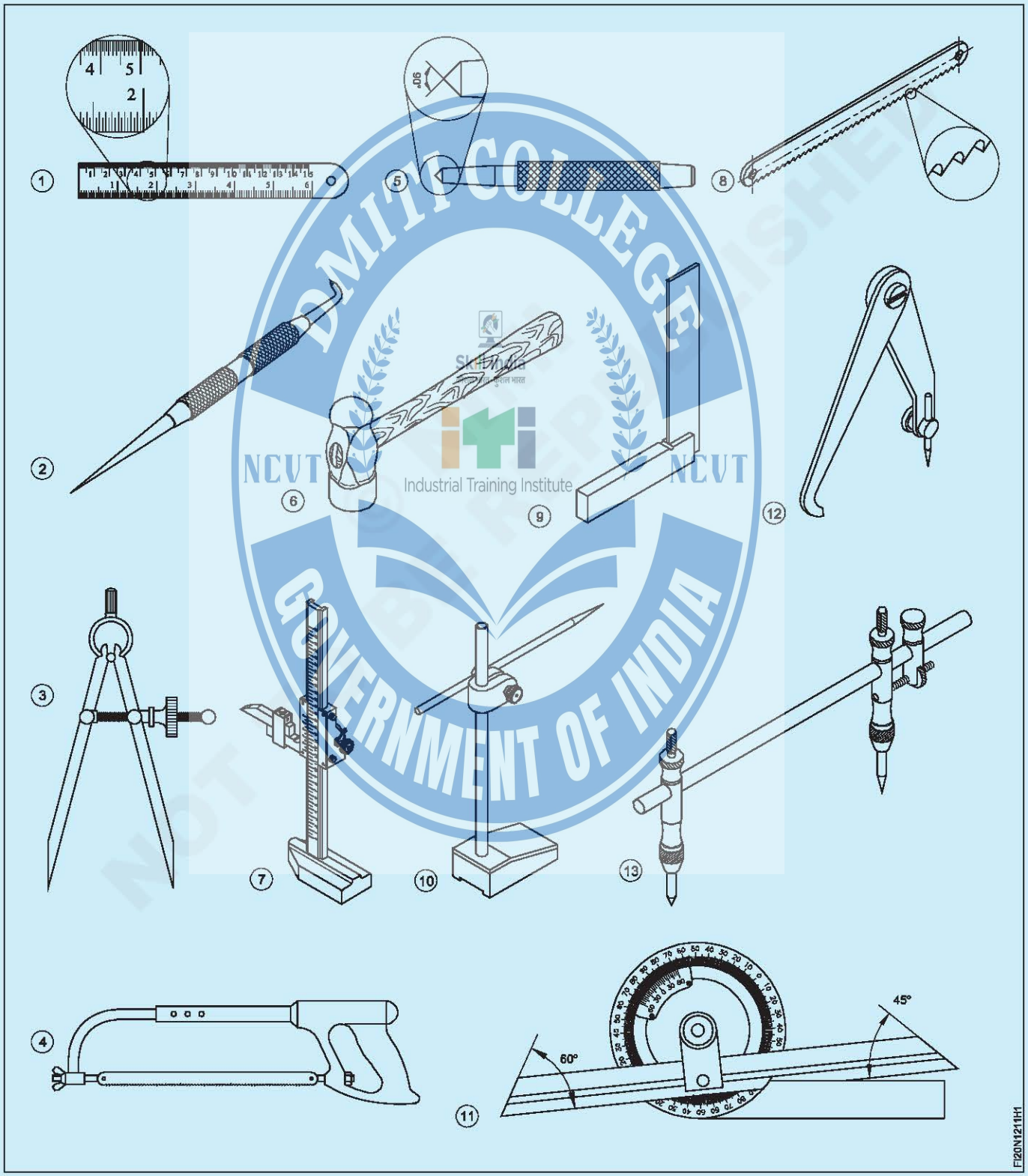
Identification of tools and equipments as per desired specifications for marking & sawing

Objectives : At the end of this exercise you shall be able to
- **identify the marking tools used in fitting shop**
- **identify the sawing tools used in fitting shop**
- **record the names of tools in table.**



Job Sequence

Instructor shall display all the tools and equipments in the section and brief their names, uses and the working condition of each tool and equipment

- Trainees will note down all the displayed tools names.
- Record it in table 1.
- Get it checked by the instructor.

Table 1

Fig. No.	Name of the tool	Remarks
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		

Selection of material as per application

Objectives : At the end of this exercise you shall be able to
- **select the material for engineering application**
- **record it in the table.**

Job Sequence

- Trainees will determine the type of material used for the purpose mentioned in the table.
- Record it in table 1.
- Get it checked by the instructor.

Table 1

S.No.	Part Name	Material used for manufacturing
1	Vernier Caliper	
2	Scriber	
3	Hacksaw blade	
4	Protective coating on Iron and steel	
5	Worm wheels, Gears	
6	Casting of guns	
7	Bell	
8	Machine Bed casting	
9	Die block, hand tools	
10	High speed steel	
11	Bolts and nuts	
12	Surface plate	

Visual inspection of raw material for rusting, scaling, corrosion etc.

Objectives: At the end of this exercise you shall be able to
- visual inspection of raw material for rusting
- scaling and corrosion.

Fig.1 Rusted components

Fig.2 Corroded gears

Fig.3 Scaled part

Job Sequence

Instructor shall arrange to display various section of raw metals with rusting, scaling corroded conditions and without any defects. Differentiate with one another Ask the trainees to record it in the table	• Observe the given raw material • Identify the formation of materials for rusting, corrosion and scaling • Record the appearance of the defects in Table1. Get it checked by the instructor

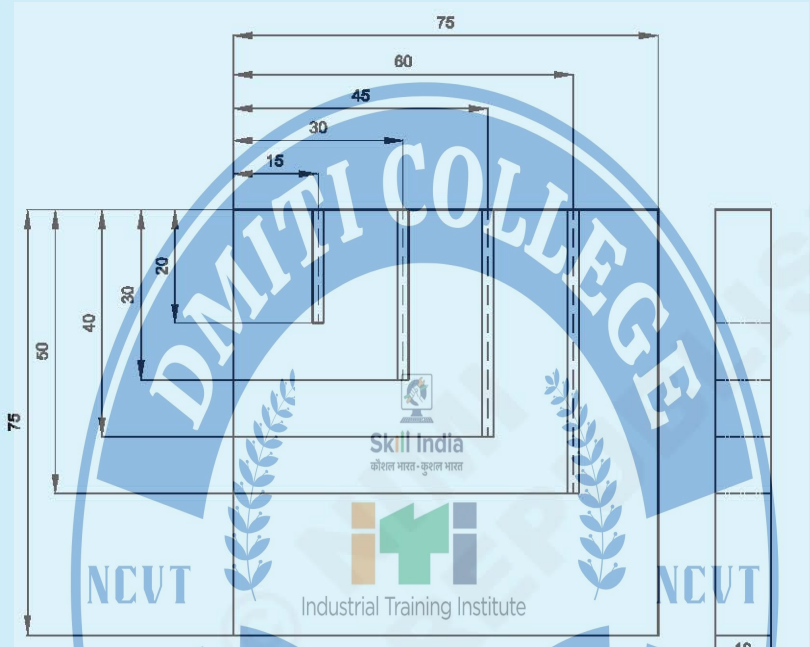
Table 1

S.No.	Defects on raw material	Brief the Appearance
1	Scaling	
2	Corrosion	
3	Rusted	

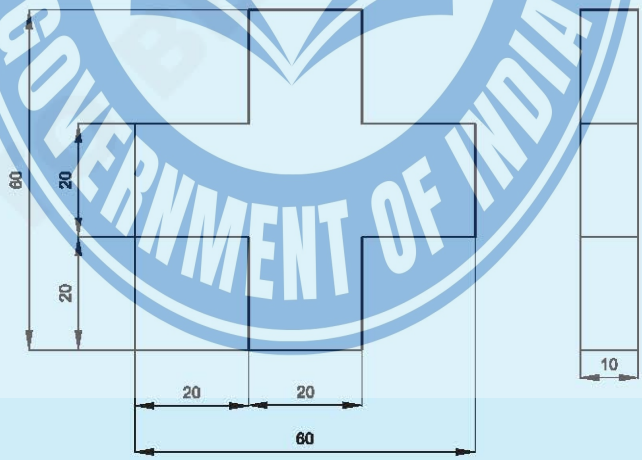
Marking out lines, gripping suitably in vice jaws, hacksawing to given dimensions

Objectives : At the end of this exercise you shall be able to
- **mark out lines using jenny caliper**
- **hold the job in bench vice**
- **cut along marked lines.**

TASK -1



TASK -2



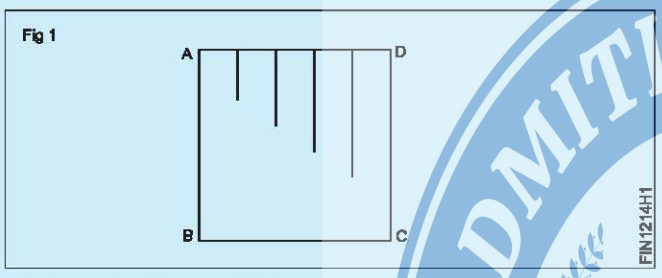
1	60 x ISF10 - 60	-	Fe310 PRE - MACHINED	-	TASK - 2	1.2.14
1	75 ISF10 - 75	-	Fe310 PRE - MACHINED	-	TASK - 1	1.2.14
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

SCALE 1:1	**MARKING AND SAWING**	TOLERANCE : ±0.5mm	TIME : 10Hrs
		CODE NO. FIN1214E1	

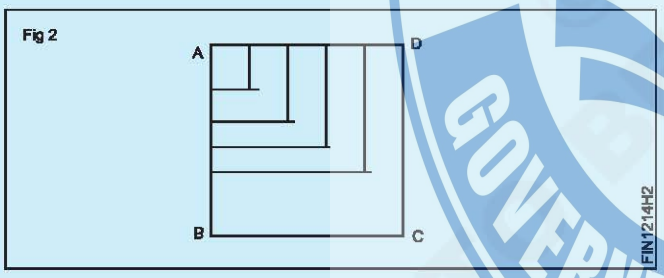
Job Sequence

TASK 1: **Marking and hacksawing**

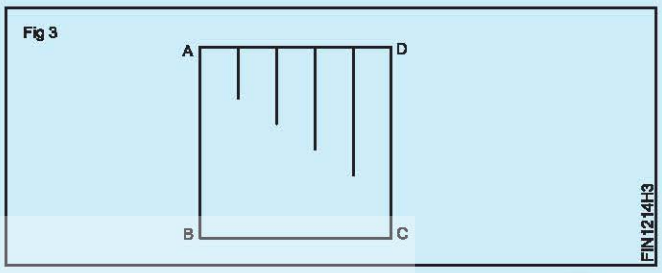
- Check the pre - machined size of 75x75x10 mm using steel rule.
- Apply marking media cellulose lacquer evenly on the surface of the Job.
- Place the job in levelling plate.
- Set the measurement 15 mm in Jenny caliper using steel rule.
- Draw parallel line of 15 mm to the side "AB" with the help of Jenny caliper as shown in Fig 1.
- Similarly, Set 30 mm, 45 mm and 60 mm and draw Parallel lines to "AB". (Fig 1).



- Set the measurement 20 mm in jenny caliper using steel rule.
- Draw parallel line to side "AD" using Jenny caliper.
- Similarly, set 30 mm, 40 mm and 50 mm and draw parallel lines to side "AD" as shown in Fig 2.



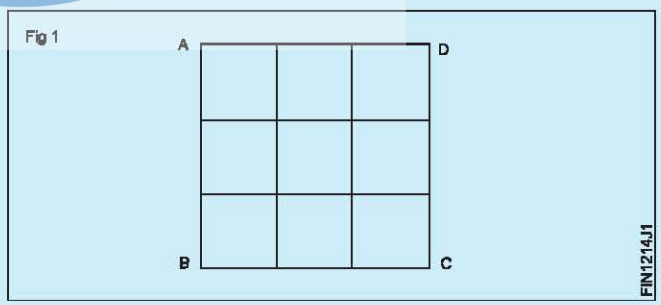
- Punch witness marks on hacksawing lines using a dot punch and a ball pein hammer Fig.3



- Hold the Job firmly in Bench vice, keeping side "AD" parallel to vice Jaws.
- Select 1 mm pitch Hacksaw blade, fix the blade in hack saw frame, pointing teeth in the forward direction.
- Tighten the blade to the required tension with the wing nut.
- File a notch at the point of hacksawing to avoid slippage of the blade.
- Start cutting with a slight downward pressure using Hacksaw.
- Saw along the lines up to punch marks.
- Apply pressure in the forward stroke.
- Release the pressure in the return stroke.
- Use full length of the blade while sawing.
- Check the size with steel rule.

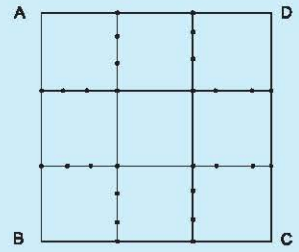
TASK 2: **Marking and hacksaw cutting**

- Check the pre-machined size of 60x60x10mm using steel rule.
- Apply marking media cellulose lacquer evenly on the surface of the Job.
- Place the job on levelling plate.
- Set the measurement 20 mm in Jenny caliper using steel rule.
- Draw parallel line of 20 mm to the side "AB" using jenny caliper Fig.1
- Similarly, with the same setting of the dimension 20 mm in Jenny caliper, draw parallel lines to "BC", "CD", and "AD". As shown in Fig 1.



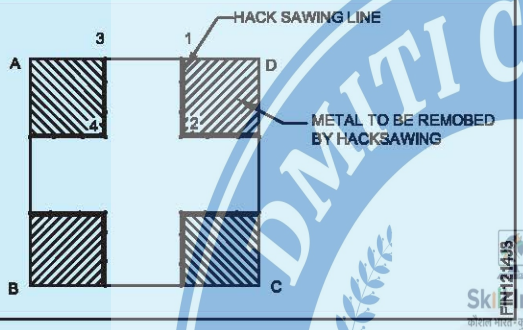
- Punch witness marks on the profile of Job using a dot punch and a Ball peen hammer as shown in Fig 2.

Fig 2



- Hold the Job firmly in Bench vice, keeping side "AD" parallel to vice Jaws. (Fig 3)
- Start cutting on side "AD", cut the line 1 to 2 upto the marked length 20 mm in right side. Fig.3

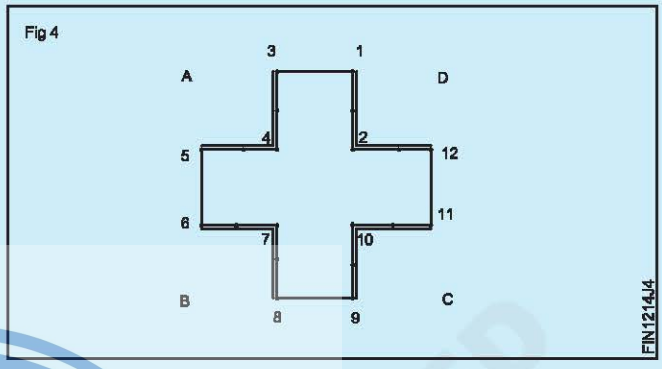
Fig 3



Ensure that half of the punch marks to be visible while sawing.

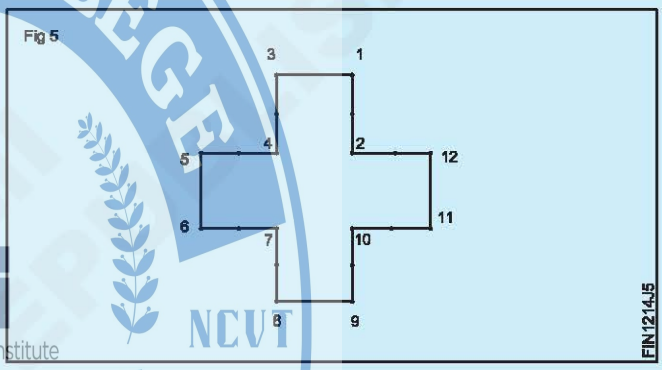
- In the same setting, without changing the position of the job cut the line 3 to 4 upto the marked length 20mm in left side as shown in Fig 3.
- Similarly, turn the job and cut the line 5 to 4, 6 to 7, 8 to7, 9 to 10, 11 to 10 and 12 to 2 as shown in Fig 4.

Fig 4



- After sawing profile of the Job shown in fig 5, check the size with steel rule.

Fig 5



Skill Sequence

Measuring with a steel rule

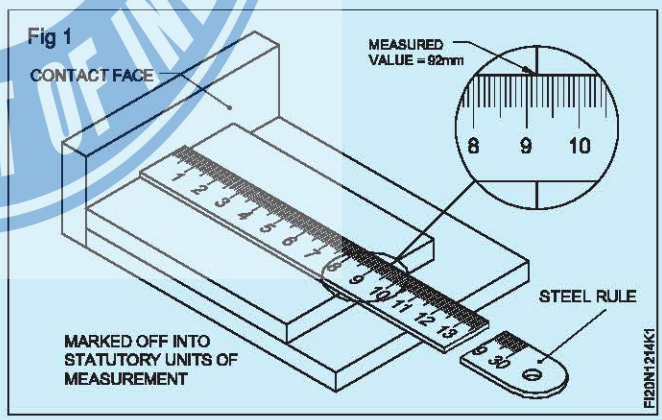
Objective: This shall help you to

- **measure the length or a part of a length of objects.**

Place the rule either directly on to the length to be measured or at right angle to the reference plane.

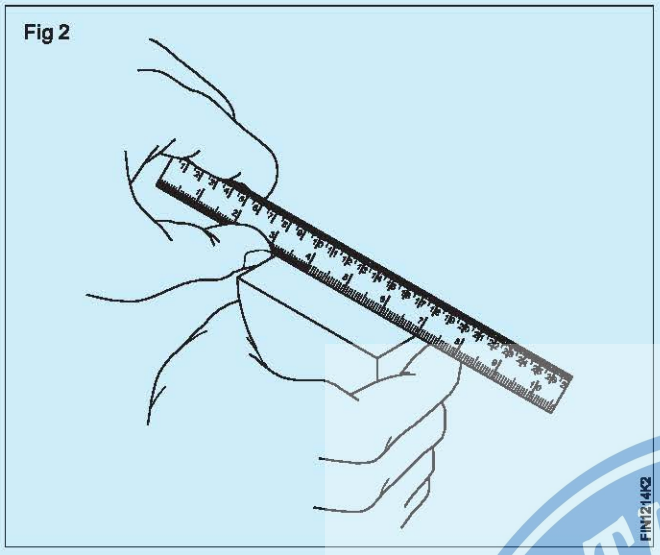
Use a contact face, if possible and read off measurements by looking at the steel rule directly. (Fig.1)

Fig 1



Measure with a rule starting off from the 1cm line if the edge of the rule is worn out or damaged. (Fig.2)

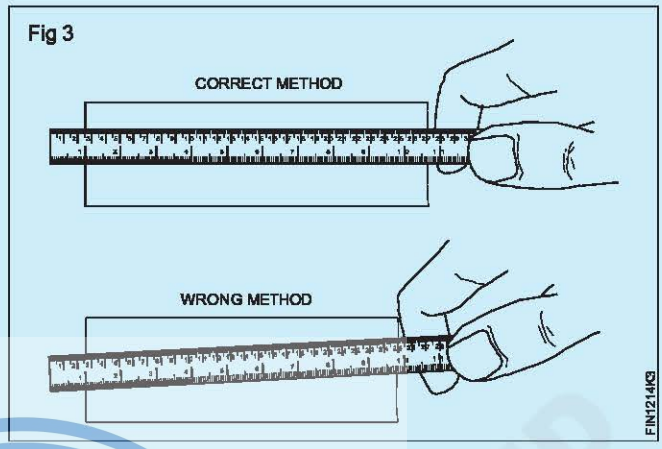
Fig 2



FIN1214K2

The rule must be held parallel to the edge of the work as otherwise the measurement will not be correct. (Fig.3)

Fig 3



FIN1214K3

Always keep the steel rule away from the cutting tools to avoid scratches/damages.

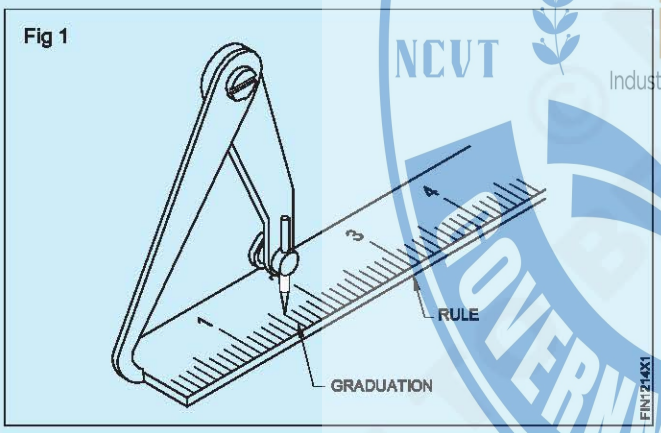
Marking lines parallel to the edge of the job

Objective: This shall help you to
- **mark parallel lines using a jenny caliper.**

Apply marking medium on the surface to be marked.

Set the jenny caliper to the size to be marked (i.e. dimension) with the help of a steel rule. (Fig.1)

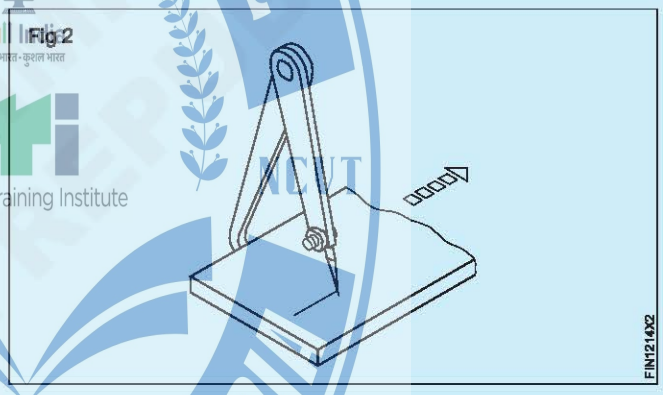
Fig 1



FIN1214X1

Transfer the set dimension to the job. (Fig.2)

Fig 2



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Incline slightly and move the jenny caliper with uniform speed and mark lines.

Make witness marks on the lines marked using a 60° prick punch. The witness marks should not be too close to one another.

Punching the marked line

Objective: This shall help you to
- **punch the line using prick punch.**

Place the job on levelling plate, such that marked lines should be approximately perpendicular to the operator.

Hold the punch between the thumb and the first two fingers of the hand where possible, rest the little finger and the edge of your hand on the marked centre point as shown in Fig.1.

Bring up the dot punch in the vertical position and strike with a ball peen hammer on the head of the dot punch lightly.

Watch the point of the punch and strike its head with the ball pein hammer Fig.2. This dot punch marks prevent the wing compass leg from slipping while scribing curved lines from the centre point.

Fig 1

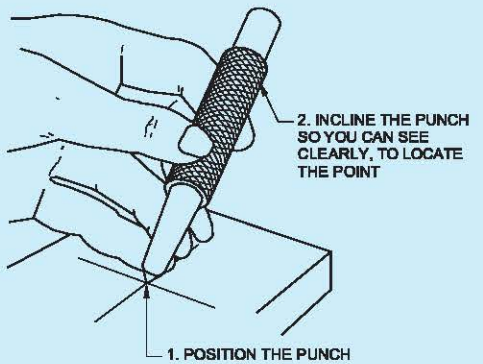
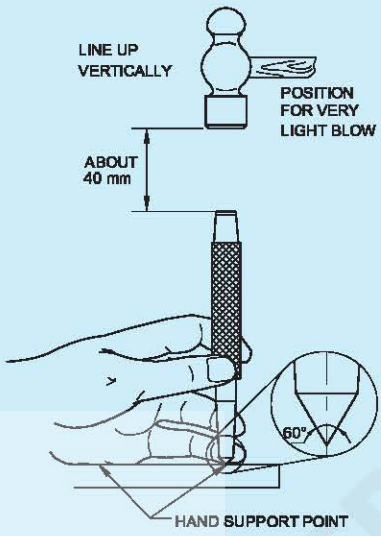


Fig 2



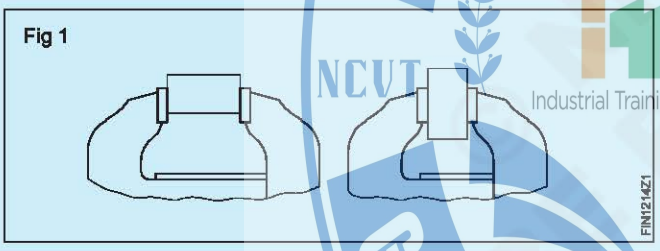
Sawing along a line

Objective: This shall help you to
- **cut along a straight line by hacksaw.**

Clamp the job to be cut according to the cross-section for sawing.

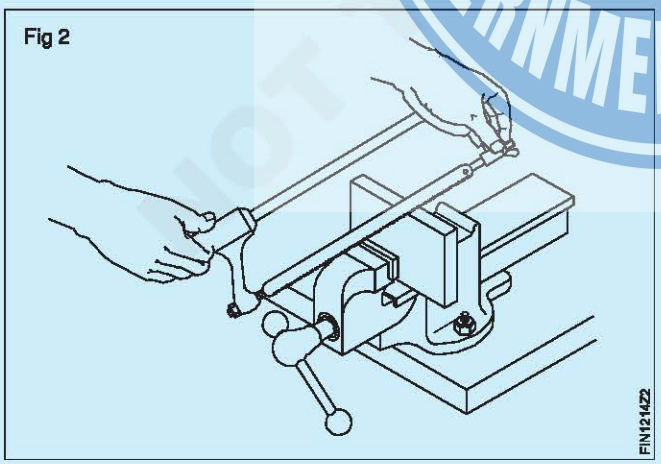
As far as possible hold the job in such a way that the flat or long side can be cut rather than the edge. (Fig.1)

Fig 1



In case the job has a profile (like steel angle), clamp the job so that sawing can be done towards the overhanging end. (Fig.2)

Fig 2



Clamp the job as long as possible on the vice and make sure that the marked sawing line is close to the side of the vice jaws in order to achieve maximum firmness.

Tighten the jaws firmly to avoid tilting and shifting of the job.

Whenever the section being cut shows chattering effect or vibration, the clamping needs improvement.

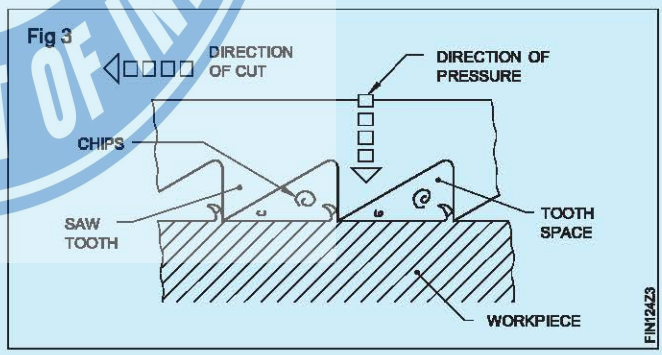
Select the correct pitch blade for cutting.

Shorter the cutting section is, finer the blade pitch. Make sure that atleast four teeth are cutting at a time.

Harder the material finer the blade pitch should be.

Fix the blade in such away that the teeth are in the direction of cut. (Fig.3)

Fig 3



Tighten and tension the blade by hand using only the wing nut.

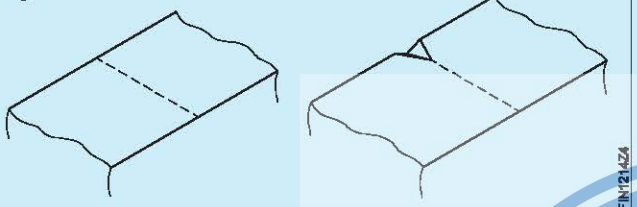
Caution

Insufficient blade tension-cut will not be straight.

Over tension-blade will break.

File a notch at the starting point on smooth and hard jobs to avoid slipping of the hacksaw. (Fig.4)

Fig 4



FIN121424

Apply a little downward hand force as long as only a few teeth are cutting. Press down only during forward (cutting) stroke.

Use the full length of the blade in order to avoid early dulling of the teeth in the middle portion of the blade.

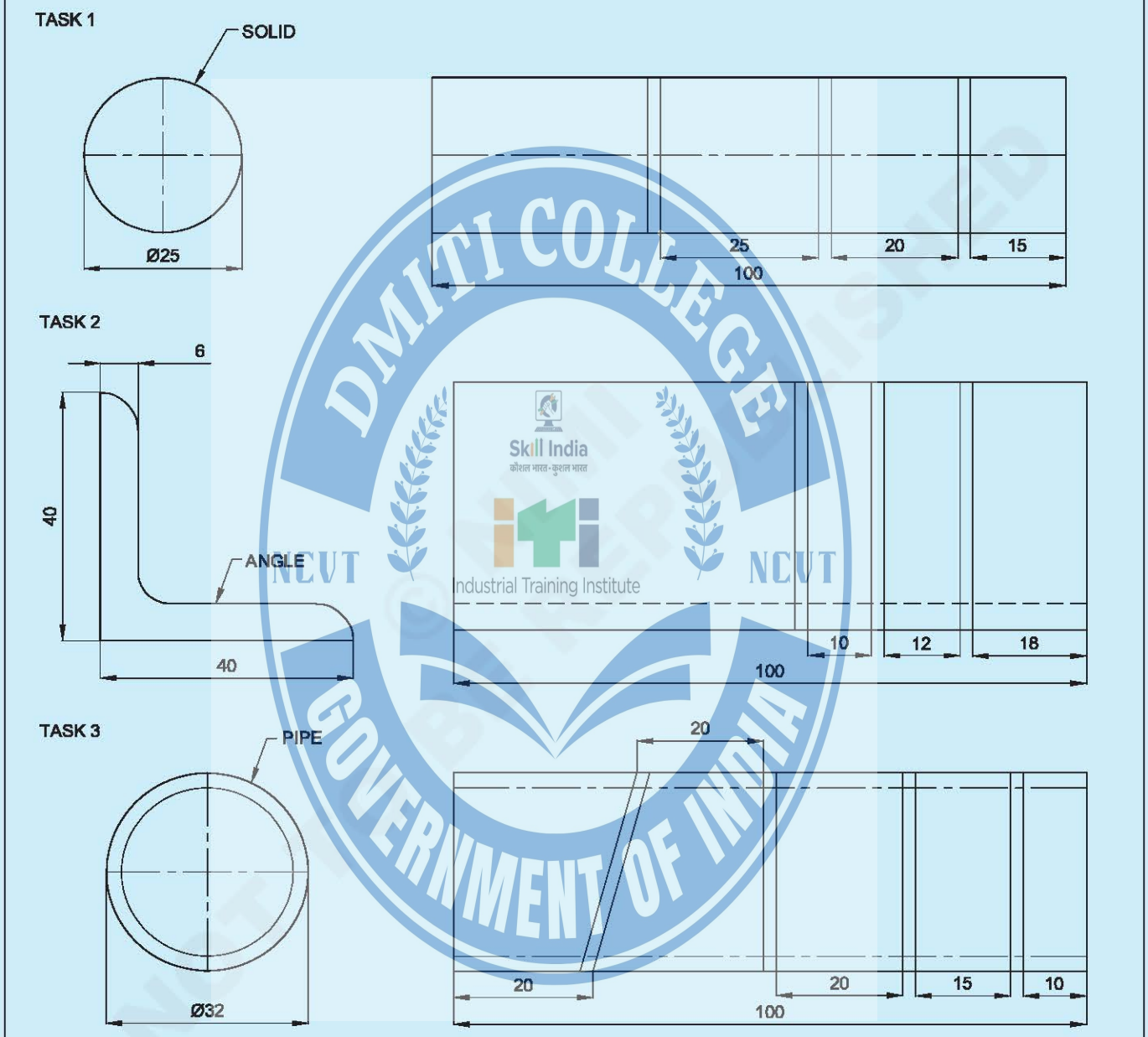
Move the blade strictly in line with the marked direction. Do not tilt the frame while sawing because bending ot the blade can cause sudden breakage of the blade.

