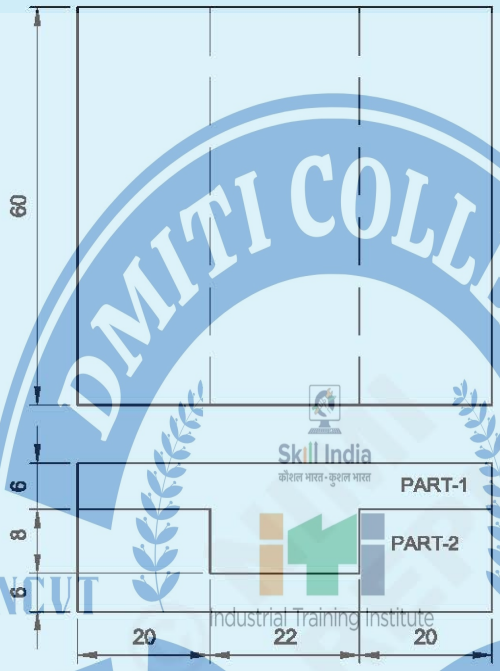
Make sliding 'T' fit

Objectives: At the end of this exercise you shall be able to
- **file flat surfaces to flat and square maintaining accuracy ± 0.04 mm**
- **mark dimension lines as per drawing**
- **file to size, shape and make sliding fit.**



Job Sequence

PART - 1

- Check the raw metal size using steel rule
- File and finish to overall size of 62x60x14 mm maintaining parallelism and perpendicularity and to the accuracy of ± 0.04 mm.
- Check the size with vernier caliper.
- Apply marking media, mark as per drawing and punch witness marks as shown in Fig 1.
- Hacksaw and remove the hatched portion of excess metal in one side of the job as shown in Fig 2.
- File the cut portion to size and shape maintaining flatness and squareness to the accuracy of ± 0.04mm.
- Similarly, cut and remove the excess metal in other side, file and check the size with vernier aliper as shown in Fig 3.

2	65ISF15-65	-	Fe 310	-	-	1.6.79
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

SCALE NTS	MAKE SLIDING 'T' FIT	TOLERANCE ±0.04mm	TIME:
		CODE NO. FI20N1679E1	

Fig 1

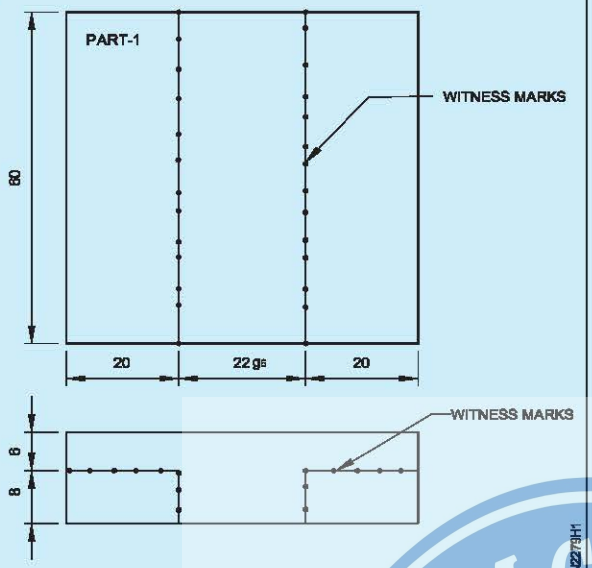


Fig 2

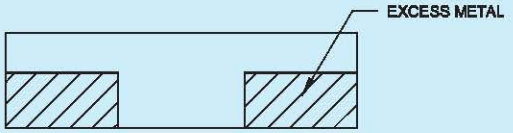
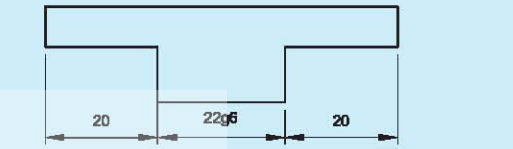


Fig 3



PART - 2

Check the raw metal size using steel rule

- File and finish to size 62x60x14 mm maintaining parallelism and perpendicularity to the accuracy of ± 0.04 mm
- Apply marking media, mark and punch the dimension lines as shown in Fig 4.

Fig 4

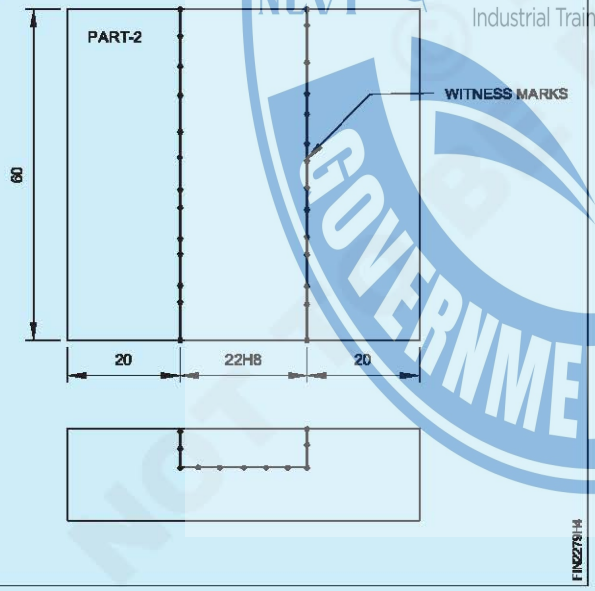


Fig 5

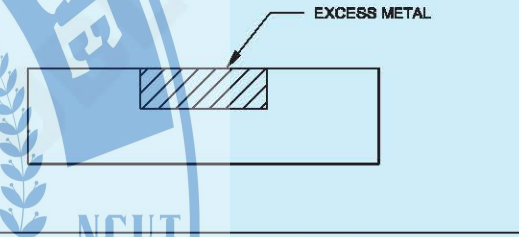


Fig 6

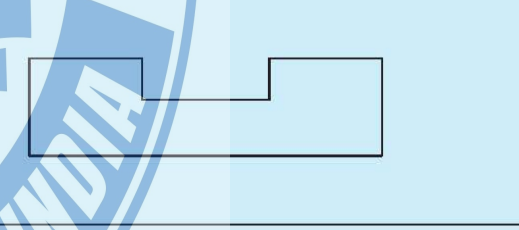
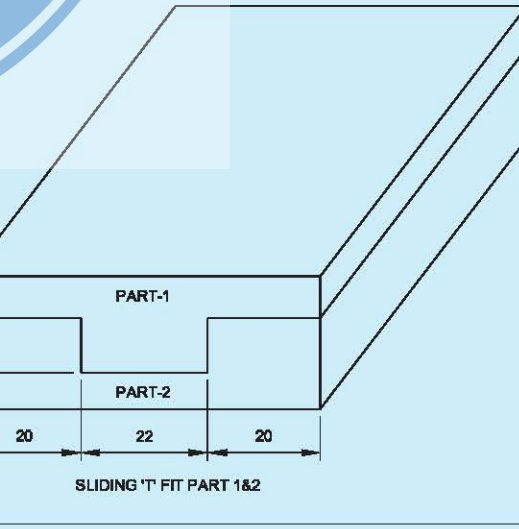


Fig 7



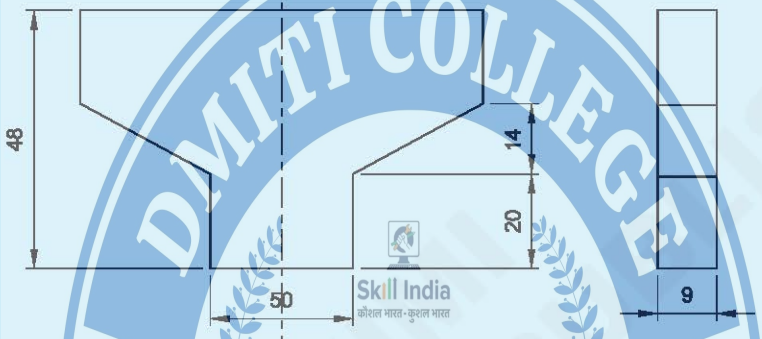
- Hacksaw chip and remove the hatched portion of excess metal as shown in Fig 5.
- File to size and shape maintaining flatness and squareness as shown in Fig 6.
- Match part 1 and 2 and slide it as shown in Fig 7.
- Finish file part 1 and 2 and de-burr all the surfaces and corners of the job.
- Apply a little oil and preserve it for evaluation.

File fit - combined, open angular and sliding sides

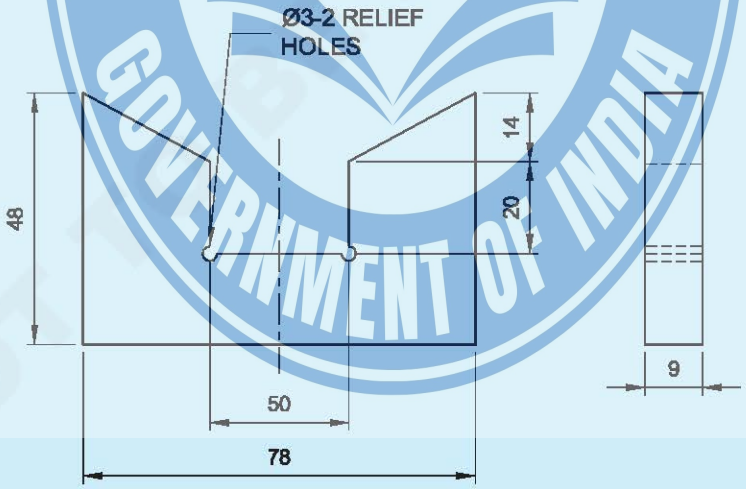
Objectives: At the end of this exercise you shall be able to

- **file surfaces flat and square to the accuracy of ± 0.04 mm**
- **mark dimension lines as per drawing**
- **file flat and angular surfaces as per drawing**
- **measure the angle using vernier bevel protractor**
- **fit combined open, angular sliding sides, finish and de-burr.**

PART-1



PART-2

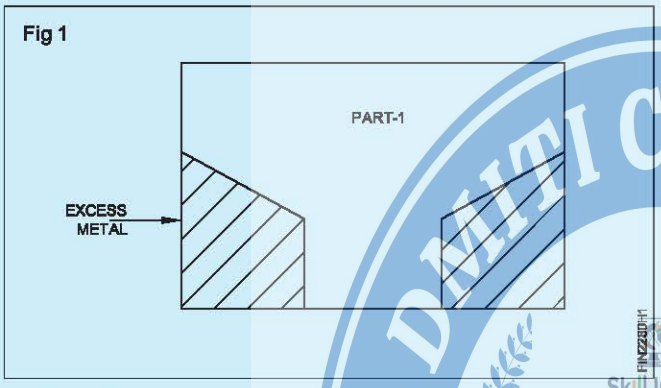


2	50ISF10-80	-	Fe 310	-	1&2	1-6-80
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
SCALE NTS	**FILE FIT-COMBINED ,OPEN ANGULAR AND SLIDING SIDES**				TOLERANCE LINEAR ±0.04mm ANGLE ±30 minutes	TIME:
					CODE NO. FI20N1680E1	

Job Sequence

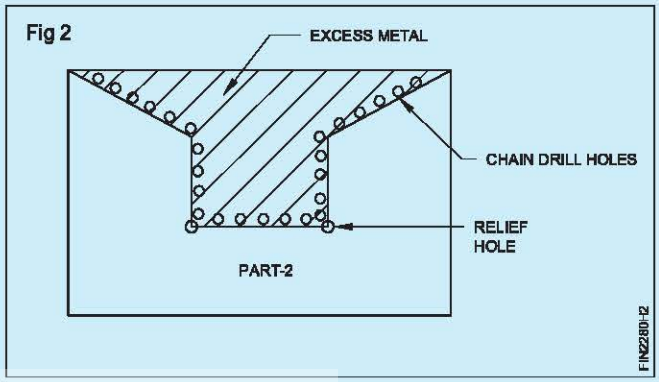
- Check the raw matal for its size.
- File part 1 and 2 to over all size 78 x 48 x 9 mm maintaining parallelism and perpendicularity.
- Check the size with vernier caliper.
- Apply marking media and mark dimension lines on part 1 and 2 as per job drawing.
- Punch witness marks on part 1 and 2.
- Hacksaw and remove the excess metal in part 1 and file to size and shape maintaining accuracy ± 0.04 mm and angle 30 minutes as shown in Fig 1.

Fig 1



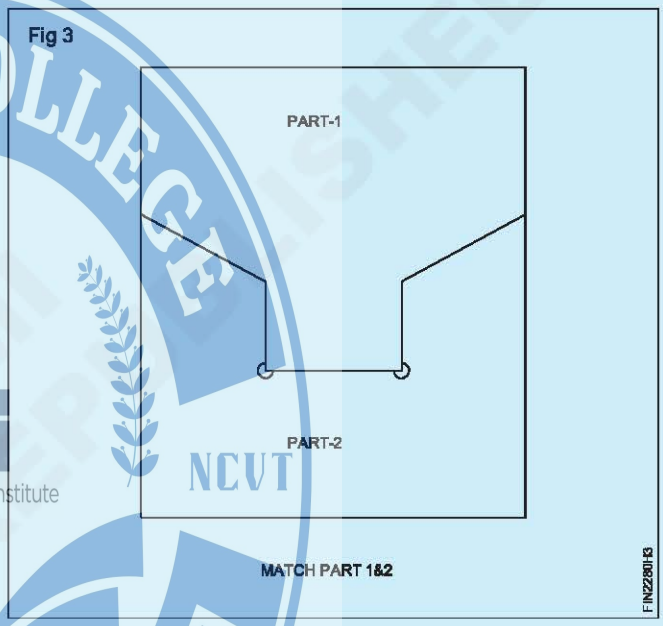
- Drill Ø 3 mm relief hole in part 'B'
- Chain drill, chip, remove the excess metal in part 'B' and file to size and shape as shown in Fig 2.
- Check the size with vernier caliper and angles with vernier bevel protector.
- Finish file on part 1 and 2 and de-burr in all corners.

