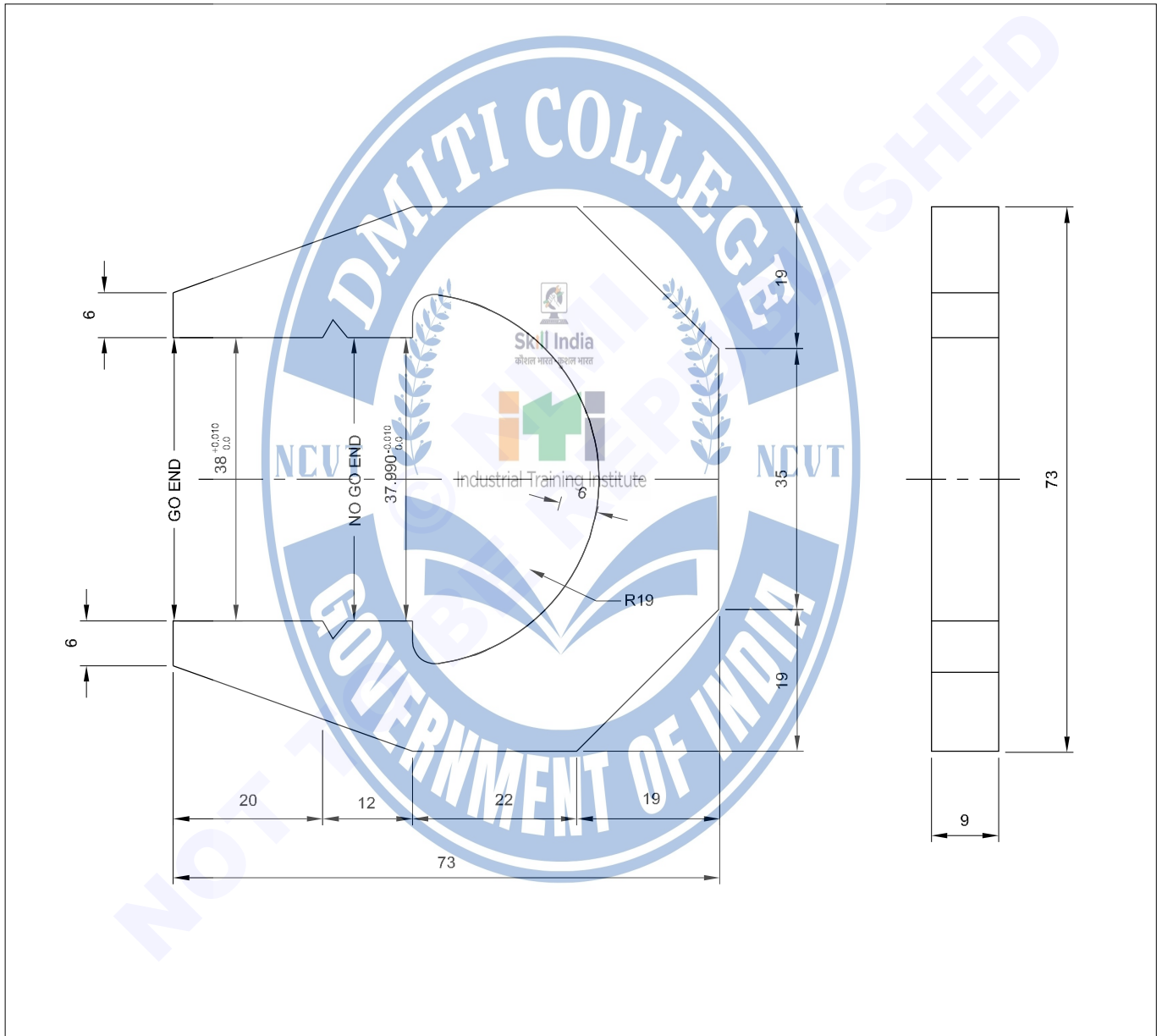
- Match part A and part B as shown in Fig 8.



Perform lapping of gauges (hand lapping only)

Objectives: At the end of this exercise you shall be able to

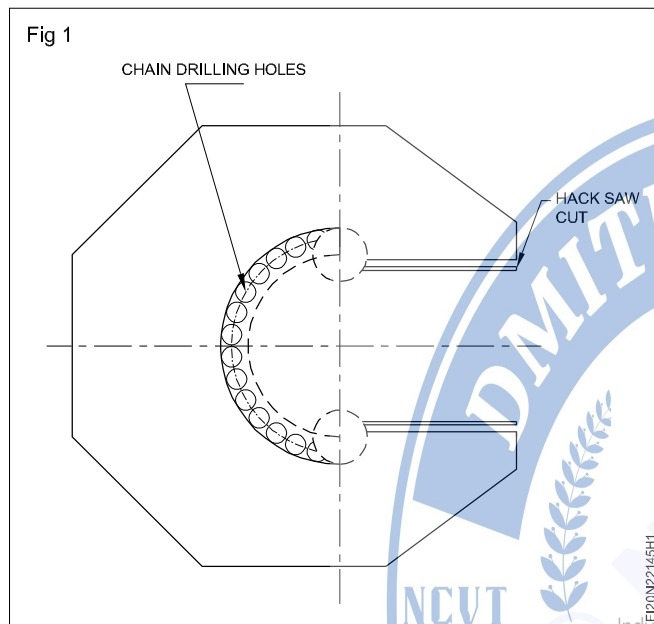
- file flat and square
- check the flatness and squareness
- mark profile as per drawing
- chain drill to remove excess metal
- file Go - end and No go - end to size
- check the gap Go end and No go end with slip gauge
- perform lapping on surface of the gauge.