Resort to cutting from the opposite side in case the deviation from the marked line is excessive.

Slow down the cutting while completing the cut to avoid breakage of the blade and injury to yourself.

Sawing different types of metals of different sections

Objectives: At the end of this exercise you shall be able to
- **cut different thickness of metals**
- **cut different sections of metals.**



1	Ø32 x 3.2 - 100 IS:1161		Fe310	05	3	1.2.15
1	ISA 40x40x6 - 100		Al310	05	2	1.2.15
1	Ø25 - 100	-	Co310	05	1	1.2.15
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

SCALE 1:1	**SAWING DIFFERENT TYPES OF METAL OF DIFFERENT SECTIONS**	TOLERANCE : ±0.5mm	TIME :
		CODE NO. FI20N1215E1	

Job Sequence

TASK 1: **Sawing on round rod**

- Check the raw material using steel rule.
- File the both ends of round rod to 100mm length.
- Remove the burrs from the edges.
- Apply marking media only where marking is required.
- Place the round rod vertically on marking table.
- Support the round rod using V block and mark the hacksawing lines by marking block.
- Punch witness mark on the sawing line with dot punch.
- Hold the Job in bench vice.
- Fix 1.8 mm pitch hacksaw blade in hacksaw frame.
- File a notch at the point of cutting to avoid slippage of the blade.
- Start cutting with a slight downward pressure on round rod using hacksaw.
- Cut on the hacksawing line giving proper pressure on forward and return stroke using full length of the blade.
- Cutting movement should be steady while sawing on round rod.
- While finishing the cut, slow down the pressure to avoid breakage of the blade and injury to yourself and others.
- Check the size of the round rod with steel rule.

Selection of hacksaw blade

- **For soft materials use 1.8 mm pitch blade while sawing.**
- **For hard materials use 1.4 mm pitch blade while sawing.**

TASK 2: **Sawing on steel angle**

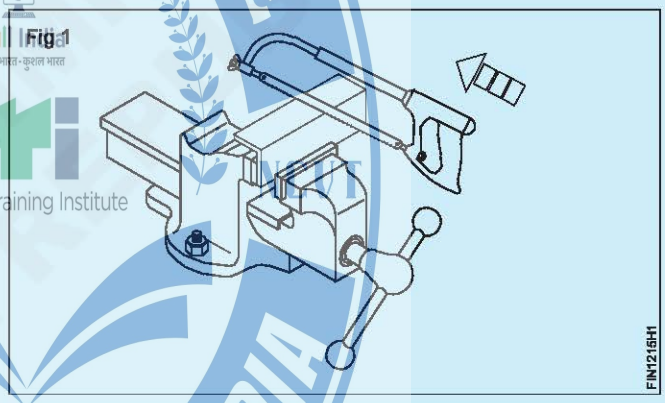
- Mark and punch the sawing lines.
- Hold the job in bench vice as shown in Figure.1
- Fix 1.8 mm coarse pitch blade in hacksaw frame.
- Cut along the sawing lines with hacksaw.
- Check the size of the angles with steel rule

Caution

Select correct pitch blade according to the shape and materials to be cut.

While sawing, two or more teeth of blade should be in contact on metal section.

Fig 1



TASK 3: **Sawing on pipe**

- Mark and punch the sawing lines.
- Hold the job in bench vice as shown in figure.1
- Fix 1.0 mm pitch blade in hacksaw frame
- Cut along the sawing lines with hacksaw.
- Turn and change the position of the pipe while hack sawing

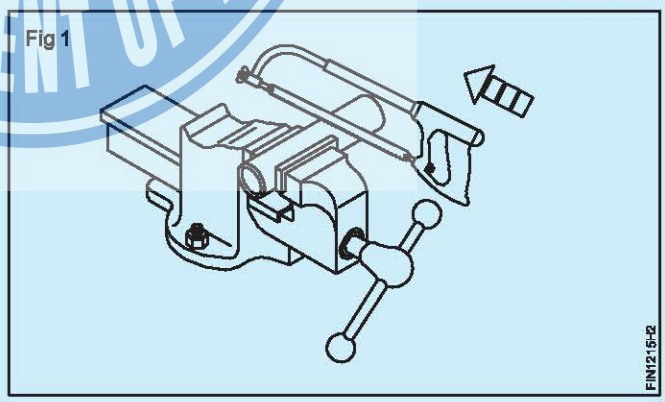
Caution

Avoid over tightening the pipe in the vice which causes deformation.

Do not cut too fast.

Cut very slow and reduce pressure while cutting through

Fig 1



Skill Sequence

Hacksawing (holding-pitch selection)

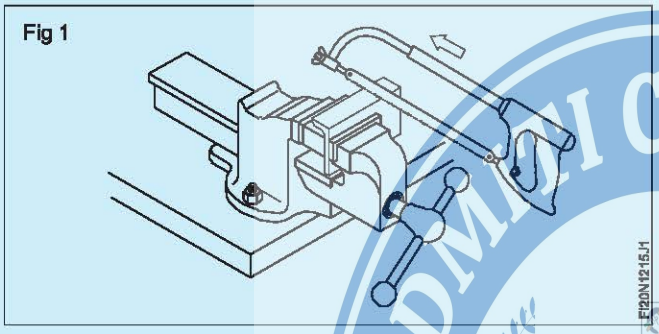
Objectives: This shall help you to
- **select blades for different metal sections**
- **hold different sections of workpieces for hacksawing.**

Holding the workpiece

Position the metal to be cut according to the cross-section for hacksawing.

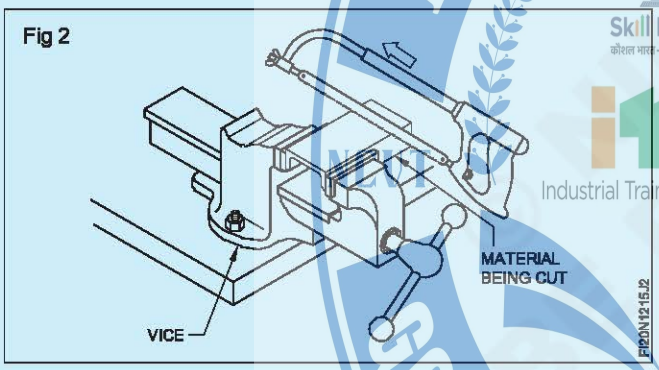
As far as possible the job is held so as to be cut on the flat side rather that the edge or the corner. This reduces the blade breakages. (Figs 1,2 and 3)

Fig 1



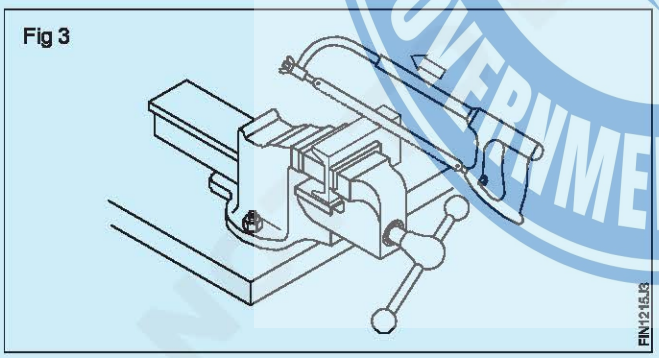
FI20N1215J1

Fig 2



FI20N1215J2

Fig 3



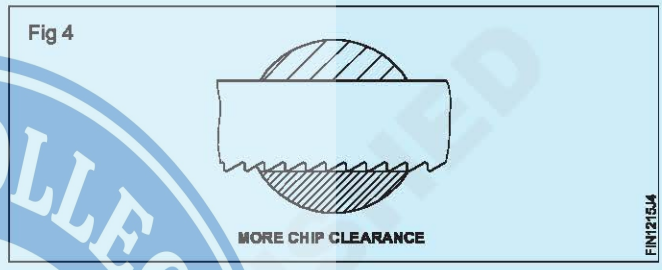
FIN1215J3

The selection of the blade depends on the shape and hardness of the material to be cut.

Pitch selection

For soft materials such as bronze, brass, soft steel, cast iron, heavy angles etc. use a 1.8mm pitch blade. (Fig.4)

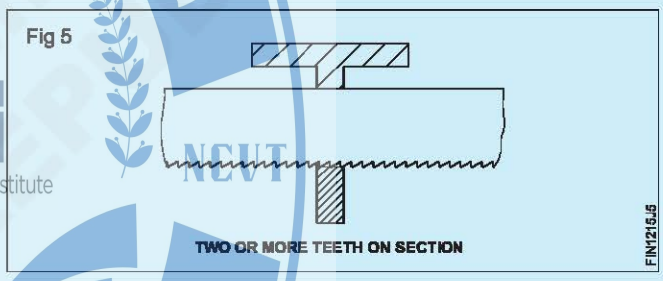
Fig 4



FIN1215J4

For tool steel, high carbon, high speed steel etc. use a 1.4mm pitch. For angle iron, brass tubing, copper, iron pipe etc, use a 1mm pitch blade. (Fig.5)

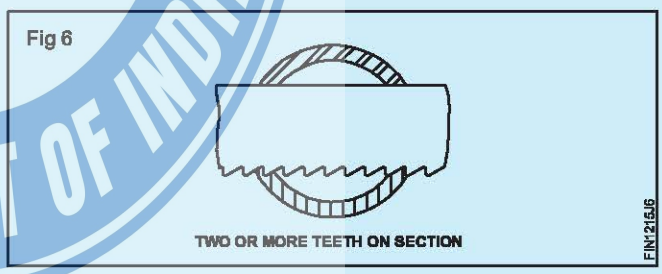
Fig 5



FIN1215J5

For conduit and other thin tubing, sheet metal work etc. use a 0.8mm pitch. (Fig.6)

Fig 6



FIN1215J6

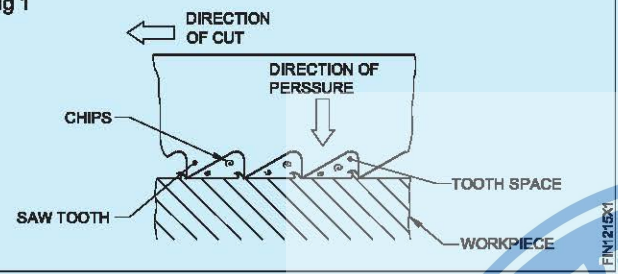
Hacksawing

Objectives: This shall help you to
- **fix hacksaw blades by maintaining correct tension and direction**
- **cut metal pieces with a hacksaw.**

Fixing of hacksaw blades

The teeth of the hacksaw blade should point in the direction of the cut and away from the handle. (Fig.1)

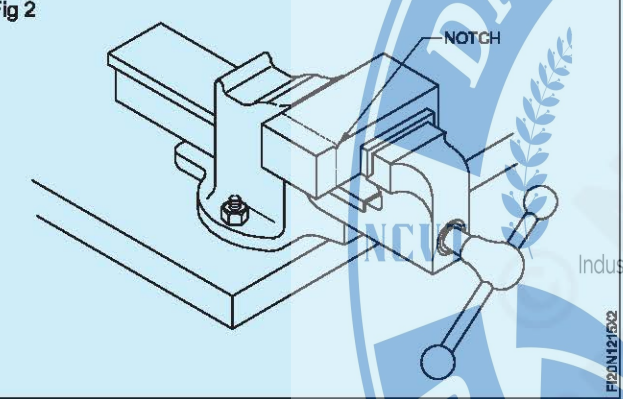
Fig 1



The blade should be held straight, and correctly tensioned before starting.

While starting the cut make a small notch. (Fig.2)

Fig 2

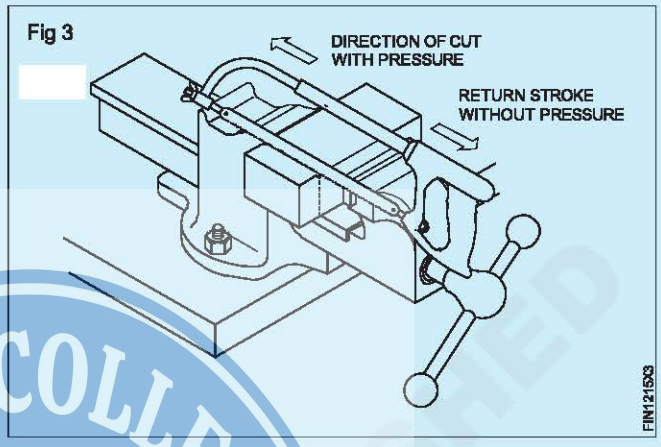


File 'V' notch using a triangular file.

The cutting movement should be steady and the full length of the blade should be used.

Apply pressure only during the forward stroke. (Fig.3)

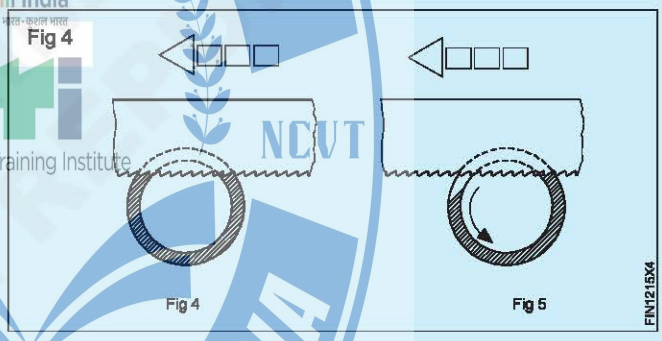
Fig 3



Atleast two to three teeth should be in contact with the work while cutting. Select a fine pitch blade for thin work. (Fig.4 & 5)

Turn and change the position of the pipe while hacksawing. (Fig.4 & 5)

Fig 4

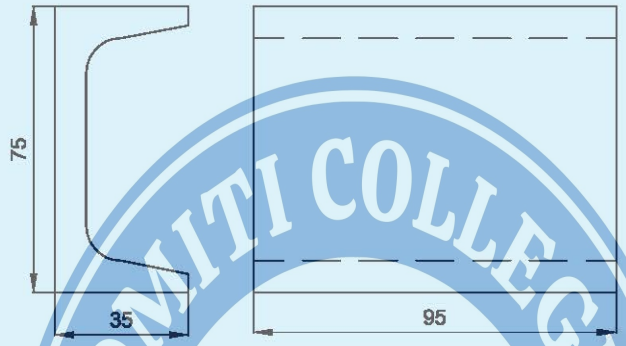


Normally, a coolant is not necessary while hacksawing by hand. However, to saw in heavy stock, intermittent coolant to be applied.

Do not move the blade too fast. While finishing a cut, slow down to avoid breakage of the blade and injury to yourself and others.

Filing channel, parallel

Objectives : At the end of this exercise you shall be able to
- **hold the job in a bench vice horizontally for filing**
- **file a flat surface with a flat bastard file**
- **check the flatness of the filed surface with a straight edge/blade of a try square**
- **check the parallelism with an outside caliper & steel rule.**



Job Sequence

- Check the stock size with a steel rule.
- Hold the job in bench vice, so that surface S_1 comes on top.(Fig 1)

Apply only limited clamping force so that the ribs do not bend

- Mark 35 mm line on surface S_2 and S_3 parallel to S_1 with a jenny caliper.
- File the rib up to the marked line (Fig 2) and check the size with steel rule.
- Check the surface level with the straight edge.
- Check the parallelism with an outside caliper and steel rule.

Fig 1

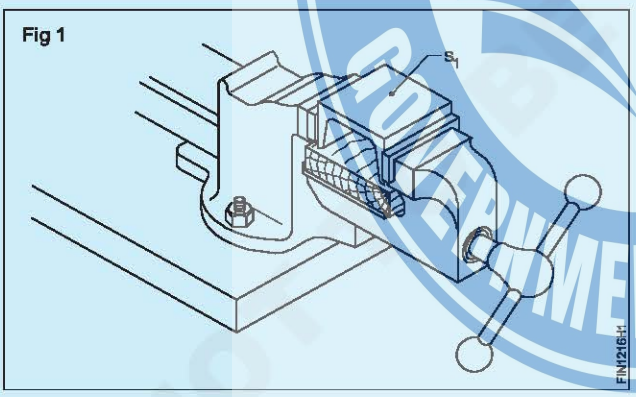
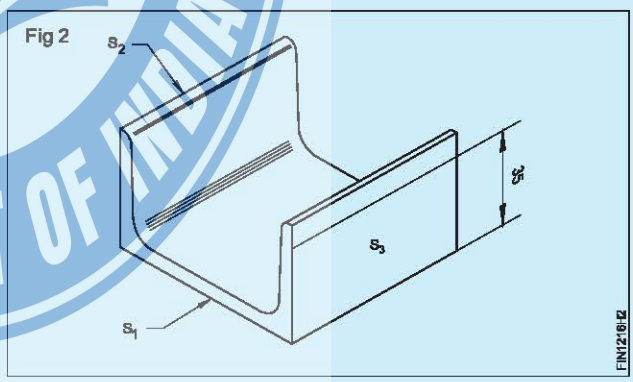


Fig 2



- File the surface S_1 with a flat bastard file.
- Check the surface level with straight edge/blade of a try square.

1	BISLC 75 - 95	-	Fe310	-	-	1.2.16
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

SCALE 1:1	CHANNEL PARALLEL	TOLERANCE : ±0.5mm	TIME :
		CODE NO. FI20N1216E1	

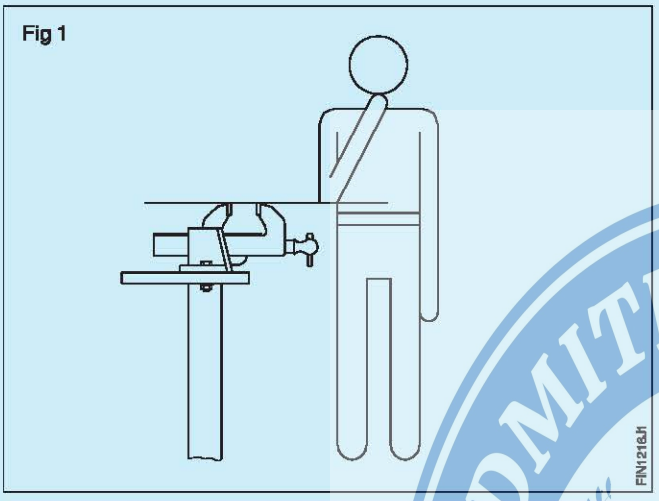
Skill Sequence

Filing flat surface

Objective: This shall be help you to
- **file flat**

Check the height of the bench vice. (Fig 1) If the height is more, use a platform and if it is less, select and use another workbench.

Fig 1

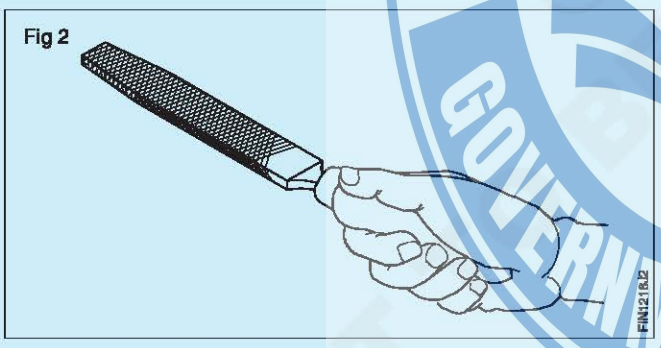


Hold the job in the bench vice with a projection of 5 to 10 mm from the top of the vice jaw.

Select flat files of various grades and length according to the

- size of the job
- quantity of metal to be removed
- material of the job.

Fig 2



Check whether the handle of the file fits tightly. Hold the handle of the file (Fig 2) and push the file forward using your right hand palm or left hand palm.

Hold the tip of the file according to the quantity of the metal to be removed.

For heavy filing. (Fig 3)

For light filing. (Fig 4)

For removing local unevenness. (Fig 5)

For removing the local unevenness draw filing can also be done. (Fig 6) The same filing can also be done for fine finishing.

Fig 3

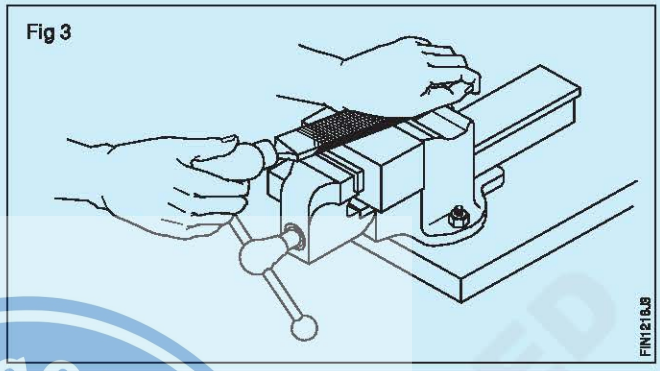


Fig 4

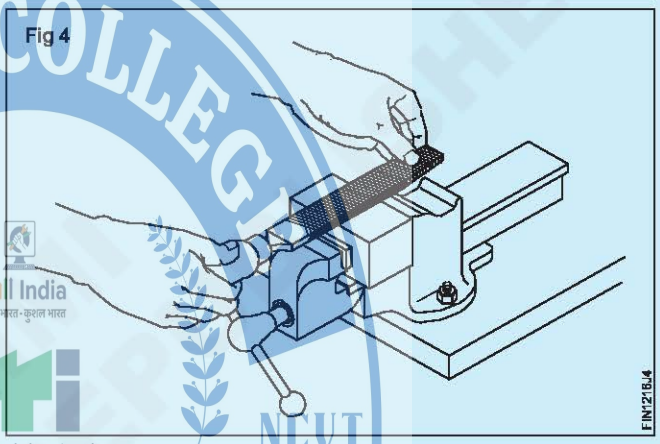


Fig 5

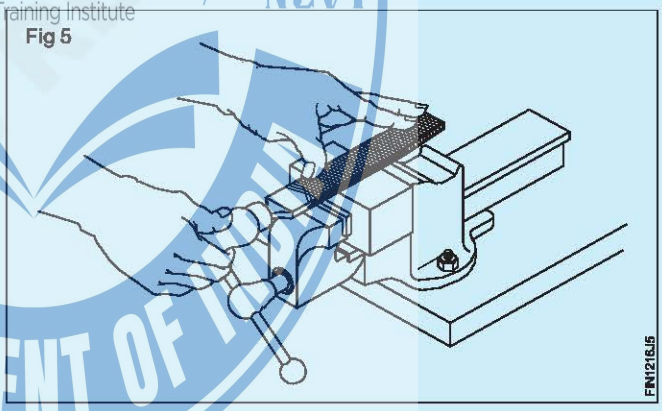
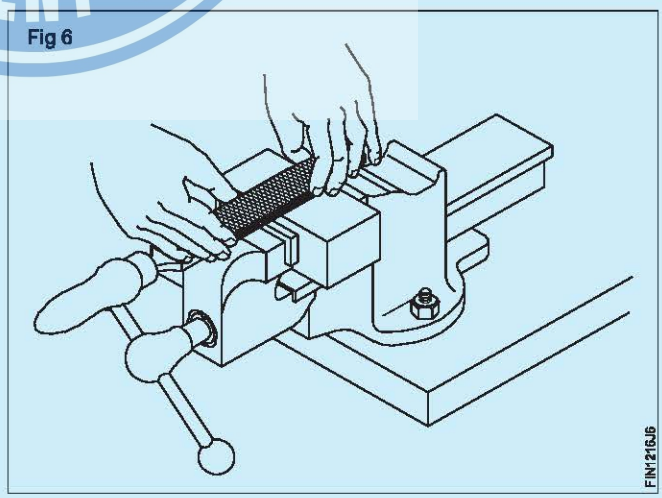


Fig 6



Start filing by pushing the file uniformly during the forward stroke and release the pressure during the return stroke.

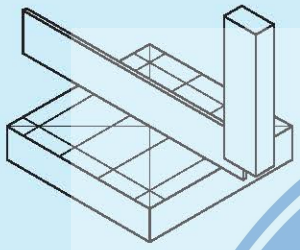
Continue giving strokes. Balance the pressure of the file in such a way that the file always remains flat and straight over the surface to be filed.

Checking flatness and squareness

Objectives: This shall help you to
- **check flatness**
- **check squareness.**

Checking flatness (Fig 1)

Fig 1



Use the blade of the try square as a straight edge for checking flatness.

Place the blade of the try square on the surface to be checked in all directions so as to cover the entire surface.

Do the checking facing the light. Light gap will indicate high and low spots.

Checking squareness: Consider the large finished surface as the reference surface. Ensure that the reference surface is filed perfectly and is free from burrs.

Butt and press the stock against the reference surface (Fig 2)

Bring down slowly (Fig 3) and make the blade touch the second surface with which the squareness is to be checked.

Light gap will indicate the high and low spots.

Fig 2

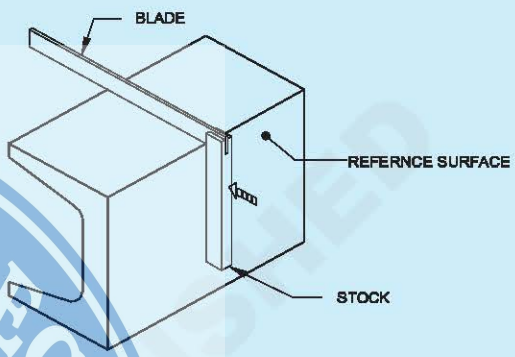
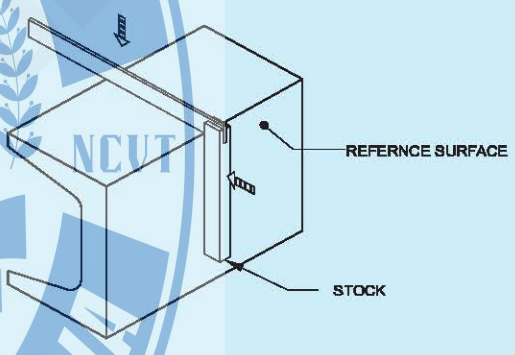


Fig 3



Scan the QR Code to view the video for this exercise

Measuring with outside calipers

Objective: This shall be help you to
- **select the right capacity caliper for measurement**
- **set the sizes both in firm joint and spring calipers**
- **read the sizes by transferring them to a steel rule or other precision measuring devices as the case may be.**

Outside calipers: Select a caliper based on the dimension to be measured.

A 150mm capacity outside caliper is able to measure sizes from 0-150mm.

Open out the jaws of the calipers until they pass clearly over the dimension to be measured. The work must be stationary when measuring the sizes. (Fig. 1)

Place one point of the leg over the workpiece and get the sense of feel of the other point of the leg.

If there is clearance on the other point of the leg, gently tap the back of one leg of the firm joint calipers on a wooden piece until it just slips from the external diameter of the workpiece to give the right sense of 'feel'. (Fig. 2)

Fig 1

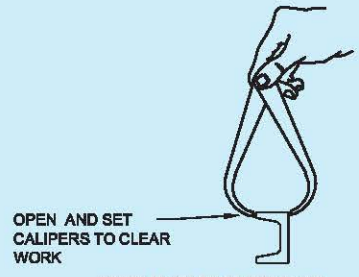
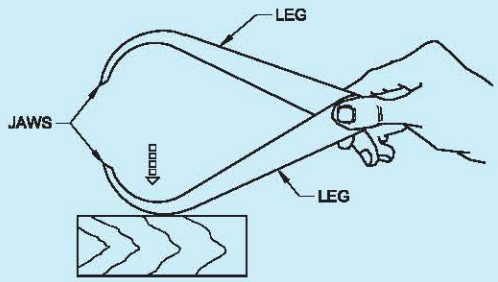


Fig 2

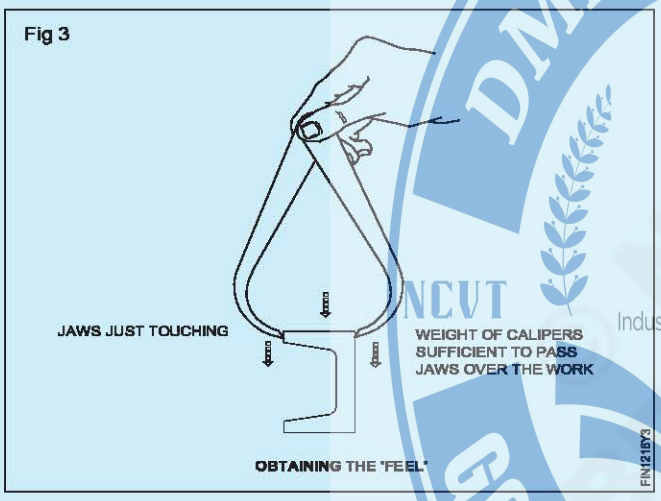


Because the accuracy of reading the sizes depends mainly upon the sense of feel of the user, high care should be exercised to get the correct 'feel'.

In the case of spring outside calipers, adjust the screw nut so that the adjustment of the jaws just slips from the external diameter of the workpiece to give the right sense of feel. (Fig.3)

When you have adjusted the outside caliper for the correct 'feel' transfer the measurement to a steel rule or any other precision measuring instrument as the case may be.

Fig 3



Checking parallelism with outside caliper. (Fig 4)

Keep the graduated steel rule on a flat surface and hold the point of one jaw firmly against the rule end. (Fig.4)

Fig 4

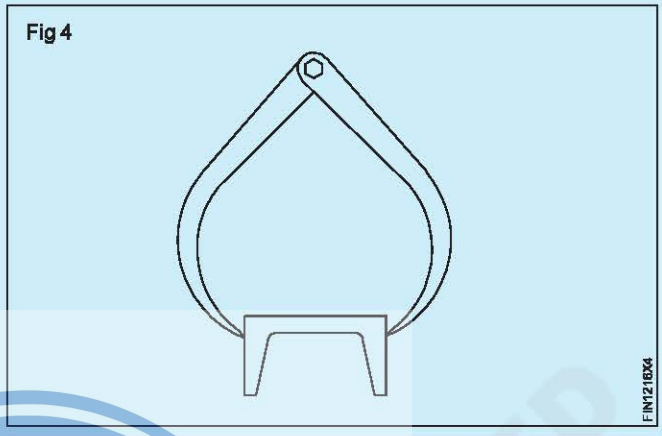
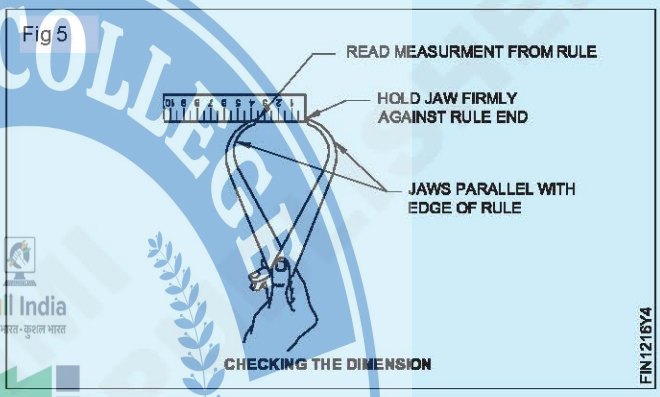


Fig 5



The point of one jaw must be placed over the graduation so that the point of the other jaw is parallel with the edge of the steel rule. (Fig 5)

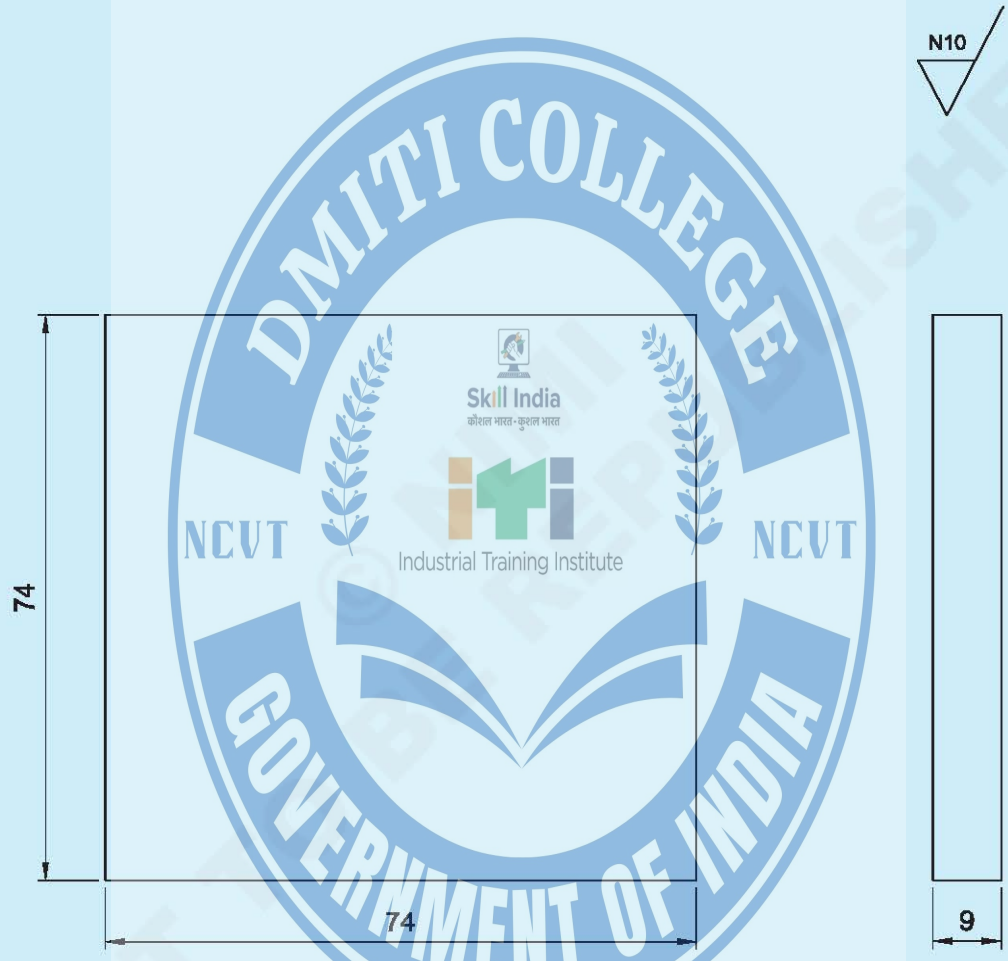
Record the reading to an accuracy of ±0.5mm.

