TRADE TRAINING-I

TTC PROGRAMME

MILLWRIGHT

TEVTA

GOVERNMENT OF THE PUNJAB
TECHNICAL EDUCATION & VOCATIONAL TRAINING AUTHORITY
PUNJAB BOARD OF TECHNICAL EDUCATION
TRADE TESTING CELL, LAHORE.

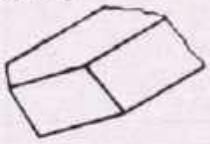
T. T. P. Series No. 27

Price Rs. 20/-

HINTS FOR OFFHAND GRINDING

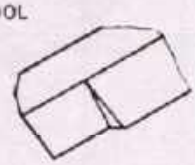
1

RIGHT HAND ROUGHING TOOL



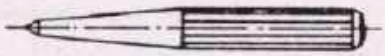
103/01 ← 2

RIGHT HAND SIDE TOOL



103/01 ← 3

CENTRE PUNCH

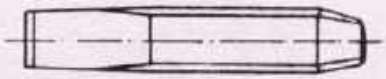


4

SCRIBER

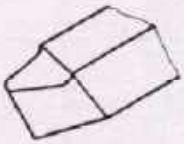
5

FLAT CHISEL



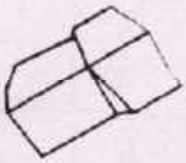
6

ROUND NOSE SMOOTHING TOOL



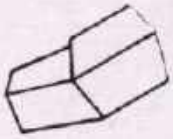
103/01 ← 7

RIGHT HAND SIDE TOOL



103/01 ← 8

RIGHT HAND ROUGHING TOOL



103/01 ← 9

TWIST DRILL

10

THE ABOVE SHOWN EXERCISES SHOULD BE COMPLETED WITHIN 2 WEEKS.

AFTER COMPLETION OF THIS OFFHAND GRINDING COURSE, THE TRAINEES SHOULD BE ABLE TO SHARPEN THE EXERCISED TOOLS IN CORRECT MANNER AND WITHOUT ANY ASSISTANCE.

THE REQUIRED MATERIALS FOR THE TOOL BITS ARE TO BE TAKEN FROM SHAPING EX.103/01. FOR THE OTHER EXERCISES WORN-OUT OR BLUNT TOOLS CAN BE USED.

SCALE	LAYOUT	No 1.0.5/1.10
MATERIAL		OFFHAND GRINDING

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

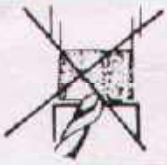
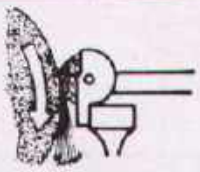
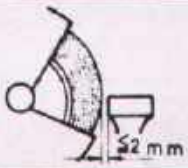
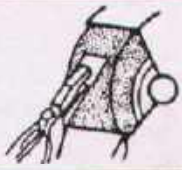
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MATERIAL REQUIRD

TRADE TRAINING I — TURNER / MACHINIST & FITTER

OFF HAND GRINDING
No:1.0.5/1 to 10

	Exercise No: (Length given in Millimeter)									Length per Trainee	Total Length for 16 Trainees	Total Weight for 16 Trainees
	2	3	5	6	7	8	9	10				
M.S.Squ. 16x16 mm R.H.Roughing Tool	150									150 mm	2.4meter	4.9 Kg
M.S.Squ. 16x16 mm R.H.Side Tool		150								150 mm	2.4meter	4.9 Kg
Tool Steel 5 mm or Spring Steel			175							175 mm	2.8meter	0.5 Kg
Tool Steel 22x11mm preforged				150						150 mm	2.4meter	4.6 Kg
M.S.Squ. 16x16 mm Round Nose Smoothing Tool					150					150 mm	2.4meter	4.9 Kg
M.S.Squ. 16x16 mm R.H. Side Tool						150				150 mm	2.4meter	4.9 Kg
M.S.Squ. 16x16mm R.H.Roughing Tool							150			150 mm	2.4meter	4.9 Kg
Worn out or condemned drills various sizes								1		1 Nos:	16 Nos:	16 Nos:

1		WHEN WORKING ON A GRINDING MACHINE, MAKE SURE THAT GUARDS AND HOODS ARE SECURELY PLACED. ALWAYS USE SOME SORT OF EYE PROTECTION, LIKE GOGGLES!
2		HAVE A CONTAINER OF COOL CLEAN WATER AVAILABLE TO COOL THE WORK AS IT BECOMES HEATED.
3		DON'T PRESS THE TOOL OR WORKPIECE CONSTANTLY AGAINST ONE PORTION OF THE GRINDING WHEEL ONLY. MOVE THE WORK ACROSS THE FULL FACE OF THE WHEEL TO PREVENT IT FROM BECOMING GROOVED.
4		DON'T GRIND ON THE SIDE OF A GRINDING WHEEL EXCEPT WHEN ABSOLUTELY NECESSARY! FOR ROUGH GRINDING ALWAYS WORK ON THE FACE OF A STRAIGHT GRINDING WHEEL!
5		BLUNT, GLAZED, GROOVED OR WOBBLING WHEELS MUST BE DRESSED OR TRUED.
6		DON'T WORK ON A GRINDING MACHINE WHICH HAS AN ABNORMAL 'SOUND'. MAYBE THE WHEEL HAS FRACTURES OR CRACKS OR IS NOT PROPERLY BALANCED.
7		WHEN GRINDING, KEEP THE TOOL REST ADJUSTED CLOSE TO THE WHEEL. A MAXIMUM DISTANCE OF 2 MM (1/16 IN.) IS RECOMMENDED TO PREVENT THE WORK FROM BEING CAUGHT BETWEEN THE REST AND THE WHEEL.
8		SMALLER TOOLS DON'T HOLD ON THE TOOL REST; SUPPORT THEM IN THE LEFT HAND AND SUPPORT THIS HAND WITH THE TOOL REST. VERY SMALL PARTS HOLD IN SUITABLE FIXTURES OR WITH PLIERS.
9		FOR HEAVY WORK, BIG GRINDING MACHINES AND COARSE GRIT WHEELS ARE REQUIRED. FOR FINE WORK, FINE GRIT WHEELS ARE REQUIRED. IF SPECIAL WORK OR MATERIALS OTHER THAN STEEL HAVE TO BE GROUND, ASK YOUR INSTRUCTOR!