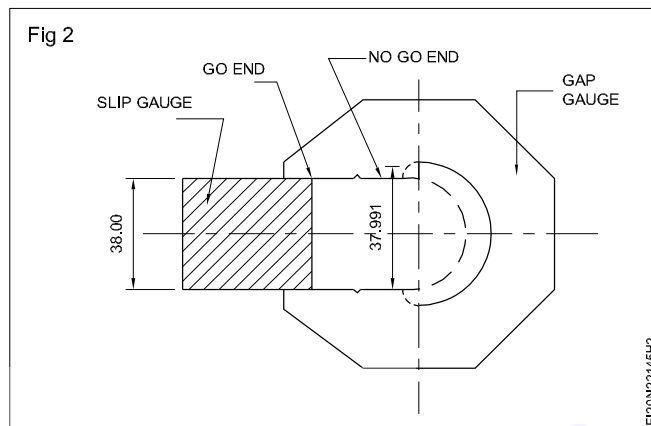
1	75 ISF 10 - 75	-	Fe 310	-	-	2.2.145
NO.OFF	STOCK SIZE	SEMI PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE 1:1	<b>PERFORM LAPPING OF GAUGES (HANDLAPPING ONLY)</b>				TOLERANCE : ± 0.02 mm	TIME : 10 Hrs
					CODE NO. FI20N22145E1	

## Job sequence

- Check the raw material for its size.
- File raw material to size 73 X 73 X 9 mm and check the size with Vernier caliper.
- Check the flatness and squareness with try square.
- Apply marking media and mark the profile as per drawing.
- Punch witness marks.
- Chain drill to remove excess metal, as shown in Fig 1.



- Cut and remove the excess metal by hacksawing and chipping.
- File the profile to size and shape maintaining accuracy of  $\pm 0.02\text{mm}$ .
- Mark the distance GO end  $38^{+0.01}_{-0.00}$  mm maximum limit of size.
- File NO GO end size to  $37.991^{-0.010}$  mm minimum limit of size.
- File 'V' notch at GO end and NO GO end meeting line.
- Finish the surface and remove the burrs on the corners of the job.
- Check GO end and NO GO end using slip gauge Fig 2.



### Lapping

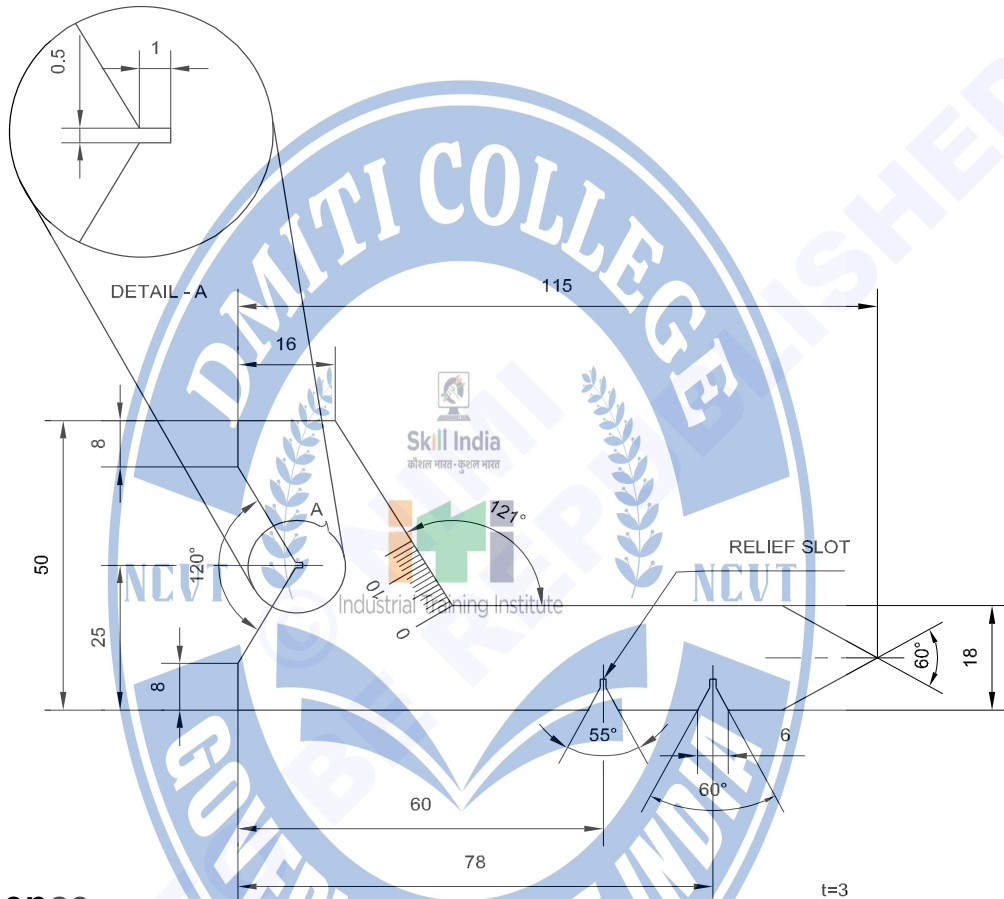
- Select a lapping plate made of closed grain cast iron.
- Charge the lapping abrasive mixed with oil on lapping plate.
- Wash off the surplus oil and abrasive on the lapping plate.
- Take suitable lapping block (which enters into 'GO' and 'NOGO' ends) and charge lapping compound.
- Rub the work against a lap charged with a lapping compound.
- Apply light pressure while lapping.
- Repeat the above procedure to lap in other surface of the job.
- Apply oil and preserve it for evaluation.