Similarly take measurement at middle and at the end. If all the dimensions are equal then it is parallel.

Filing flat and square (rough finish)

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

- **hold the job in a bench vice horizontally for filing**
- **file a flat surface**
- **check the flatness of filed job using straight edge/try square blade**
- **check the squarness of the job with trysquare.**



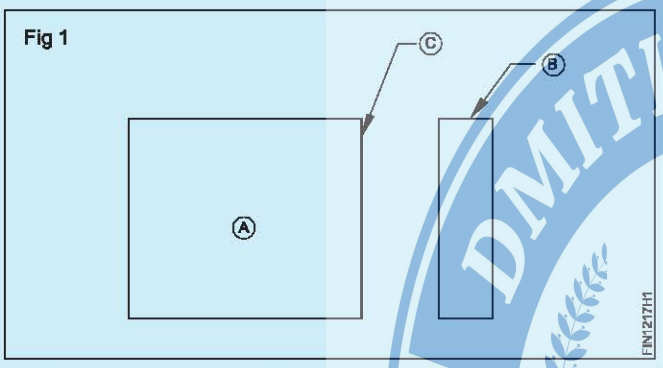
1	75 ISF 10-75	-	Fe310	-	1	1.2.17
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE 1:1	FITTING FLAT AND SQUARE (ROUGH FINISH)				TOLERANCE : ±0.5mm	TIME :
					CODE NO. FI20N1217E1	

Job Sequence

- Check the raw material size using steel rule.
- Remove the scaling by flat rough file.
- File side (A) with flat bastard file (fig 1)
- Check the flatness by blade of a try square
- File side (B) and maintain the squareness with respect to side (A).
- Similarly file side (C)
- Check the squareness with a try square.

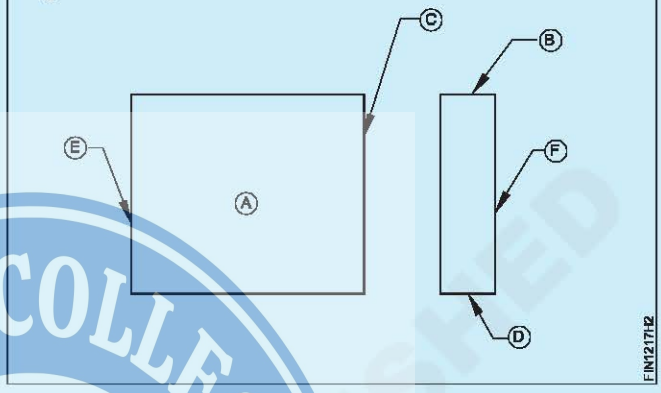
The side A,B and C are mutually perpendicular to each other (Fig 1)

Fig 1



- Set Jenny caliper to 74 mm using steel rule
- Draw parallel lines of 74 mm from side (B) and (C)
- Punch the marked line using dot punch and ball pein hammer
- Set and file sides (D) and (E) to 74mm and maintain squareness to all other sides.
- Maintain (D) and (E) parallel to side (B) and (C) (Fig.2)

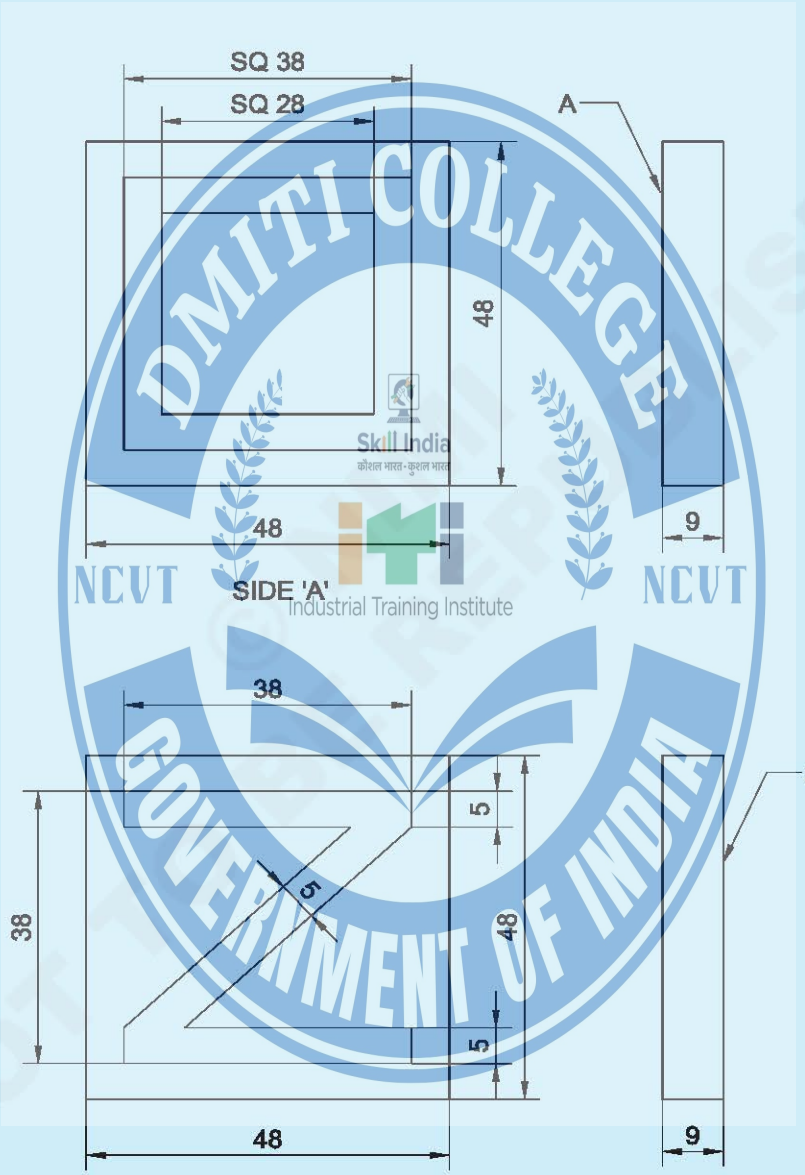
Fig 2



- Check the dimensions with a steel rule and squareness with a try square
- File surface (F) and maintain the thickness of 9mm parallelism to side A.
- Remove sharp edges. Apply little amount of oil and preserve it for evaluation.

Filing practice, surface filing, marking of straight and parallel lines with odd leg caliper and steel rule

Objectives: At the end of this exercise you shall be able to
- **file and finish the flat to the required size**
- **mark lines using odd leg caliper**
- **punch the marked lines.**



SIDE 'B'

NOTE: Use same material for both the markings (Side A & B)

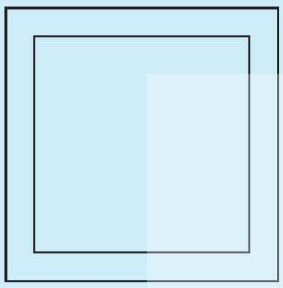
1	50 ISF 10-50	-	Fe310	-	-	1.2.18
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE 1:1	**MARKING WITH ODD LEG CALIPER AND STEEL RULE**				TOLERANCE : ±0.5mm	TIME :
					CODE NO. FI20N1218E1	

Job Sequence

Mark on side A

- Check the raw material size using steel rule
- File 3 sides mutually perpendicular to each other.
- Mark and file to size 48x48x9 mm.
- Set 5 mm in odd leg caliper and draw parallel lines to all sides (Fig 1)

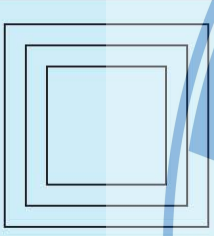
Fig 1



FI20N1218H1

- Similarly, set 10mm in odd leg caliper and draw parallel lines to all sides. (Fig 2) Punch on the marked line.

Fig 2

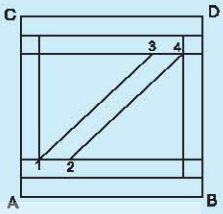


FI20N1218H2

Mark on side B

- Set 5 mm in odd leg caliper and draw parallel lines to side AB, CD, CA and DB Fig 3.

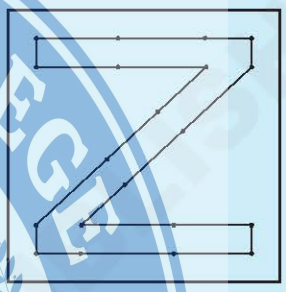
Fig 4



FI20N1218H3

- Set 10 mm and draw parallel lines to side AB and CD.
- Mark 5 mm on line 1 and 2, 3 and 4 as shown in Fig.4.

Fig 4



FI20N1218H4

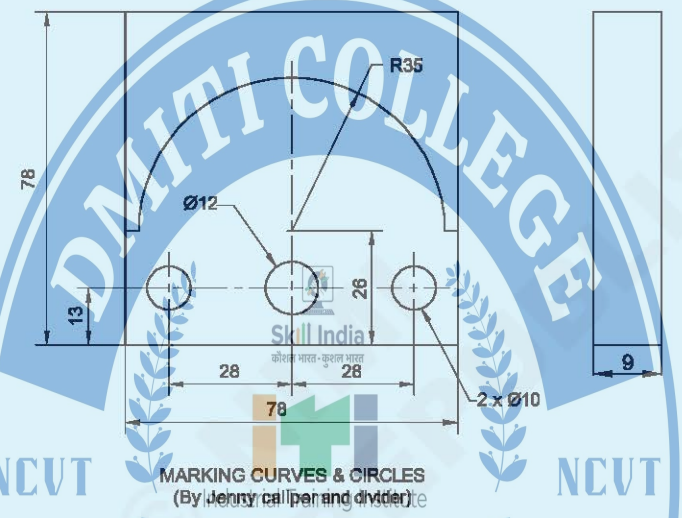
- Join point 1 and 3, 2 and 4, and punch witness marks as shown in Fig 4 & Fig 5.
- Apply little oil and preserve it for validating the marking.

Marking practice with dividers, odd leg calipers and steel rule (circles, arcs, parallel lines)

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

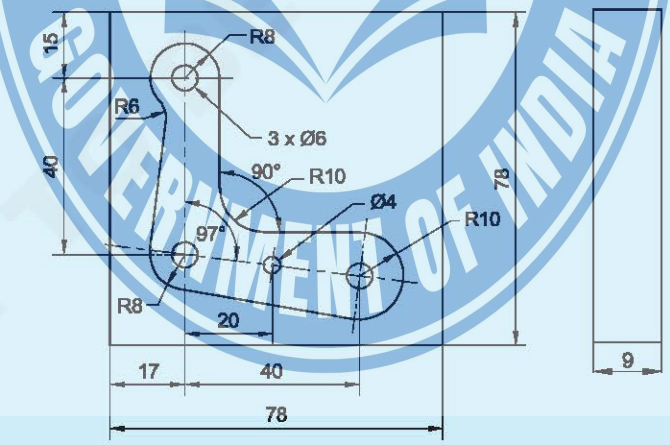
- **mark parallel lines with jenny caliper**
- **mark angular lines with a protractor and scriber**
- **mark arcs, circles and tangents with divider and scriber.**

TASK 1



MARKING CURVES & CIRCLES
(By Jenny caliper and divider)

TASK 2



MARKING TANGENTS & ARCS

NOTE: Use same material for both the tasks (side A & B)

1	80 ISF 10-80	-	FE 310	-	-	1.2.19
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

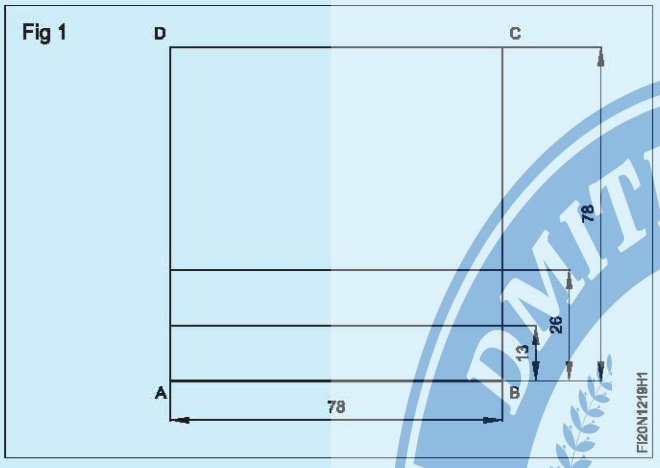
SCALE 1:1	MARKING PRACTICE	TOLERANCE : ±0.5mm	TIME :
		CODE NO. FI20N1219E1	

Job Sequence

TASK1: **Marking curves & circles**

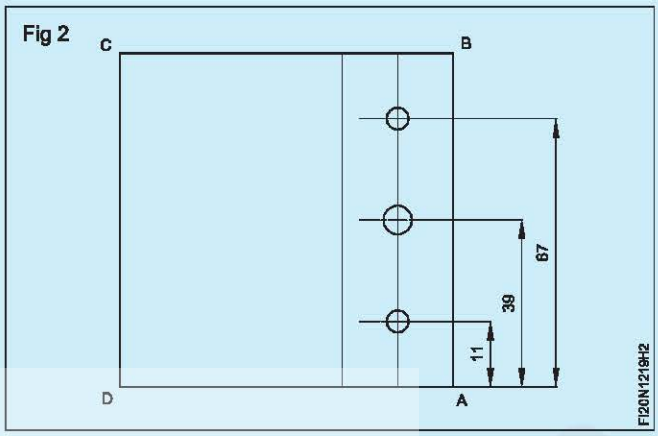
- Check the raw material size using steel rule
- File the raw material to size 78x78x9 mm
- Apply marking media cellulose lacquer on the surface of the Job.
- Set the dimension 13 mm in Jenny caliper and draw parallel line as per drawing with reference to 'AB'.Fig 1
- Similarly, set the dimensions 26mm and draw parallel line Fig 1

Fig 1



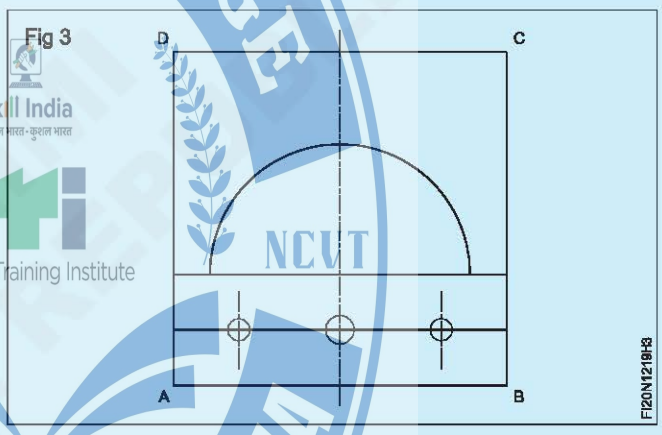
- Set the dimension 11 mm in Jenny caliper and draw parallel line as per drawing with reference to 'DA'. Fig 2
- Similarly, set the dimensions 39 mm, 67 mm and draw parallel lines. Fig 2
- Punch on the intersecting point of centre lines to draw circle and radius using prick punch 30°

Fig 2



- Set the radius 5mm, 6mm in divider and draw circles, as per drawing. (Fig 3)
- Set the radius 35 mm and draw arc as per drawing. (Fig 3)
- Punch witness marks on the circles and radius.
- Preserve it for evaluation.

Fig 3



TASK 2: **Marking tangents & arcs**

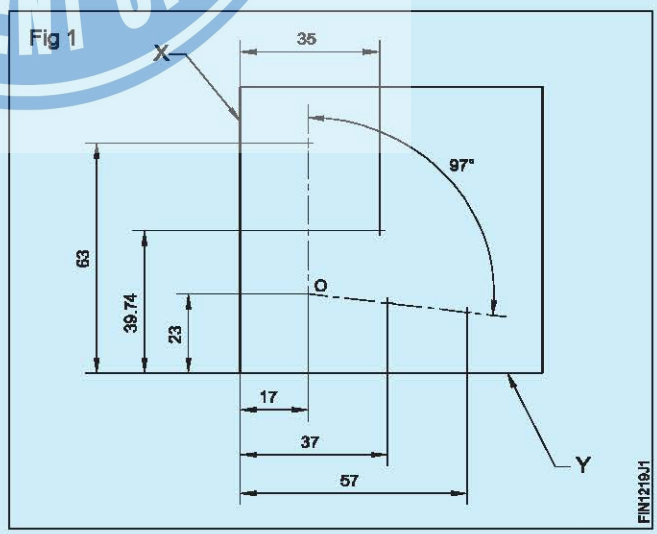
Step 1

- Check the material for its size and its squareness
- Apply marking media on one face of the job.

Step 2

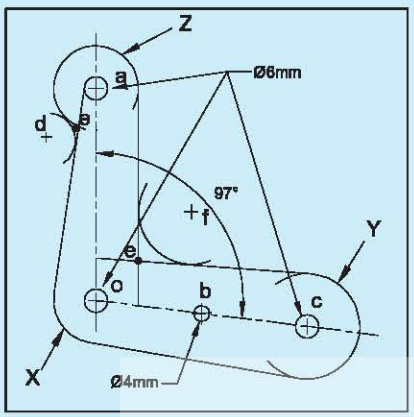
- Draw parallel lines of 17,35,37 and 57 from side 'X' (Fig 1).
- Mark parallel lines of 23,39.74 and 63mm from side 'Y' (Fig 1).
- Set 97° on the bevel protractor
- Mark 97° line through point 'O' and set the centres of other two circle
- Punch centre marks on all four circles

Fig 1



Step 3 (Fig 2)

Fig 2

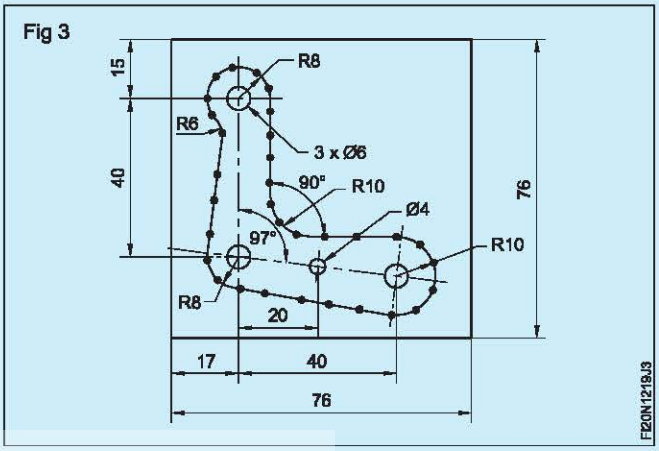


- Draw Ø6 mm circle at 'a','o','c' and Ø4 mm circle at 'b'.

Step 4 (Fig 2)

- Draw an arc, R8 mm from the centre 'a' and 'o'
- Draw an arc, R10 mm from the centre 'c'.
- Draw tangent lines to join X,Y and Z as shown in Fig 2.
- Draw the tangent lines from the arc drawn, the inter section of the tangent (e) is the centre for joining the tangent with arc.
- Draw R10 mm arc from the centre at point 'f' as shown in Fig 2

Fig 3



- Similarly, draw R6 mm arc at point 'd'

Step 5 (Fig 3)

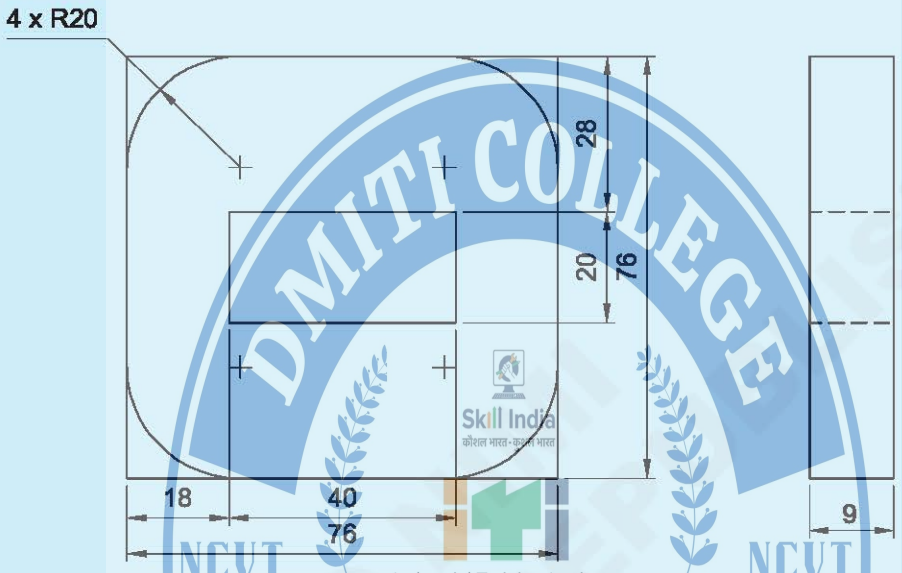
- Punch on the marked lines with equal intervals Fig 3.
- Preserve the job for evaluation.

Marking off straight lines and arcs using scribing block and dividers

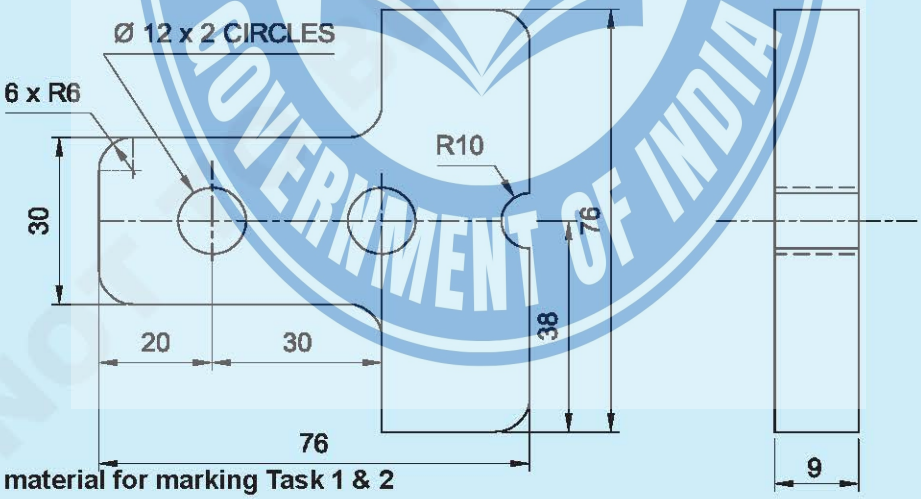
Objectives: At the end of this exercise you shall be able to
- **mark parallel lines using scribing block**
- **mark arcs using dividers.**

Scan the QR Code to view the video for this exercise

TASK 1



TASK 2



NOTE: Use same material for marking Task 1 & 2

1	80 ISF 10 - 80	-	Fe310	-	-	1.2.20
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

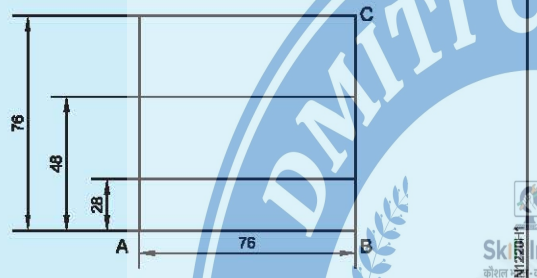
SCALE 1:1	MARKING STRAIGHT LINES & ARCS USING SCRIBING BLOCK & DIVIDERS	TOLERANCE : ±0. 5mm	TIME :
		CODE NO. FI20N1220E1	

Job Sequence

TASK 1: **Marking straight lines & arcs**

- Check the raw material size using steel rule.
- File three sides mutually perpendicular to each other.
- Mark and file to size of 76 x 76 x 9 mm
- Clean Marking Table, Angle plate, Scribing block and Steel rule with soft cloth.
- Place Scribing block, Angle plate and Steel rule on marking table.
- Support the Steel rule along with Angle plate.
- Set the dimension 28 mm in scribing block using Steel rule.
- Support the Job along with angle plate and scribe dimension line 28 mm in scribing block with reference to side 'AB' Fig 1

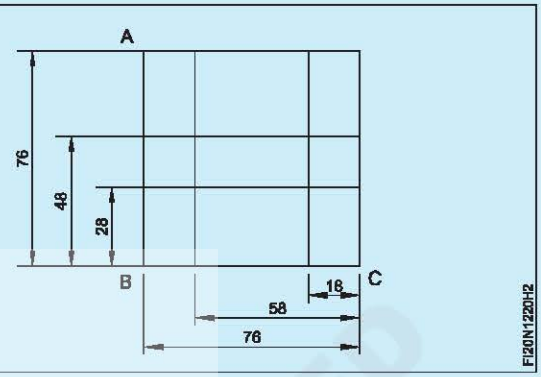
Fig 1



- Similarly, set 48 mm and scribe line with reference to side 'AB.
- Turn and place the Job with reference to side 'BC'
- Set the size 18 mm and scribe line with reference to side 'BC' Fig 2.

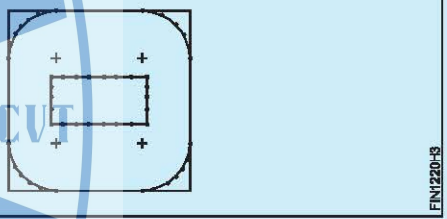
- Similarly, set the size 58 mm and scribe line with reference to side 'BC'

Fig 2



- Set the size 20 mm and scribe line with reference to all over the four sides to draw radius.
- Punch on the four radius point with a 30° prick punch.
- Draw 20 mm radius using divider in four corners.
- Punch on the marked lines with equal intervals. (Fig 3)
- Preserve it for evaluation.

Fig 3

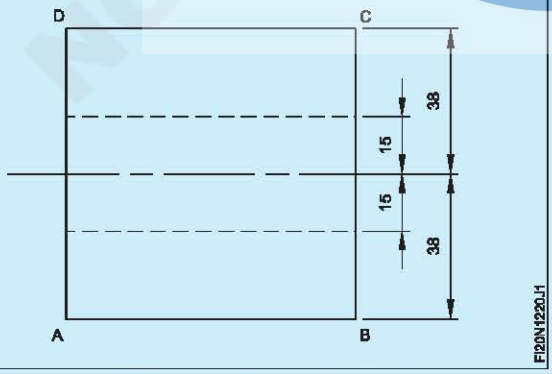


TASK 2: **Marking straight lines, arcs & edges**

On other side of job, mark and punch TASK 2 as per drawing.

- Mark the centre line 38mm from reference surface AB.
- MArk 15mm above the centre line and 15mm below the centre line as per drawing. (Fig 1)

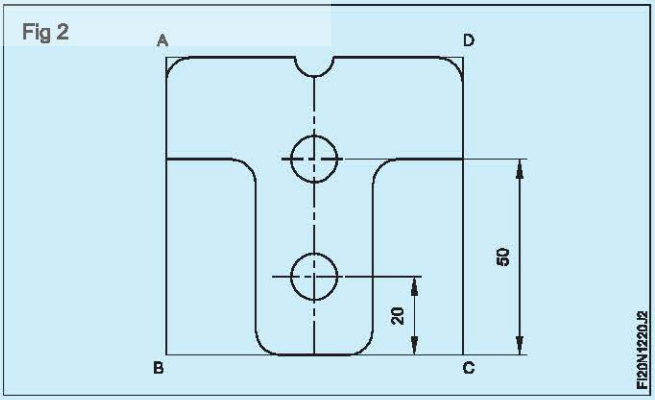
Fig 1



- Mark 20mm and 50mm on the centre line draw reference surface BC. (Fig 2)

- Mark radius R6 on 6 places.
- Join radius lines as per drawing.
- Draw ∅ 12mm circle on the marked reference of 20mm and 50mm.
- Mark corner of the centre R10mm as shown in Fig 2.
- Punch on the mark line by 60° dot punch.

Fig 2



Skill Sequence

Marking parallel lines using surface gauge

Objective: This shall help you to
- **Mark parallel lines using a surface gauge**

Scan the QR Code to view the video for this exercise

Check the free movement of the scriber and other sliding units.

Clean the base of the surface gauge.

Keep the base firmly on the surface plate.

Rest the steel rule against the angle plate and set the scriber to the size to be marked. (Fig 1)

Make sure that the job has no burrs and has been properly cleaned.

Apply a thin and even coating of the marking media.

Butt the job against the angle plate.