Fig 2



- Match part 1 and 2 as shown Fig 3.
- Apply a little oil and perserve it for evaluation.

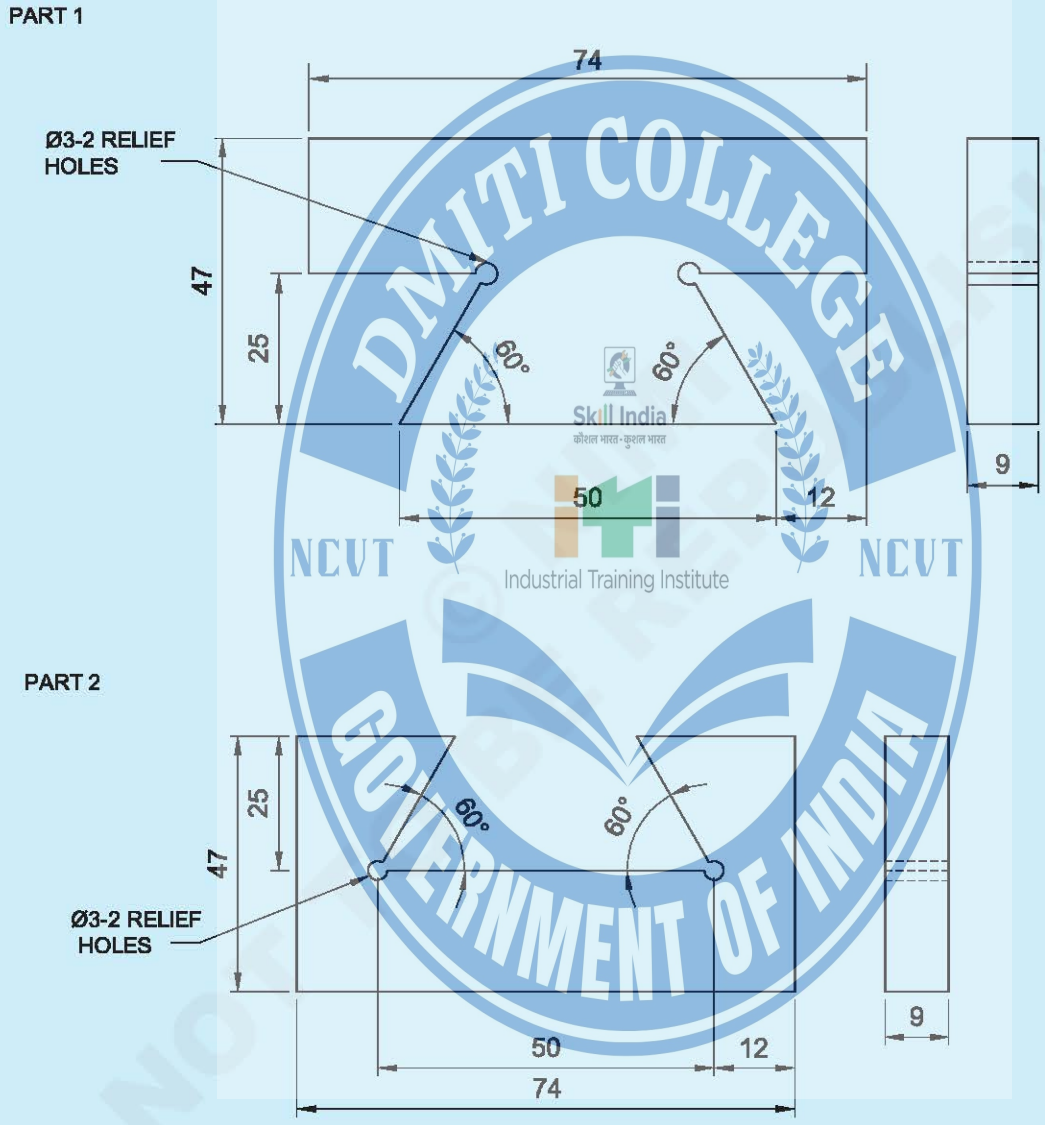
Fig 3



File internal angles 30 minutes accuracy open, angular fit

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

- **file surfaces parallel and square within an accuracy of ± 0.04 mm**
- **mark dimension and angular lines as per drawing**
- **file flat and angular surfaces as per drawing**
- **check the angle using vernier bevel protector to an accuracy of 30 minutes**
- **fit angular surfaces as per drawing, finish and de-burr.**



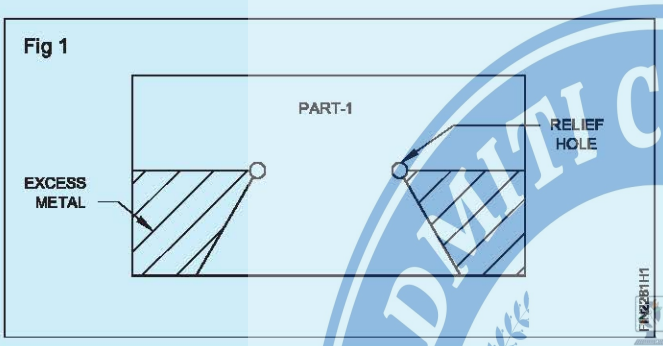
2	50ISF10 - 80	–	Fe310	–	1&2	1.6.81
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

SCALE : 1:1	FILE INTERNAL ANGLES 30 MINUTES ACCURACY OPEN , ANGULAR FIT	TOLERANCE LINEAR ±0.04 mm ANGLE ±30	TIME: 15Hrs
		CODE NO: FI20N1681E1	

Job Sequence

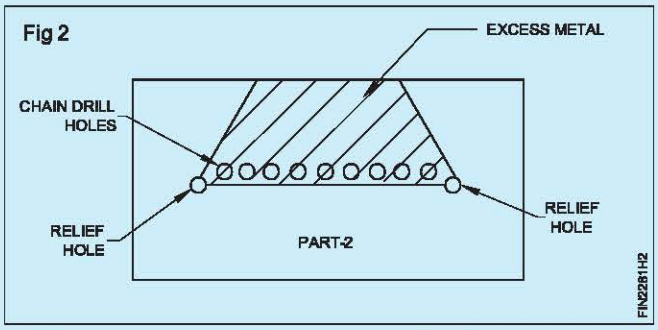
- Check the raw material size.
- File part 1 and 2 to over all size 74 x 47 x 9 mm maintaining flat and squareness.
- Apply marking media on the surface and mark dimension lines on part 1 and 2 as per job drawing.
- Punch witness marks on part 1 and 2.
- Drill Ø 3 mm relief holes in part 1 and 2.
- Hacksaw and remove the excess metal in part 1 and file the cut portion to size and shape maintaining the accuracy ± 0.04 mm and angles 30 minutes as shown in Fig 1.

Fig 1



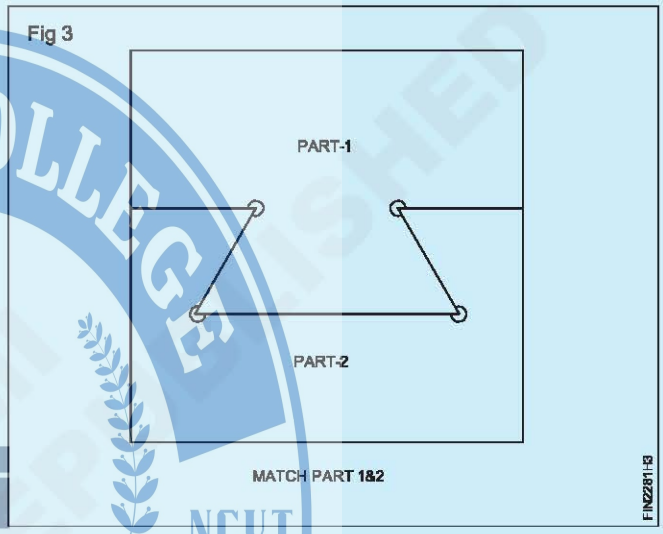
- Chain drill, chip, hacksaw and remove the excess metal in part 2 and file to size and shape as shown in Fig 2.
- Check the size with vernier caliper and angles with vernier bevel protector.

Fig 2



- Match part 1 and 2 as shown in Fig 3.
- Apply a little oil and preserve it for evaluation.