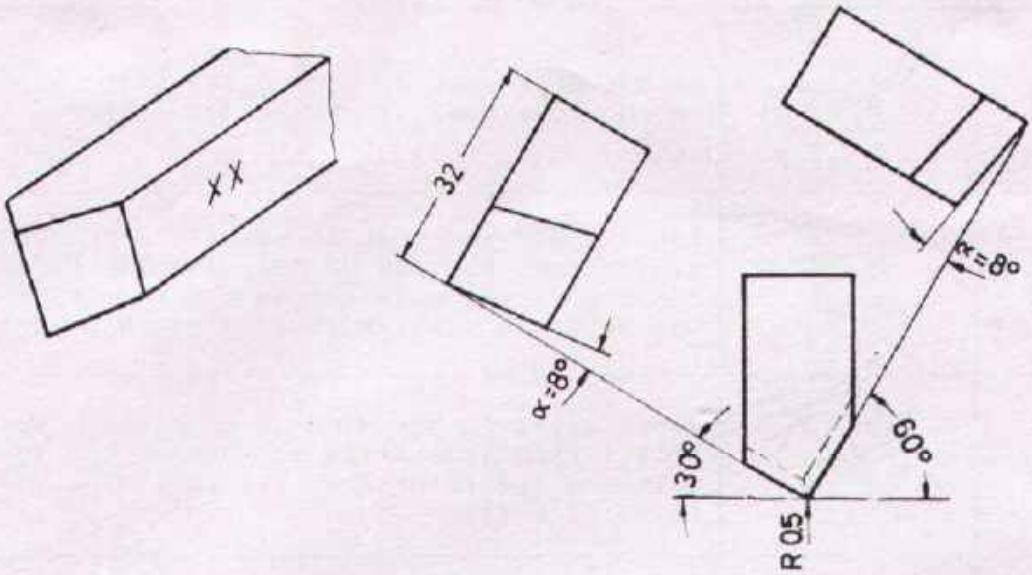
HINTS FOR OFFHAND GRINDING

NO. 1.0.5/01

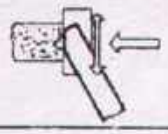
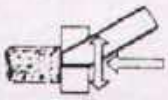
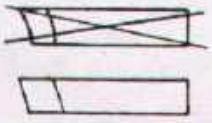
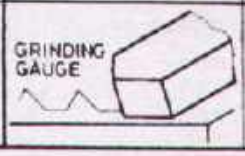
OFFHAND GRINDING

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME



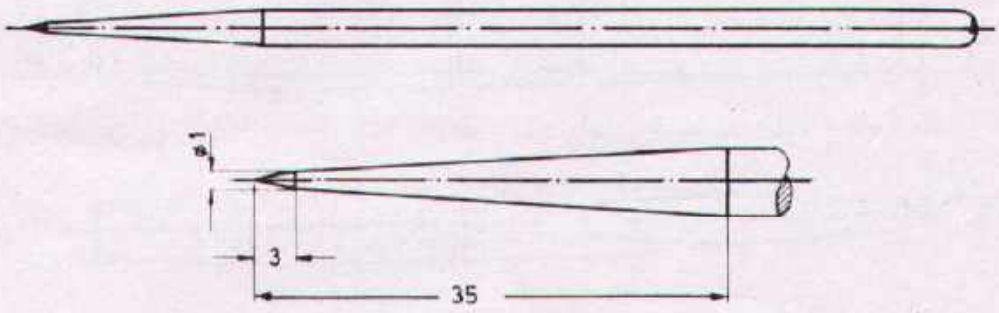
SEQUENCE OE OPERATIONS

NO.	Symbol	Tools	Descriptions
1		PEDESTAL WHEEL GRINDING MACHINE SAFETY GOGGLES BEVEL PROTRACTOR	GRINDING OF 60° ANGLE
2		AS UNDER NO. 1	GRINDING OF 30° ANGLE
3		CUP WHEEL GRINDING MACHINE SAFETY GOGGLES GRINDING GAUGE	GRINDING OF 60°, 30° ANGLES & RADIUS
4		TO AVOID HOLLOW GRINDING, THE CUP WHEEL GRINDER SHOULD BE USED FOR FINAL GRINDING	
5		GRINDING GAUGE	CHECKING OF CLEARANCE ANGLES. HOLD THE GRINDING GAUGE IN RIGHT ANGLE.

SCALE 1:1	RIGHT HAND ROUGHING TOOL (WITHOUT TOP RAKE ANGLE)	No 1.0 5/02
MAT From Ex 1.0 3/1		OFFHAND GRINDING

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK GERMAN TECHNICAL TRAINING PROGRAMME