Hold the job in one hand and move the scriber point touching the surface across the work and mark.(Fig 2)

Fig 1

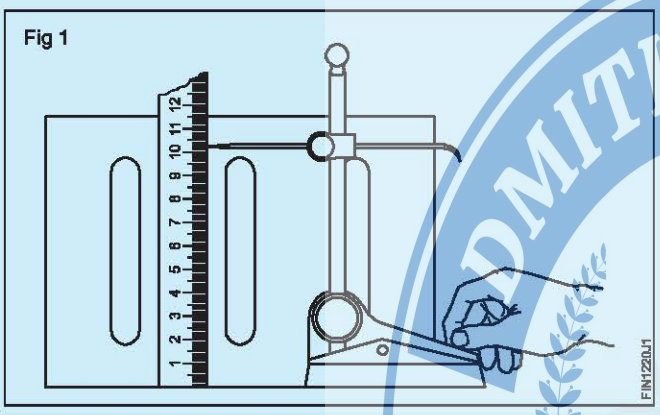
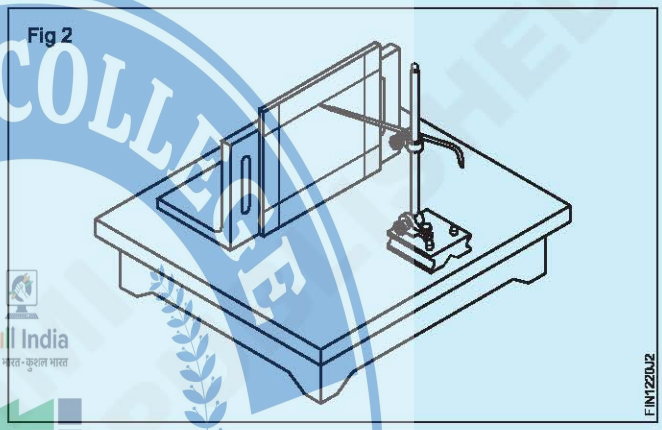


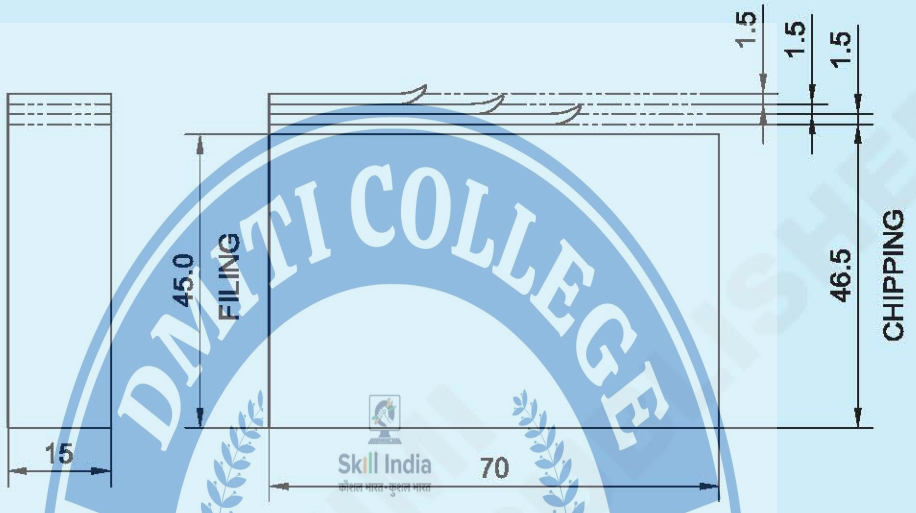
Fig 2



Chipping flat surfaces along a marked line

Objective: At the end of this exercise you shall be able to
- **chip surfaces evenly using a flat chisel.**

Note: Each trainee should practice chipping of 3 layers of 1.5 mm deep.



Job Sequence

- Apply marking media and mark the depth of metal to be removed by chipping.
- Punch the marked line with a dot punch.
- Hold the job firmly in the vice.
- Support the job with wooden block while chipping

If necessary give a wooden support below the work piece so that the marked line should be above the vice jaw face.

- Select a flat chisel 20 mm width with a proper cutting edge.
- Select a ball pein hammer of 1 kg.
- Hold the chisel at approximately 35° angle of inclination in chipping position.
- Hold the hammer at the end of the handle to get more leverage.

Caution: Chisel should be free from mushroom head.

Hammer handle should be securely fixed with eye hole with a wedge.

Use goggles while chipping.

Use a chipping guard behind the vice to arrest the flying chips.

1	50 ISF 15 - 70	-	Fe310	-	-	1.2.21
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE 1:1	**CHIPPING FLAT SURFACE**				TOLERANCE : ±0.5mm	TIME :
					CODE NO. FI20N1221E1	

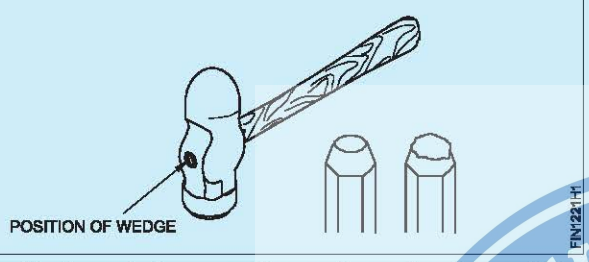
Skill Sequence

Chipping using flat chisel

Objective: This shall help you to
- **chip metal pieces.**

Before commencing chipping: Select a mushroom-free chisel and choose a hammer with a well secured handle. (Fig 1)

Fig 1

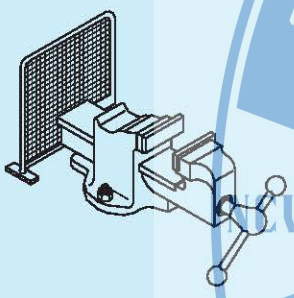


Wipe off oily substances, if any, from the face of the hammer.

Wear safety goggles.

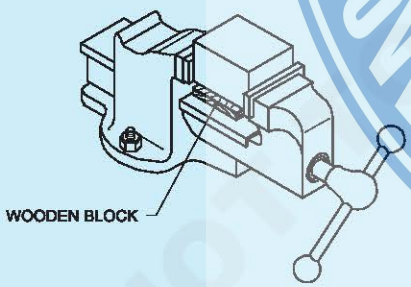
Install the chipping screen. (Fig 2)

Fig 2



Chipping process: Hold the work in a vice. If necessary, support the work on a wooden block. (Fig 3)

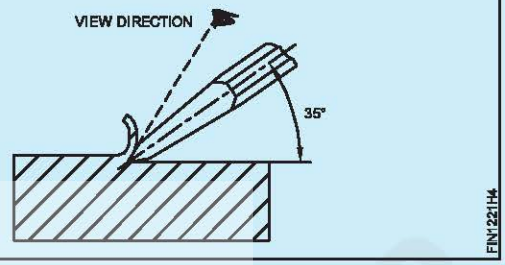
Fig 3



Position the chisel at an angle 35° (approximately) to cut the metal in uniform thickness. (Fig 4)

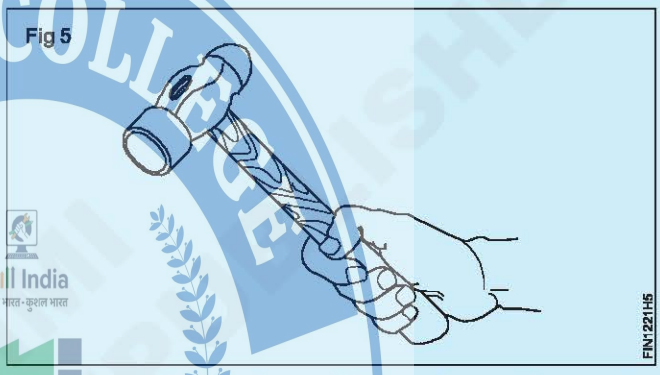
Hammer the head of the chisel by looking at the point of the chisel. (Fig 4)

Fig 4



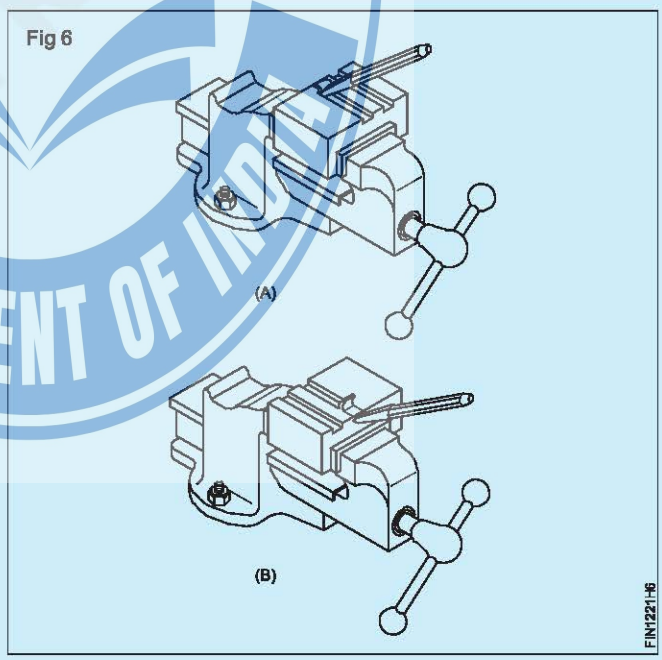
Hold the hammer at the end of the handle for maximum leverage. (Fig 5)

Fig 5



Stop chipping before the end of the surface; otherwise the edge of the job will break off. To prevent this, chip the end of the job from the opposite direction. (Figs 6A & B)

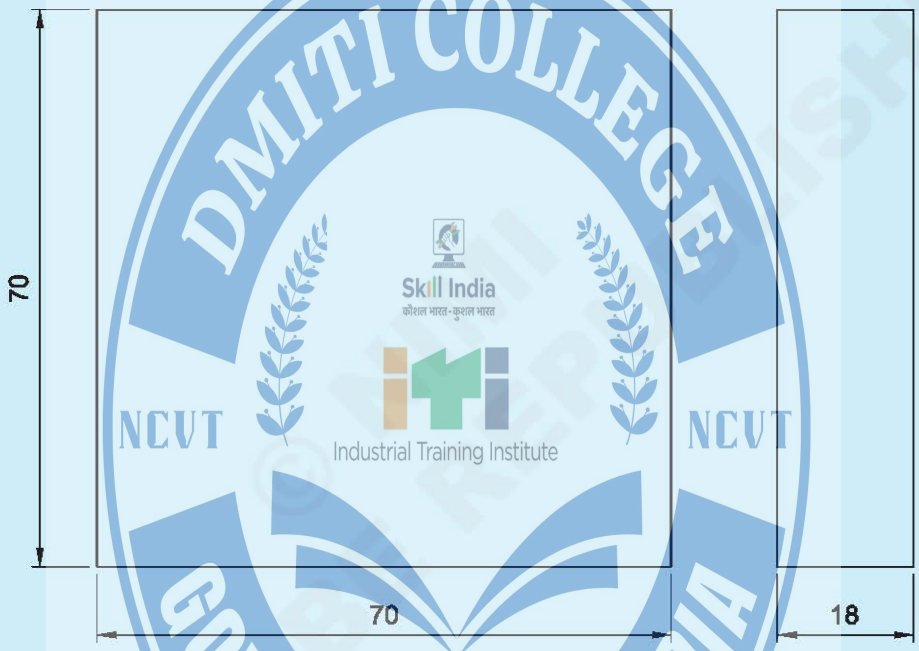
Fig 6



Marking, filing, flat, square and check using Try - square

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

- **hold the job in a bench vice horizontally for filing**
- **file flat and square and maintain the sizes within ±0.5mm**
- **check the flatness of filed job using straight edge try square blade**
- **check the squareness of the job with try square.**



Job Sequence

- Check the raw material size using steel rule.
- File 3 sides mutullay perpendicular to each other.
- Mark and file to size 70x70x18mm by maintaining the size ±0.5mm.
- Check the size with steel rule
- Check the squareness with try square and flat surface with straight edge/blade of try square.
- Clean and apply oil and preserve it for evaluation.

1	75 ISF 20-75	-	Fe310	-	-	1.2.22
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE 1:1	FILING FLAT AND SQUARE				TOLERANCE :- ±0.5mm	TIME :
					CODE NO. FI20N1222E1	

Marking according to simple blue prints for locating position of holes, scribing lines on chalked surfaces with marking tools

Objectives: At the end of this exercise you shall be able to
- **mark drill holes and radius using divider**
- **mark angular lines using bevel protractor**
- **mark straight lines using marking block**
- **mark pitch circle diameter using divider.**

Fig 1

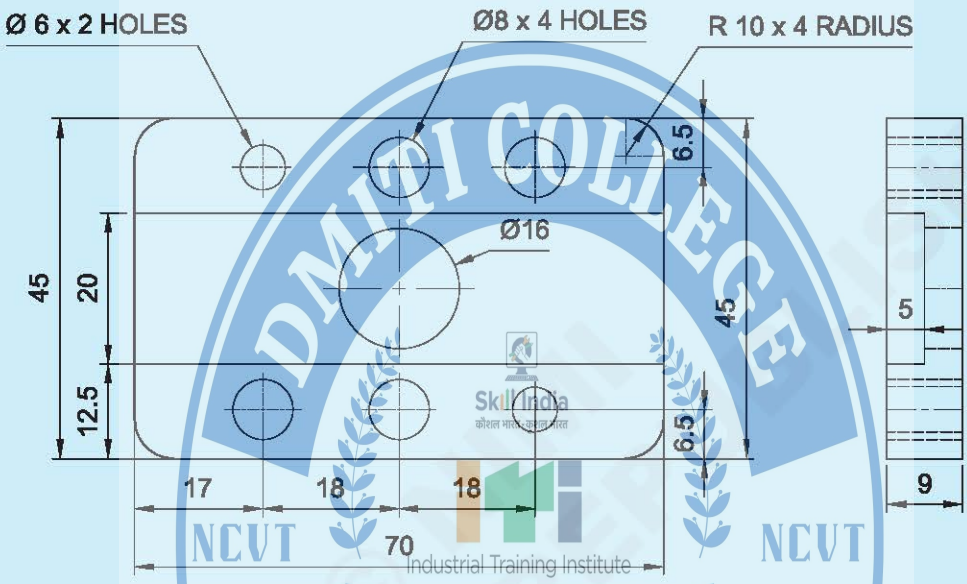
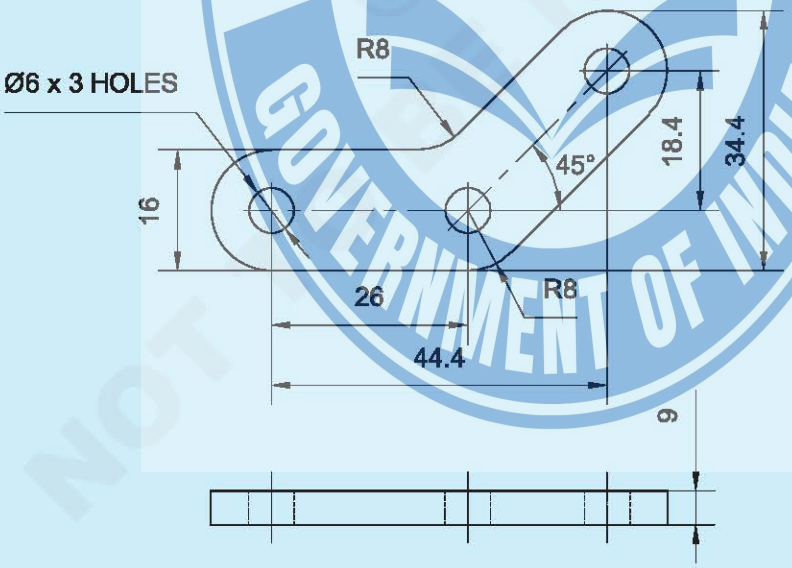


Fig 2



1	50 ISF 10-50	-	Fe 310	-	Fig 3	
2	50 ISF 10-75	-	Fe 310	-	Fig 1,2,4	1.2.23
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

SCALE 1:1	**MARKING PRACTICE**	TOLERANCE : - ±0.5mm	TIME :
		CODE NO. FI20N1223E1	

Fig 3

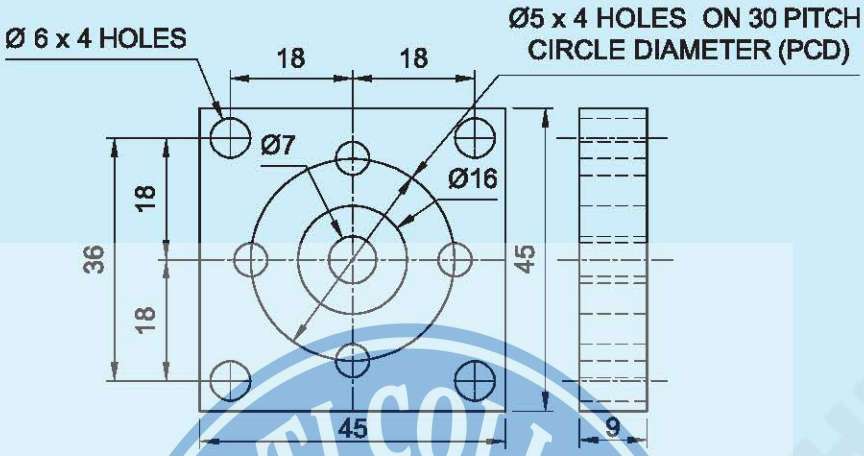
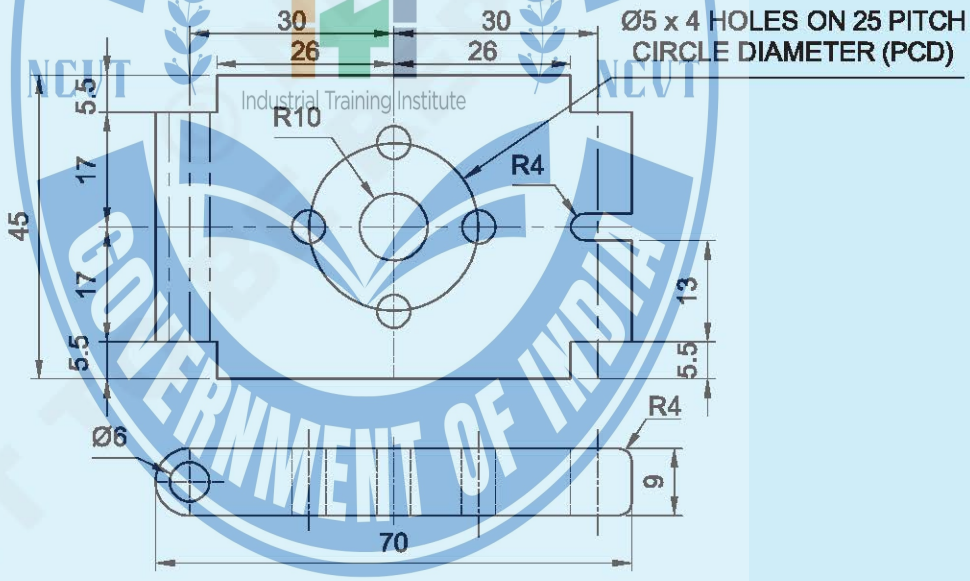


Fig 4



NOTE: Use both the surfaces of metal for marking Fig 1,2 & 4

-	-	-	-	-	-	1.2.23
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE 1:1	MARKING PRACTICE				TOLERANCE : ±0.5mm	TIME :
					CODE NO. FI20N1223E2	

Job Sequence

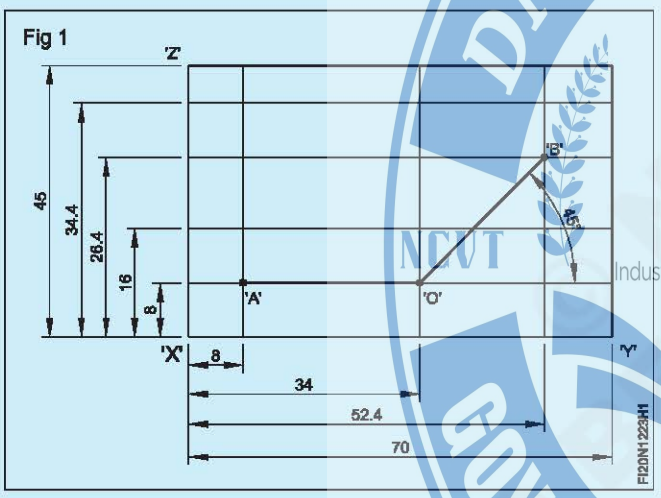
Figure: 1

- Check the raw material size using steel rule
- File raw metal to size 70 x 45 x 9mm and check with steel rule.
- Apply marking media on the surface of the job.
- Mark circular holes centre, radius and groove as per drawing using a Jenny caliper.
- Set the divider and draw circles ∅ 6 mm, ∅ 8 mm, and ∅ 16 mm as per drawing.
- Punch witness marks on marked line using a dot punch.
- Check the marking with steel rule.

Figure: 2

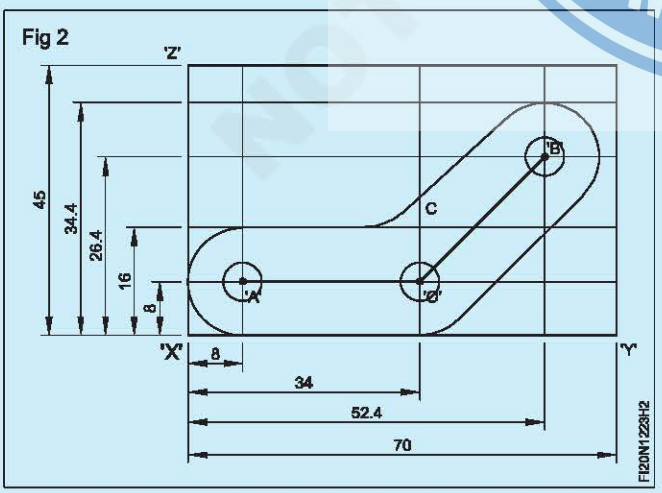
- Apply marking media on the another surface of the job.
- Mark 8mm, 16mm, 26.4 mm and 34.4 mm lines using Jenny caliper with reference to 'xy'.
- Mark 8mm, 34 mm and 52.4 mm lines using Jenny caliper with reference to 'xz'. fig 1.

Fig 1



- Mark 45° angular line at point 'o' using Bevel Protector as per drawing.
- Locate the intersecting point 'A',' O' and 'B' using prick punch 30°. Fig 2

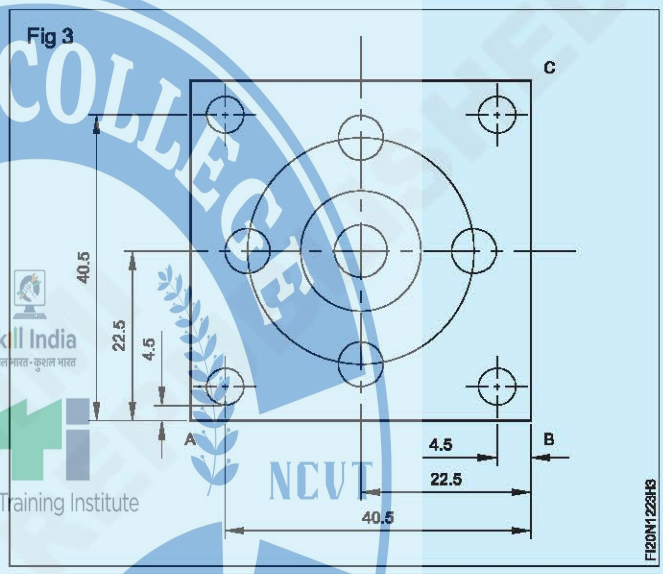
Fig 2



- Set the radius 3 mm in divider and draw circles Ø 6mm 3 holes at point 'A','O' and 'B' as shown in Fig 2
- Similarly, set the radius 8 mm and draw half round as shown in Fig 2
- Draw tangent line as shown in Fig 2.
- Draw external radius 8mm, from point 'C' with references to tangent lines.
- Draw radius 8 mm at point 'o' to join tangent lines.
- Punch the witness marks on profile of the drawing.
- Check the marking with steel rule.

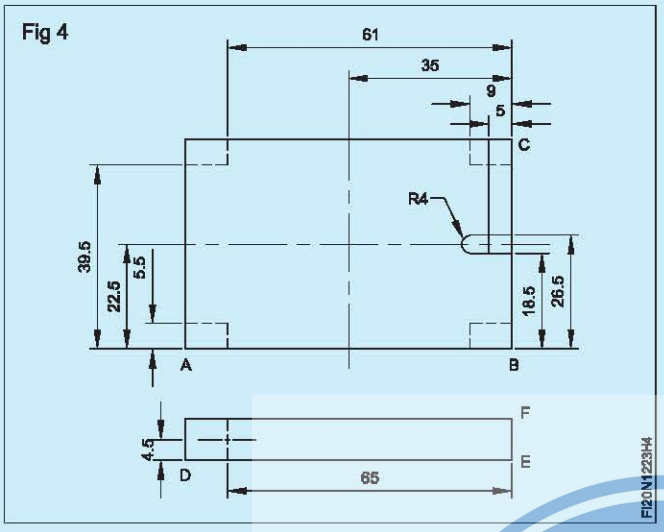
Figure 3

Fig 3



- Apply marking media on the surface of job (45x9x45mm)
- Mark job centreline 22.5mm with reference to AB
- Mark 4.5mm, 40.5mm lines using jenny caliper with reference to AB
- Mark job centreline 22.5mm with reference to BC.
- Punch on the intersection point of job centreline by using prick punch.
- Mark 4.5m, 40.5mm lines using jenny caliper with reference to BC.
- Set the radius 3mm, 3.5mm,8mm,15mm and draw circle as per drawing.
- Set the radius 2.5mm and draw 4 circles as per drawing.

Figure 4

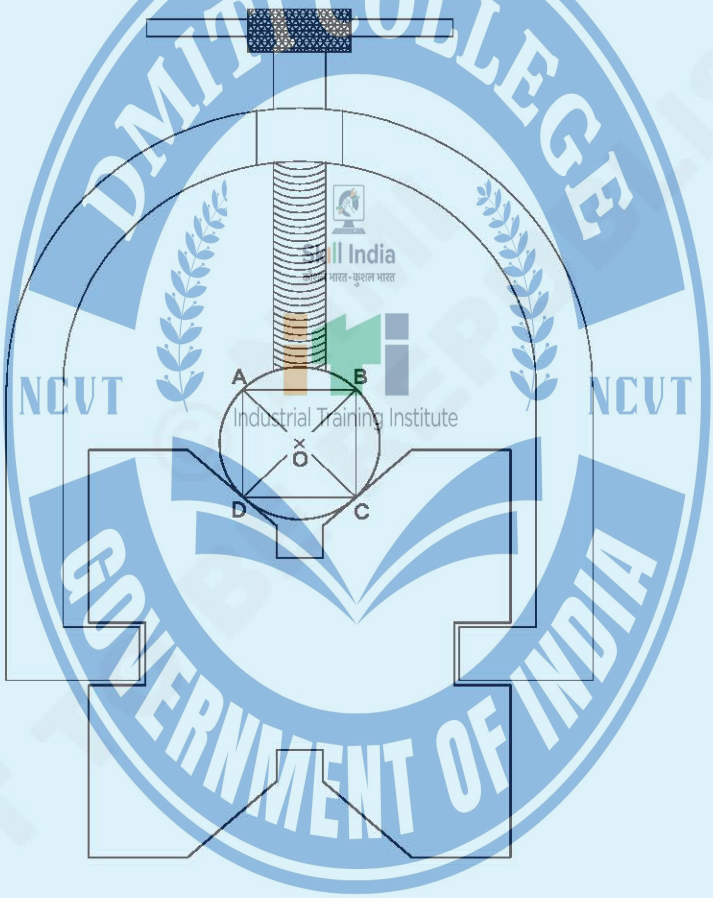


- Apply marking media on two surfaces of the job 70x9x45mm
- Mark 5.5mm centre line 22.5mm, 39.5mm and 20.5mm, 24.5mm with reference to AB.
- Mark 5mm, 9, centre line 35mm,61mm lines with reference to BC.
- Punch on the intersecting point of job centreline by using prick punch.
- Set the radius 5mm,12.5mm and draw circles as per drawing.
- Set the radius 4mm and draw the arc as per drawing.
- Set the radius 2.5mm and draw the circle at 4 places as per the drawing.
- Place the job in horizontal position.
- Mark 65mm with reference to EF and mark 4.5mm with reference to DE.
- Punch on the intersecting point using prick punch.
- Set radius 3mm and draw circle as per drawing.

Finding center of round bar with the help of 'V' block and marking block

Objectives: At the end of this exercise you shall be able to
- **select appropriate sizes of 'V' block to hold round bar**
- **find the centre of round bar using 'V' block and marking block.**

Scan the QR Code to view the video for this exercise

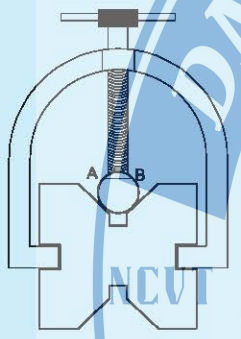


1	Ø50-50	-	Fe310	-	-	1.2.24
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE 1:1	FINDING CENTER OF A ROUND BAR				TOLERANCE : - ±0.5mm	TIME :
					CODE NO. FI20N1224E1	

Job Sequence

- File the faces of round bar
- Apply marking media on a face of round bar
- Clean marking table, 'V' block, marking block and steel rule
- Place 'V' block, marking block and steel rule on marking table.
- Set the round bar on 'V' block and clamp it with 'U' clamp.
- Place the marking block scriber on top of the round bar and read measurement in steel rule.
- Measure the height of round bar using steel rule
- Set the measurement in marking block using steel rule lesser than 10mm from the top of the round bar reading.
- Scribe line 'AB' on face of round bar using marking block as shown in fig 1.

Fig 1



- Loosen the 'U' clamp
- Rotate and set the line AB to 90° using try square and Tighten the 'U' clamp and scribe line BC (Fig 2).
- Repeat the same procedure to scribe lines CD and AD Fig 3.

Fig 2

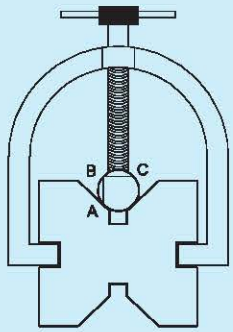
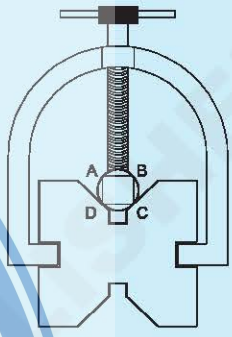
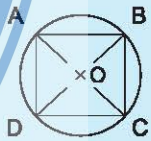


Fig 3



- Loosen the 'U' clamp and take out the round bar outside and keep it on marking table.
- Join the coordinate points 'AC' and 'BD' using steel rule and scriber fig 4.
- Punch on the intersecting point 'O' using centre punch 90°.
- Point 'O' is the centre of round bar.
- Preserve it for evaluation.

Fig 4

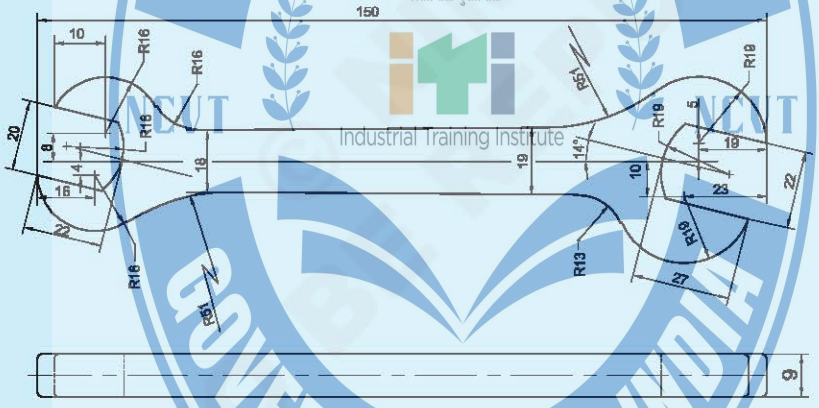


Joining straight line to an arc

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

- **mark lines on metallic surfaces with marking block**
- **mark lines with scriber**
- **mark angles with bevel protractor**
- **bisect the angles with divider**
- **draw circles, arcs and tangents with divider and scriber**
- **register the profile with dot punch.**

TASK 1



1	65 ISF 10-155	-	Fe310	-	TASK-1	1.2.25
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

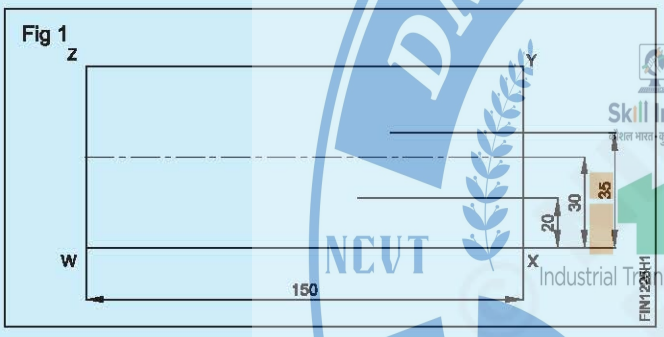
SCALE 1:1	JOINING STRAIGHT LINE TO AN ARC	TOLERANCE : - ±0.5mm	TIME
		CODE NO. FI20N1225E1	

Job sequence

TASK 1: **Spanner**

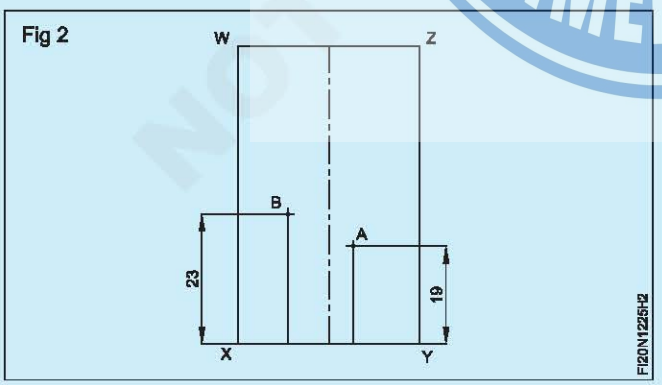
- Check the raw material size using steel rule.
- File metal to size 150 x 64 x 9 mm.
- Apply marking media on the surface of the job.
- Clean marking table, marking block, angle plate and steel rule.
- Set the size 30 mm in marking block using steel rule.
- Place the job on marking table and support it with angle plate.
- Mark centre line datum 30 mm with reference to side 'WX' Fig 1.
- Set the size 30 + 5 = 35 mm in marking block and scribe a line right side to 19 mm length as shown in job drawing with reference to side 'WX' Fig 1.
- Similarly, set the size 30 - 10 = 20 mm and scribe a line in right side to 23 mm length as shown in job drawing with reference to side 'WX' Fig 1.