- **Lapping compound consists of abrasive particles suspended in a vehicle such as oil, parffin, grease etc.**
- **Lapping can be carried out either in wet and dry condition.**

**Preparation of drill gauges**

**Objectives:** At the end of this exercise you shall be able to

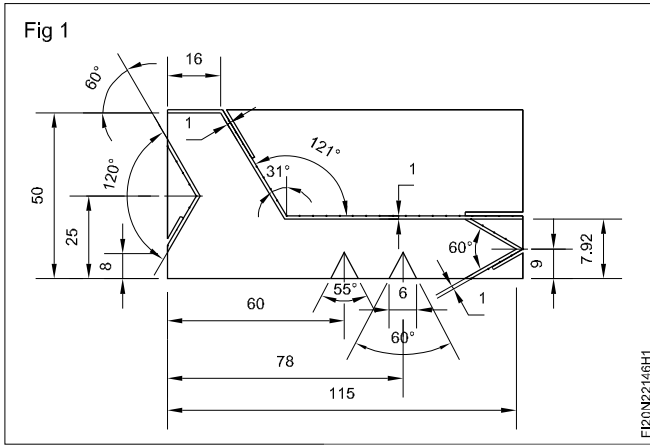
- file thin sheet metal to size.
- lay out on sheet metal as per drawing
- file angular surface to an accuracy of  $\pm 5'$
- file and finish the gauge to the shape and size as per drawing
- check the drill lip length and angle in drill gauge.



**Job Sequence**

- Check the material size as per drawing
  - File the metal to size 115 x 50 x 3 mm and check the size with vernier caliper
  - Check the flatness and squareness with try square
  - Mark the dimensions as per drawing with vernier height gauge
  - Punch the witness marks Fig:1
  - Saw and remove excess material by hacksawing (Fig:2)
  - Make three relief slots as per drawing by hacksawing.
- Ensure that about 1 mm material is left from the witness marks by hacksawing for filing and finishing.**
- File and finish 120° angle using triangular file and needle file.

1	ISST125 x 3.55 - 55	-	Fe310	-	2.2.146
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	EX NO.
SCALE 1:1	<b>PREPARATION OF DRILL GAUGES</b>			TOLERANCE: $\pm 0.02$ mm	TIME: 10hrs
				CODE NO. F120N22146E1	

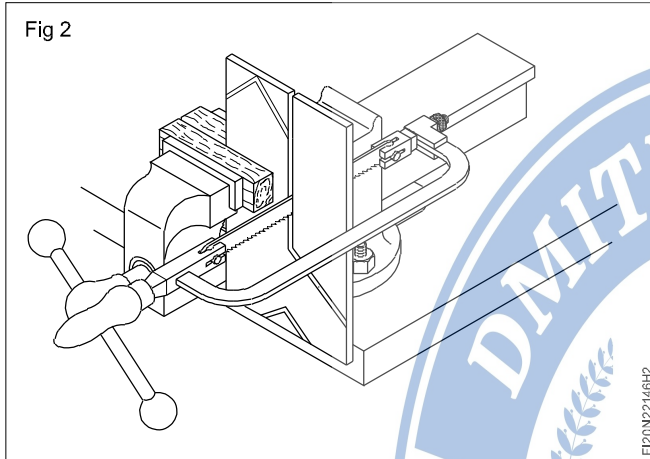


FE20N22146H1

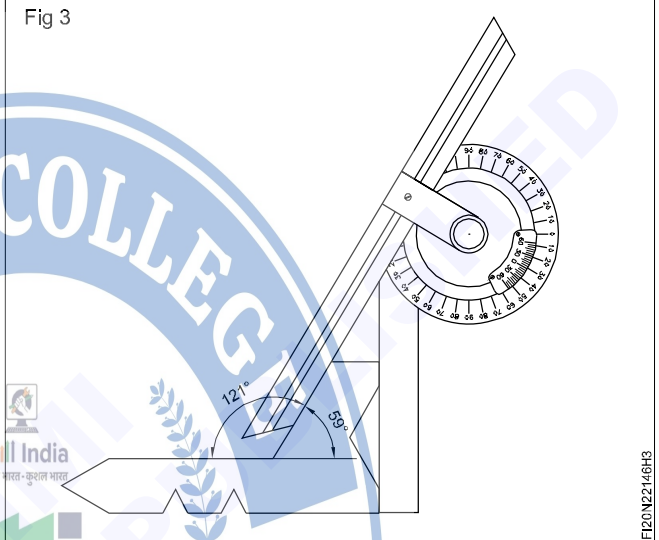
- Deepen the graduations with a carbide tool bit held in a vernier height gauge.
- Finish and deburr all the surfaces .
- Check the drill angle and lap depth of a drill
- Apply little oil and preserve it for evaluation.