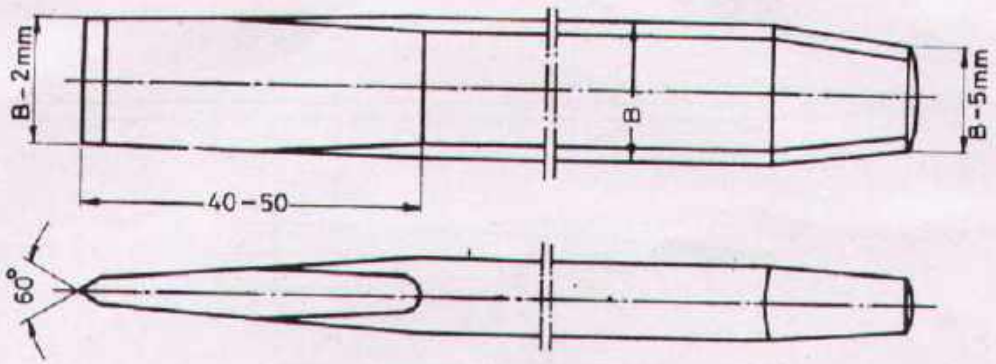


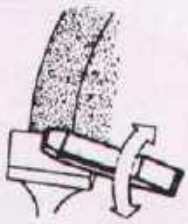
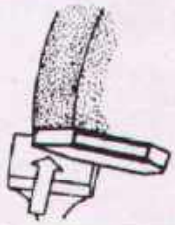
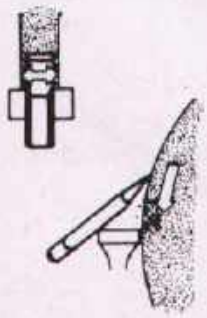
Nos.	Symbol	Tools	Descriptions
1		PEDESTAL WHEEL GRINDING MACHINE SAFETY GOGGLES CHECKING TOOLS	GRINDING OF LONG CONE
2		PEDESTAL WHEEL GRINDING MACHINE SAFETY GOGGLES	GRINDING OF CONICAL POINT

SCALE 1:1, 2:1	SCRIBER	NO 1.0.5/05
MAT. CARBON STEEL		OFFHAND GRINDING

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

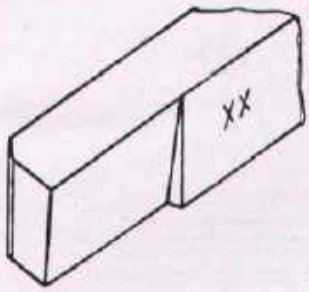


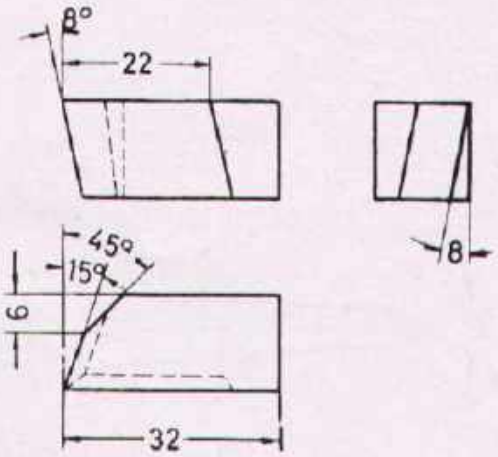
Nos.	Symbol	Tools	Descriptions
1		PEDESTAL WHEEL GRINDING MACHINE SAFETY GOGGLES	GRINDING OF CHISEL HEAD
2		PEDESTAL WHEEL GRINDING MACHINE SAFETY GOGGLES	GRINDING OF THE LONG CONICAL PORTION
3		PEDESTAL WHEEL GRINDING MACHINE SAFETY GOGGLES	SHARPENING OF CUTTING EDGE

SCALE 1 : 1	FLAT CHISEL	NO 105 / 06
MAT. CARBON STEEL		OFFHAND GRINDING

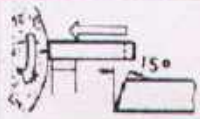
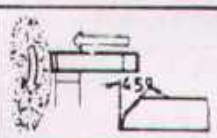
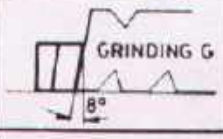
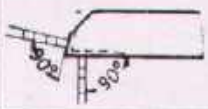
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME





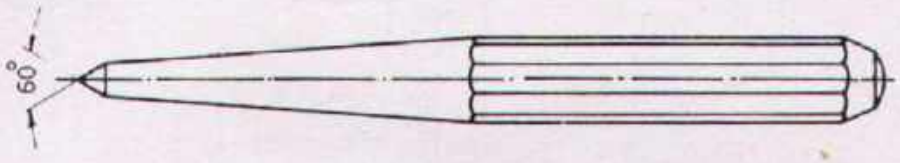
SEQUENCE OF OPERATIONS

NO	Symbol	Tools	Descriptions
1		PEDESTAL WHEEL GRINDING MACHINE SAFETY GOGGLES BEVEL PROTRACTOR	PREGRINDING OF 15° ANGLE
2		AS UNDER NO. 1	PREGRINDING OF 45° ANGLE
3		CUP WHEEL GRINDING MACHINE SAFETY GOGGLES GRINDING GAUGE	GRINDING OF SECONDARY CLEARANCE ANGLE 8°
4		AS UNDER NO. 3	GRINDING OF SIDE CLEARANCE ANGLE 8°
5		GRINDING GAUGE	CHECKING
6		GRINDING GAUGE	CHECKING

SCALE 1:1	RIGHT HAND SIDE TOOL (WITHOUT TOP RAKE ANGLE)	No 1.0 5 /0
MAT. From Ex.1.0.3/1		OFFHAND GRINDING

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK GERMAN TECHNICAL TRAINING PROGRAMME

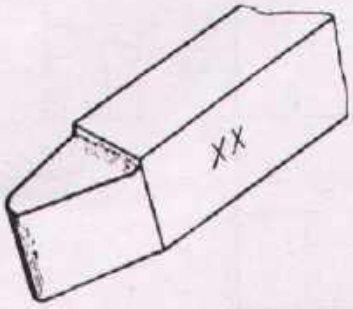


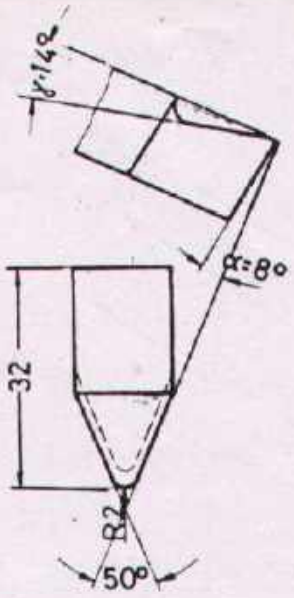
Nos.	Symbol	Tools	Descriptions
1		PEDESTAL WHEEL GRINDING MACHINE SAFETY GOGGLES BEVEL PROTRACTOR	ROTATE THE CENTRE PUNCH TO PRODUCE CONICAL POINT COOL THE CENTRE POINT AS SOON AS IT BECOMES HEATED

SCALE 1 : 1	CENTRE PUNCH	NO 1.0.5/04
MAT. CARBON STEEL	from Ex. 2.13.2/18	OFFHAND GRINDING

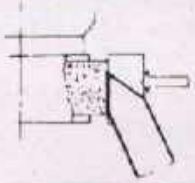
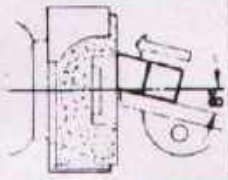
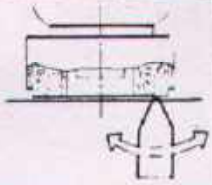
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME





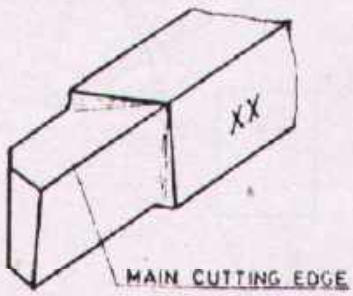
SEQUENCE OF OPERATIONS

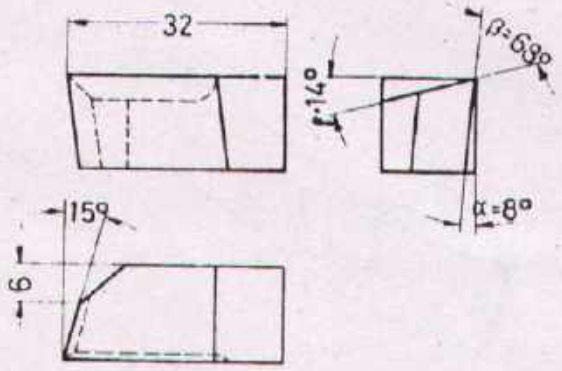
NO	Symbol	Tools	Descriptions
1		PEDESTAL WHEEL GRINDING MACHINE SAFETY GOGGLES GRINDING GAUGE	PREGRINDING OF 50°
2		CUP WHEEL GRINDING MACHINE SAFETY GOGGLES GRINDING GAUGE	GRINDING OF CLEARANCE ANGLE 8
3		CUP WHEEL GRINDING MACHINE SAFETY GOGGLES RADIUS GAUGE	GRINDING OF RADIUS 2 MM
4		GRINDING MACHINE SAFETY GOGGLES GRINDING GAUGE	GRINDING OF TOP RAKE ANGLE 14°, AS SHOWN ON STRAIGHT GRINDING WHEEL

SCALE 1 1	ROUND NOSE SMOOTHING TOOL	No 10.5/07
MAT. From Ex.10.3/1		OFFHAND GRINDING

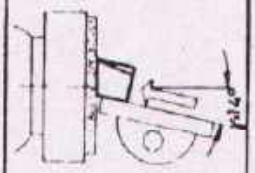
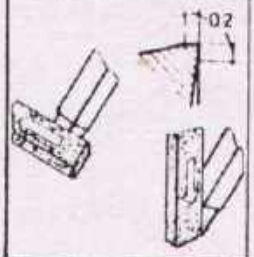
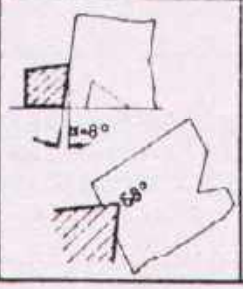
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK GERMAN TECHNICAL TRAINING PROGRAMME