Fig 1



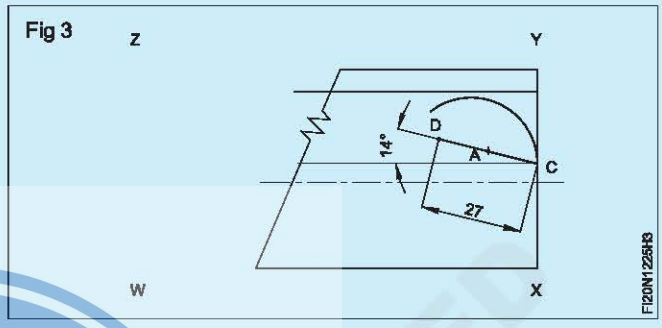
- Turn the job and support it with angle plate with reference to side 'XY' Fig 2.
- Set the size 19 mm and scribe a line with reference to side 'XY' and mark point 'A' at the intersecting line. Fig 2
- Similarly, scribe a line to size 23 mm with reference to side 'XY' and mark point 'B' at the intersecting lines. Fig 2

Fig 2



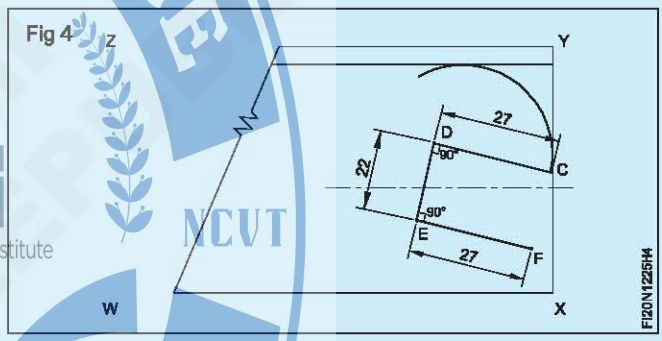
- Set the radius 19 mm and draw radius at point 'A'.
- Radius line intersect the object reference side 'XY' at point 'C.' Fig 3
- Mark 14° angle at point 'C' using bevel protractor and scribe a Angular line to the distance 27 mm and mark point 'D'. Fig 3

Fig 3



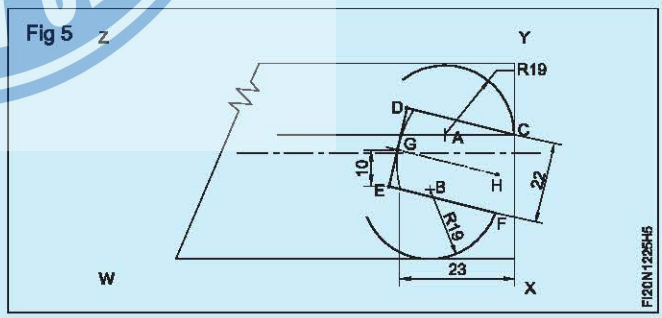
- Mark 90° Angular line with reference to line 'CD' to the distance 22 mm and mark point 'E' as shown in the job drawing. Fig 4
- Similarly, mark 90° Angular line with reference to line 'DE' to the distance 27 mm and mark point 'F'. Fig 4

Fig 4



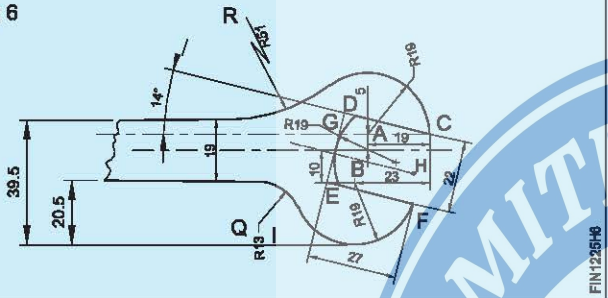
- Mark the centre line on line 'DE' and name it as 'G'. Fig 5
- From point 'G' draw a perpendicular line to the length of 19 mm downward and mark it as 'H'. Fig 5
- Draw radius of 19 mm from the point 'H' in such a way that the arc should meet point 'E' and 'D' through centre point 'G'. Fig 5

Fig 5



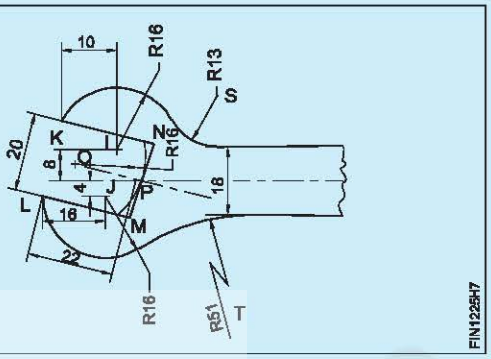
- Set the radius 19 mm and draw an arc at point 'B'.
- Radius line intersect the object reference side 'XY' at point 'F'. Fig 5
- Scribe a line 30 + 9.5 = 39.5 mm horizontal line with reference to side 'WX'. Fig 6
- Similarly, scribe a line 30 - 9.5 = 20.5 mm horizontal line with reference to side 'WX' to mark the width of spanner in right end. Fig 6
- Join the spanner object lines by drawing a radius of 13 mm from point 'Q' in downward side and radius 51 mm from point 'R' in upward side and complete the spanner as shown in job drawing. Fig 6

Fig 6



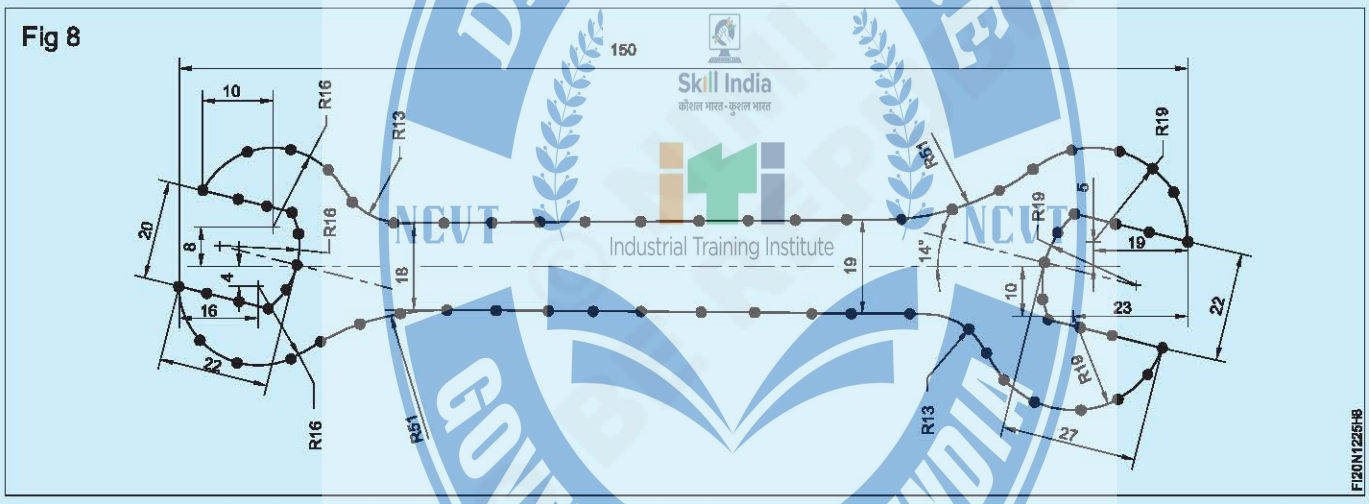
- Similarly, follow the above procedures to mark the left side end of the spanner from points I, J, K, L, M, N, O, P, S and T to complete the spanner profile marking. Fig 7

Fig 7



- Punch on the marked lines for prominent marks. Fig 8
- Check the size with steel rule.

Fig 8



Skill Sequence

Marking with a vernier height gauge

Objective: This shall help you to
- **mark with a vernier height gauge.**

What is the main function of the vernier height gauge?

One of the primary functions of the vernier height gauge is to scribe lines on a workpiece to known heights.

How to use a vernier height gauge?

The height gauge scriber must be checked against the reference surface to confirm whether the zero of the vernier coincides with the zero of the beam scale when the scriber contacts the reference surface. (Fig.1)

Check for free movements of the sliding unit.

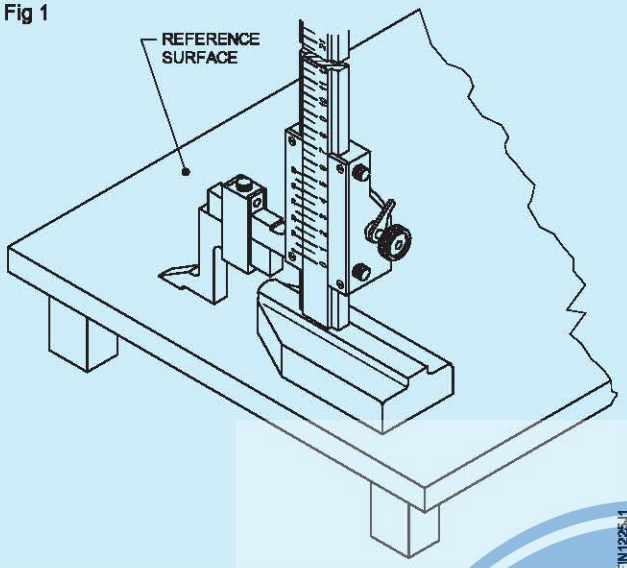
Make sure that the workpiece has no burr and has been properly cleaned.

Workpiece necessiaties clamping to an angle plate. If thin, the application of the marking media should be light thin and even.

Keep the vernier height gauge base firmly on the suface plate.

Hold the scriber at an angle to the workpiece and pull the corner of the scriber across the work. (Fig.2)

Fig 1



Do not allow the base to lift.

Do not apply too much pressure to peel off metal from the workpiece. This will avoid damage to the scriber point. Centre points can be located by scribing lines at right angles.

Scribe first all lines of dimensions in one direction. Secondly scribe all the lines in another direction. (Fig 2).

Place the work at 90° and scribe the lines to work. Job surfaces should be finished flat and smooth to avoid lifting during marking.

Precautions to get exact lines.

Ensure the scriber point is sharp always. Sharpen only the inclined surface of the scriber point. (Fig 3)

Frequent sharpening should be avoided. Ask the instructor to sharpen the scriber for you.

Fig 2

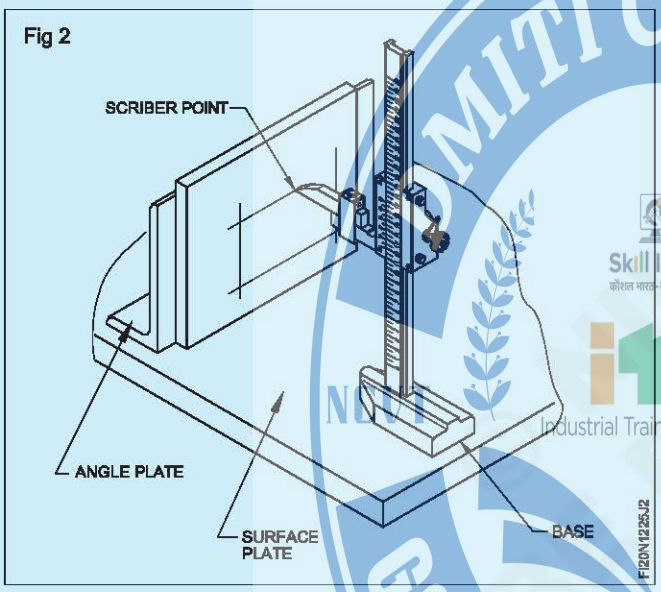
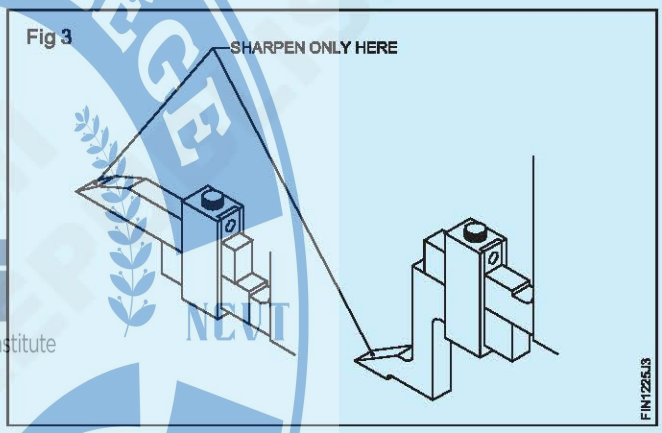


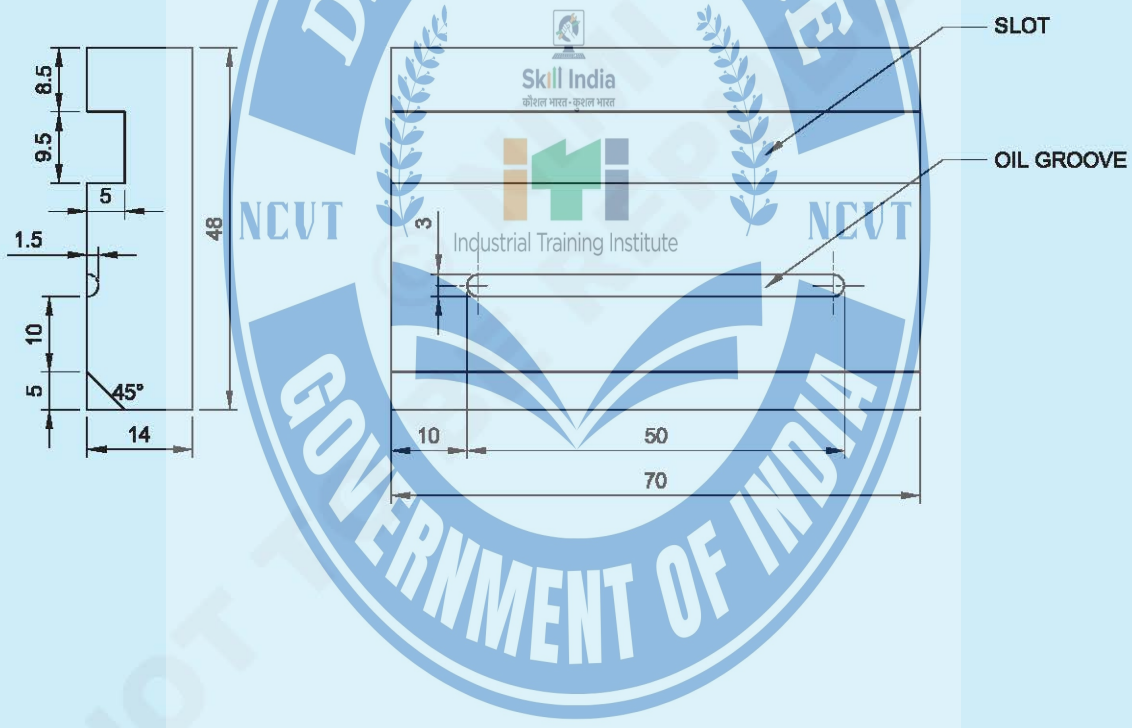
Fig 3



Chipping, chamfering, chip slots and oil grooves (straight)

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

- **mark slot, groove and chamfer as per drawing**
- **chip slot with cross cut chisel by maintaining the dimensions**
- **chip oil groove with round nose chisel and maintaining dimensions**
- **chip angular surface using flat chisel.**



1	50 ISF 15-72	-	Fe310	-	-	1.2.26
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

SCALE 1:1	CHIPPING SLOT AND OIL GROOVE	TOLERANCE : ±0.5mm	TIME
		CODE NO. FIN1226E1	

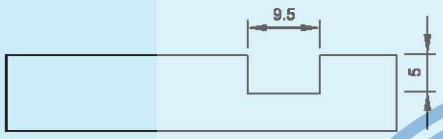
Job Sequence

- Check the raw material size with steel rule
- File and finish the raw metal to size 70x48x14 mm.
- Mark the Job as per drawing and punch the witness mark with dot punch 60°.

Chipping straight slot

- Hold the job in bench vice firmly.
- Chip the slot using cross cut chisel and maintain the dimension 9.5 mm width to the depth of 5 mm. Fig 1.

Fig 1

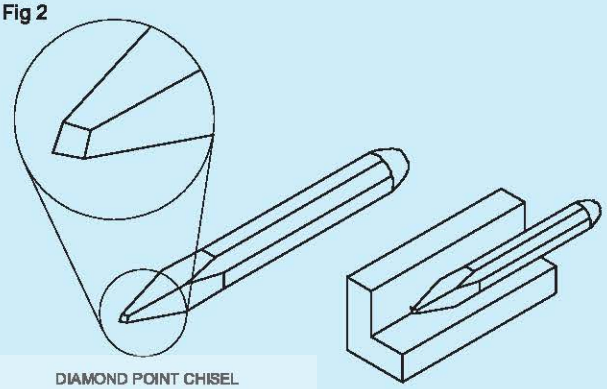


FIN1226H1

Keep a rag soaked in lubricating oil handy for intermittent cooling of the cutting edge of chisel.

- Chip the corners of the slot using diamond point chisel fig 2.

Fig 2



DIAMOND POINT CHISEL

FIN1226H2

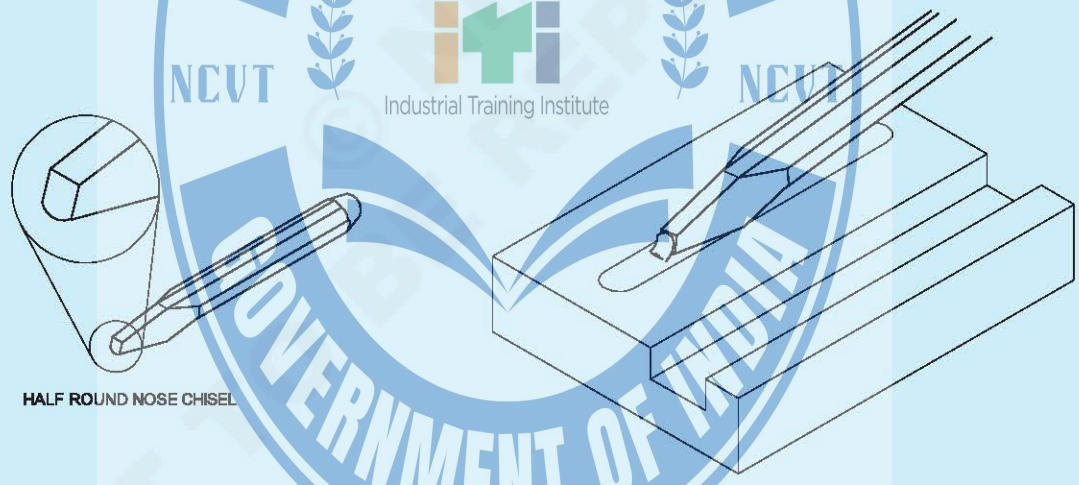
Chipping oil groove

- Similarly, chip oil groove width 3 mm x depth 1.5 mm with round nose chisel and Ball pein hammer fig 3.
- Check the width and depth of slot and oil groove with steel rule and depth gauge.

Chipping chamfer

- Chip the chamfered portion 5 x 45° using flat chisel and a Ball Pein hammer as shown in job drawing.
- De - burr all the faces and corners of the Job.

Fig 3

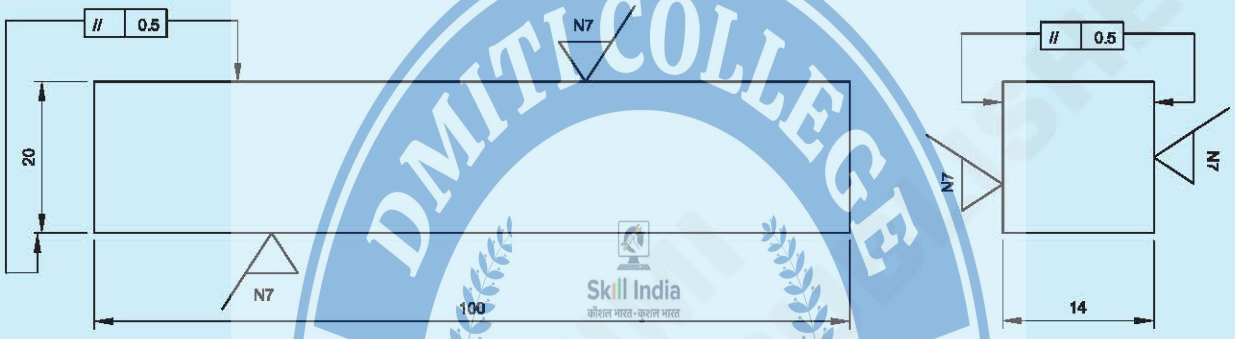


HALF ROUND NOSE CHISEL

FI20N1226H3

Filing flat, square and parallel to an accuracy of ±0.5mm

Objectives: At the end of this exercise you shall be able to
- **file flat, parallel surfaces within an accuracy of ±0.5mm**
- **check dimensions with steel rule**
- **check parallelism with an outside caliper**
- **check right angle with try square.**

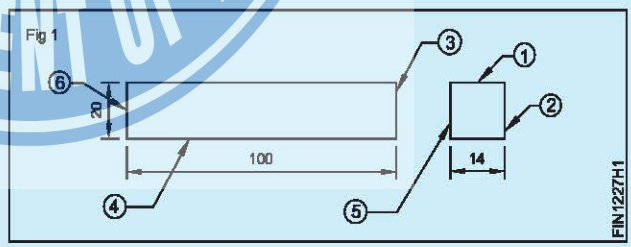


Job Sequence

- Remove burrs and check the size of the raw material.
- File diagonally (Fig.1) side 1 with a 350mm flat bastard file.
- Frequently check the flatness with a try square blade.
- File the same side with a flat second cut file and finish with a flat smooth file.
- File side 2, flat and at 90° to side 2 and side 1.
- File side 3, flat and at 90° to side 2 and side 1.
- Mark sizes as per drawing.
- File side 4 parallel to side 1. (use a caliper to check parallelism.
- File and finish side 5 parallel to side 2.
- File and finish side 6 parallel to side 3.
- Check the size with steel rule.

Remove the hard surface scale from the surface to be filed, using the edge of a flat bastard file.

- Clean, apply little oil and preserve it for evaluation.



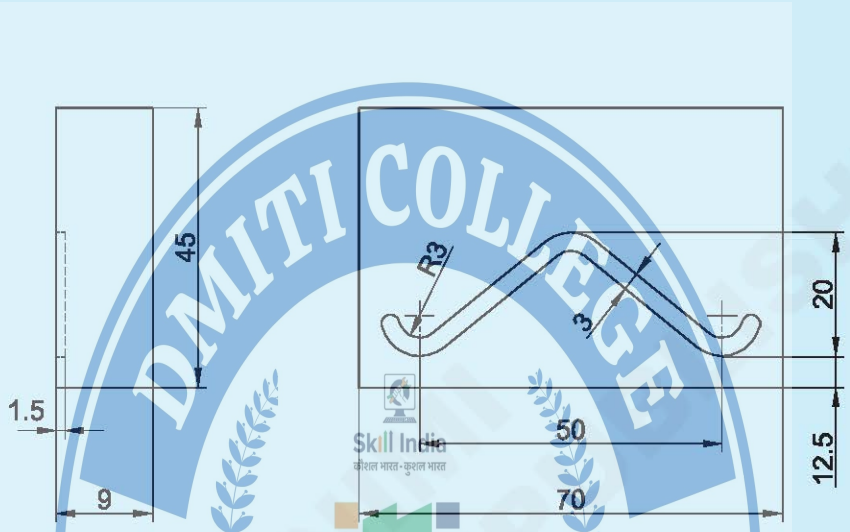
1	25 ISF 15-105	-	Fe310	-	-	1.2.27
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

SCALE 1:1	FILING FLAT AND SQUARE (PARALLEL BLOCK)	TOLERANCE : ±0.5mm	TIME
		CODE NO. FI20N1217E1	

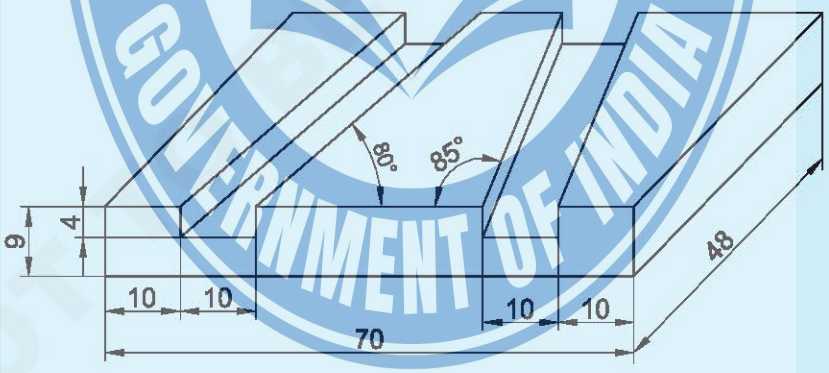
Chip curve along a line - mark out, keyways at various angles and cut key ways

Objectives: At the end of this exercise you shall be able to
- **chip curve on flat bearing surface with uniform crosssection using round nose chisel**
- **chip keyways at various angles with cross cut and diamond point chisel.**

TASK 1



TASK 2



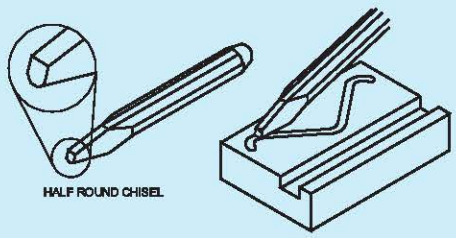
2	75 ISF 10 - 50		Fe 310	–		1.2.28
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX.NO
SCALE NTS	**CHIP RING OIL GROOVE AND KEYWAYS AT VARIOUS ANGLES**				TOLERANCE : ±0.5mm	TIME
					CODE NO. FI20N1228E1	

Job Sequence

TASK 1: **Chipping oil groove.**

- Check the raw metal with steel rule
- File and finish the raw metal to size 70 x 45 x 9mm
- Mark the oil groove curve as per drawing.
- Chip the oil groove with round nose chisel maintaining the dimension width 3 mm. (Fig .1)
- Check the size with steel rule.

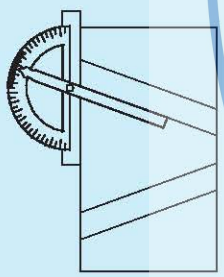
Fig 1



TASK 2: **Chipping keyways at various angles**

- Check the raw metal for its size
- File to size 70x48x9 mm
- Check the size with steel rule
- Check the squareness with try square
- Apply marking media and mark keyways using vernier height gauge and keyway angles using vernier bevel protractor. (Fig 2)

Fig 2



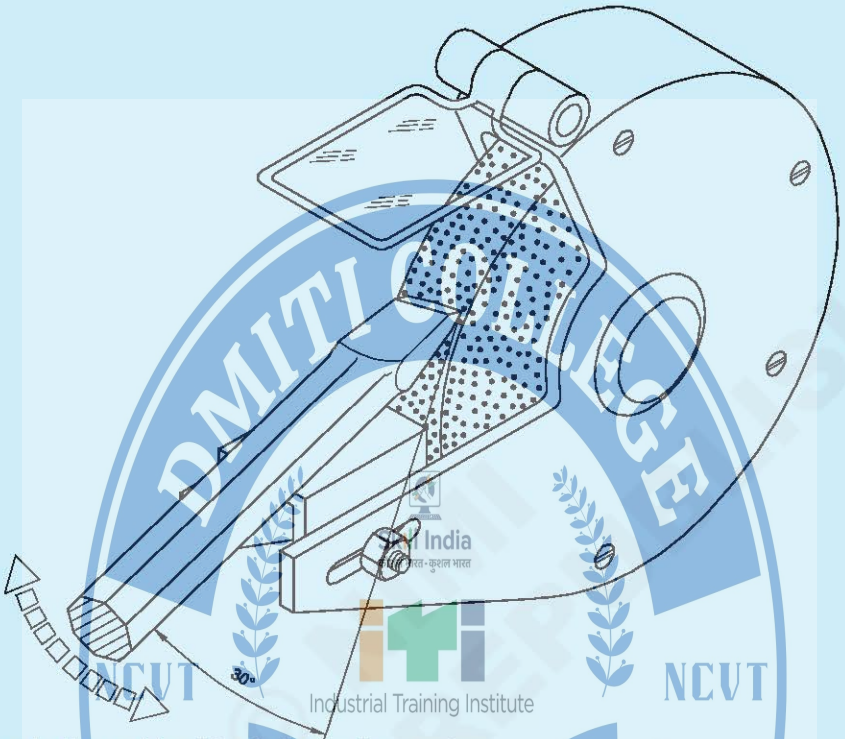
- Punch witness marks
- Hold the job in bench vice
- Chip keyways with cross cut chisel to the required depth
- Chip keyways sharp corners with a diamond point chisel
- Check the job size with steel rule
- Check the angles with bevel protractor
- Finish the job and deburr it.
- Apply thin coating of oil and preserve it for evaluation

Grind the chisels well

- **Look always at the cutting edge**
- **Cool the cutting edge from time to time**

Sharpening of chisel

Objectives: At the end of this exercise you shall be able to
- **re-sharpen the flat chisel using pedestal/bench grinder**
- **operate safely the pedestal or bench grinding machine.**



F120N1229E1

NOTE: Instructor shall provide chisels for resharpening

Skill Sequence

Grinding of flat chisel

Objective: This shall help you to
- **grind a flat chisel when they become blunt.**

Before grinding: Check the grinding wheel by,

– sliding the finger tip across the grinding wheel to detect glazing

– (In case of glazing, dress the wheel.) For dressing use silicon carbide sticks and seek the help of the instructor. (Fig 1)

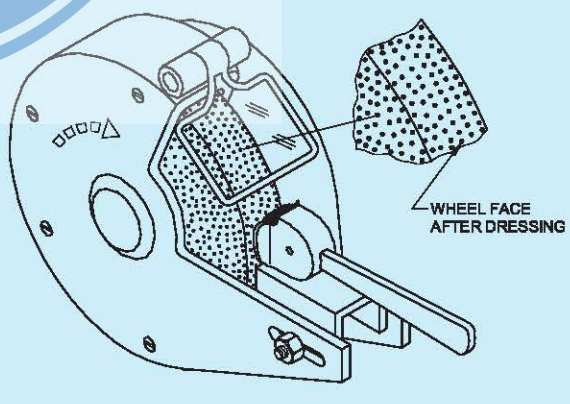
– visually check for cracks.

Switch on the grinder, stand by the side of the wheel for safety, and see whether the wheel runs 'true' and has no excessive vibration. In case of excessive vibration, truing is necessary. Ask the instructor for advice.

Ensure that there is enough coolant in the container.