**Note:**

**Hold the metal sheet in bench vice along with wooden block and file the sheet thickness to size (Fig 4)**

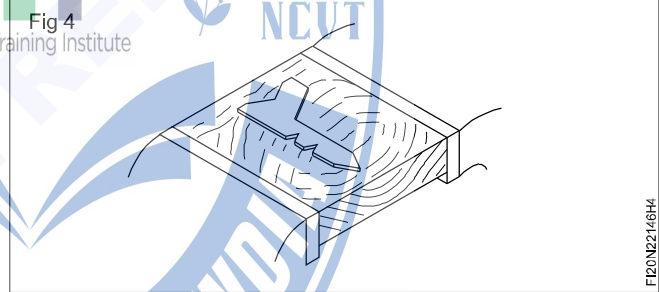


FE20N22146H2



FE20N22146H3

- File and finish 31° angle with reference to 50 mm width side using flat triangular area needle file. (Fig 3)
- File and finish 121° angle with flat triangular and needle file.
- File and finish 60° and 55° angle flat triangular and needle file.
- Measure the dimensions with vernier caliper measure the angles with vernier bevel protractor.
- Mark the graduation as per drawing with a vernier height gauge



FE20N22146H4

**Skill Sequence**

**Drill angle grinding and checking with drill gauge**

**Objective:** This shall help you to

- **grind setting angle of a drill and cheese with drill gauge.**

A drill will lose the sharpness of its cutting edges due to continuous, and improper use of drills spoil the cutting edges.

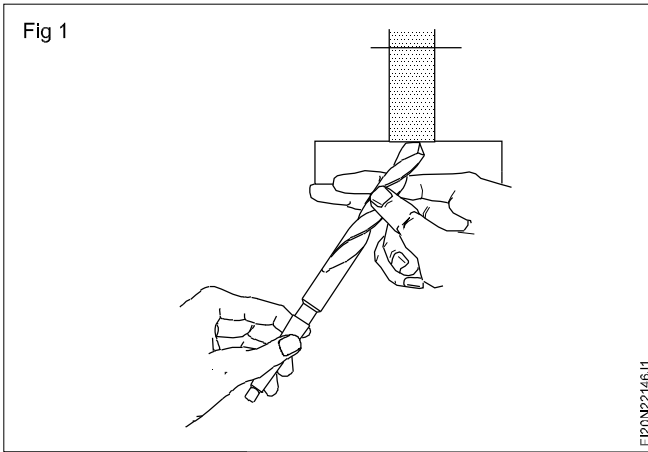
Spoiled or blunt cutting edges of the drills must be sharpened on a grinder.

Check the grinding wheel for loading, glazing, trueness and cracks. Call your instructor for advice. Dress and true the wheel if necessary.

Protect your eyes either with goggles or by lowering the eye protecting shield near the tool rest and adjust the tool rest 2 mm closer to the wheel, if necessary.

Switch on the grinder

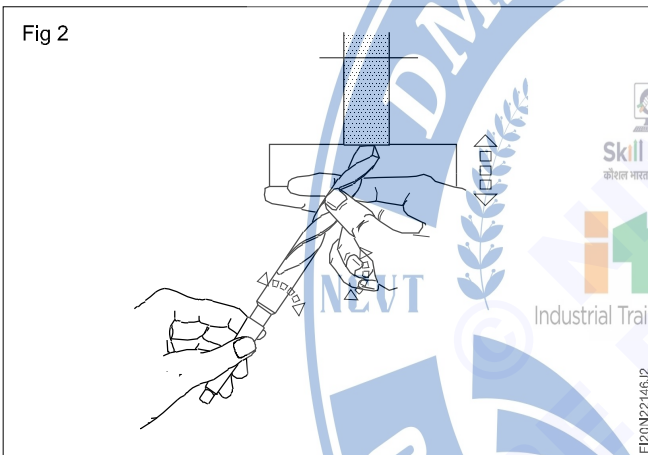
Hold the shank of the drill lightly between the thumb and the forefinger, and with the other hand hold the portion near the point Fig 1.



The hand near the point of the drill should be pivoted lightly on the tool rest for easy manipulation.

Hold the drill level Fig 1 and turn it to  $59^\circ$  to the face of the wheel and swing the drill slightly downward and towards left Fig 2.

Rotate the drill the right by turning it between the thumb and the forefinger Fig 2.



This turning movement is not necessary for smaller dia. drills.

While swinging down, apply a slight forward motion. This will help to form the clearance angle.