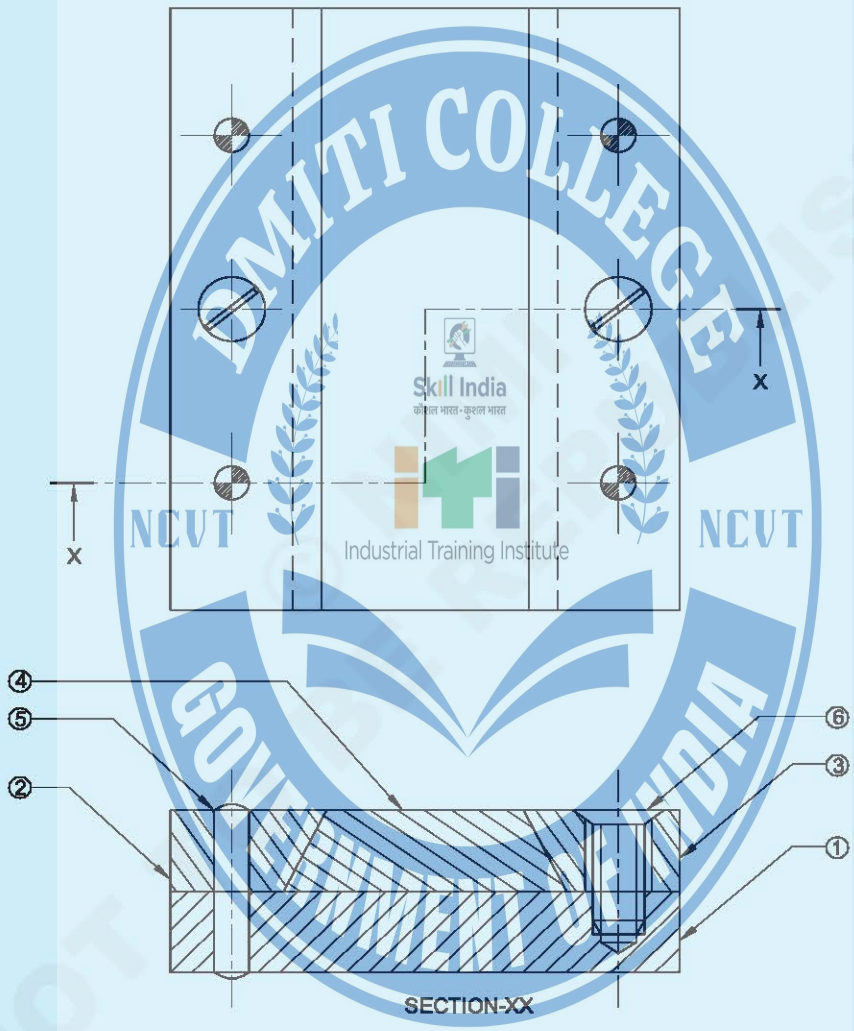
Fig 3



Make sliding fit with angles other than 90°

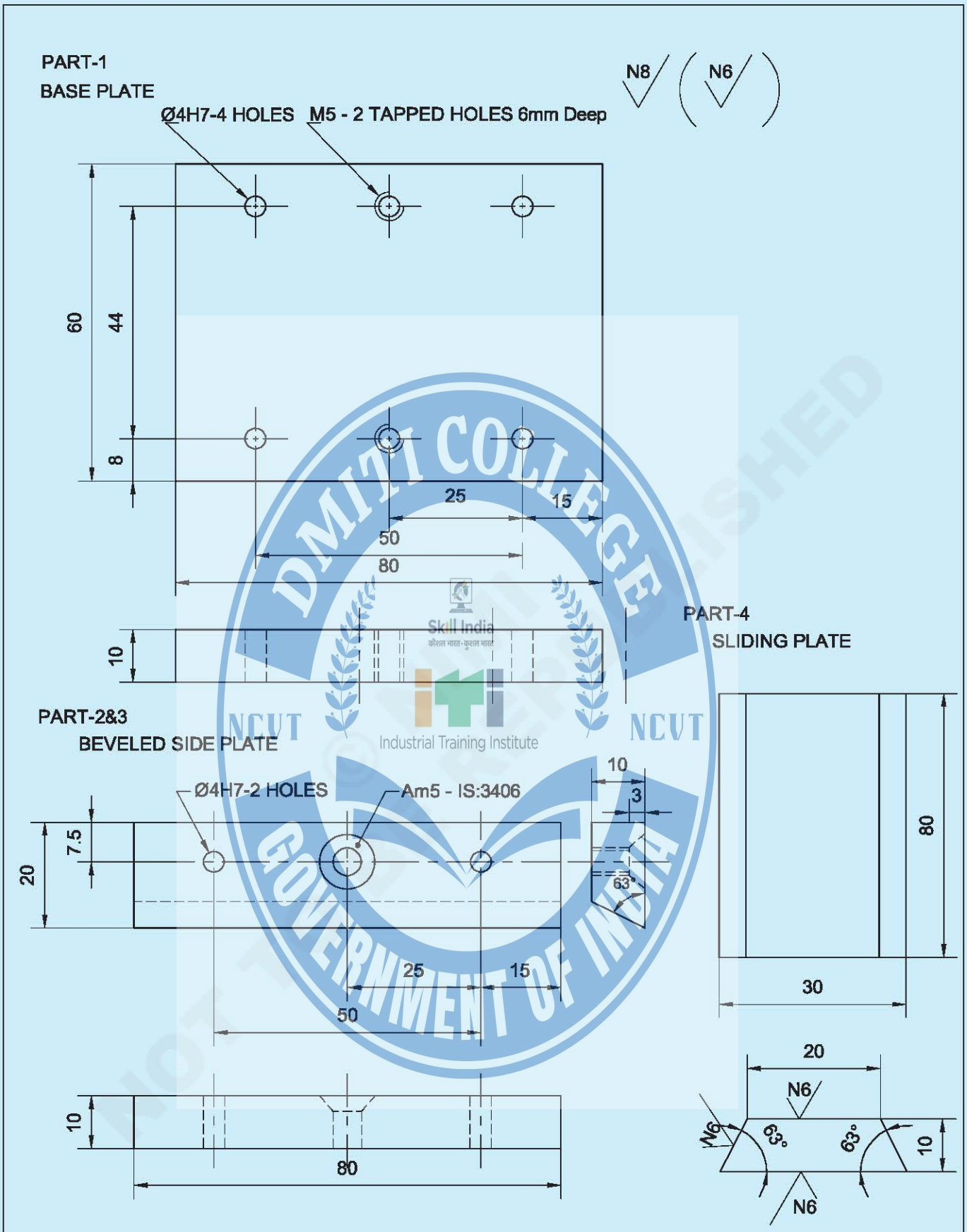
Objectives: At the end of this exercise you shall be able to

- **file and finish flat and angular surfaces within an accuracy of ± 0.04 mm and ± 30 minutes**
- **mark and drill holes as per drawing**
- **cut internal thread to assemble countersink screws**
- **prepare and assemble components using screws and dowel pins**
- **assemble components to achieve sliding fit with angular mating surfaces.**



2	AM5-15ISI:1365	CSK SCREW	30CB		6	
4	4H8x20ISI:2393	CYLINDRICAL PIN	40CB		5	
1	35ISF12-85	SLIDING PLATE	Fe310		4	
2	25ISF12-85	BEVELED SIDE PLATE	Fe310		2&3	
1	65ISF12-85	BASE PLATE	Fe310	–	1	1.6.82
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

SCALE NTS	MAKE SLIDING FIT WITH ANGLES OTHER THAN 90°	TOLERANCE ±0.04 mm	TIME:
		CODE NO: FI20N1682E1	

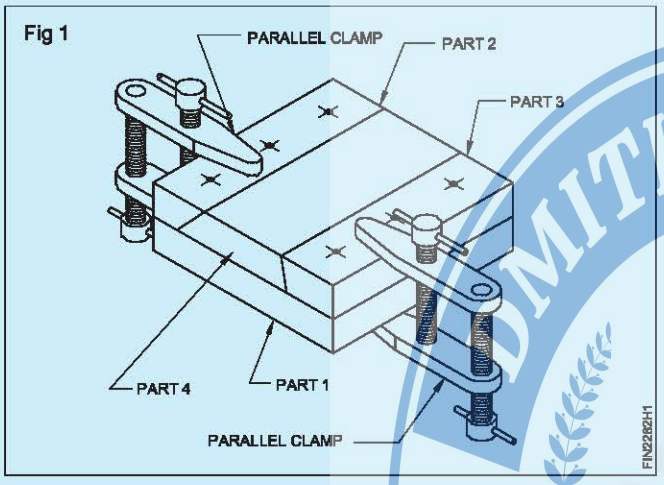


SCALE 1:1	BASE PLATE & BEVELED SIDE PLATES	DEVIATIONS	TIME
		CODE NO. FI20N1682E2	

Job Sequence

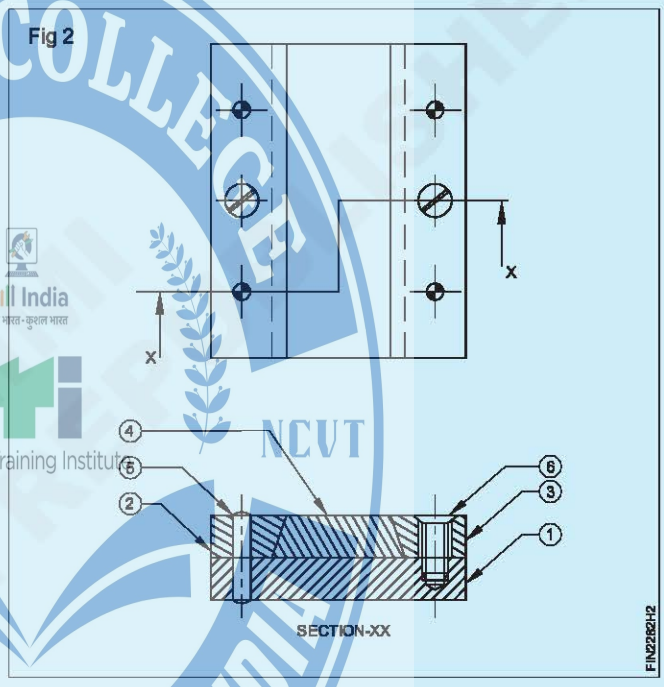
- Check the raw material for its size.
- File the material of part 1, 2, 3 and 4 to over all sizes maintaining the accuracy of ± 0.04 mm.
- Apply marking media on part 1, 2, 3 and 4 surfaces and mark lines as per drawing.
- Punch witness marks.
- Hacksaw and file in part 2, 3 and 4 and file to size and shape as per job drawings.
- Assemble and clamp part 1,2,3 and 4 together in drilling machine table with parallel clamps as shown in Fig 1.

Fig 1



- Fix Ø 3.8 mm drill in drilling machine spindle through drill chuck and drill through hole.
- Fix Ø 4 mm hand reamer in tap wrench and ream the drilled hole to fix Ø 4 mm dowel pin without disturbing the assembly setting.
- Clean the reamed hole and insert Ø 4 mm dowel pin.
- Similarly, drill other dowel pin holes one by one and ream the drilled hole one by one and fix the dowel pins without disturbing the assembly.
- Fix Ø 4.2 mm drill in drilling machine spindle through drill chuck and drill holes for cutting internal thread to fix counter sink screws in assembly without disturbing the setting.
- Separate the assembly parts 1,2,3 and 4 and chamfer the tapping holes both ends in part 1 using countersink tool.
- Drill free hole Ø 5.5 mm for CSK screw in part 2 and 3.
- Counter sink the drilled holes to seat the counter sink head screws in part 2 and 3.
- Hold the part 1 in bench vice.
- Cut internal thread using M5 hand tap and tap wrench.
- Clean the threads with out burrs.
- Cut and file in part 2, 3 and 4 to size and shape as per job drawing and check the size with vernier caliper and angles with vernier bevel protractor.
- Assemble part 1,2,3 and 4 as per job drawing along with dowel pins and counter sink screws.
- Fit and slide part 4 in the assembly as shown in Fig 2.

Fig 2

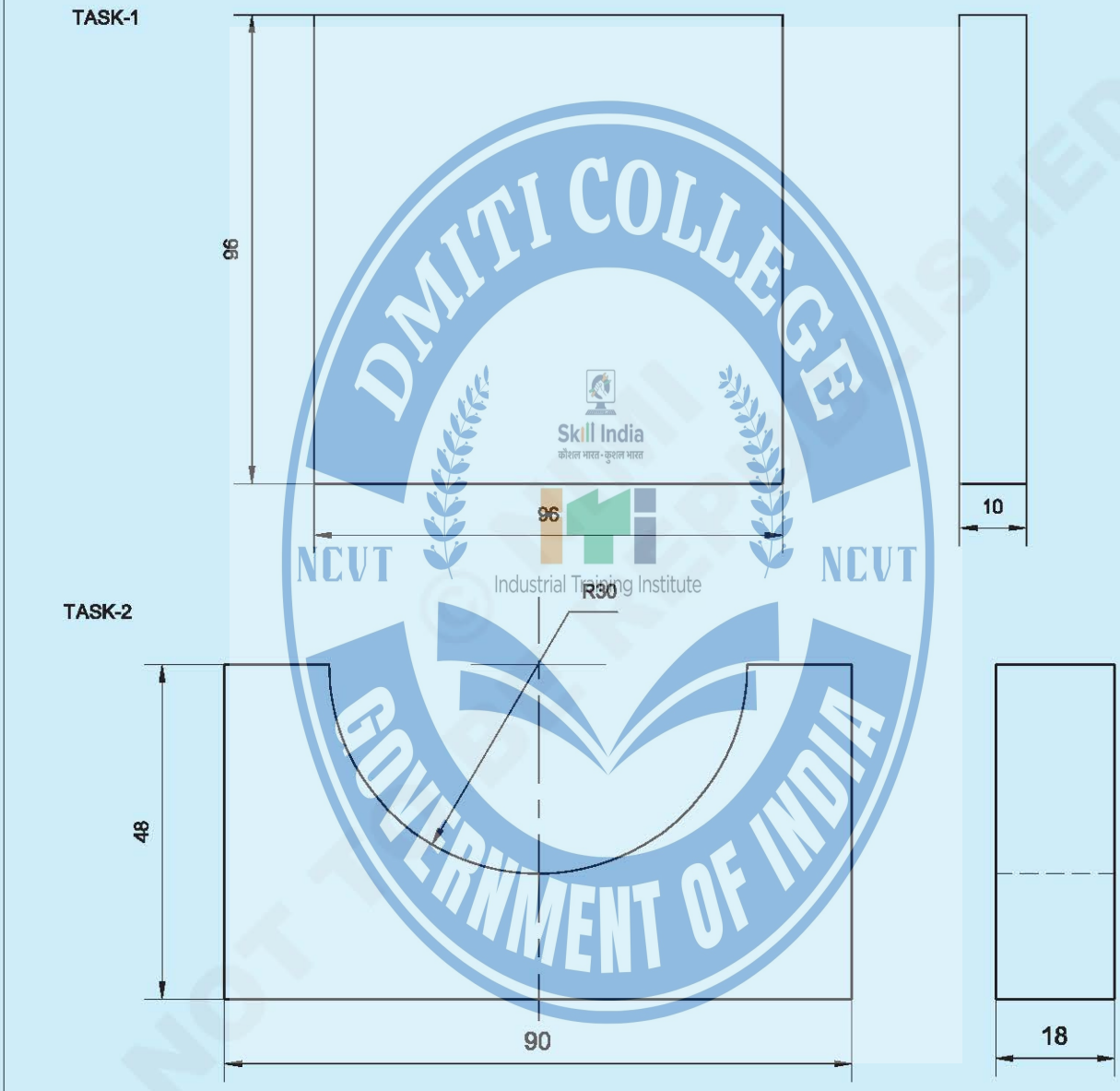


- Disassemble all the parts from assembly.
- Finish file on part 1,2,3 and 4 and remove burrs in all the corners of the job.
- Re-assemble all the parts together as per job drawing.
- Apply a little oil and preserve it for evaluation.

Scrap on flat surfaces, curved surfaces and parallel surfaces and test

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

- **file surfaces flat and square to the accuracy of ± 0.04 mm**
- **find high spots on flat and curved surfaces using prussian blue**
- **scrap on flat, curved surfaces and test.**



1	100ISF12-100	→ 1.6.85	Fe310	-	TASK-1	1.6.83
1	100ISF20-50	→ 1.6.85	Fe310	-	TASK-2	1.6.83
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

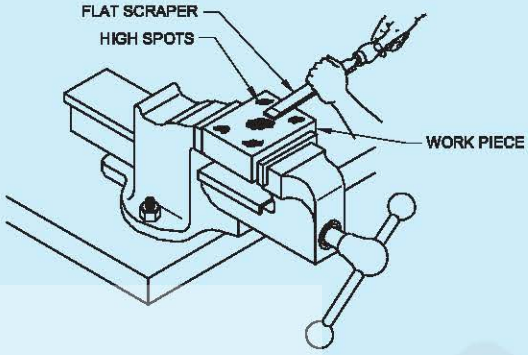
SCALE NTS	SCRAP ON FLAT SURFACES , CURVED SURFACES AND PARALLEL SURFACES AND TEST	TOLERANCE ±0.04 mm	TIME :
		CODE NO. FI20N1683E1	

Job Sequence

TASK 1: **Scraping on flat surface**

- Check the raw material for its size.
- File metal to size 96x96x10 mm maintaining flatness and squareness.
- Check the size with vernier caliper.
- Clean the surface plate with soft cloth.
- Apply prussion blue evenly on the surface plate.
- Place the job on surface plate and move slightly forward and backward
- Take the job from surface plate and notice the blue spotted marks on the flat surface.
- Hold the job in bench vice
- Scrap and remove the high spots on the flat surface of the job using flat scraper Fig1.
- Wipe off the scraped surface with soft cloth to remove burrs.
- Again, place the scraped surface on prussion blue applied surface and move forward and backward and notice the high spot marks.