Protect your eyes with goggles or lower the protecting shield near the tool rest. (Fig 2)

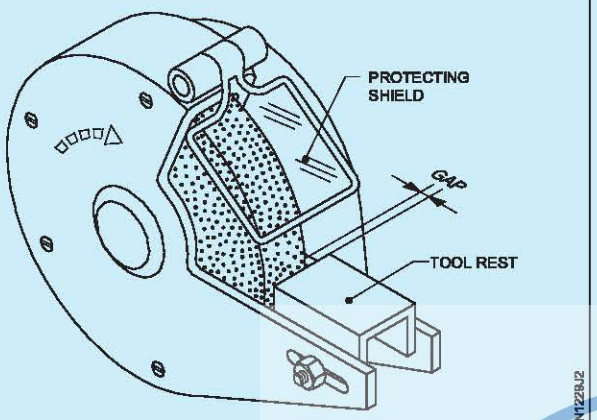
Fig 1



FIN1228J1

Adjust the tool rest 2 mm closer to the wheel, if necessary. (Fig 2)

Fig 2

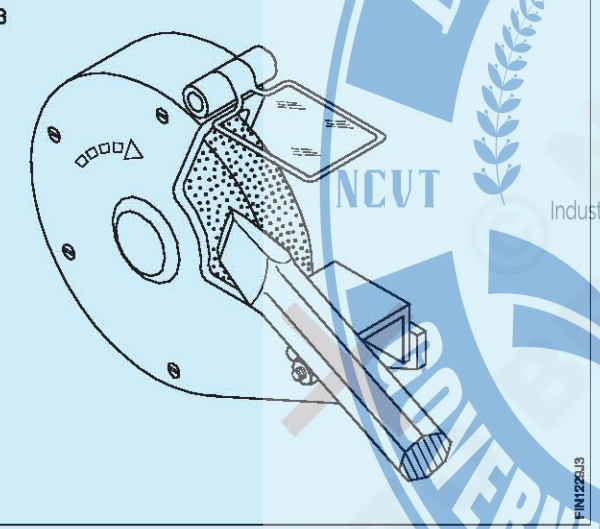


During grinding: Take a blunt chisel for re-grinding. Chisels will become blunt due to use. For efficient chipping, chisels are to be re-sharpened regularly.

Do not use cotton waste or other material for holding the chisel while grinding.

Use only the face of the wheel and not the sides (Fig 3)

Fig 3

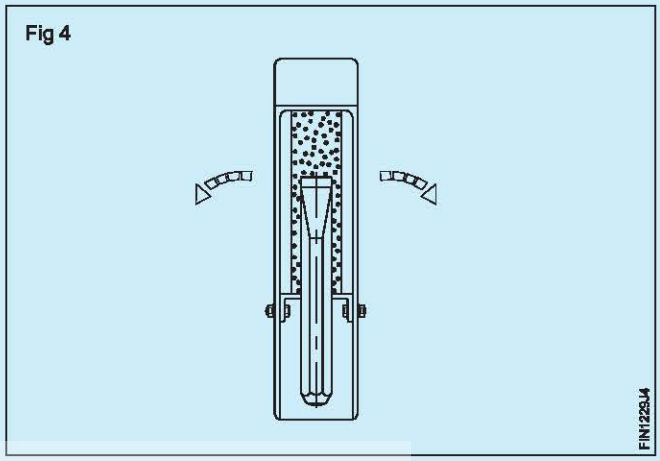


Switch on the grinder.

Hold the chisel edge parallel to the wheel surface; the body of the chisel must be at an angle of 30° in such a way as to get 60° wedge angle. (Fig 5)

Rest the body of the chisel on the tool rest (A) (Fig.5) and allow the point to touch the wheel. (Figs 4 & 5)

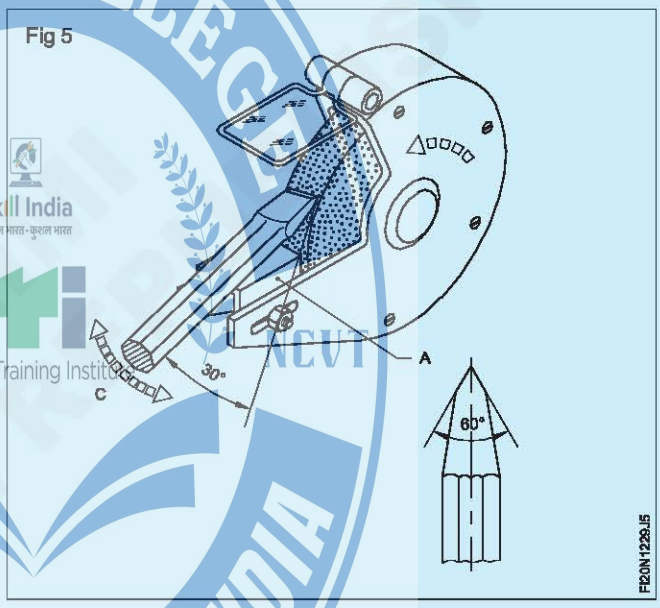
Fig 4



Keep the pressure as minimum as possible to prevent excessive heating of the cutting edge, (avoid blue colour i.e. annealing effect).

Rock the point on both sides in an arc to provide convexity at the cutting edge. (Fig 5) See the arrows 'C'.

Fig 5



Dip the chisel in the coolant as and when it is required so as to avoid overheating.

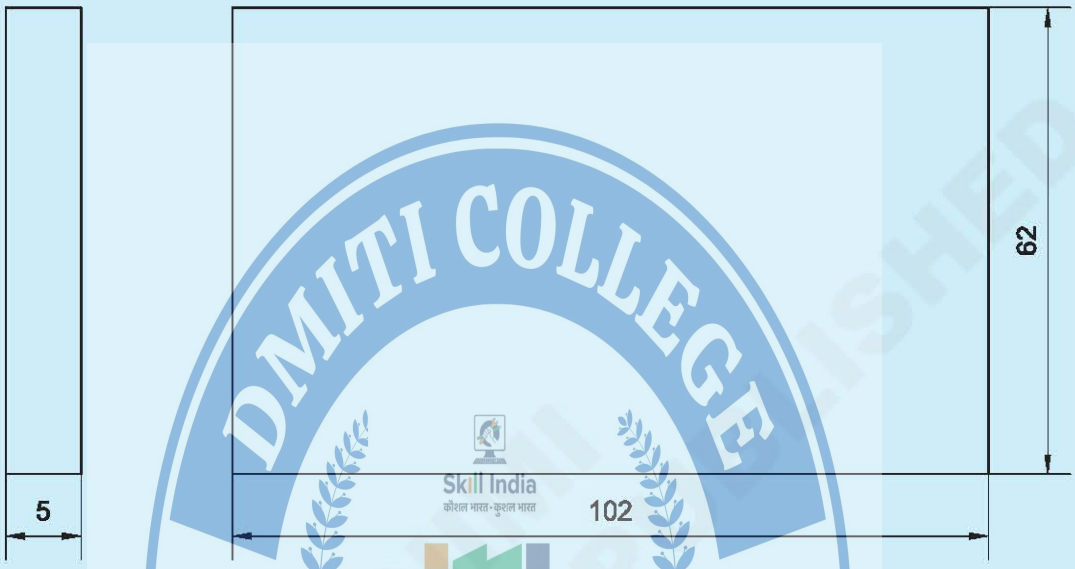
Repeat the grinding on the opposite side of the cutting edge.

Check the wedge angle with a bevel protractor.

File thin metal to an accuracy of 0.5mm

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

- **file surfaces flat and square within ±1mm using flat bastard and second cut file**
- **check flatness and squareness using a try-square**
- **check thickness using an outside caliper.**



Job Sequence

- Remove burrs, if any using a flat second cut file and ensure the metal surface is free from oil or grease.
- Check the raw material for its size with a steel rule 300mm.
- Hold the workpiece in a 125mm jaw bench vice on its ends.
- Ensure the work is held horizontally.

Do not over-tighten the workpiece.

- File the top surface with a flat bastard file 250mm.
- Check flatness with a try-square.
- File to medium finish using a flat second cut file 250mm.
- Hold the workpiece to file the longer side.
- File and check flatness and squareness with previously finished surfaces using a try-square 150mm.
- File the adjacent shorter side flat and square to both the finished surface.
- Remove burrs and mark sizes as per job drawing, using a steel rule, try-square and scriber.
- File the other two sides flat and square, maintaining the dimensions.

Use soft jaws to protect the finish filed surface while holding the workpiece in the benchvice.

- File the other flat surface parallel and check the thickness using an outside caliper.

1	65 ISF 6 x 105		Fe310-O	–	–	1.2.30
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

SCALE 1:1	FILING THIN METAL	TOLERANCE: ±0.5mm	TIME
		CODE NO. FI20N1230E1	

Cleaning files

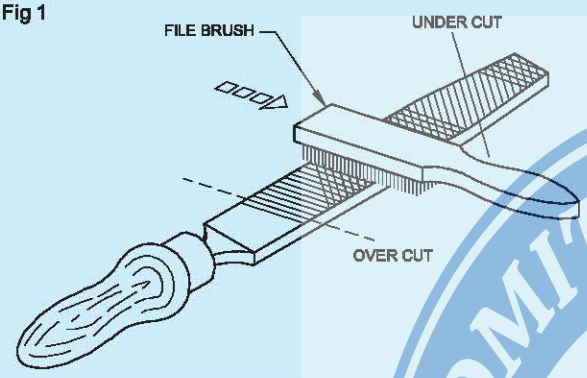
Objective: This shall help you to
- **clean files.**

Introduction

During filing, the metal chips (Filings) will clog between the teeth of the files. This is known as 'pinning' of files. Files which are pinned will produce scratches on the surface being filed, and also will not bite well.

Use a file brush to remove pinning of the files. (Fig.1)

Fig 1



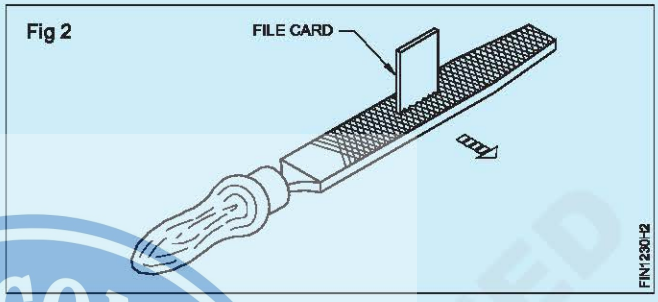
When filing a workpiece to a smooth finish more 'pinning' will take place because the pitch and depth of the teeth are less.

Application of chalk on the face of the file will help reduce the penetration of the teeth and 'pinning'.

Pull the file brush along the direction of the overcut.

Take out the filings which do not come out easily by the file card by a brass or copper strip. (Fig.2)

Fig 2



Use only soft metal strips (brass or copper) for cleaning new files.

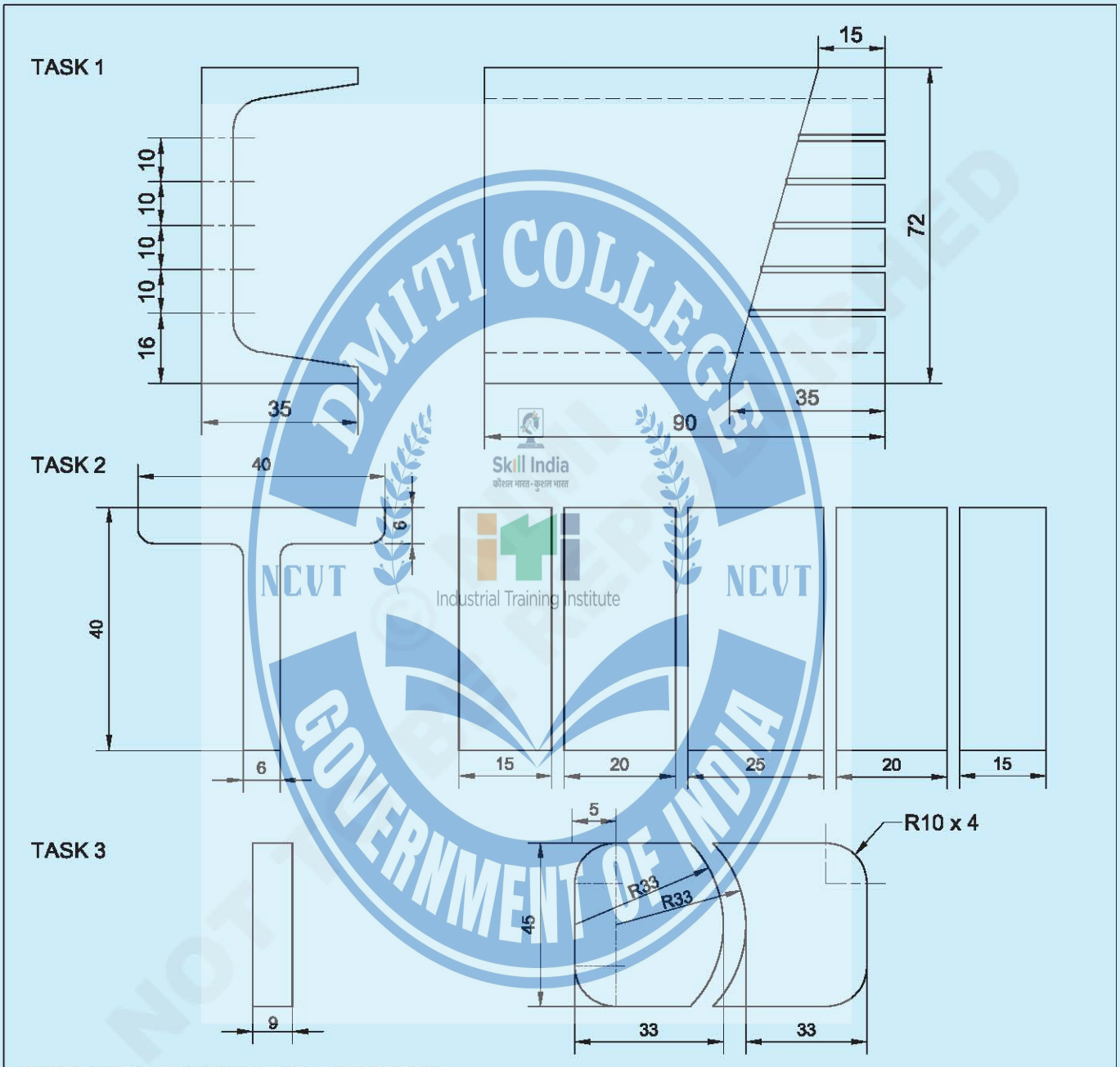
The sharp cutting edges of the files will wear out quickly if a steel file card is used.

Clean the file frequently in order to remove the filings embedded in chalk powder.

Saw along a straight line, curved line, on different section of metals

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

- **saw in straight line on different sections of metals, channel and 'T' section**
- **saw in curved line on flat section of metal.**



NOTE : USE EX.NO : 1.2.16 FOR TASK 1

NO.OFF	STOCK SIZE	SEMI PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX NO :
1	50 ISF 10 - 75		Fe 310		TASK 3	1.2.31
1	ISNT 40 - 100		Fe 310		TASK 2	1.2.31
1	-	1.2.16 ←	Fe 310		TASK 1	1.2.31

SCALE : 1.2	SAWING ON VARIOUS SECTION OF METAL IN STARAIGHT LINE AND CURVED LINE	TOLERANCE ±0.5mm	TAME :
		CODE NO. FI20N1231E1	

Job Sequence

TASK 1: **Hacksawing on channel**

- Check the material to size.
- File and finish to size 90x72x35mm
- Apply marking media on the surface.
- Mark the required number of saw cut with a jenny caliper and steel rule.
- Punch the marked line.
- Hold the workpiece firmly on the bench vice.
- Select the correct pitch blade (1.0mm pitch)
- Fix the blade in the hacksaw frame pointing teeth in the forward direction.
- Tighten the blade with required tension with the wing nut.
- File a notch at the point of cutting, to avoid slippage of the blade.
- Start cutting with a slight downward pressure.
- Release the pressure in the return stroke.
- Use full length of the blade.

Caution: In case the blade brakes in half the way, do not use a new blade. Finish the cut with a used blade.

Don't tilt the frame while sawing.

TASK 2: **Hacksawing on 'T' section**

- Mark and hold the job in a bench vice.
- Punch witness marks
- File 'V' notch at the point of cutting to avoid slippage of blade
- Fix 1.4mm pitch hacksaw blade in hacksaw frame
- Start cutting with a slight downward pressure on 'T' section using hacksaw.
- Cut along the marked lines and separate the cutting portions.
- Cutting movement should be steady while sawing on 'T' section.
- While finishing a cut, slow down the pressure to avoid breakage of the blade and injury to you and others.
- Check the sizes of the cutting portions of the 'T' section with steel rule.

TASK 3: **Hacksawing on flat section**

- Check all the raw material size.
- File and finish raw material to size of 71x45x9mm.
- Apply lamp chalk and mark the profile as per drawing
- Punch witness marks on marked lines.
- Hold the job in bench vice
- File 'V' notch at the point of cutting to avoid slippage of the blade using triangular file.
- Fix 1.4 mm pitch flexible hacksaw blade in hacksaw frame.
- Start cutting with a slight downward pressure on metal using hack saw.
- Cut along the curved lines and separate the cutting portions
- Check the sizes of the cutting portions with steel rule.

Skill Sequence

Filing radius (external)

Objective: This shall help you to
- **file external radius.**

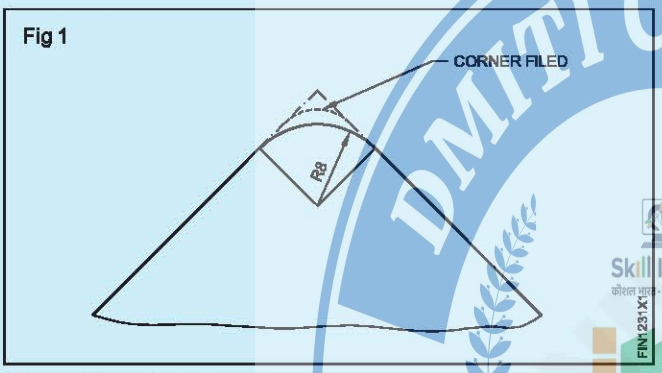
Filing radius is entirely a different technique, and needs considerable skill for filing accurately with a good finish.

In this type of filing, the file has to be held perfectly horizontal widthwise, and at the same time a rocking motion given lengthwise. The surface filed should not have any flat surface and should have a uniform curve. Radius filing of external surfaces is carried out in different steps.

Rough filing of corners

The corners are filed and brought closely to line using a flat bastard file. (Fig.1)

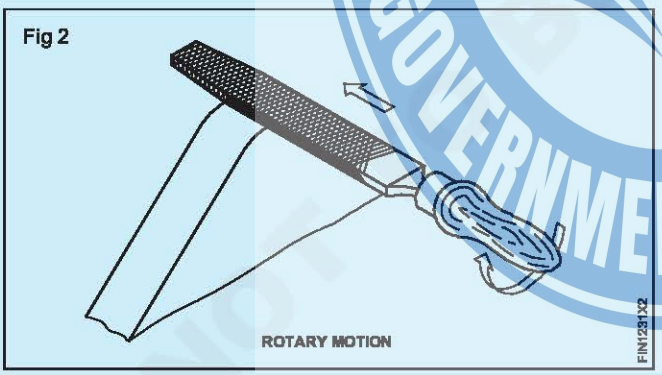
Fig 1



Rounding of corners

The flat surfaces are rounded and brought near about to finishing size, using a flat second cut file. In this, the file is moved forward across the curve with a turning motion. (Fig.2)

Fig 2

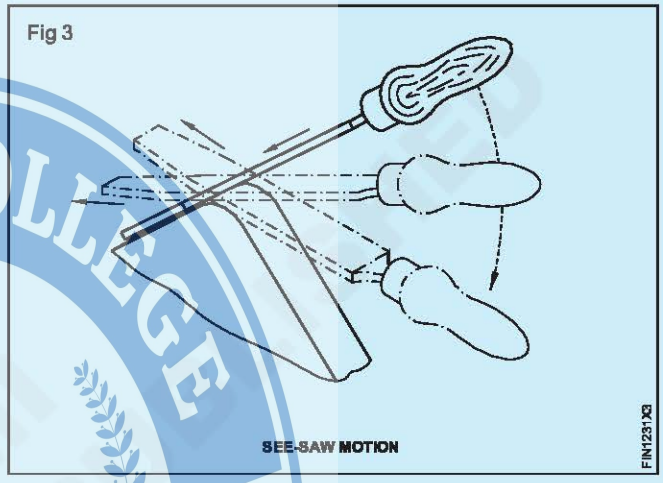


Check periodically with a radius gauge

Final finishing of radius

For finishing steps, a smooth file is used. The file is given a see-saw motion along the curved line until the required radius is formed. (Fig.3)

Fig 3



While filing make sure:

- to check the radius frequently with a radius gauge.
- to use the broad surface to the job as datum for checking the size.
- not to give excessive pressure while filing radius as the file is likely to slip.

Checking the radius

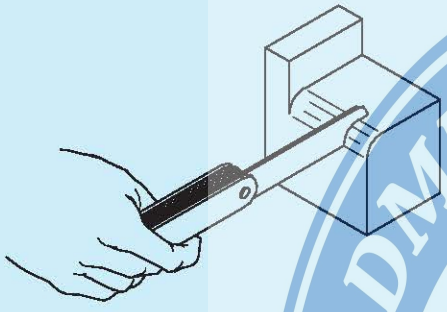
Objective: This shall help you to
- **check the radius with a radius gauge.**

Scan the QR Code to view the video for this exercise

Before checking with a radius gauge ensure the radius gauge is perfectly clean. Remove burrs, if any, from the workpiece. Check and make sure the profile of the gauge is not damaged.

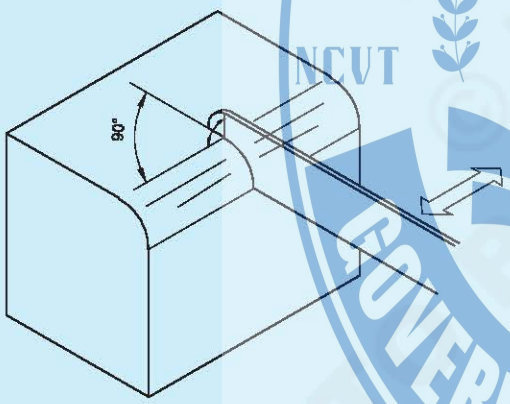
The radius gauge should be held perpendicular to the radius to be checked. (Fig.1 and 2)

Fig 1



FIN1231Y1

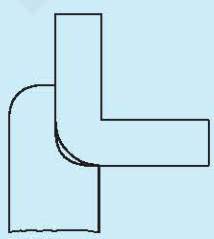
Fig 2



FIN1231Y2

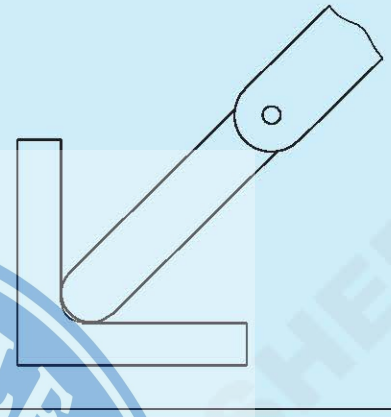
Observe the contact surfaces for any light passing through, check against the background of light. The gauge should be moved along the filed length of the radius for checking. (Figs 3 and 4)

Fig 3



FIN1231Y3

Fig 4



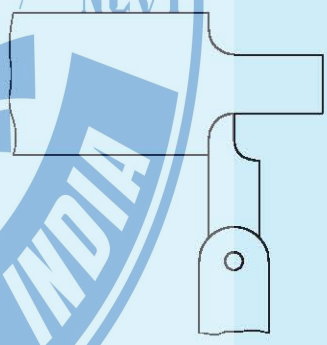
FIN1231Y4

File and adjust the radius gradually according to the radius gauge.

The right radius is the one that matches correctly with the gauge. (Fig.5)

After using the radius gauges, wipe them, clean with a clean cloth and apply a light film of oil before storing.

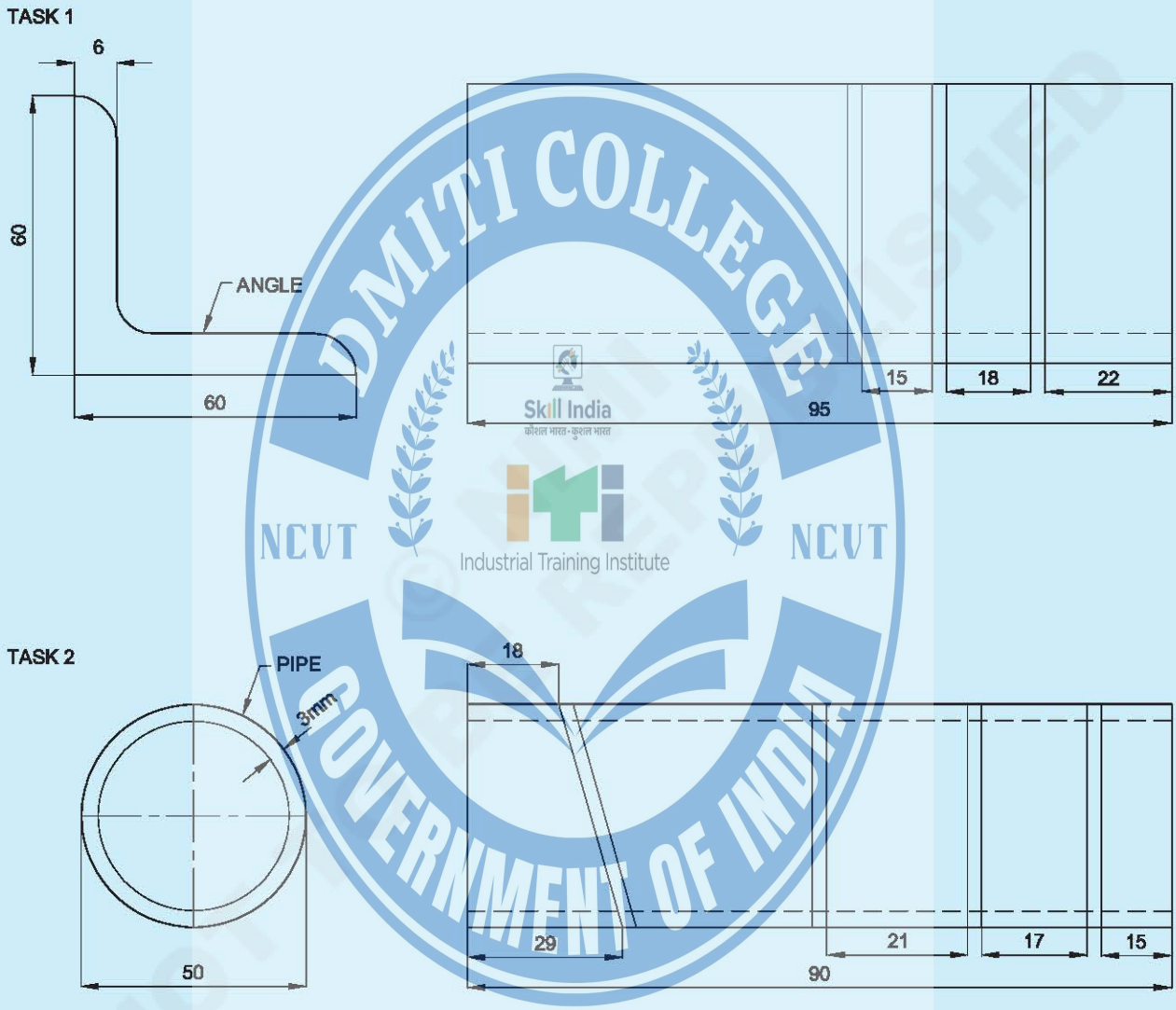
Fig 5



FIN1231Y5

Straight saw on thick section of M.S.angle and pipe

Objectives: At the end of this exercise you shall be able to
- **mark and cut pieces on equal angle section.**
- **mark and cut pieces on pipe.**



2	PIPE Ø 50 x 3 x 100mm	-	GI PIPE	-	TASK -2	1.2.32
1	ISA 60x 6 x100mm	-	Fe310	-	TASK -1	1.2.32
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE 1:1	STRAIGHT SAW ON M.S ANGLE AND PIPES				TOLERANCE : ±0.5mm	TIME
					CODE NO. FI20N1232E1	

Job Sequence

TASK 1 : **Hacksawing on steel angle**

- Check the raw material using steel rule
- File the steel angle to size 100 mm length.
- Mark and punch the sawing the lines.
- Hold the job in bench vice as shown in Fig 1
- Fix 1.8 mm coarse pitch blade in hacksaw frame.
- Cut along the sawing lines with hacksaw.
- Check the size of the angles with steel rule.
- De-burr and preserve it for evaluation.

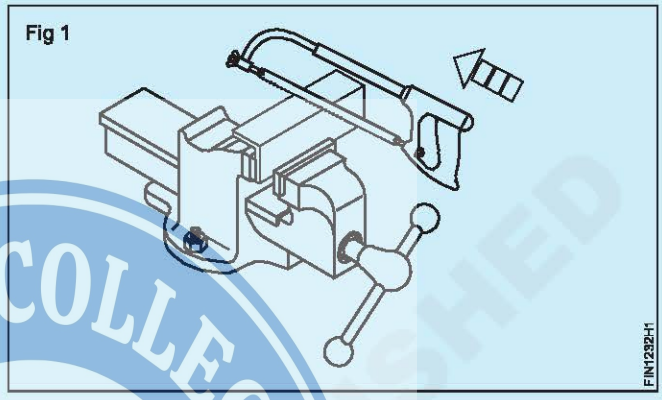
Scan the QR Code to view the video for this exercise

Caution

Select correct pitch blade according to the shape and material to be cut.

While sawing, two or more teeth of blade should be in contact on metal section.

Fig 1



TASK 2 : **Hacksawing on pipe**

- Check the pipe size using steel rule.
- File the pipe ends to size 90 mm length.
- Mark and punch the sawing lines.
- Hold the job in bench vice as shown in Fig 1.
- Fix 1.0 mm pitch blade in hacksaw frame.
- Cut along the sawing lines using hacksaw.
- Turn and change the position of the pipe while hacksawing
- Check the size of pipe using steel rule.
- De-burr and preserve it for evaluation.

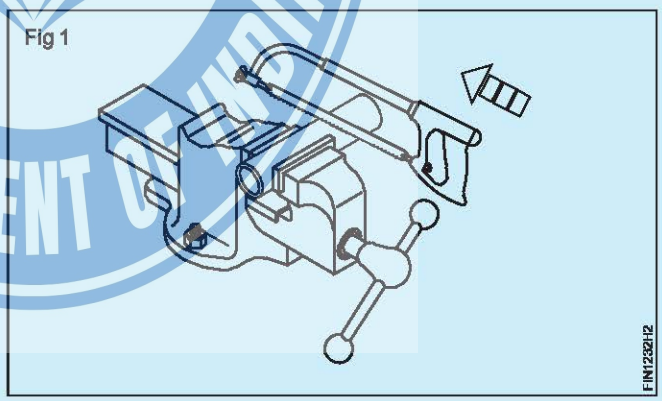
Caution

Avoid over tightening the pipe in the vice which causes deformation.

Do not cut too fast.