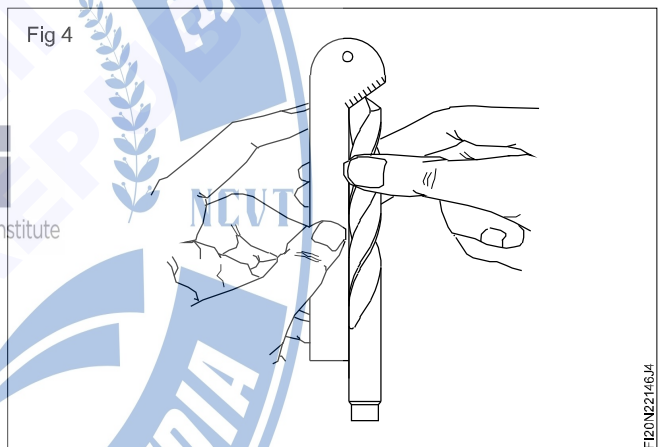
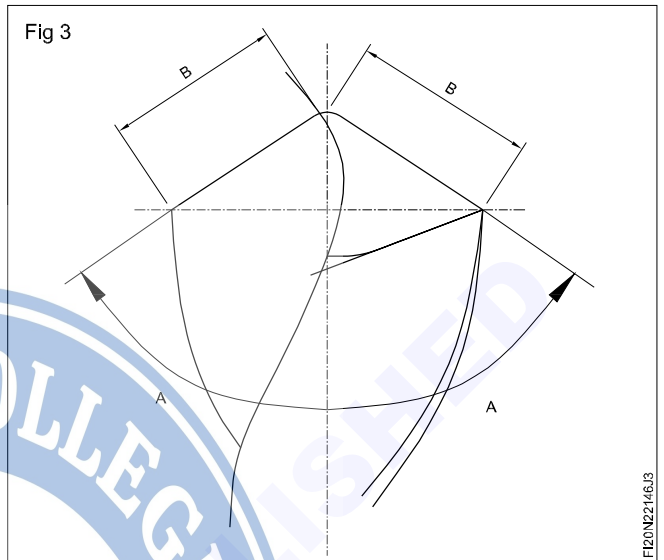
While swinging and turning the drill make sure you do not grind the other cutting edge.

All movements of the drill in angular turning, swinging and forward movements, should be well coordinated. They should result in one smooth movement to produce a uniformly finished surface.

Repeat the process to re-sharpen the other cutting edge.

Check both the cutting edges with a drill angle gauge, for correctness of the lip angle and equality of the lip lengths Fig 3 and 4.

Check the lip clearance angle in Fig 5 visually. The angle should be between  $8^\circ$  to  $12^\circ$ .



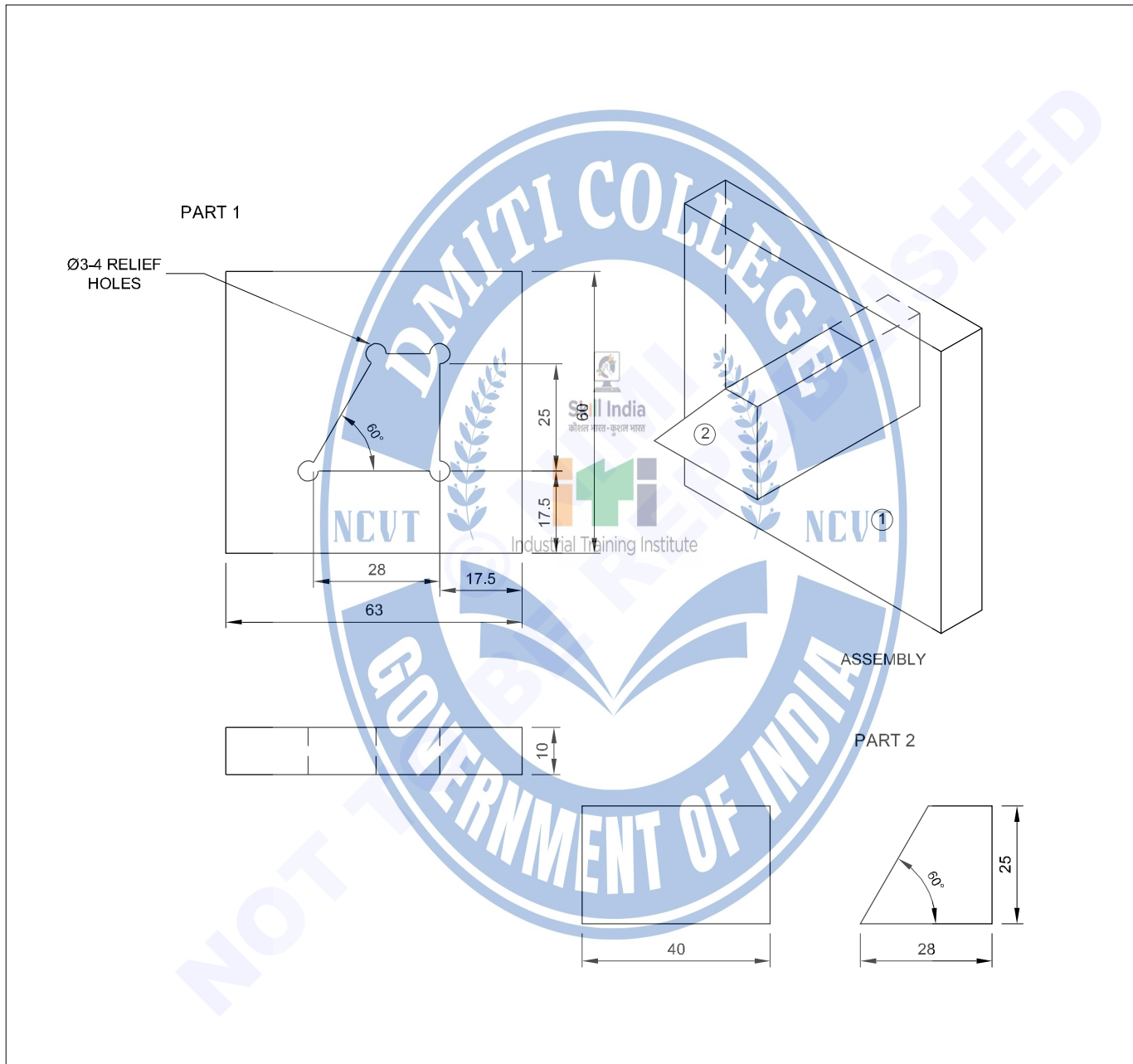
When you are satisfied correct equal angle and equal lip length. Drill a hole in a scrap metal. Before drilling confirm correct drill speed (r.p.m) use cutting fluid.