Fig 1

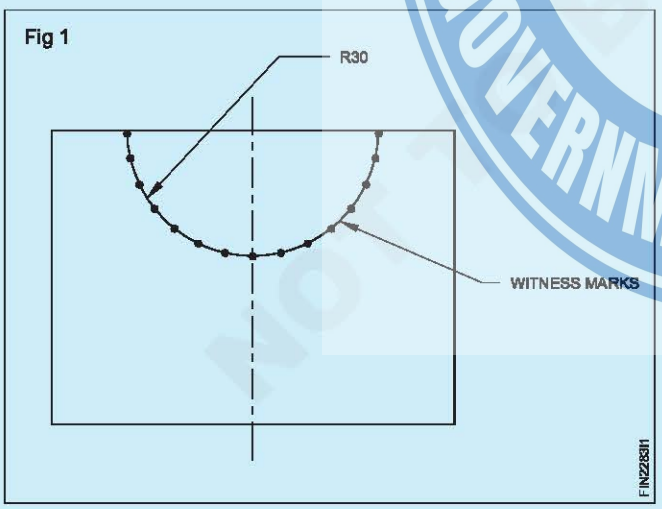


- Repeat the scraping process untill the prussion blue spotted marks spread over the entire surface of the job.
- Wipe off the scraped surface with soft cloth.
- Apply thin coat of oil and pressure it for evaluation.

TASK 2: **Scraping on curved surface**

- Check the raw material for its size.
- File metal to size 90x48x18 mm maintaining flatness and squareness.
- Check the size with vernier caliper.
- Apply marking media, mark and punch as shown in Fig 1.

Fig 1



- Chain drill holes remove excess material as shown in Fig 2.
- Cut and remove the hatched portion of chain drilled holes excess metal using web chisel and ball pein hammer as shown in Fig 3.

Fig 2

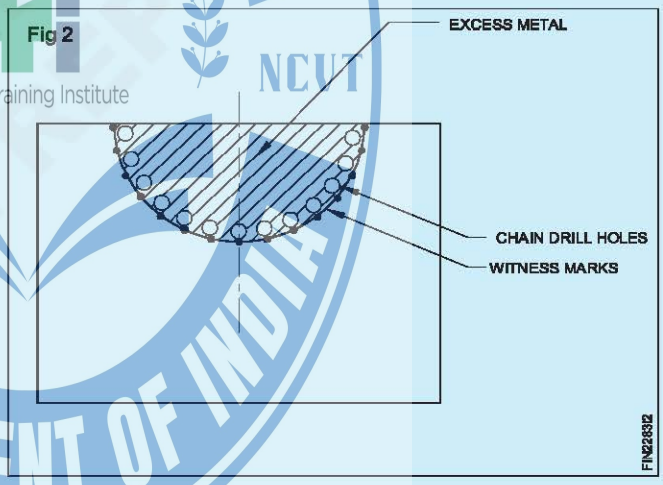
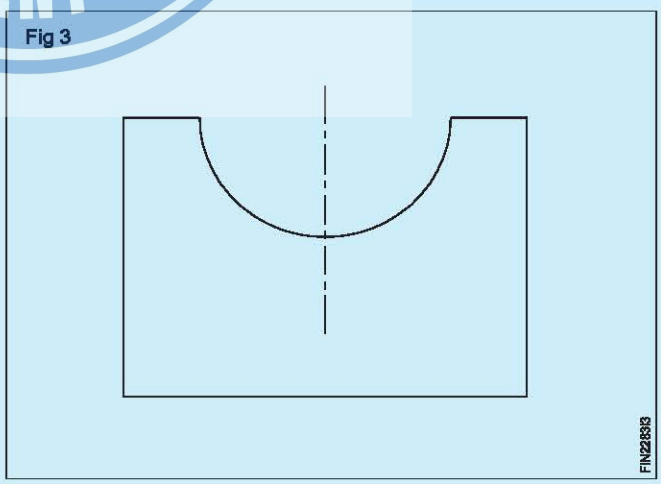


Fig 3



- File curved surface with half round file and check the curved profile with template.
- Hold the round test bar Ø 60 mm in bench vice along with aluminium vice clamps.
- Apply thin coat of prussion blue on the one end of cylindrical surface of test bar.
- Place the curved surface of the job on prussion blue applied test bar and rotate back and forth.
- Notice the blue spotted marks on curved surface.
- Hold the job in bench vice.
- Scrap and remove the high spots on the curved profile surface using half round scraper.
- Wipe off the scraped surface with soft cloth to remove burrs.
- Again, apply prussion blue on the test bar and place the curved scrapped surface on test bar and rotate back and forth.
- Repeat the scrapping process until the prussion blue spotted marks spread over the entire curved surface of the job.
- Wipe off the scraped surface with soft cloth.
- Apply thin coat of oil and preserve it for evaluation.

Skill sequence

Scraping curved surfaces

Objective: This shall help you to

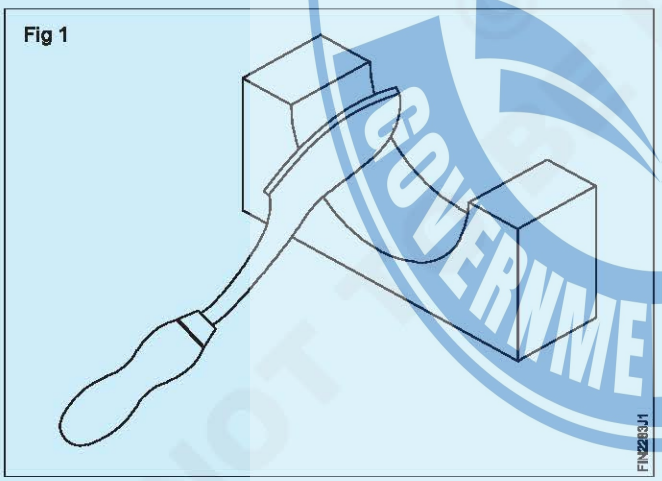
- **scrap and test curved surfaces.**

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

Method

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

Fig 1



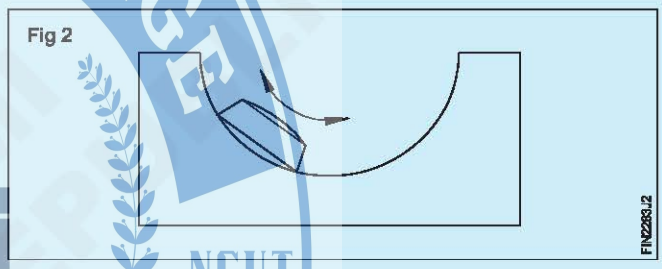
Pressure is exerted with the other hand on the shank for cutting.

Rough scraping will need excessive pressure with longer strokes.

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

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

Fig 2



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

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

Fig 3

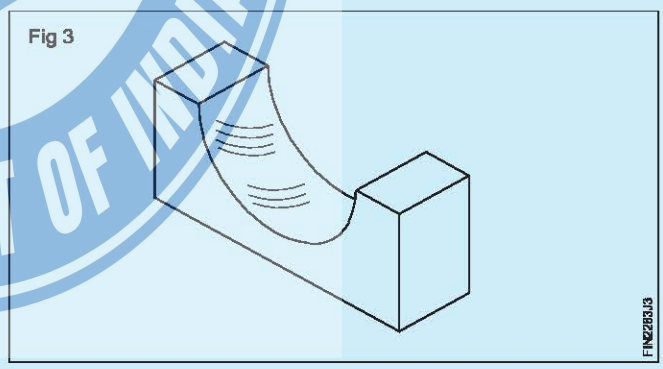
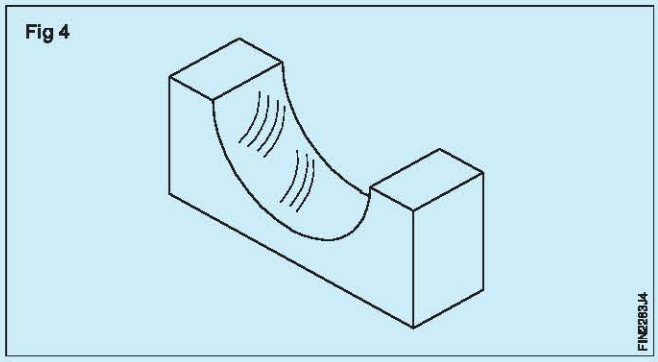


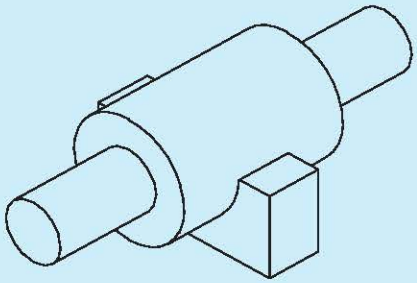
Fig 4



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

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

Fig 5



Sharpening a flat scraper

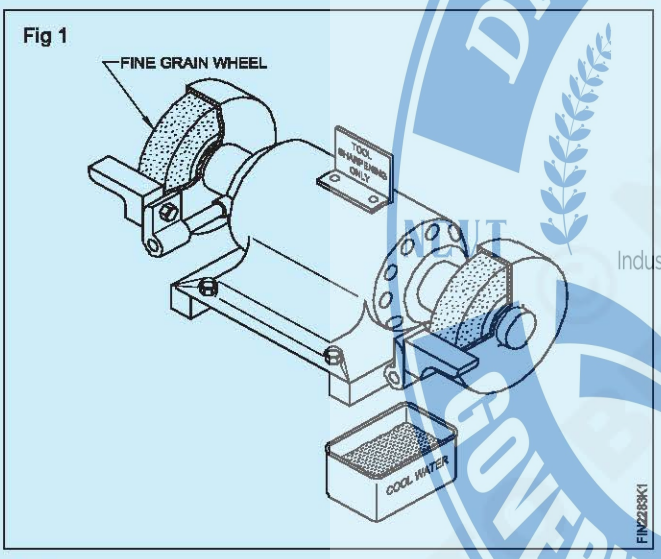
Objective: This shall help you to
- **sharpen a flat scraper by grinding and honing.**

Flat scrapers are sharpened by grinding the cutting edge and honing both faces.

To avoid overheating while grinding, use wet wheel grinding or ensure that there is a cooling arrangement for the pedestal/bench grinder.

Select a grinding wheel with fine grain. (Fig 1)

Fig 1

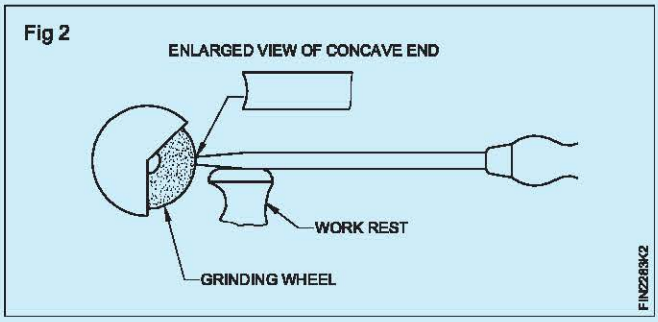


Soft grade aluminium oxide grinding wheel with large diameter gives best results.

Check for gap between the work-rest and the grinding wheel, and adjust, if necessary.

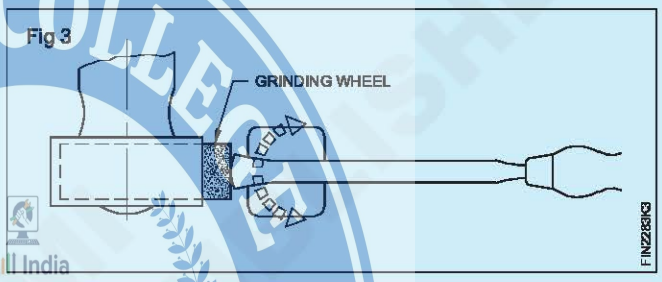
For grinding the cutting edges, hold the scraper horizontal and flat on the tool rest. (Fig 2)

Fig 2



Move the scraper in an arc to provide a slightly concave surface on the cutting edge. (Fig 3)

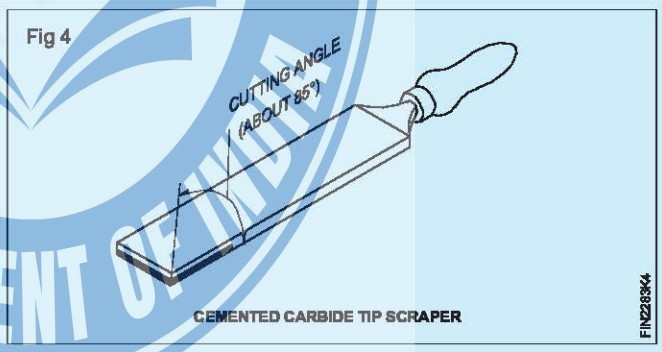
Fig 3



If the scraper is carbide-tipped use silicon carbide or diamond wheels. (Fig 4)

The cutting edges sharpened by grinding should be honed. Honing removes grinding marks and provides keen cutting edges.