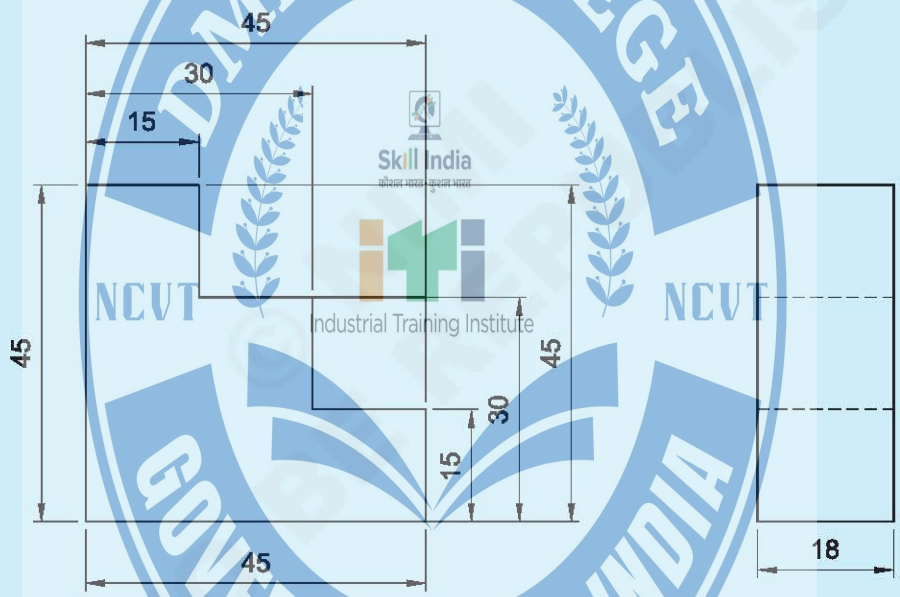
Cut very slow and reduce pressure while cutting through.

Fig 1



File steps and finish with smooth file to accuracy of ±0.25mm

Objectives : At the end of this exercise you shall be able to
- **mark steps with vernier height gauge**
- **cut metal by hacksawing**
- **file and finish steps to an accuracy of ± 0.25mm.**

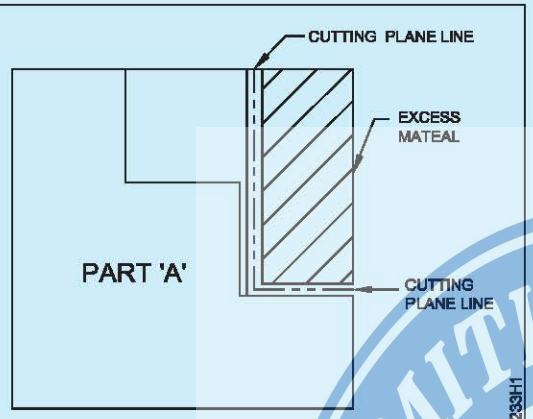


2	50 ISF 20 x 50	-	Fe310	-	1	1.2.33
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE 1:1	**STEP FILING AND MATCHING**				TOLERANCE : ±0.25mm	TIME
					CODE NO. FIN1233E1	

Job Sequence

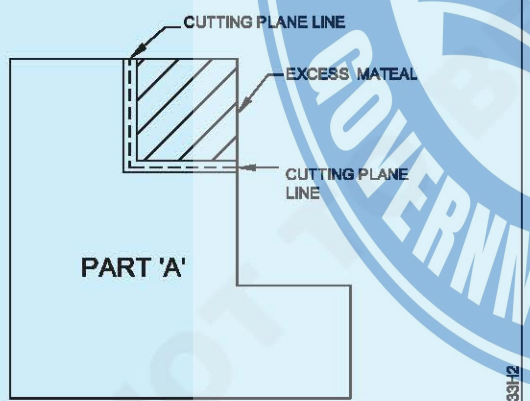
- Check the raw metal with steel rule.
- File and finish the raw metal to size 45x45x18 mm.
- Mark the steps with vernier height gauge as per drawing and punch witness marks.
- Cut and separate the excess material by sawing fig 1

Fig 1



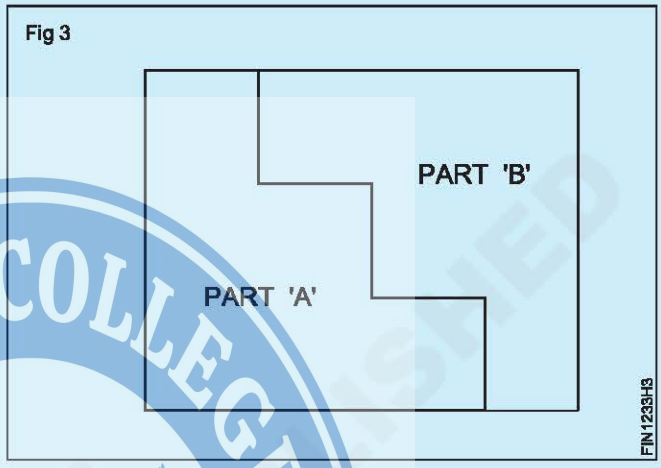
- File step with safe edge file using bastard, second cut and smooth grades.
- Measure the job sizes with outside micrometer maintaining the accuracy of ± 0.25 mm.
- Check the squareness with try square
- Similarly, cut and separate the excess material by sawing Fig 2

Fig 2



- File step with safe edge file using different grades
- Measure the job size with outside micrometer
- Check the squareness with try square
- Finish and de-burr the job
- Similarly, file and finish the another part 'B' and match with one another. Fig 3

Fig 3

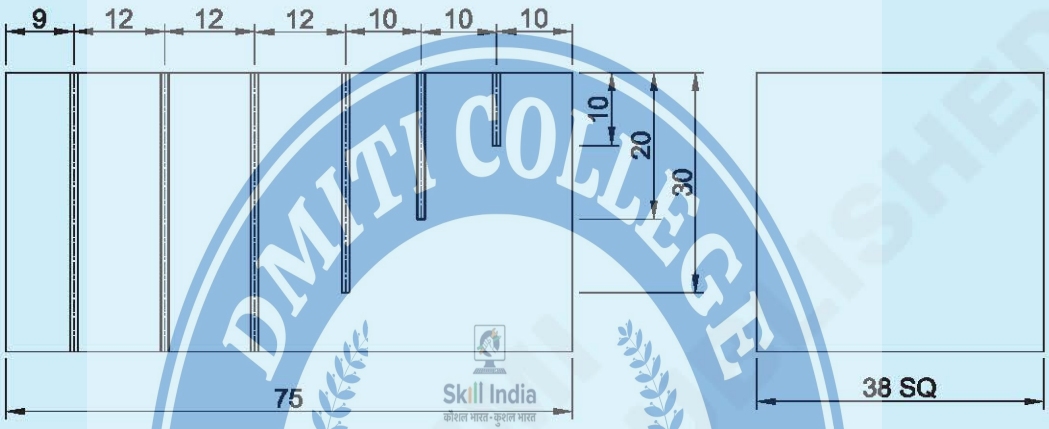


- Apply thin coat of oil and preserve it for evaluation.

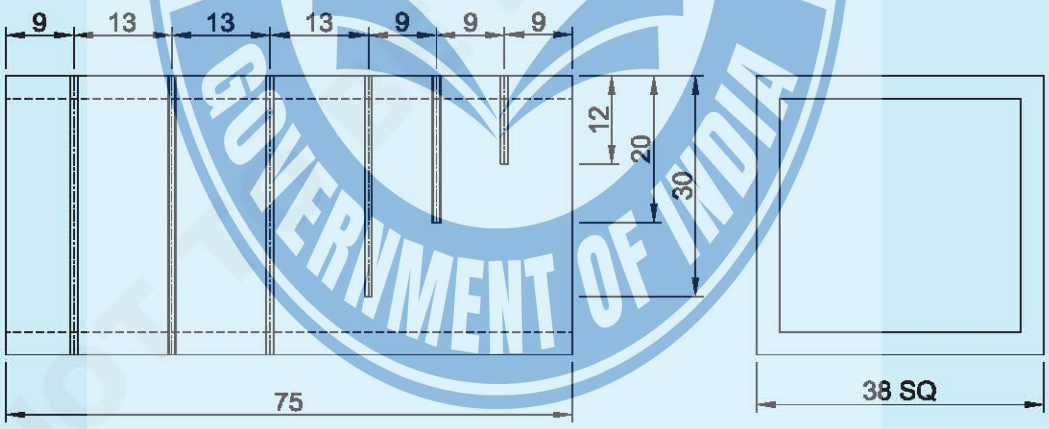
File and saw on M.S. square and pipe

Objectives: At the end of this exercise you shall be able to
- **file, mark and saw in M.S.square as per drawing**
- **file, mark and saw in M.S.square hollow pipe as per dimensions.**

TASK 1



TASK 2



NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
1	▫ 40-78 HOLLOW PIPE	-	Fe310	-	TASK 2	1.2.34
1	■ 40-78	-	Fe310	-	TASK 1	1.2.34

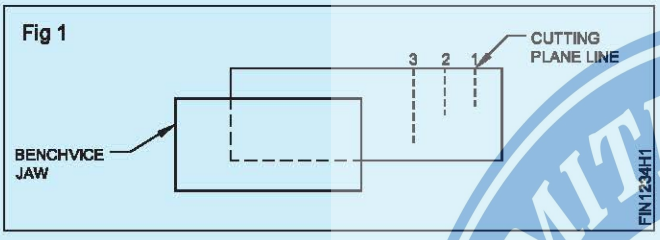
SCALE 1:1	**FILE AND SAW ON M.S SQUARE AND PIPE**	TOLERANCE : ±0.5mm / TIME
		CODE NO. FI20N1234E1

Job Sequence

Task 1 : **Hacksawing on square section.**

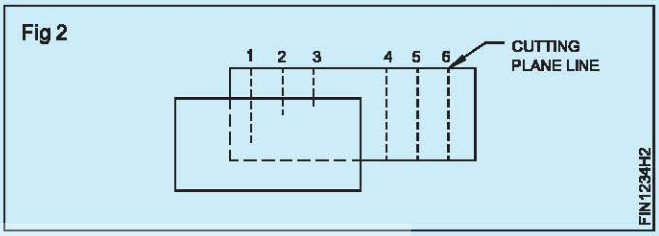
- Check the raw material size using steel rule.
- File and finish all sides of M.S. Square to 75x38x38mm and maintain parallelism and perpendicularity to each other.
- Mark and punch as per the drawing.
- Hold the job in bench vice, such that 35mm projecting outside jaw of bench vice
- Cut along the marked line1,2 and 3 to the required depth Fig 1

Fig 1



- Hold the job as shown in Fig.2 to saw the other 3 pieces.
- Saw along the marked line and maintain perpendicularity and parallelism of the Job.

Fig 2



The cut piece should be parallel and should have uniform sawing mark

Frequently wet the blade in soluble oil

- Deburr the job and preserve it for evaluation.

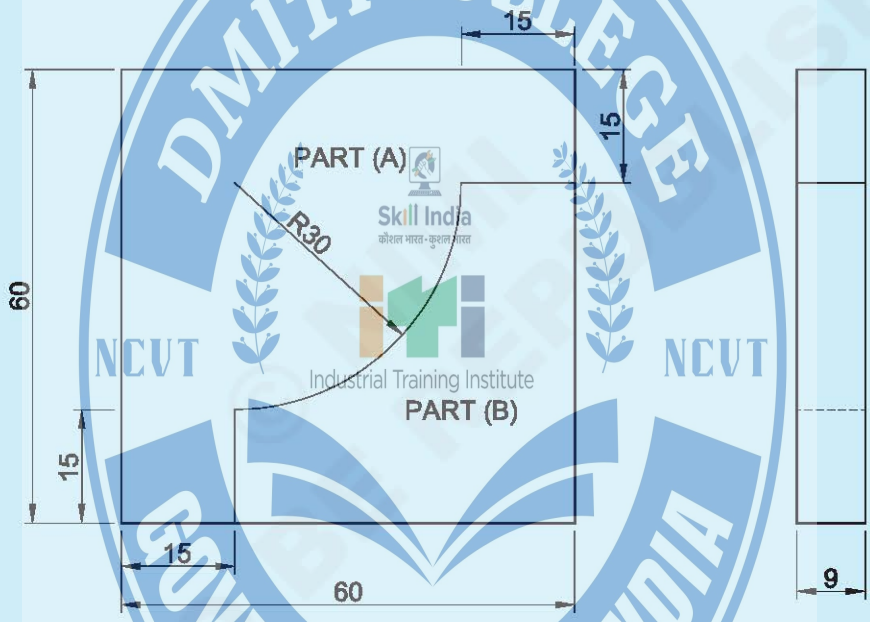
Use coarse pitch blade for solid material and fine pitch blade for Hollow section.

Task 2 : **Hacksawing on square pipe.**

- Check the raw metal size using steel rule.
- File and finish of M.S round pipe to 75 x 38 x 38 mm and maintain parallelism and perpendicularity to each other.
- Mark and punch as per drawing.
- Hold the job in bench vice and cut along the marked lines to the required depths as shown in job drawing.
- Check sawn metal with steel rule.
- De-burr the job and preserve it for evaluation.

File radius along a marked line (convex and concave) and match

Objectives : At the end of this exercise you shall be able to
- **mark convex and concave radius**
- **file, convex and concave radius as per dimension**
- **match convex and concave radius as per drawing.**



1	50 ISF 10-50	-	Fe310	-	PART 'B'	1.2.35
1	65 ISF 10-65	-	Fe310	-	PART 'A'	1.2.35
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

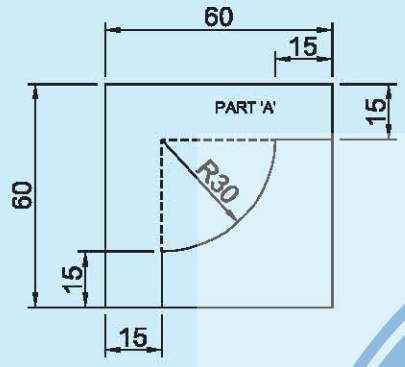
SCALE 1:1	**FILE CONVEX & CONCAVE RADIUS AND MATCH**	TOLERANCE : ±0.1 mm	TIME
		CODE NO. FI20N1235E1	

Job Sequence

Part 'A'

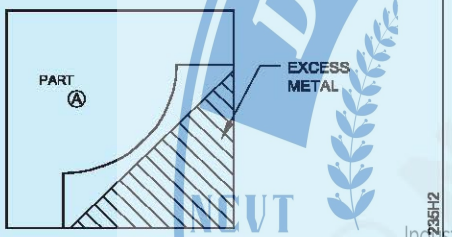
- Check the raw metal size using steel rule.
- File and finish to size 60x60x9 mm maintaining parallelism and perpendicularity.
- Mark and punch in part 'A' as shown in fig 1.

Fig 1



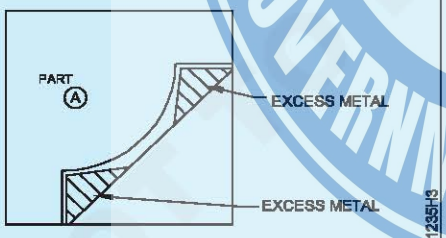
- Mark line as shown in fig 2 leaving the metal 1 mm away from the object line.

Fig 2



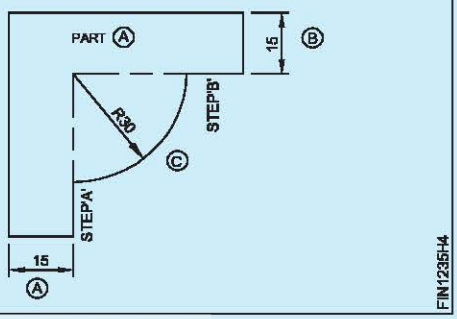
- Cut and remove, excess metal by sawing.
- Mark lines as shown in fig 3 and cut along the marked lines and remove excess metal.

Fig 3



- File step 'A' to 15 mm with safe edge file and half round file using different grades and check the size with vernier caliper fig 4.
- Similarly, file step 'B' and check the size fig 4.
- File convex radius 'C'to 30 mm with half round file using different grades and check the radius profile with template

Fig 4



Instructor may arrange a template to check the radius.

Caution:

The flat surfaces are rounded and brought near about to finishing size, using a half round second cut file. In this, the file is moved across the curve with a rotary motion.

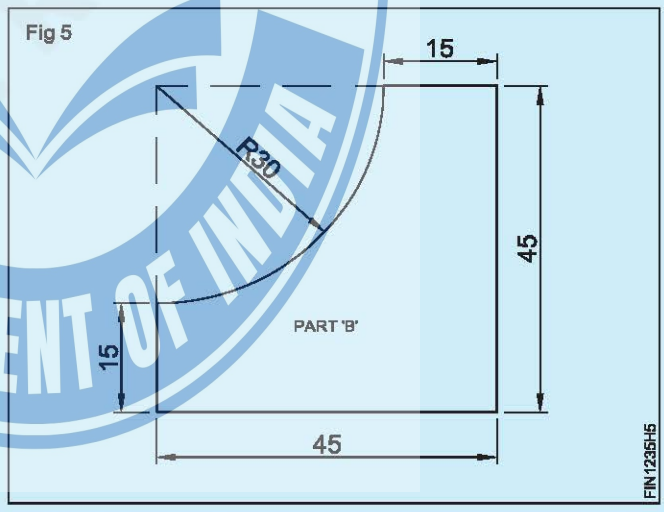
Check the radius frequently with a template.

Do not give excessive pressure while filing radius, as the file may likely to slip.

Part 'B'

- File and finish to size 45x45x9 mm maintaining parallelism and perpendicularity.
- Mark and punch the part 'B' as shown in fig 5.

Fig 5



- Mark line as shown in fig 6 and cut along the marked line and remove excess metal
- Mark line as shown in fig 7 and cut along the marked lines and remove excess metal.
- File concave radius with half round file using different grades and check the size with vernier caliper.
- Check the concave radius with template.
- Finish file and De - burr in part 'A' and 'B'

Fig 6

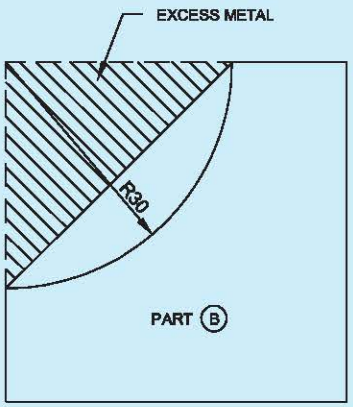
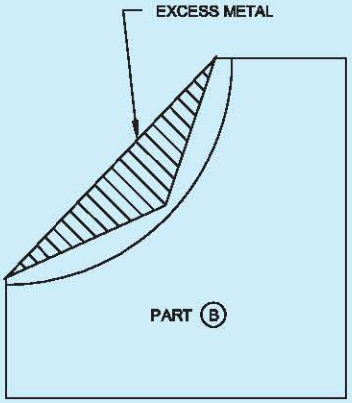


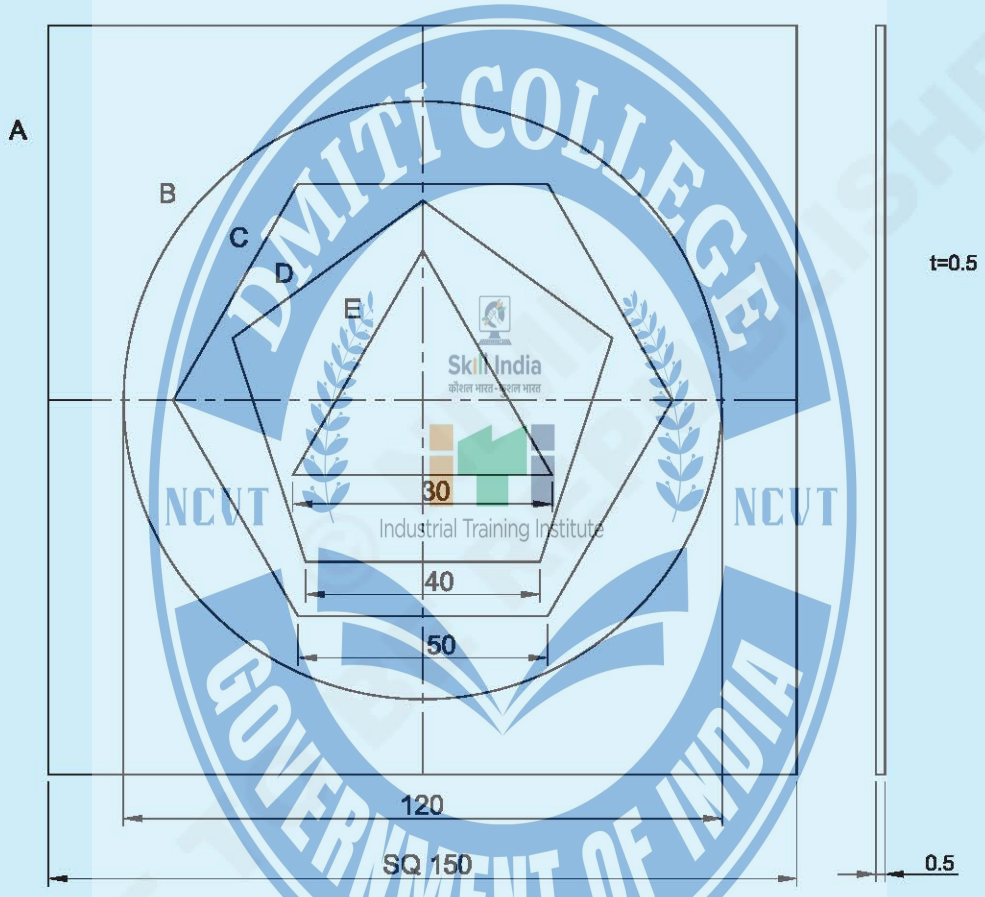
Fig7



- Match part 'A' and 'B' as shown in Job drawing.
- Apply a little oil and preserve it for evaluation.

Chip sheet metal (shearing)

Objectives: At the end of this exercise you shall be able to
- **draw different types of geometrical shapes**
- **chip the different geometrical shapes by flat chisel.**



A . SQUARE
B . CIRCLE
C . HEXAGON
D . PENTAGON
E . TRIANGLE

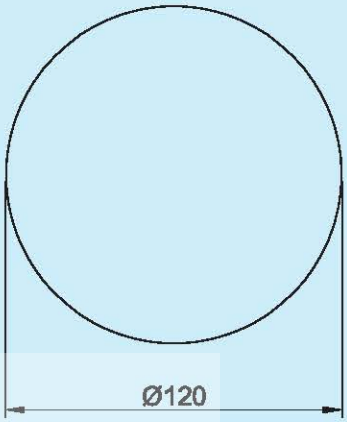
1	ISSH 160 x 160 x 0.5	-	G.I STEEL	-	-	1.2.36
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

SCALE 1:1	CHIPPING DIFFERENT GEOMETRICAL SHAPES	TOLERANCE : ± 1mm	TIME
		CODE NO. FI20N1230E1	

Fig 1

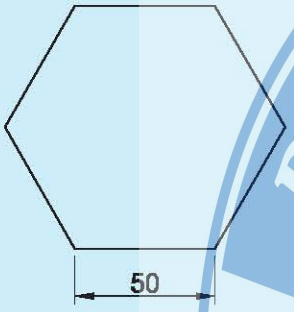
SQUARE

Fig 2



CIRCLE

Fig 3

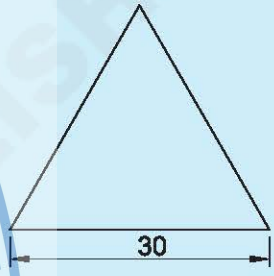


HEXAGON

Fig 4

PENTAGON

Fig 5



TRIANGLE

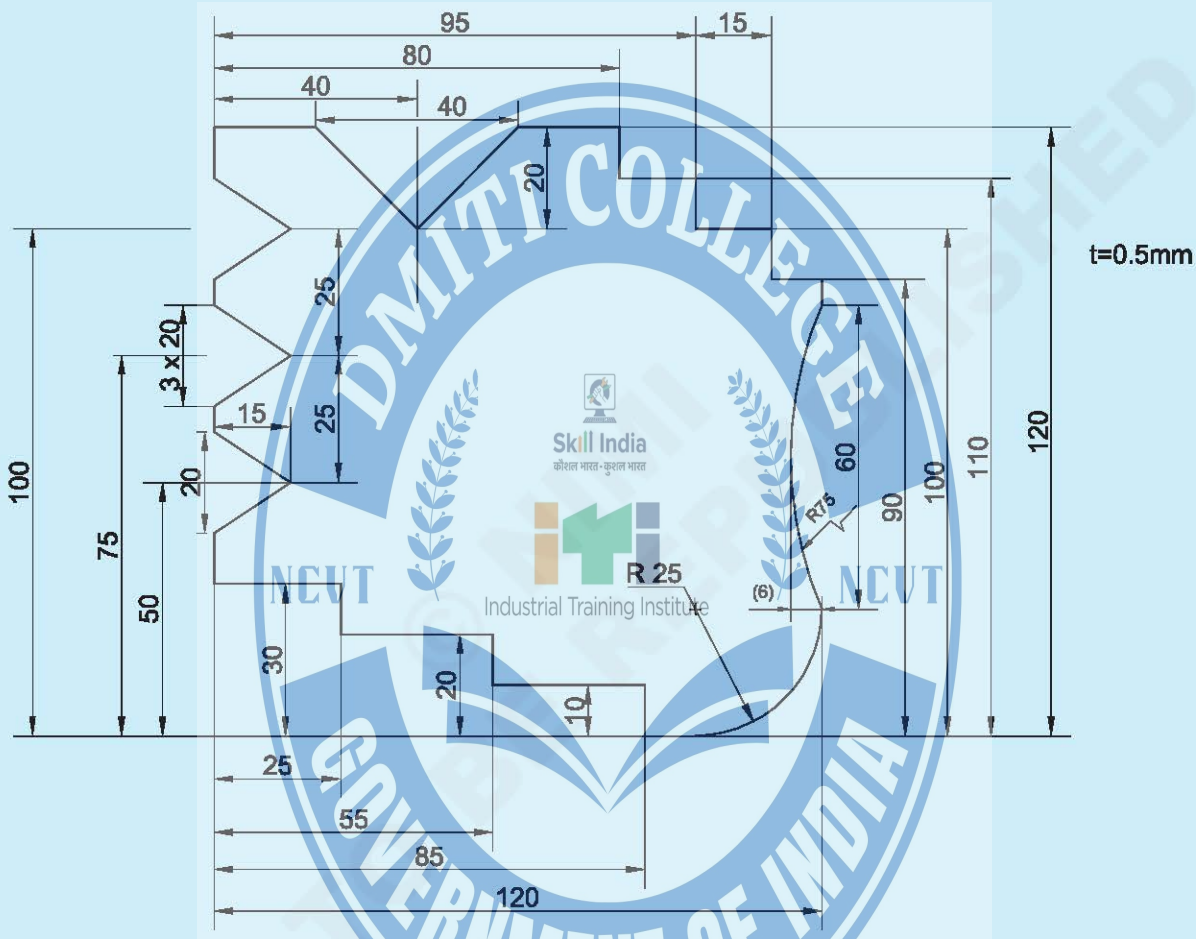
Job Sequence

- Planish the sheet metal on a tin man's Anvil using mallet.
- Check the sizes of the sheet 150x150x0.5 mm using a steel rule.
- Mark the centre line as shown in job drawing.
- Punch the centre point using a prick punch 30° and a ball pein hammer.
- Mark a square of 150mm side using a steel rule, straight edge, 'L' square and scriber.
- Draw a circle of ϕ120mm from the same centre point using steel rule and divider.
- Mark a hexagon of 50 mm side in the circle as shown in job drawing
- Mark a pentagon of 40 mm side within the hexagon as shown in job drawing.
- Mark an equilateral triangle of 30 mm side within pentagon as shown in job drawing.
- Place the sheet on Anvil.
- Cut the square 150 mm side using flat chisel and ball pein hammer fig 1.
- Similarly, cut the other geometrical profiles. Circle (Fig.2) hexagon (Fig.3) pentagon (Fig.4) and triangle (Fig.5) using flat chisel and ball pein hammer
- Check the different geometrical profiles with steel rule.

1	ISSH 160 x 160 x 0.5	-	G.I STEEL	-	-	1.2.36
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE 1:1	**CHIPPING DIFFERENT GEOMETRICAL SHAPES**				TOLERANCE : ± 1mm	TIME
					CODE NO. FI20N1236E2	

Chip step and file

Objectives: At the end of this exercise you shall be able to
- **mark and chip as per drawing**
- **file step to the given dimension.**



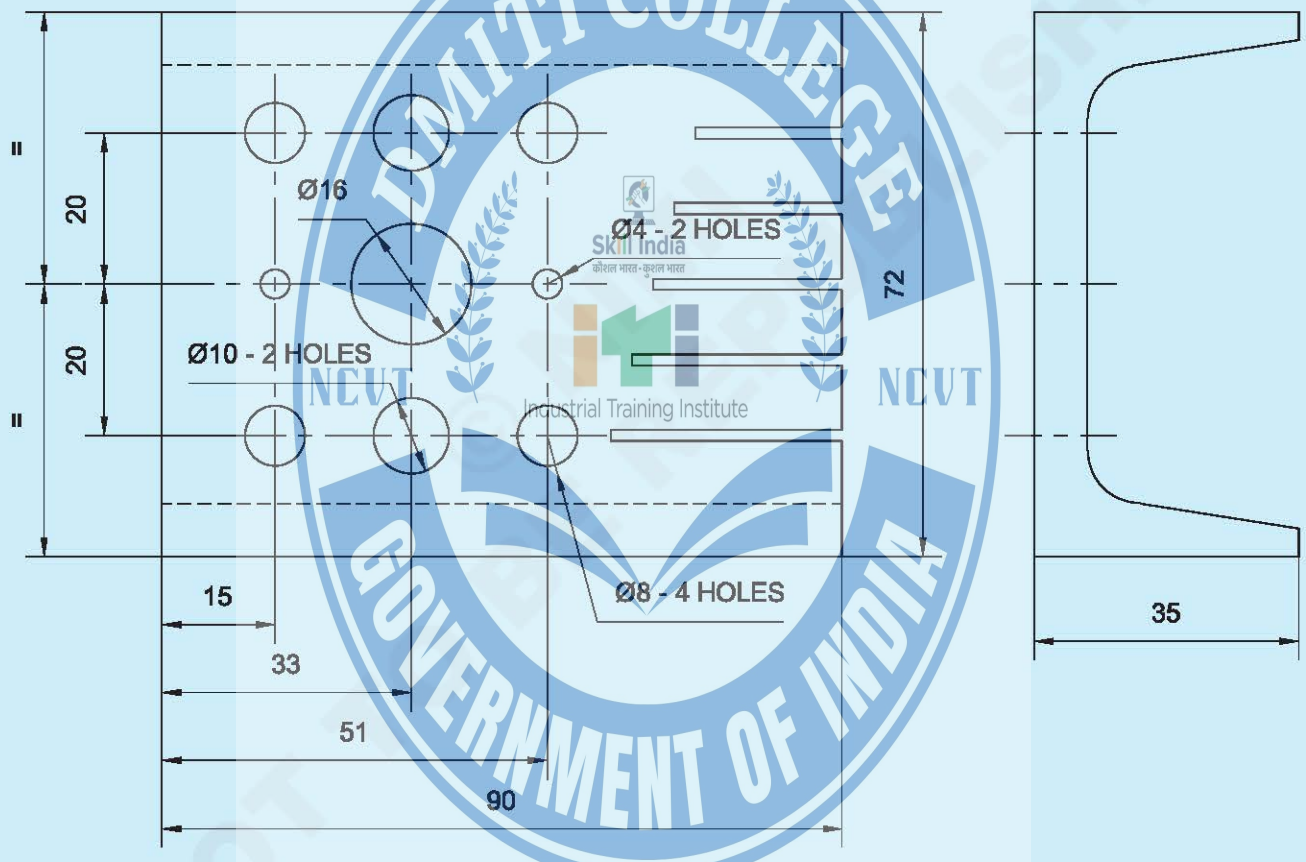
Instructor should assign the work to trainees.

- Write the job sequence to do the work
- List out the tools and equipment required
- Mark and cut the profile using chisel and file the profile to an accuracy of ± 0.5 mm

1	ISSH 125 x 125 x 0.5	-	STEEL SHEET	-	-	1.2.37
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX NO.
SCALE 1:1	PROFILE MARKING AND CUTTING				TOLERANCE ±0.5mm	TIME
					CODE NO. FI20N1237E1	

Mark off and drill through holes

Objectives: At the end of this exercise you shall be able to
- **mark off using vernier height gauge**
- **drill through holes using pillar/bench drilling machine.**



NOTE: USE EX.NO: 1.2.31 TASK 1

1		1.2.31 ←	Fe310-O	-	-	1.2.38
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX NO.