Verify the condition of the hole while drilling. Did the drill chatter? If chattering happened, this could be caused by too much lip clearance. If the hole is over size by more than 0.12 to 0.25 mm then check lips lengths for uneven or the lip angles for uneven.

File and fit straight and angular surfaces internally

Objectives: At the end of this exercise you shall be able to

- file and finish part 1 & 2 as per dimensions keeping straight
- file angle tolerance of 10 minutes and angle face tolerance of  $\pm 0.02\text{mm}$
- to remove internal material by drilling & filing
- assemble part 1 & 2 with a sliding fit.



1	SQ 30 - 45	INSERT	Fe-310	-	2	2.2.147
1	65ISF12-70	BASE	Fe-310	-	1	2.2.147
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE 1:1		<b>FILE AND FIT STRAIGHT AND ANGULAR SURFACES INTERNALLY</b>			TOLERANCE : $\pm 0.02 \text{ mm}$	TIME : 13hrs
					CODE NO. FI20N22147E1	

# Job Sequence

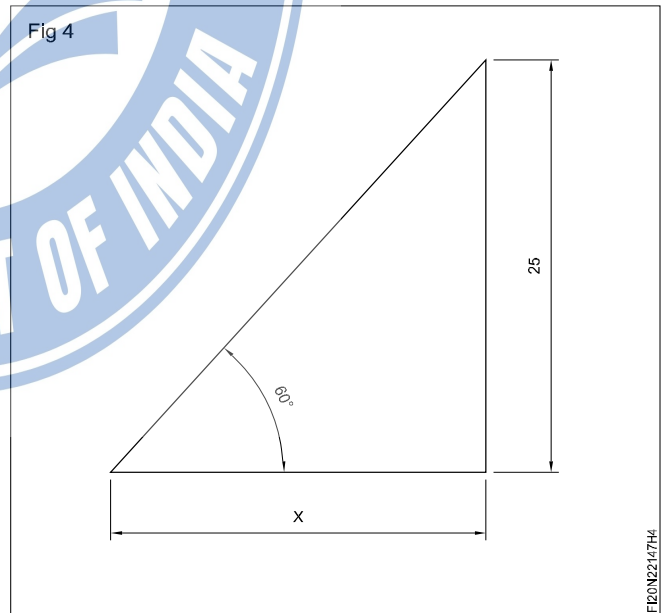
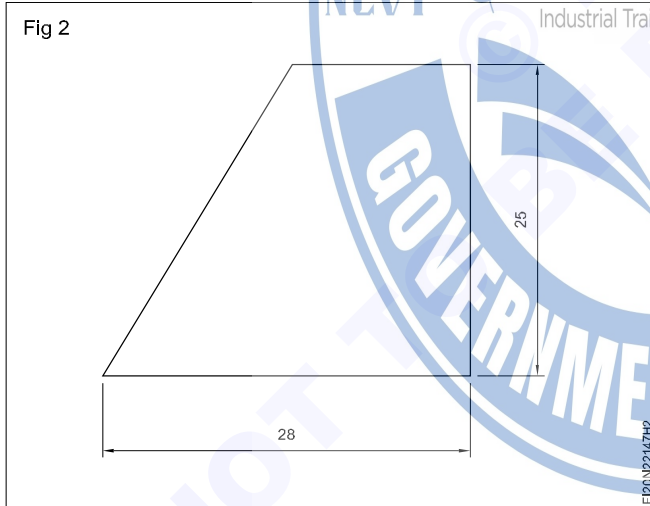
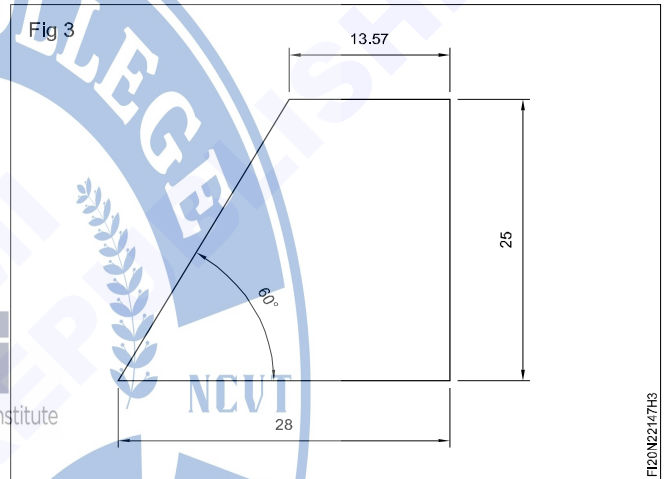
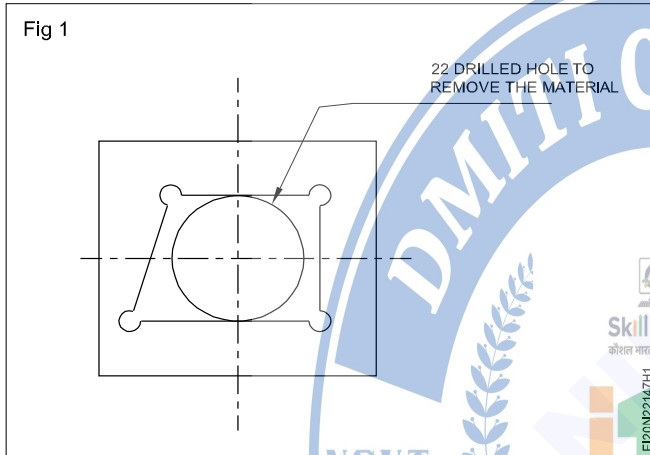
## Part :1