Fig 4



Use a fine grade aluminium oxide oilstone for honing.

While honing use a lubricant.

Mix light mineral oil with kerosene for preparing the lubricant.

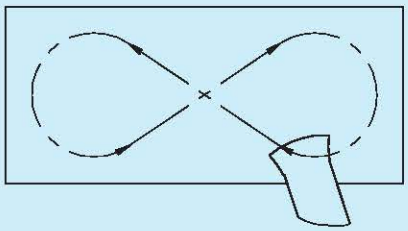
Hone the faces first with a movement as shown in Fig 5.

Then hone the cutting end by placing the scraper in an upright position on the oilstone with a rocking movement. (Figs 6 and 7)

What should be the cutting angle? It should be

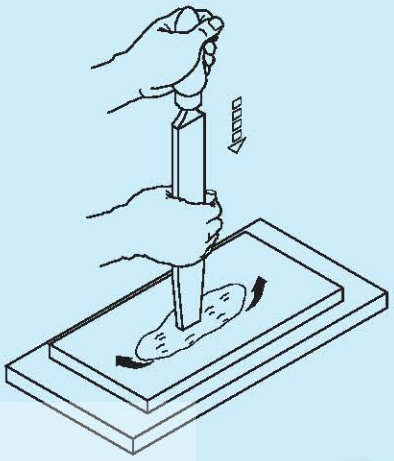
- for rough scraping - 60°
- for final scraping - 90°.

Fig 5



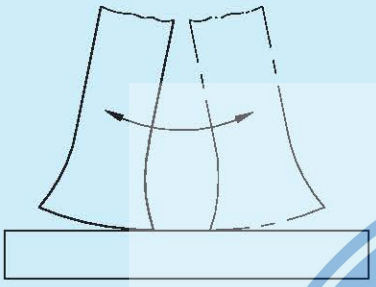
FIN2283K5

Fig 6



FIN2283K6

Fig 7



FIN2283K7

Sharpening half round scrapers

Objective: This shall help you to

- **sharpen a half round scraper.**

Scrapers are usually re-sharpened on oilstones. When cutting edges are badly damaged, they are ground on pedestal grinders.

Sharpening half round scrapers

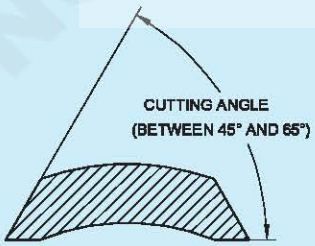
Half round scrapers have two cutting edges on the rounded back. (Fig 1)

Fig 1

FIN2283U1

The cutting edges are formed by the bottom surface, and the flat surfaces are ground on the rounded back of the scraper. (Fig 2)

Fig 2

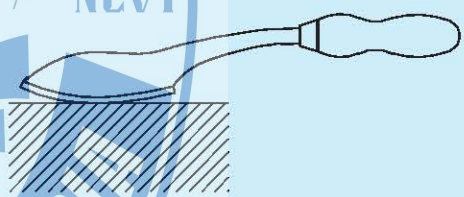


SECTION OF HALF - ROUND SCRAPER

FIN2283U2

Grind the bottom surfaces with a slight curve. This helps the cutting edges to make point contact on the surfaces being scraped. (Fig 3)

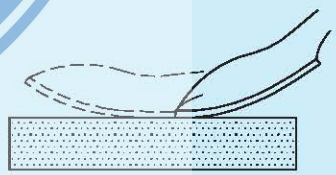
Fig 3



FIN2283U3

Rub the bottom surface with a rocking motion on the oli stone for re-sharpening. (Fig 4)

Fig 4



FIN2283U4

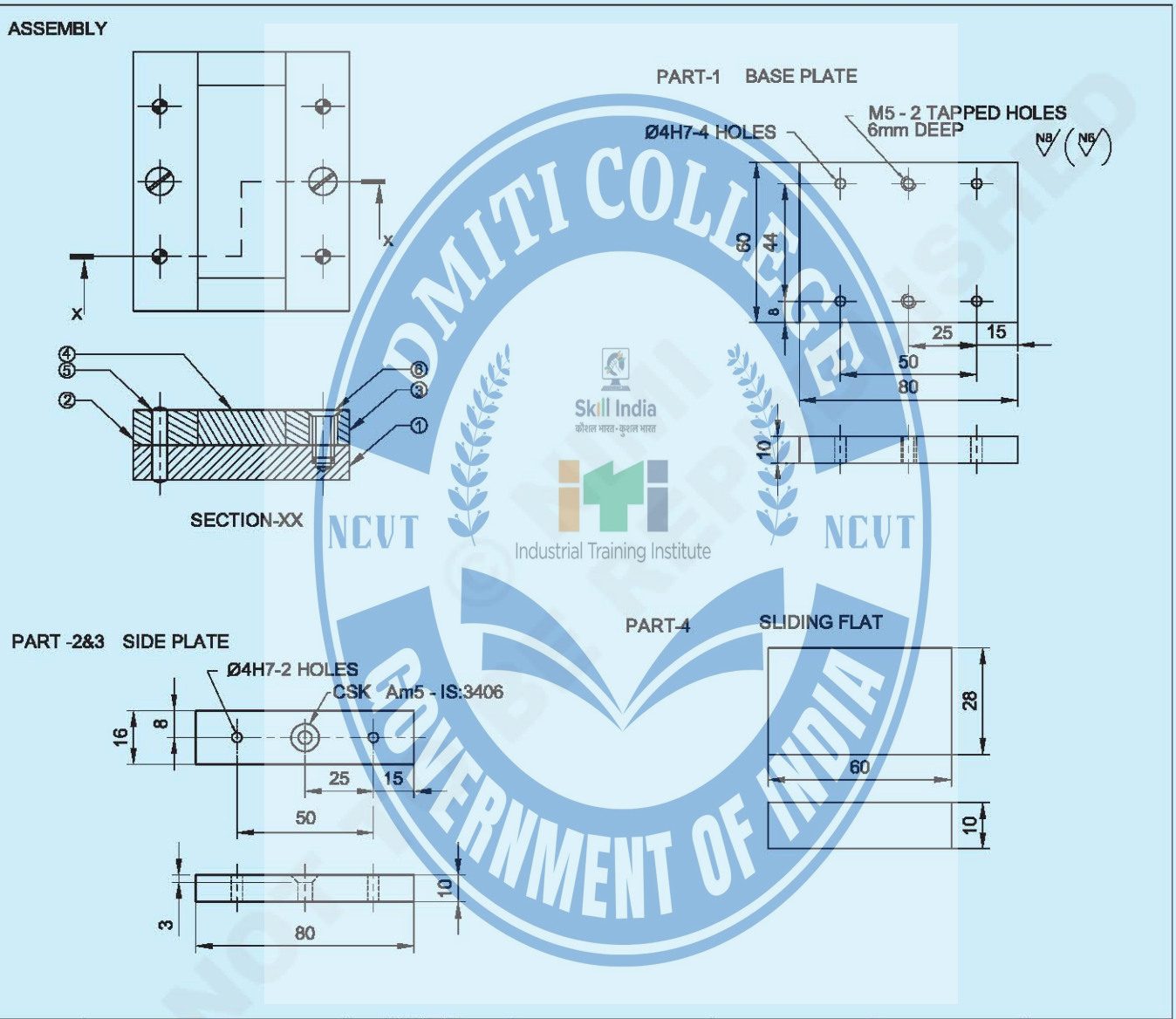
When the cutting edge is blunt it can be re-sharpened by grinding the bottom surface.

As far as possible avoid grinding of the edges. (Flat surface ground on the rounded back.)

Make and assemble, sliding flats, plain surfaces

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

- **file surfaces to flat and square to the accuracy of ± 0.04 mm**
- **mark dimension lines as per drawing**
- **prepare all the parts as per drawing**
- **drill dowel pin holes, counter sink screw holes**
- **assemble and slide flat in plain surfaces.**



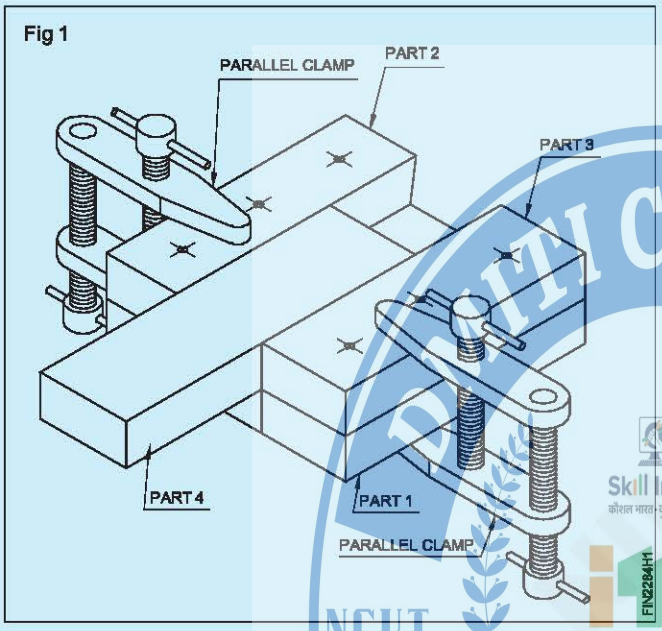
2	M5-16	COUNTER SUNK SCREW	-	-	6	-
4	Ø4-20	DOWEL PIN	-	-	5	-
1	65 ISF 12-32	SLIDING FLAT	Fe310	-	4	-
2	20 ISF 12-85	SIDE PLATE	Fe310	-	2&3	-
1	65 ISF 12-85	BASE PLATE	Fe310	-	1	1.6.84
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

SCALE NTS	SLIDING FIT	TOLERANCE ±0.04 mm	TIME:
		CODE NO. FI20N1684E1	

Job Sequence

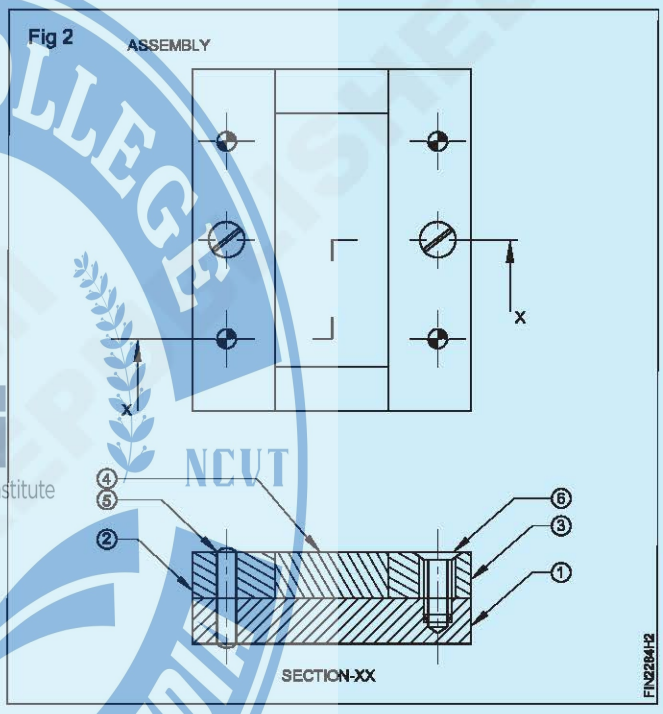
- Check the raw material for its size.
- File job for part 1,2 3 and 4 to size and shape as per drawing.
- Apply marking media on part 2 and 3 and mark to locate the dowel pin holes, countersink screw holes as per drawing.
- Assemble and clamp part 1,2 3 and 4 together in drilling machine table with parallel clamps as shown in Fig 1.

Fig 1



- Fix Ø 3.8 mm drill in drilling machine spindle through drill chuck and drill through hole.
- Fix Ø 4 mm hand reamer in tap wrench and ream the drilled hole to fix Ø 4 mm dowel pin without disturbing the assembly setting.
- Clean the reamed hole and insert Ø 4 mm dowel pin.
- Similarly, drill holes for other 3 dowel pin holes one by one and ream the drilled holes one by one and fix the dowel pins without disturbing the assembly.
- Fix Ø 4.2 mm drill in drilling machine spindle through drill chuck and drill holes for tap drill holes for fixing counter sink screws in assembly without disturbing the setting.
- Separate the assembly parts 1,2 3,4 and chamfer the tapping holes both ends in part 1 using countersink tool.
- Hold part 1 in bench vice.
- Drill free hole Ø 5.5 for countersink screw on part 2and 3 and countersink the hole to seat ountersink head screw .
- Cut internal thread using M5 hand tap and tap wrench.
- Clean the thread without burrs
- Assemble part 1, 2,3 and 4 as per job drawing along with dowel pins and countersink screws.
- Fit and slide part 4 in the assembly as shown in Fig 2.