SCALE 1:1	DRILLING THROUGH HOLES	TOLERANCE : ±0.1mm	TIME
		CODE NO. FI20N1238E1	

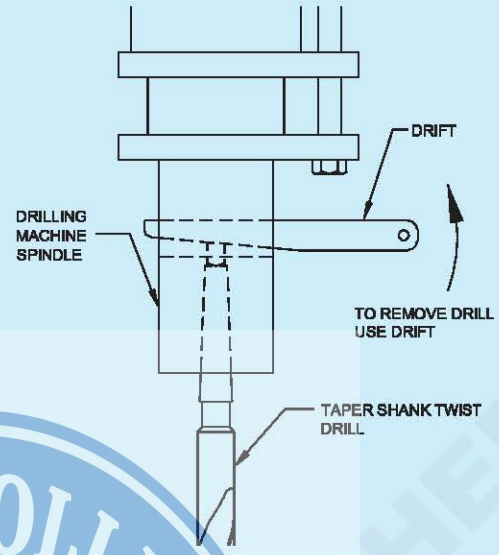
Job Sequence

- Check the raw material for its size.
- Apply marking media.
- Mark as per the drawing dimensions and punch the centre of holes with centre punch.
- Periphery of the big holes should be punched with prick punch 60°.
- Fix the job on the machine vice
- Fix centre drill in drill chuck, align with hole centre and centre drill to the required depth.
- Fix Ø 4mm drill in drill chuck
- Set the spindle speed for Ø 4 mm drill.
- Ø 4mm drill can be used as a pilot for all the holes.
- Fix Ø 8, Ø 10 and Ø 16 mm drill one by one and drill through holes as per job drawing.
- Use coolant while drilling

Caution: Use chuck key for tightening the drill in the drill chuck.

- Use drift to remove the taper shank drill from drilling machine spindle. (Fig 1)

Fig 1



- Do not hammer on drift to remove it out.
- Adjust the rpm of the spindle to suit the diameter of the drill. Ask your instructor.
- Finish the job and de-burr all corners.
- Apply thin coat of oil and preserve it for evaluation.

Skill Sequence

Locating hole accurately by drilling centre drill

Objective: This shall help you to
- **drill centre holes with a drilling machine.**

Drilling centre holes by combination drills is an accurate method of locating the position of the holes (i.e. within ± 0.025mm). In drilling operations, this method will be specially helpful while drilling deeper holes, and holes of fairly accurate locations. For doing centre drilling, proceed as follows.

Hold the combination centre drill in the drill chuck and check whether it 'runs true'. Adjust the spindle speed to suit the combination drill.

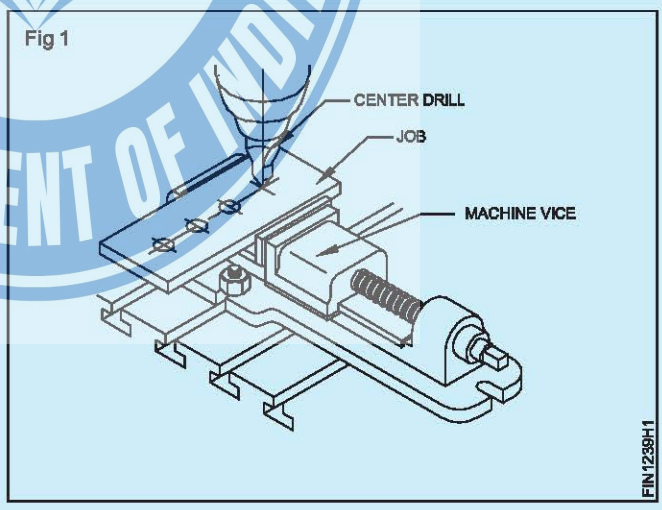
Adjust the job together with the vice and align with the centre punch mark. (Fig 1)

Drill a centre hole up to the depth of 3/4th of the counter sink. Do not apply undue pressure on the centre drill.

Apply sufficient quantity of cutting fluid.

Remove the centre drill. Fix of the required diameter twist drill. Check if it 'runs true'. Start drilling the through hole.

Fig 1



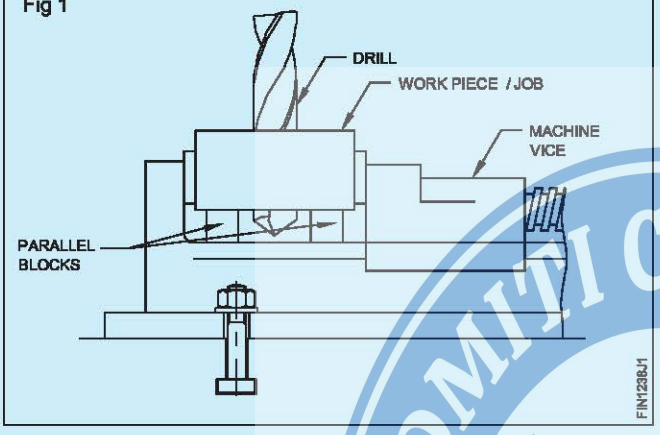
Drilling through holes

Objective: This shall help you to
- **drill holes of different diameter in a drilling machine.**

Punch the centre of the hole to be drilled by a centre punch.

Set the job in the machine vice securely by using two parallel bars to clear the drill (Fig 1)

Fig 1



Fix the drill chuck into the spindle of the drilling machine.

Fix the 4 mm dia drill in the drill chuck for pilot hole.

Select the spindle speed by shifting the belt in the appropriate cone pulleys.

Drill all the holes first by 4mm drill. This will serve as a pilot hole for 8 mm, 10 mm and 16 mm dia drills.

Drill Ø 8 mm.

Drill Ø 10 mm hole.

Remove the drill and drill chuck.

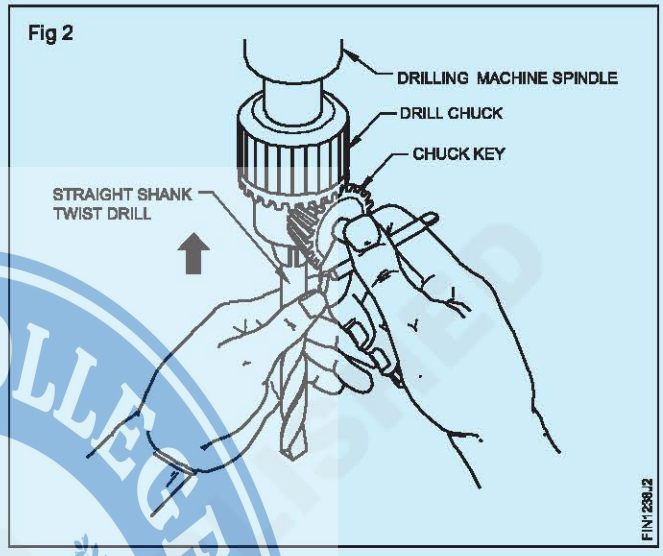
Caution: Do not remove chips with your bare hands- use brush.

Do not try to change the belt while the machine is running.

Ensure that the drill do not penetrate into the vice.

Fix securely the drill deep into the drill chuck. (Fig 2)

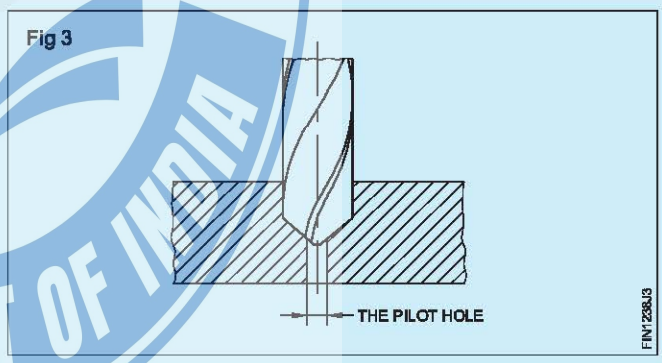
Fig 2



Since the web of large diameter drills are thicker, the dead centres of those drills do not sit in the centre punch marks. This can result in the shifting of the hole location. Thick dead centres can not penetrate into the material easily and will impose severe strain on the drill.

These problems can be overcome by drilling pilot holes initially. (Fig 3)

Fig 3

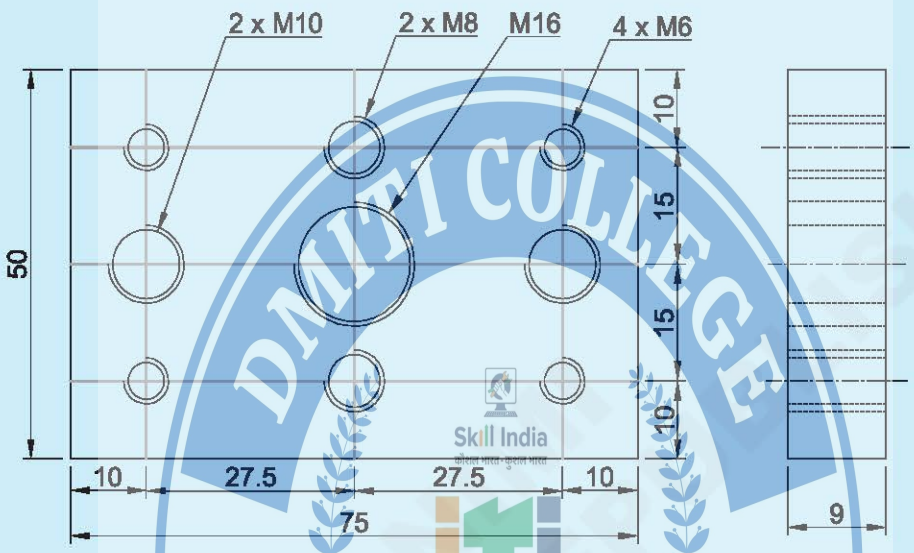


Exercise 1.2.39

Drill and tap on M.S.flat

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

- **mark the tap holes with vernier height gauge**
- **determine the tap drill size**
- **drill tap drill hole on the job and chamfer it**
- **cut internal thread by hand tapping.**



Job Sequence

- Check the raw metal and file to size 75x50x9 mm.
- Mark the hole centres for the tap drill holes with vernier height gauge.

Drilling

- Set the pillar drilling machine for drilling operation
- Set the job on the machine vice.
- Fix the centre drill in a drill chuck.
- Align centre drill with centre location of hole and drill a centre hole..
- Fix Ø 5 mm drill in a drill chuck and drill all the centre drilled holes. (this serves as pilot hole for larger diameter drills).
- Drill two holes Ø 6.8 mm for M 8 tap.
- Drill two holes Ø 8.5 mm for M 10 tap.
- Drill Ø 14 mm at the centre of the work for M16 tap.
- Fix the counter sink tool in a drilling machine and chamfer all the tap drill holes both sides to 1.0 mm depth.

Tapping

- Fix the Job in bench vice.
- Cut M6 internal thread using M6 hand tap and tap wrench.
- Similarly, cut internal threads using M8, M10 and M16 hand tap and tap wrench
- Finish and De - burr all the surfaces of the Job.
- Clean all the threads without burrs.
- Apply a little oil and preserve the job for evaluation

1	60 ISF 10 x 78 mm	-	Fe310	-	-	1.2.39
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE 1:1	DRILLING AND TAPPING				TOLERANCE : ±0. 1mm	TIME
					CODE NO. FI20N1239E1	

Tapping through holes

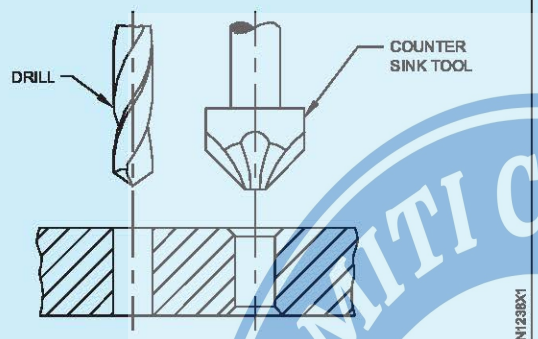
Objective: This shall help you to
- **cut internal threads using hand taps.**

Determine the tap drill size either using the formula or the table.

Drill the hole to the required tap drill size. [An undersized hole will lead to breakage of the tap].

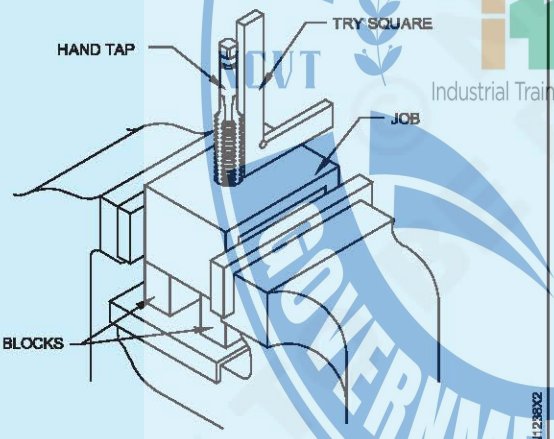
Chamfer the end of the drilled hole for easy aligning and starting of the tap. (Fig 1)

Fig 1



Hold the work firmly and horizontally in the vice. The top surface of the job should be slightly above the level of the vice jaws. This will help in using a try square without any obstruction while aligning the tap. (Fig 2)

Fig 2



Fix the first tap (taper tap) in the correct size tap wrench. Too small a wrench will need a greater force to turn the tap. Very large and heavy wrenches will not give the 'feel' required to turn the tap as it cuts and may lead to breakage of the tap.

Position the tap in the chamfered hole vertically by ensuring the wrench is in a horizontal plane.

Exert steady downward pressure and turn the tap wrench slowly in the clockwise direction to start the thread. Hold the tap wrench close to the centre. (Fig 3)

Remove the wrench from the tap when you are sure of starting the thread without disturbing the setting.

Check and make sure that the tap is vertical by using a try square in two positions at 90° to each other. (Figs 4 & 5)

Fig 3

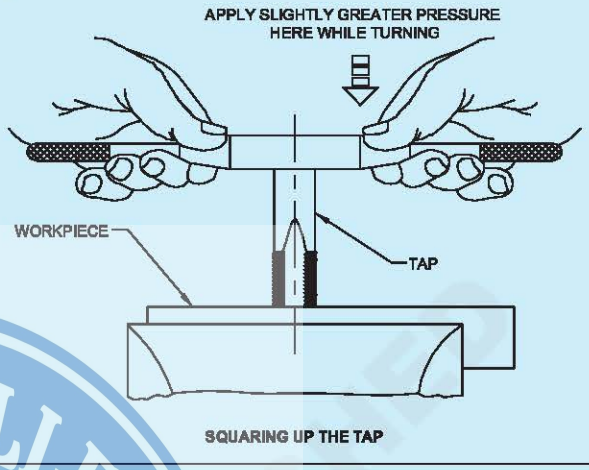


Fig 4

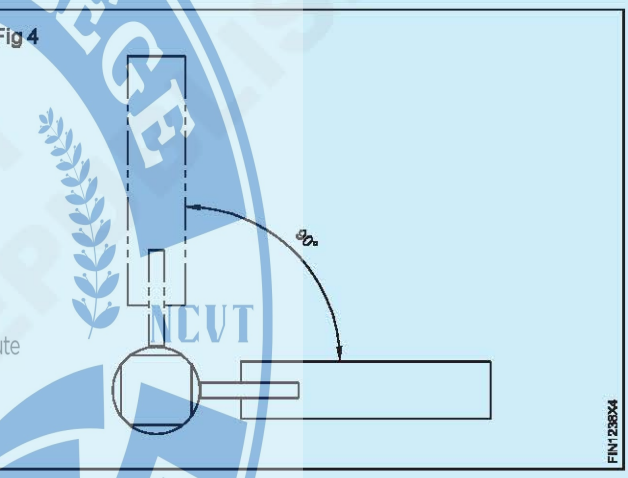
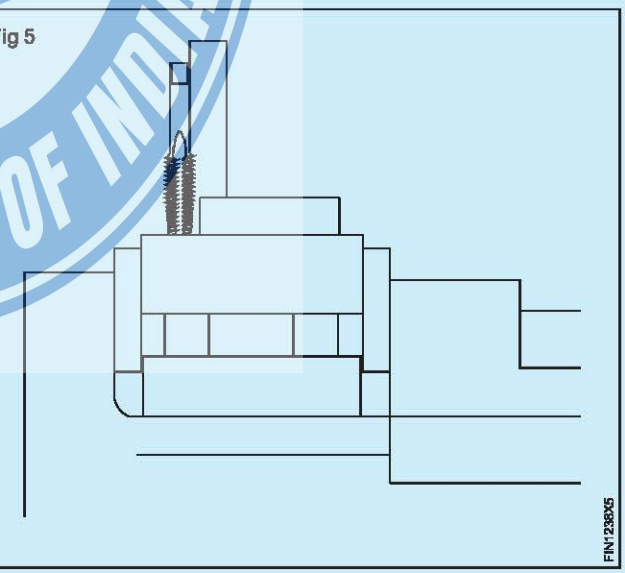


Fig 5

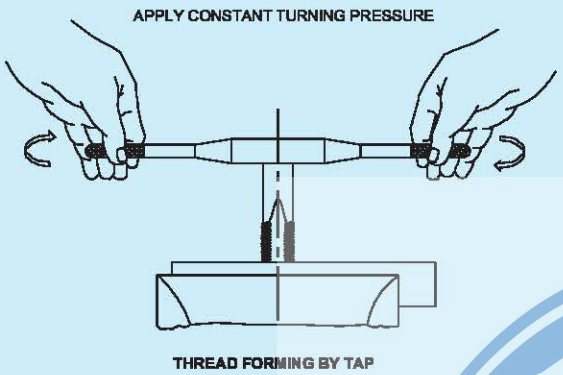


Make correction if necessary by exerting slightly more pressure on the opposite side of the tap inclination.

Check the tap alignment again. The tap alignment should be corrected within the first few turns. If it is tried afterwards there is a chance of breaking of the tap.

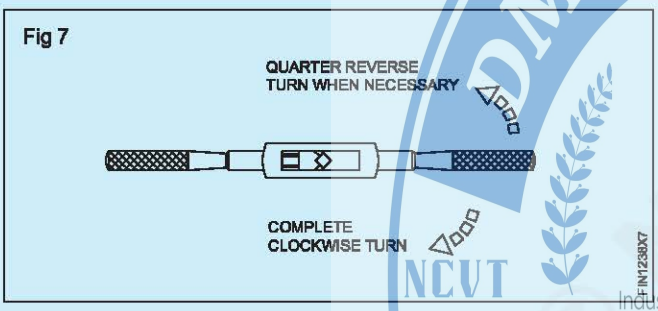
Turn the wrench lightly by holding at the ends without exerting any downward pressure after the tap is positioned vertically. The wrench pressure exerted by the hands should be well balanced. Any extra pressure on one side will spoil the tap alignment and can also cause breakage of the tap. (Fig 6).

Fig 6



Continue cutting the thread. Turn backwards frequently about quarter turn, to break the chips. (Fig 7)

Fig 7



Stop and turn backwards when any obstruction to the movements is felt.

Use a cutting fluid while cutting the thread to minimise friction and heat.

Cut the thread until the hole is totally threaded.

Finish and clean up using the intermediate and plug tap. The intermediate and plug tap will not cut any thread if the first tap has entered the hole fully.

Remove the chips from the work and clean the tap with a brush.

Make sure that the dia of the hole to be tapped is correct for the given size of the tap.

Turn backwards frequently about quarter turn to break the chips.

Select the length of wrench suitable to the size of the tap. Over length of wrench may cause the breakage of tap.

Punch letter and number (letter punch and number punch)

Objective: At the end of this exercise you shall be able to
- **punch the letters and numbers.**

Job Sequence

- Check the raw material size.
- Mark the line to punch the letters.
- Measure the length.
- Count the letters on each line.
- Select the size of the letters according to space
- Position the letter punch and hold vertical position hammer vertically above the punch.
- Practice letter and number punching.

1	SS 110 x45 x 2mm	-	STAINLESS STEEL	-	-	1.2.40
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE 1:1	**LETTER AND NUMBER PUNCHING PRACTICE ON KEY CHAIN TALLY**				TOLERANCE : NIL	TIME
					CODE NO. FI20N1240E1	

Skill Sequence

Objective: This shall help you to
- **punch letters and numbers.**

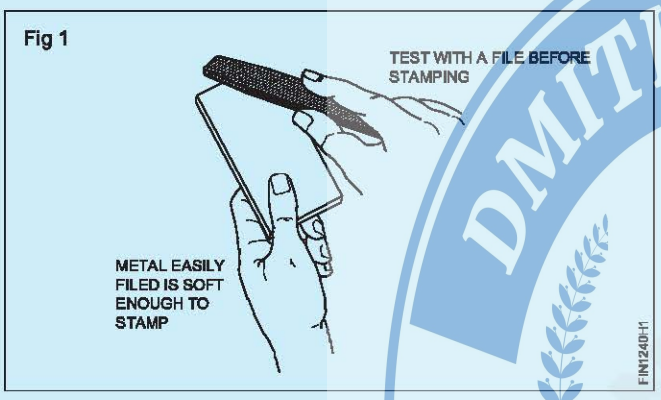
Letter and number punches

These hardened and tempered steel punches are used to stamp identifying symbols, letters or numbers as required on the work.

They are obtainable with symbols ranging in size from 0.8 mm to 13 mm.

They are kept in boxed sets.

Use a file on the work to be stamped to check the work is softer than the punch. Any attempt to stamp hard material would damage the punch. Use an electric pencil or acid etching to mark hard materials. (Fig 1)



Each symbol must be made with a single blow. A second blow gives a distorted second impression.

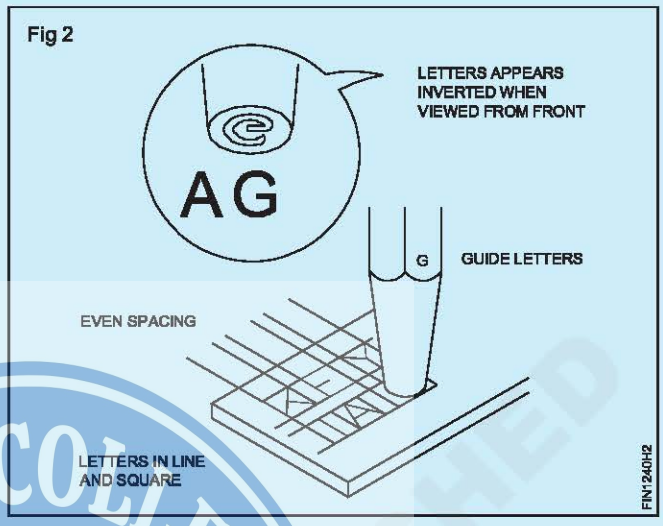
Letters such as **M** and **W** may require firmer blows to produce the same depth of impression such as letters **I** and **T** can make.

The depth of impression for a given blow varies with the softness of the material.

Practice on different metals.

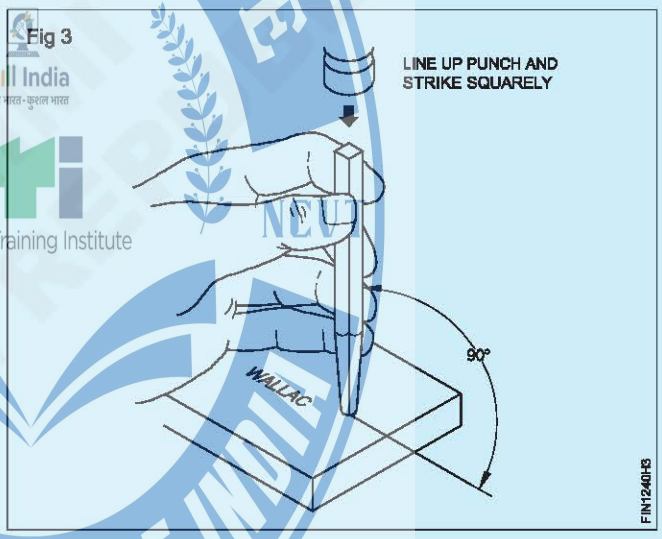
Use the punches in the following manner :

- Mark out the guidelines for the symbols.
- Check that you have the correct symbol.
- Position the punch so that the symbol will be in line, square, correctly spaced and the correct way up. (Fig 2)



Hold the punch in a vertical position. (Fig 3)

Hold the hammer vertically above the punch. (Fig 3)



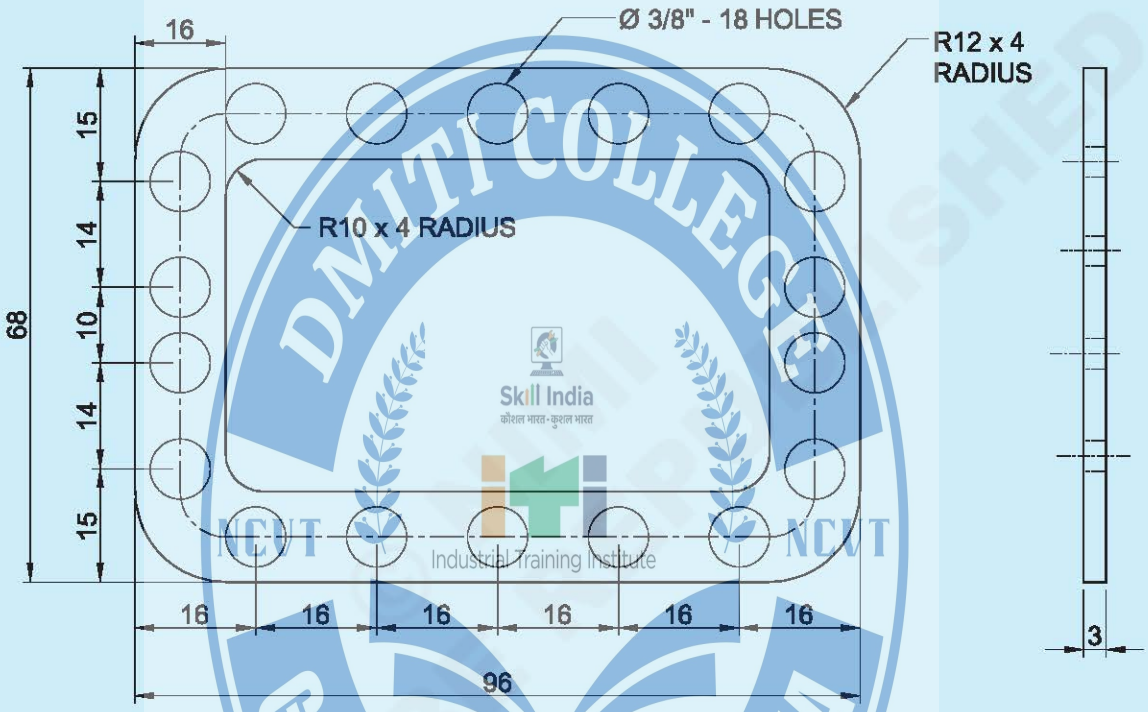
Watch the point of the punch.

Strike the punch squarely with one firm blow.

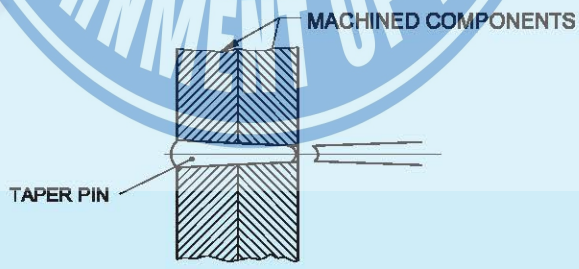
Practice use of different punches

Objectives: At the end of this exercise you shall be able to
- **mark and punch holes on gasket with hollow punch**
- **dismantle taper pin/dowel pin in an assembly.**

TASK 1



TASK 2



1	GASKET 100 x 70 x 3.0mm	-	RUBBER	-	-	1.2.41
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE 1:1	PRACTICE WITH HOLLOW AND PIN PUNCH				TOLERANCE : NIL	TIME
					CODE NO. FI20N1241E1	

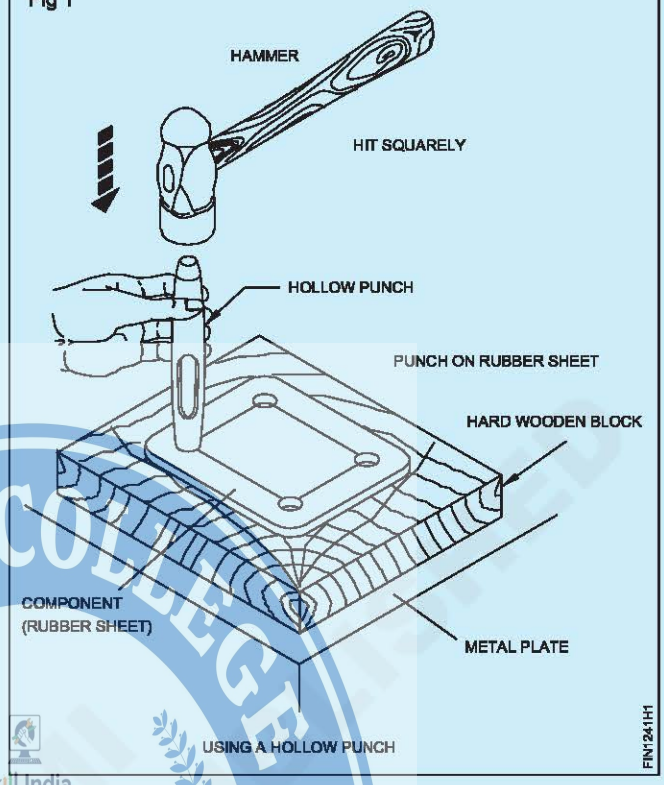
Job Sequence

TASK 1 : **Mark and punch holes on gasket**

- Mark as per drawing in Gasket.
- Locate the intersection of the hole point using pencil.
- Draw Ø 8 mm hole circles with divider.
- Punch and make a hole with Ø 8 mm Hollow punch - Fig 1.

For TASK 1 provisions may be made for Gasket/ Leatheroid sheet/Rubber or cork sheet for the practice.

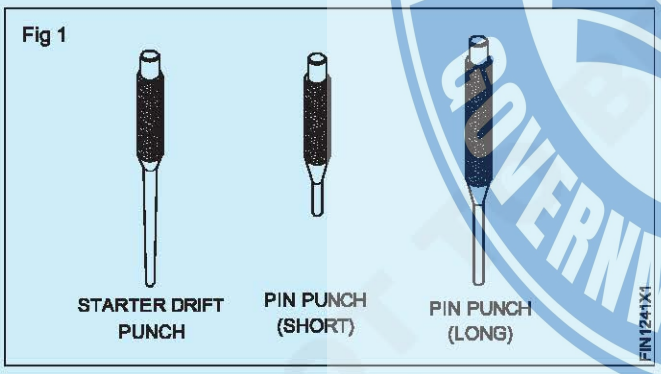
Fig 1



TASK 2 : **Taper dowel pin dismantle**

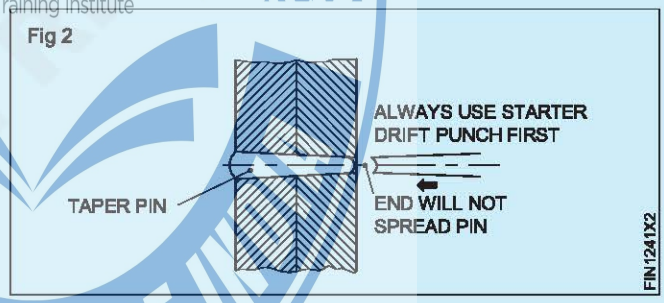
- Select a suitable pin punch according to the dismantling of taper pin fig 1.

Fig 1



- Always use starter drift punch first to dismantle the taper pin in machine assembly. (Fig 2)
- Use pin punch (short) or (long) also to dismantle the taper pin in assembly.
- While dismantling the dowel taper pin, strike with hammer on dowel pin with light blow.

Fig 2



For TASK 2 provisions may be made for disassemble the fixtures of jigs where the dowel pins are provided for practice or removal of dowels.