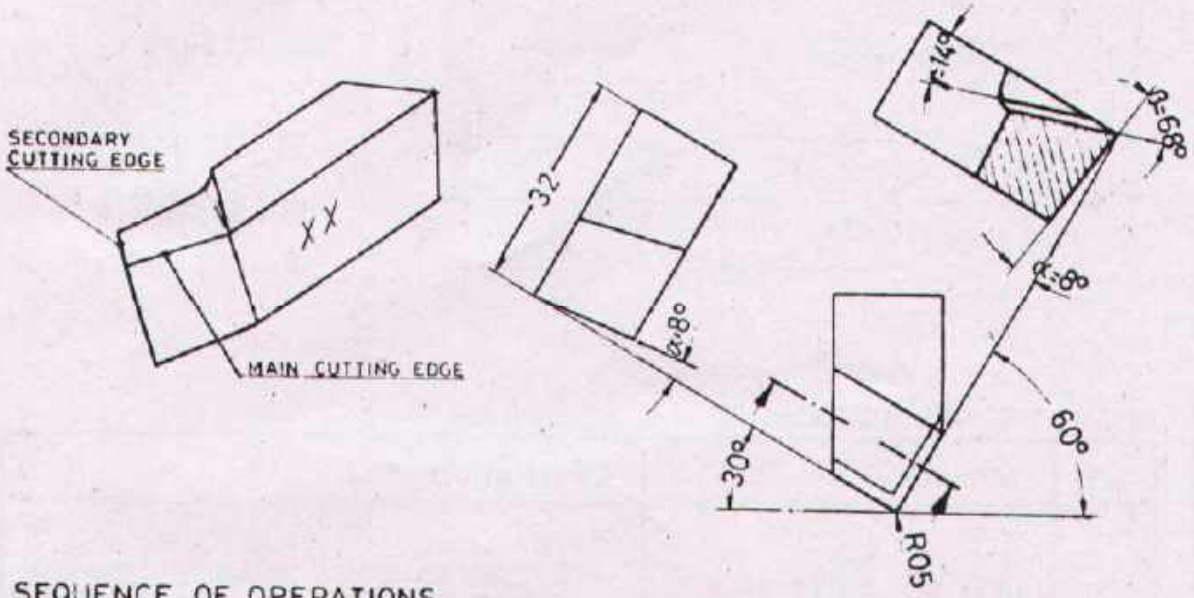
SEQUENCE OF OPERATIONS

NO.	Symbol	Tools	Descriptions
1	COMPLETE THE TOOL UPTO THE STAGE AS DONE IN EXERCISE 1.0.4/02.		
2		CUP WHEEL GRINDING MACHINE SAFETY GOGGLES	ADJUSTING OF GRINDING TABLE TO 14°. GRINDING OF TOP RAKE ANGLE γ = 14°.
3		OILSTONE	OILSTONING OF THE CUTTING EDGE
4		GRINDING GAUGE	CHECKING OF CLEARANCE ANGLE α = 8° CHECKING OG CUTTING ANGLE β = 68°.

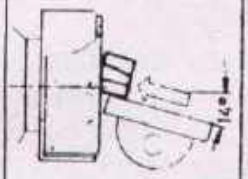
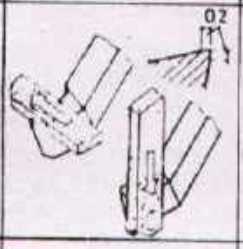
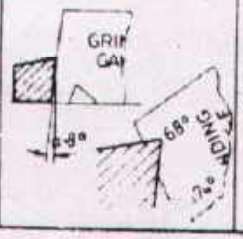
SCALE 1:1	RIGHT HAND SIDE TOOL	No 1-0.5/08
MAT. From Ex.1-0 2/1		OFFHAND GRINDING