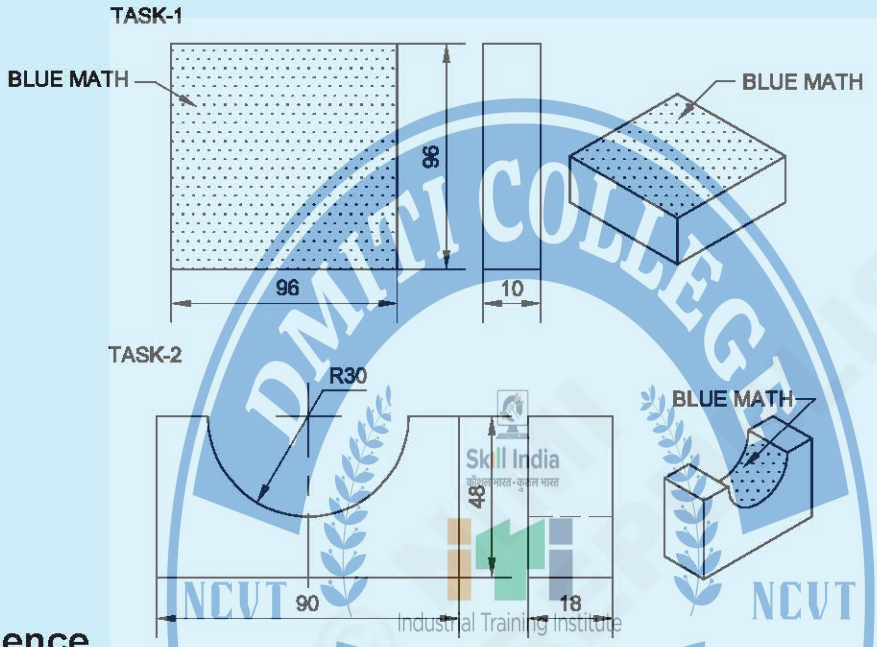
Fig 2



- Disassemble all the parts from assembly.
- Finish file on the surface of part 1,2,3,4 and remove burrs in the corners of the job.
- Re-assemble all the parts together as per job drawing.
- Apply thin film of oil and preserve it for evaluation.

Check for blue match of bearing surfaces - both flat and curved surfaces by whit worth method

Objectives: At the end of this exercise you shall be able to
- **apply prussion blue on surface plate and cylindrical test bar**
- **check the blue match of high spots on flat surface using surface plate**
- **check the blue match of high spots on curved surface using test bar.**



Job Sequence

TASK 1: **Checking blue math on flat surface**

- Use exercise no:1-6-83 Task 1 job for this exercise.
- Clean the surface plate with soft cloth.
- Apply prussion blue evenly on the surface plate.
- Place the job on the surface plate
- Move slightly forward and backward and notice the blue match spreaded over entire the flat surface.

TASK 2: **Checking blue math on curved surface**

- Use exercise no: 1-6-83 Task 2 job exercise.
- Clean the cylindrical test bar with soft cloth.
- Hold the test bar in bench vice along with aluminium vice clamp.
- Apply prussion blue evenly on the curvature of the test bar.
- Place the curved surface of the job on test bar and rotate slightly on back and forth.
- Notice the blue match spreaded over the entire curved surface.

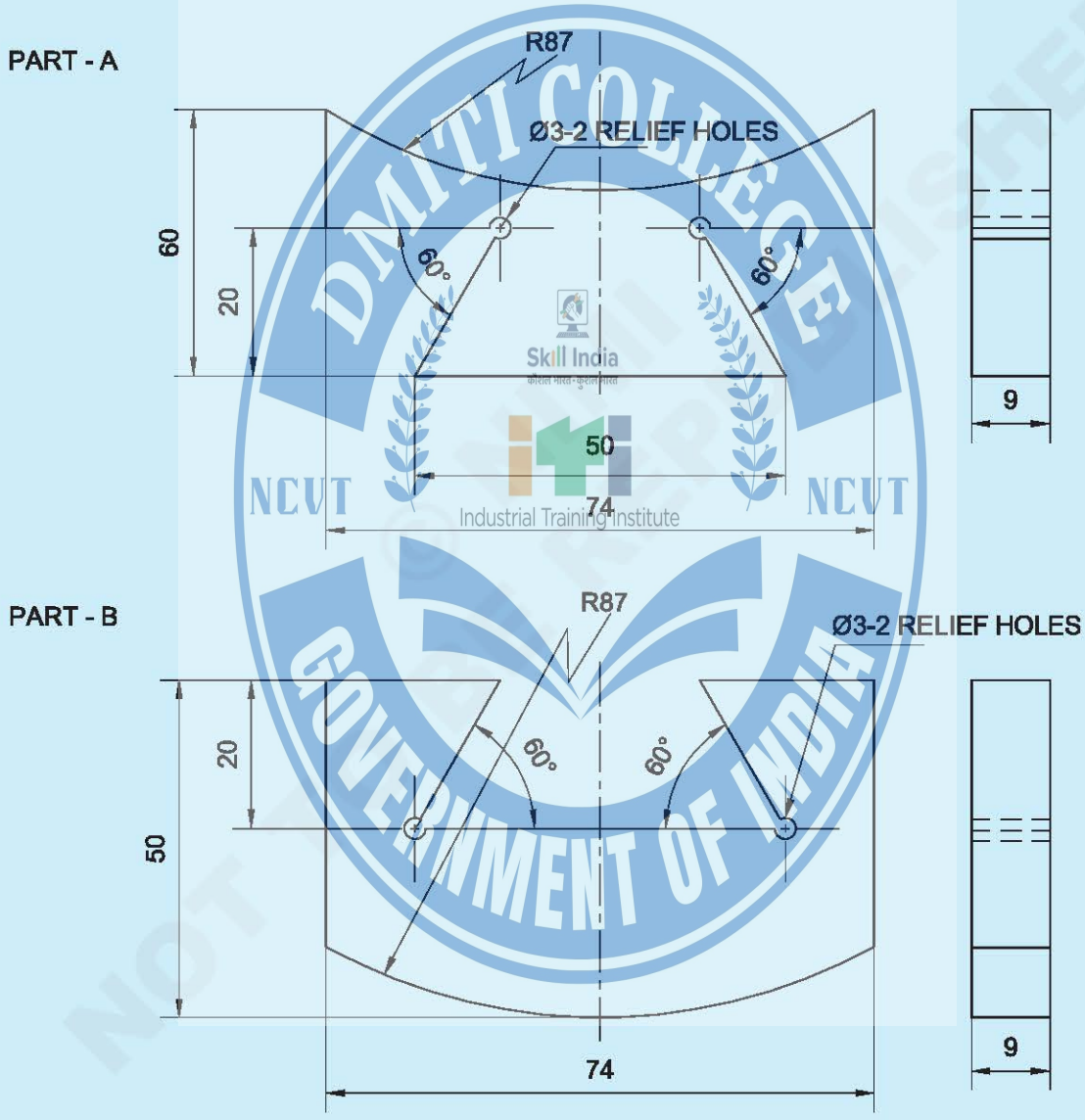
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
-	-	1.6.83 ←	-	-	TASK-1	1.6.85
-	-	1.6.83 ←	-	-	TASK-2	1.6.85

SCALE NTS	CHECK FOR BLUE MATH OF BEARING SURFACES-BOTH FLAT AND CURVED SURFACES BY WHIT WORTH METHOD	TOLERANCE ±0.04 mm	TIME:
		CODE NO. FI20N1685E1	

File and fit combined radius and angular surface (accuracy ± 0.5 mm) angular and radius fit

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

- **file flat and parallel surface to an accuracy of ± 0.04 mm**
- **mark dimension lines as per drawing**
- **chain drill, chip to remove excess material**
- **file dovetail and curved profile as per drawing and check the angles with vernier bevel protractor and curved surface with template**
- **fit combined radius and angular surface.**



1	75 ISF 10 - 55	-	Fe310	-	B	1.6.86
1	75 ISF 10 - 65	-	Fe310	-	A	1.6.86
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

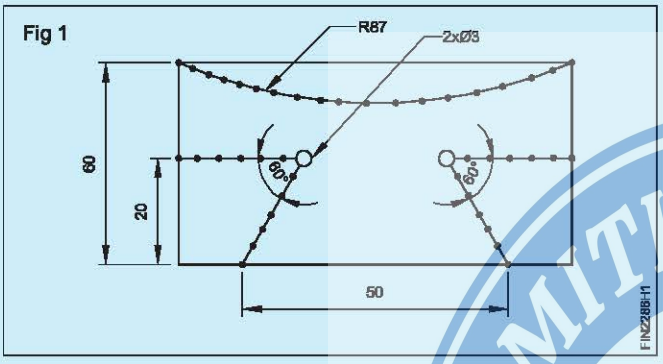
SCALE 1 :1	FILE AND FIT COMBINED RADIUS AND ANGULAR SURFACE (ACCURACY±0.5mm), ANGULAR AND RADIUS FIT	TOLERANCE ±0.04mm ANGLE 30 MINUTES	TIME:
		CODE NO FI20N1686E1	

Job Sequence

PART A

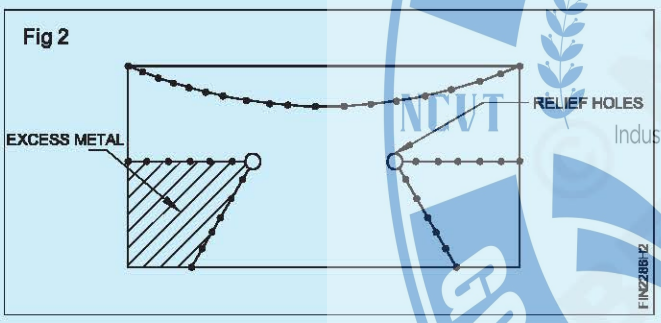
- Check the raw metal size using steel rule.
- File and finish to overall size of 74x60x9 mm maintaining parallelism, perpendicularity and to the accuracy of ± 0.04 mm
- Check the size with vernier caliper.
- Apply marking media, mark as per drawing and punch witness marks as shown in Fig 1.

Fig 1



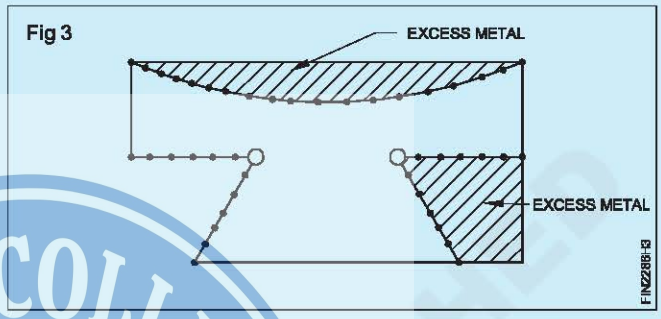
- Drill relief holes Ø 3 mm as shown Fig 2.
- Hacksaw and remove the hatched portion of excess metal in one side as shown in Fig 2.

Fig 2



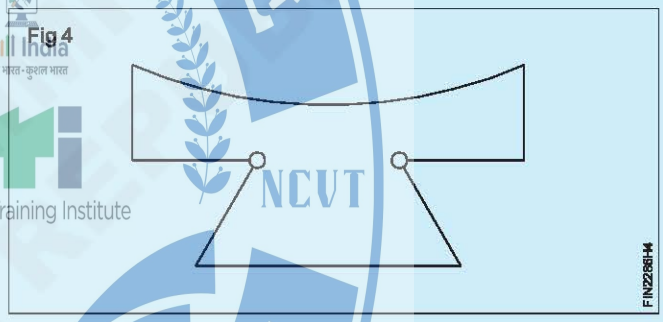
- File to size maintaining accuracy of ± 0.04 mm for linear dimension and 30 minutes accuracy for angular dimension.
- Check the size with vernier caliper and angle with vernier bevel protector.
- Similarly, cut and remove excess metal in other side and file to size and shape as shown in Fig 3.

Fig 3



- Cut and remove the excess metal in curvature side and file curved profile to size and shape as shown in Fig 4.
- Check the curved profile with template.

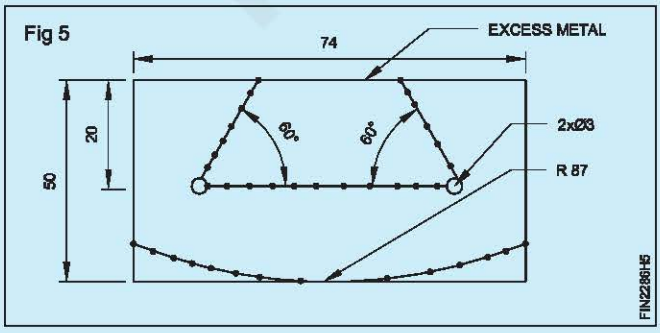
Fig 4



PART B

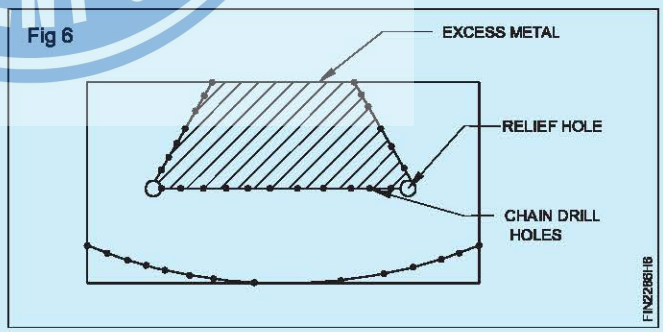
- File and finish to overall size of 74x50x9 mm maintaining parallelism and perpendicularity and to the accuracy of ± 0.04 mm.
- Check the size with vernier caliper.
- Apply marking media, mark as per drawing and punch witness marks as shown in Fig 5.