- Check the raw material for its size.
- File to size and check for flatness and squareness
- Mark all dimensions and angle on work piece using vernier height gauge and vernier bevel protractor.
- Punch on the marked lines
- Drill relief holes of  $\varnothing 3$  mm on all corners.
- Remove unwanted internal material by drilling and using square and triangular files.
- Angular edges to be finished with triangular file.
- Straight edges to be finished with safe edge file

- Part 1 to be finished to suit with part 2.
- Part 1 and 2 for straight and angular surfaces fit in a sliding way.
- Apply thin coat of oil to prevent corrosion and preserve it for evaluation.

## Part :2

- Check the raw material for its size.
- File to size and check for flatness and squareness
- Mark all dimensions and angle on work piece using vernier height gauge and vernier bevel protractor.
- Punch on the marked lines
- File and finish the part as  $28 \times 25 \times 40$  mm and angle to  $60^\circ$ .



Drawings

$$\tan 60^\circ = \frac{\text{opp}}{\text{adj}} = \frac{25}{x}$$

$$1.1732 = \frac{25}{x}$$

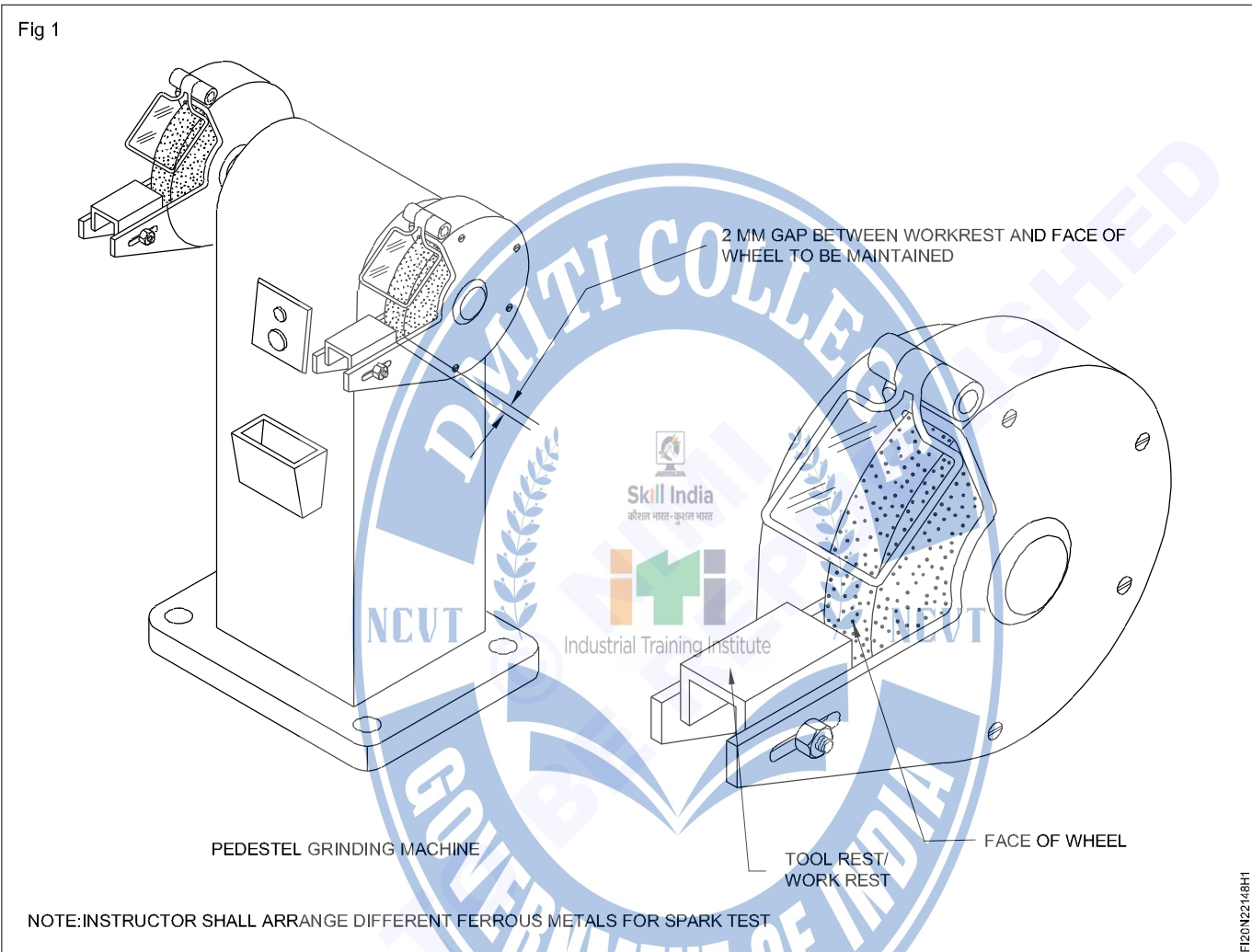
$$\therefore x = \frac{25}{1.1732} = 14.43 \text{ mm}$$

$$28 - 14.43 = 13.57 \text{ mm}$$

## Identify different ferrous metals by spark test

**Objectives:** At the end of this exercise you shall be able to

- support the metals on tool rest
- grind the metals on wheel face
- Identify different ferrous metals by spark test.