Fig 5



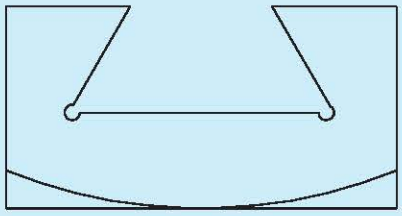
- Drill relief holes Ø 3 mm and drill chain drill holes to remove excess metal as shown Fig 6.

Fig 6



- Hacksaw, chip and remove the hatched portion of excess metal and File the chipped portion to size and shape as shown in Fig 7.

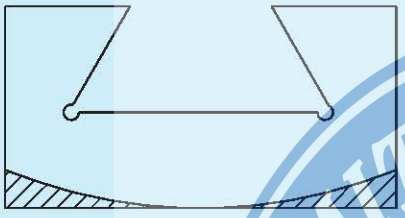
Fig 7



FIN2286-I7

- Hacksaw and remove the hatched portion of excess metal on curved surface shown in Fig 8.

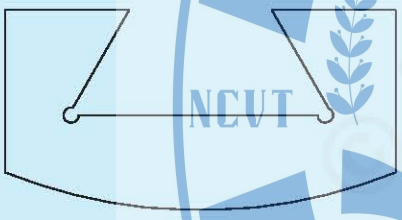
Fig 8



FIN2286-I8

- File the curved portion to size and shape as shown in Fig 9.

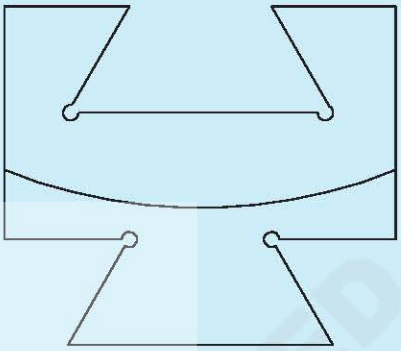
Fig 9



FIN2286-I9

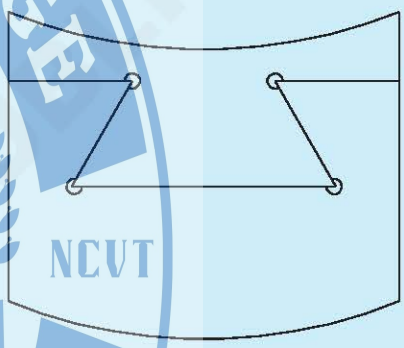
- Check the curved profile with template.
- Match part A and B as shown in Fig 10 and 11
- Finish file in part A,B and remove the burrs in all the corners.

Fig 10



FIN2286-IHA

Fig 11

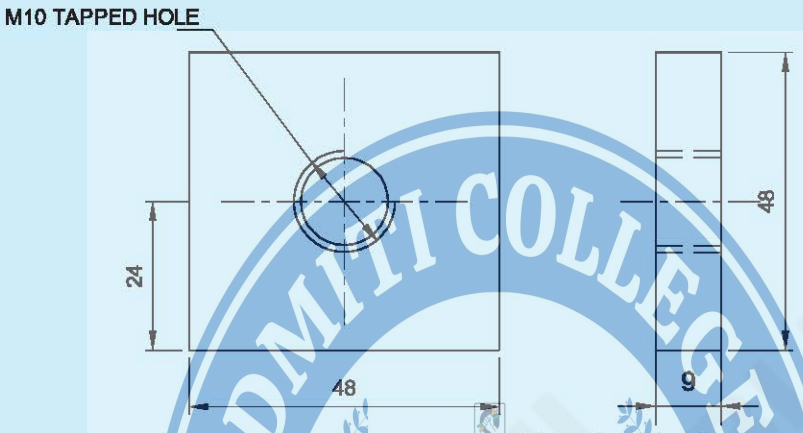


FIN2286-IHB

- Apply a little oil and preserve it for evaluation

Locate accurate holes and make accurate hole for stud fit

Objectives: At the end of this exercise you shall be able to
- **file surfaces flat and square**
- **determine tap drill size for tapping hole and drill the hole**
- **cut M10 internal thread using tap with wrench**
- **fit stud in the threaded hole.**

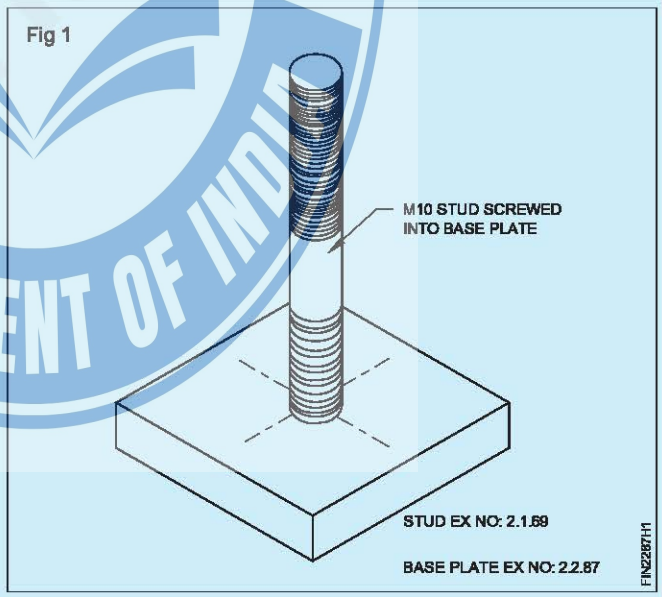


NOTE: USE EX NO: 2.1.69 STUD FOR FIT

Job Sequence

- Check the raw material for its size.
- File metal to size 48x48x9 mm maintaining flatness and squareness.
- Check the size with vernier caliper.
- Mark drill hole at the centre of the job as per drawing.
- Determine the tap drill size for M10 tap.
- Hold job in bench vice
- Fix centre drill in drill chuck and drill centre drilling to locate the drill hole centre.
- Similarly, fix Ø 6 mm drill and drill pilot hole.
- Fix Ø 8.5 mm drill and drill through hole for tapping.
- Chamfer on both ends of the drilled hole using countersink tool.
- Hold the job in bench vice.
- Cut M10 internal thread using hand tap and tap wrench.
- Clean the thread to remove the burrs.
- Check the thread with screw pitch gauge.
- Fit stud in the threaded hole Fig 1.
- Use the stud in Ex No. 1.5.69 TASK 1
- Apply a little oil and preserve it for evaluation

Fig 1



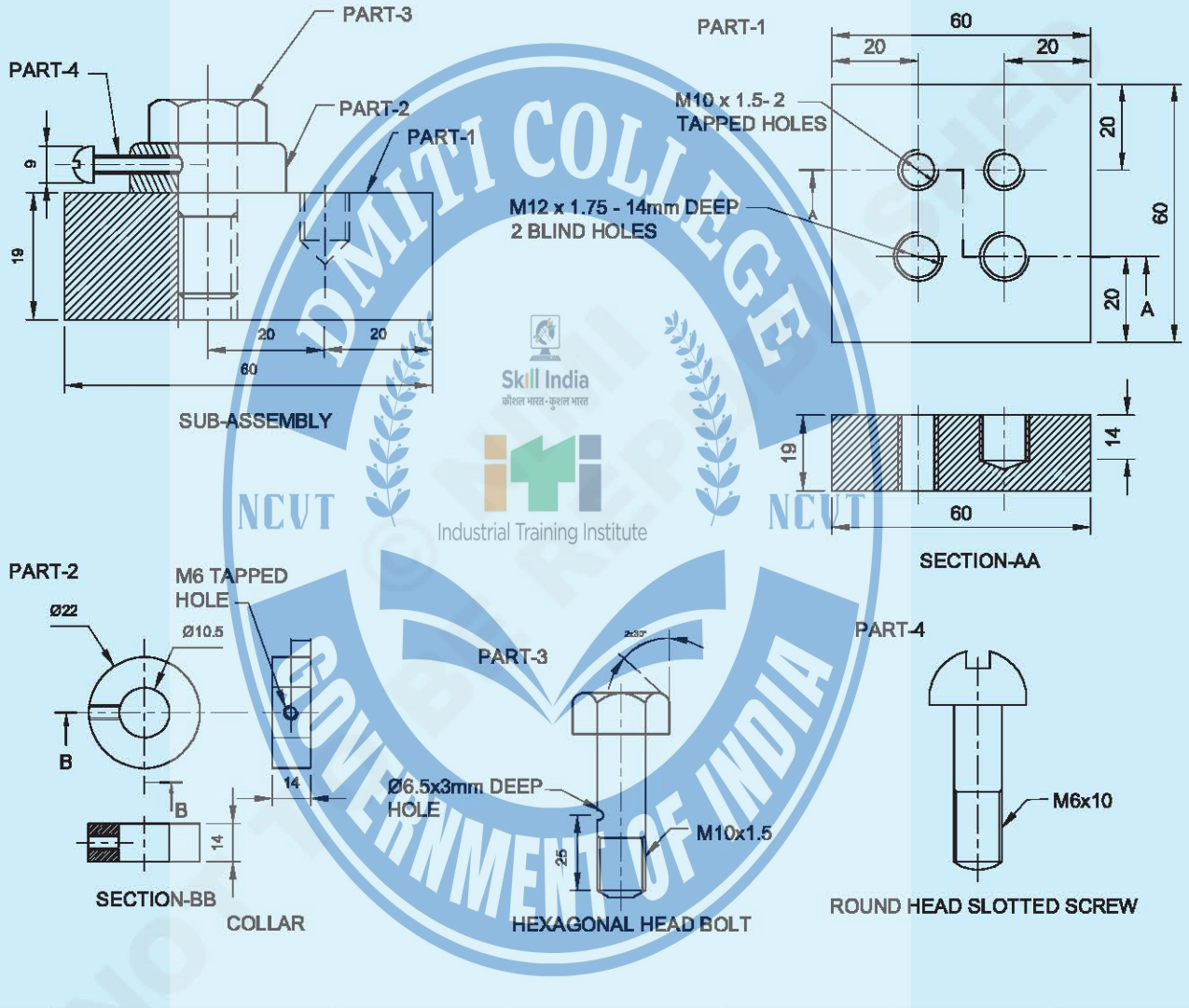
1	50 ISF 10 - 50	-	Fe310	-	-	1.6.87
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

SCALE 1 :1	LOCATE ACCURATE HOLES & MAKE ACCURATE HOLE FOR STUD FIT	TOLERANCE ±0.04mm	TIME :
		CODE NO. FI20N1687E1	

Fasten mechanical components/sub-assemblies together using screws, bolts and collars using hand tools

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

- **file surface flat and square**
- **mark drill holes as per drawing**
- **cut M6 internal thread using hand tap and tap wrench**
- **assemble together all the parts as per drawing.**



NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.
1	ROUND HEAD SLOTTED SCREW M6x10	-	Fe310	-	4	
1	-	1.5.69 PART-2 ←	Fe310	-	3	
1	25 ISF15-25	-	Fe310	-	2	
1	-	1.5.68 ←	Fe310	-	1	1.6.88

SCALE 1:1	FASTEN MECHANICAL COMPONENTS/SUB-ASSEMBLIES TOGETHER USING SCREWS,BOLTS AND COLLARS USING HAND TOOLS	TOLERANCE ±0.04mm	TIME :
		CODE NO. FI20N1688E1	

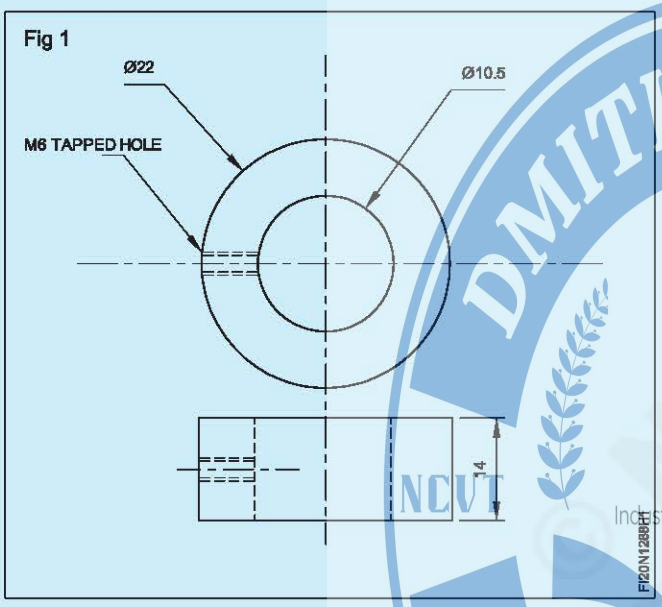
Job Sequence

- Use Ex: No 2.1.68 for part 1 and Ex.No 2.1.69 part 2 for part 3.