### Job Sequence

- Prepare the grinding machine for grinding.
- Support the metals on tool rest/work rest.
- Apply light pressure on the face of wheel with metal.
- Grind the metals on wheel face.
- Identify the metal by spark length and colour.

#### Different metals

- Low carbon steel.
- Medium carbon steel.
- High carbon steel.
- High speed steel.
- Stainless steel

**Grind the metal only on the face of the grinding wheel.**

- Grind the following different metals and identify the sparks as shown in Fig 1 & 2

## Skill Sequence

### Spark test

**Objectives:** This shall help you to

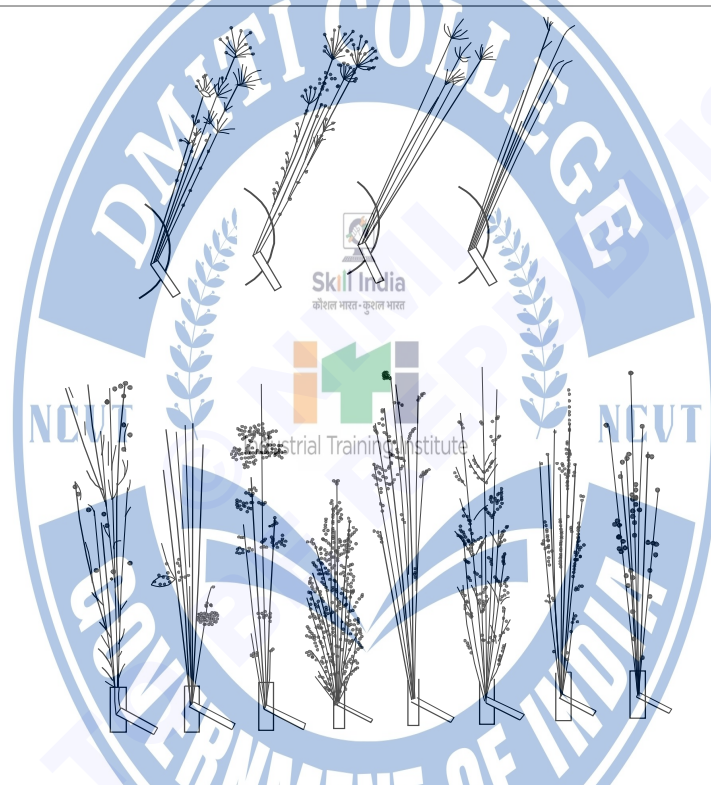
- identify the spark testing in different metals by grinding
- perform grinding process in grinding machines.

It is a method of determining the general classification of ferrous materials. It normally entails taking a piece of metal, usually scrap, and applying it to grinding wheel in order to observe the sparks emitted. These sparks can be compared to a chart or to sparks from a known test sample to determine the classification. Spark testing also can be used to sort ferrous materials, establishing the difference from one another by noting whether the spark is the same or different.

Spark testing is used because it is quick, easy and inexpensive. Moreover, test samples do not have to be prepared in any way, so, often, a piece of scrap is used. The main disadvantage to spark testing is its inability to identify a material positively; if positive identification is required, chemical analysis must be used. The spark comparison method also damages the material being tested, atleast slightly.

Spark testing most often is used in tool rooms, machine shops, heat treating shops, and foundries.

Fig 1



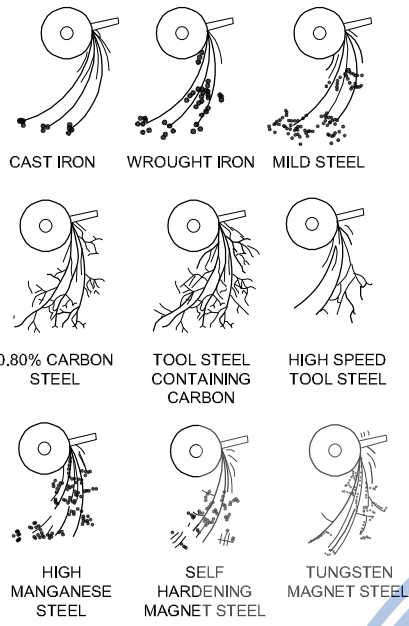
#### Process

A bench grinder is usually used to create the sparks, but sometimes this is not convenient, so a portable grinder is used. In either case, the grinding wheel must have adequate surface velocity, at least 23 m/s (4500 surface feet per minute (sfpm)), but should be between 38 and 58 m/s (7500 - 11500 sfpm). The wheel should be coarse and hard, therefore aluminium oxide or carborundum often are employed. The test area should be in an area where there is no bright light shining directly into the observer's eyes. Moreover, the grinding wheel and surrounding area

should be dark so that the sparks can be observed clearly. The test sample is then touched lightly to the grinding wheel to produce the sparks.

The important spark characteristics are colour, volume, nature of the spark, and length. Note that the length is dependent on the amount of pressure applied to the grinding wheel, so this can be a poor comparison tool if the pressure is not exactly the same for the samples. Also, the grinding wheel must be dressed frequently to remove metallic build-up.

Fig 2



FD20ND2148J2