Prepare collar: (Part 2)

- Check the raw material size.
- File flatness and squareness
- Mark in collar as per job drawing and punch the hole centre and the outer circumference of collar.
- Drill the centre of hole Ø 10.5 mm and chamfer sink the drilled hole both sides.
- Hold the job in bench vice and file the circumference of collar to Ø 22 mm and thickness 14mm. Fig 1

Fig 1



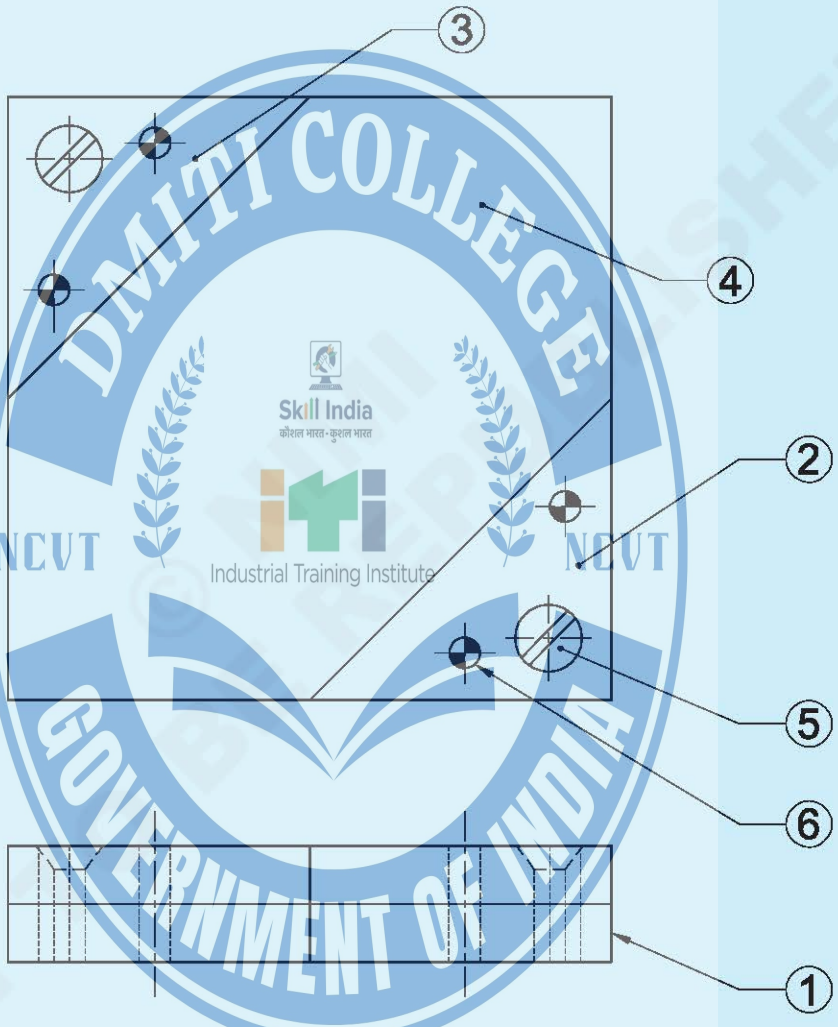
- Check the size with vernier caliper.
- Clean the parts 1,2 and 3.
- Assemble the parts 1 and 2 using hexagonal bolt and tighten the bolt using suitable double ended spanner/ ring spanner.
- Mark the tap drill hole centre on middle of the collar as shown in job drawing
- Set the assembly in drilling machine table using suitable clamping device.
- Make drill hole collar Ø 5.2 mm for M6 tap and drill upto opening of ID 10.5mm in hexagonal bolt as shown in job drawing.
- Separate the parts 1,2, and 3.
- Fix counter sink tool in drilling machine and chamfer the Ø 5.2 mm drilled hole.
- Hold the collar in bench vice
- Cut M6 internal thread using hand tap and tap wrench.
- Re-assemble the parts 1,2 and 3 and tighten the hexagon bolt using suitable double ended spanner / ring spanner.
- Screw the round head slotted screw in collar as shown job drawing and make it tight using suitable screw driver and complete the sub-assemblies.
- Apply thin coat of oil and preserve it for evaluation.

Make sliding fits assembly with parallel and angular mating surface

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

- **file surface flat and parallel to the accuracy of ± 0.04 mm**
- **mark dimension lines as per drawing**
- **file and prepare all the parts for assembly**
- **drill holes for dowel pins and countersink screws**
- **assemble components using dowel pins and counter sink screws**
- **fit and slide the angular mating surface, finish and de-burr.**

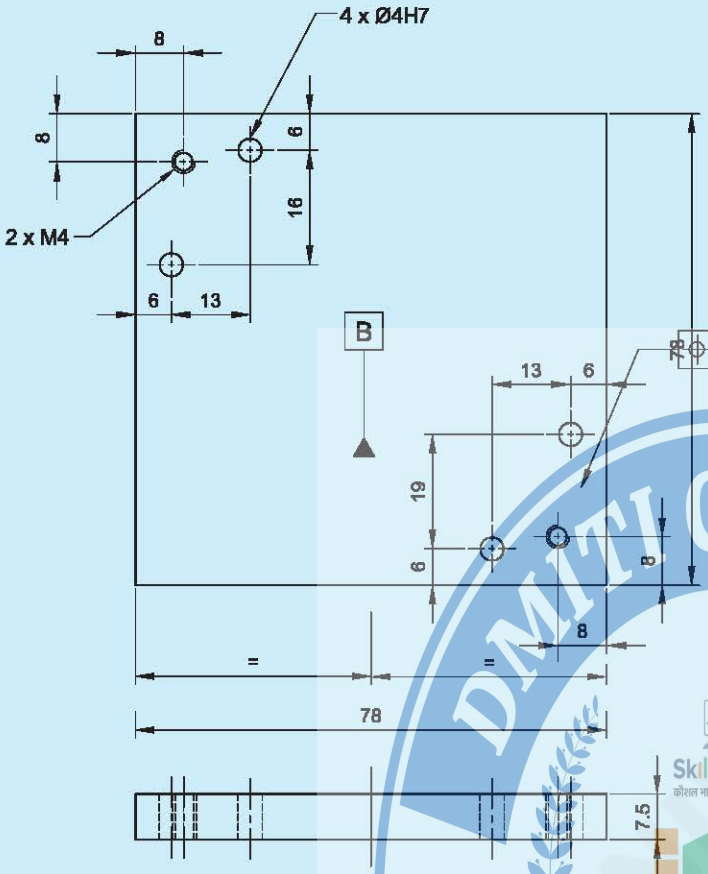
ASSEMBLY



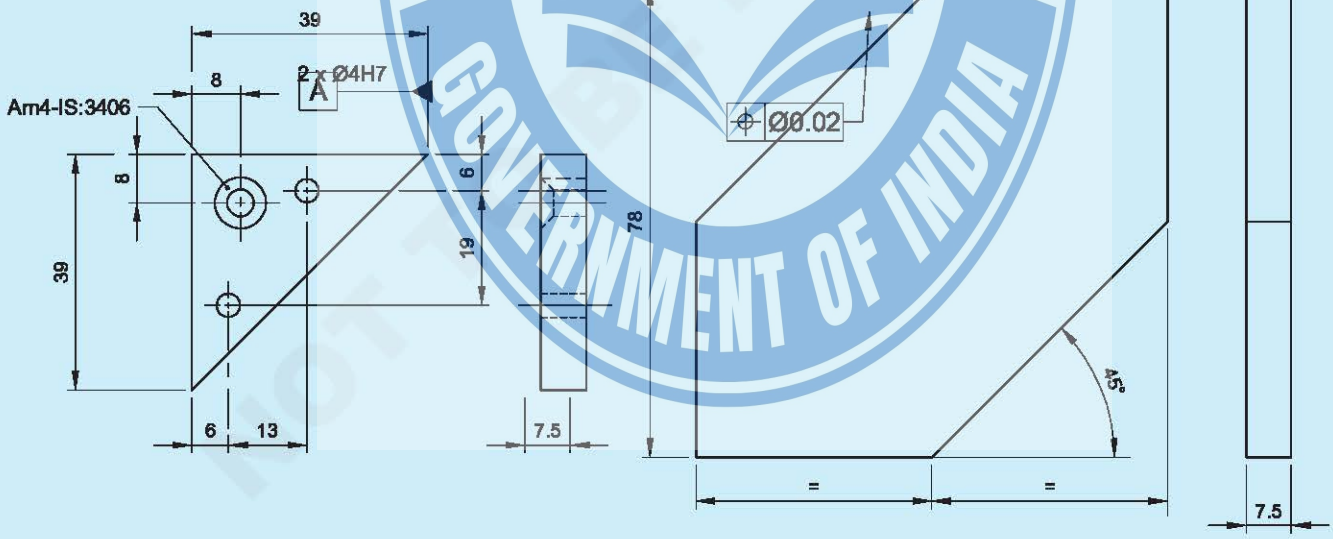
4	4h8 x 14 IS:2393	CYLINDRICAL PIN	Std	-	6	-
2	AM4 x 14 IS:1365	CSK HEAD SCREW	Std	-	5	-
1	80ISF8 - 80	-	Fe310	-	4	-
2	40ISF8 - 42	-	Fe310	-	2&3	-
1	80ISF8 - 80	-	Fe310	-	1	1.6.89
NO.OFF	STOCK SIZE	SEMI-PRODUCT	MATERIAL	PROJECT NO.	PART NO.	EX. NO.

SCALE 1:1	MAKE SLIDING FITS ASSEMBLY WITH PARALLEL AND ANGULAR MATING SURFACE.(±0.04mm)	DEVIATIONS: ±0.04mm	TIME :
		CODE NO. FI20N1689E1	

PART-1 BASE PLATE



PART-2&3 SIDE PLATES



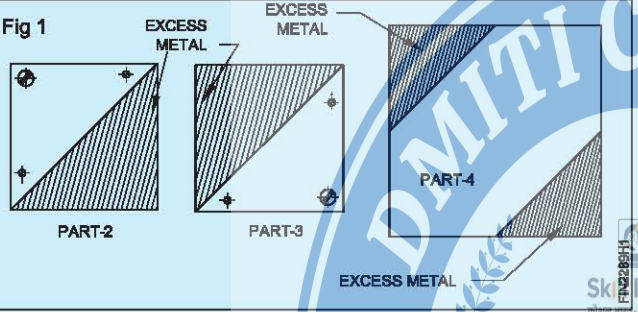
PART-4 SLIDING PLATE

SCALE 1:1	BASE PLATE	TOLERANCE	TIME
		CODE NO. FI20N1689E2	

Job Sequence

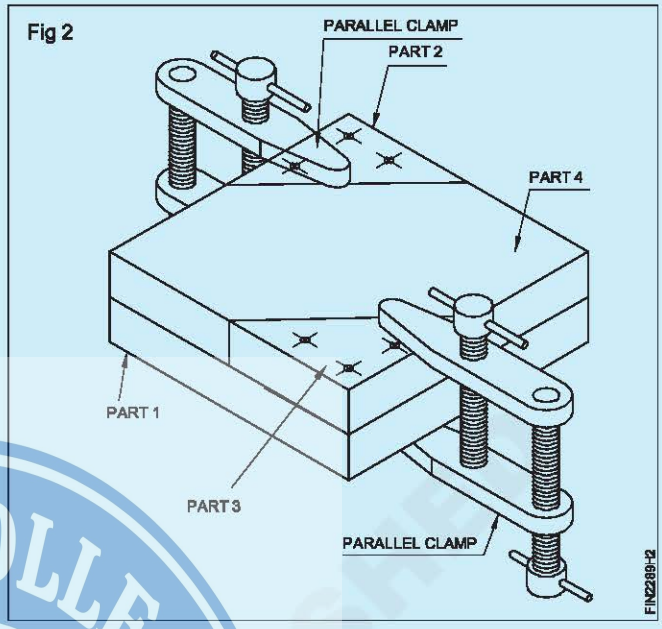
- Check the raw material for its size.
- File the materials for part 1,2,3 and 4 to overall sizes maintaining the accuracy ± 0.04 mm.
- apply marking media on part 2,3 and 4 and mark linear dimensional lines with vernier height gauge and angular lines with vernier bevel protector.
- Punch witness marks on part 2,3 and 4.
- Punch on drill hole marks for dowel pins and counter sink screws assembly using centre punch.
- Cut and remove the excess metal from part 2,3,4 and file to size and shape as per job drawing and check the size with vernier caliper and angles with vernier bevel protractor. (Fig 1)

Fig 1



- Assemble and clamp part 1,2 and 3 together in a drilling machine table with parallel clamps as shown in Fig 2.
- Fix Ø 3.8 mm drill in drilling machine spindle through drill chuck and drill through holes for dowel pin assembly.
- Fix Ø 4 mm hand reamer with tap wrench and ream the drilled hole to fix Ø 4 mm dowel pins without disturbing the assembly setting.
- Clean the reamed hole with soft cloth and insert Ø 4 mm dowel pin.
- Similarly, drill for other dowel pin holes one by one and ream drilled holes to fix Ø 4 mm, 3 dowel pins, one by one without disturbing the assembly setting.

Fig 2



- Determine tap drill size for M4 internal thread
- Fix Ø 3.3 mm drill in drilling machine spindle through drill chuck and drill tap drill two holes as shown in job drawing.
- Seperate the assembly part 1,2,3 and 4.
- Fix counter sink tool in drilling machine and chamfer in both ends of drilled holes to cut internal thread in part 1.
- Hold the part 1 in bench vice and cut internal thread using M4 tap and tap wrench.
- Fix counter sink tool and counter sink the drilled holes in part 2 and 3 to seat the counter sink head screws and drill a clearance hole for M4 counter sink screws.
- Finish file on part 1,2,3, 4 and remove burrs in all corners of the job and assemble the parts all together using dowel pins, counter sink screws as shown in job drawing.
- Apply a thin coat of oil and preserve it for evaluation.