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME



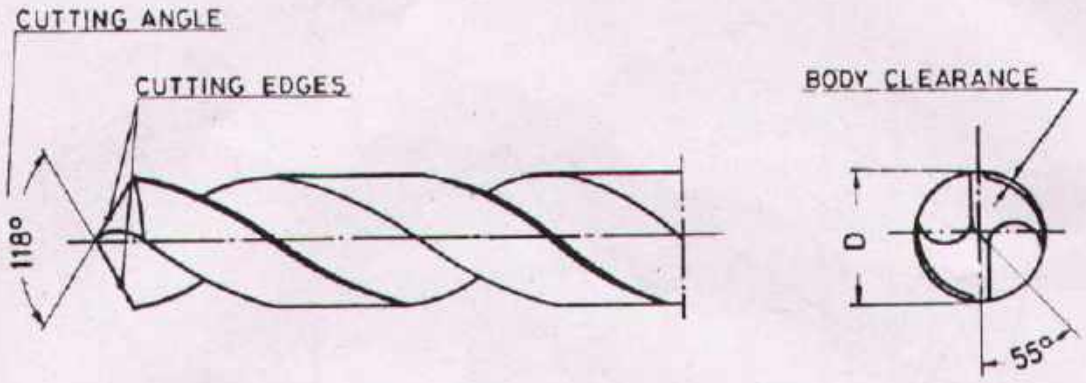
SEQUENCE OF OPERATIONS

NO	Symbol	Tools	Descriptions
1	COMPLETE THE TOOL UPTO THE STAGE AS DONE IN EXERCISE 1.0.4/01.		
2		CUP WHEEL GRINDING MACHINE SAFETY GOGGLES	ADJUSTING OF GRINDING TABLE TO 14°. GRINDING OF TOP RAKE ANGLE $\gamma = 14^{\circ}$.
3		OILSTONE	OILSTONING THE CUTTING EDGE, TO PRODUCE BETTER FINISH ON WORK AND TO PROLONG THE LIFE OF THE TOOL.
4		GRINDING GAUGE	CHECKING OF CLEARANCE ANGLE $\alpha = 8^{\circ}$. CHECKING OF CUTTING ANGLE $\beta = 68^{\circ}$.

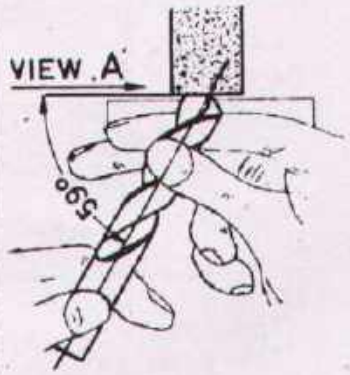
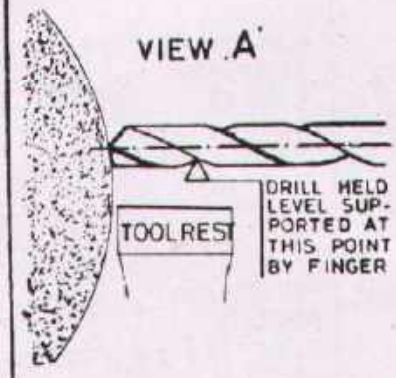
SCALE 1:1	RIGHT HAND ROUGHING TOOL	No. 1.0.5/09
MAT. From Ex 1.0.2/1		OFFHAND GRINDING

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK GERMAN TECHNICAL TRAINING PROGRAMME



SEQUENCE OF OPERATIONS

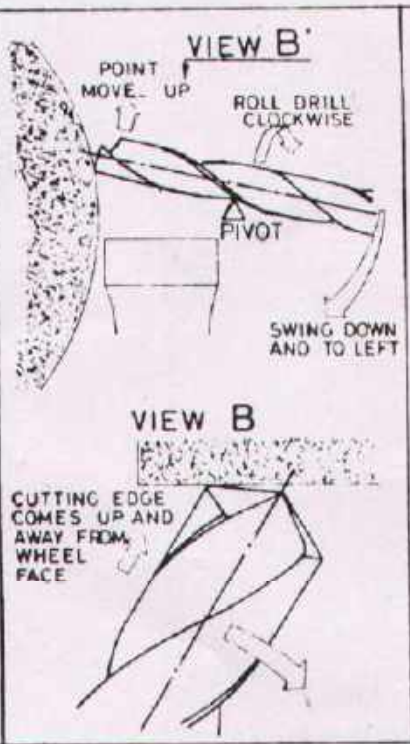
NO.	Symbol	Descriptions
1	 	FOR THIS EXERCISE A 10 TO 15 MM Ø TWIST DRILL WOULD BE SUITABLE. EITHER THE TWIST DRILL CAN BE HELD AS SHOWN, OR THE HANDS CAN BE PLACED IN OPPOSITE POSITION. 1.1 STAND IN FRONT OF THE WHEEL AND SLIGHTLY TO THE LEFT OF THE MACHINE. 1.2 HOLD THE DRILL BETWEEN THE THUMB AND FIRST FINGER OF THE RIGHT (OR LEFT) HAND. 1.3 SUPPORT THE HAND ON THE TOOL REST WITH OTHER FINGERS. 1.4 HOLD THE SHANK OF THE DRILL BETWEEN THE THUMB AND FINGER OF THE LEFT (OR RIGHT) HAND. 1.5 POSITION YOURSELF BY MOVING THE FEET SO THAT THE DRILL MAKES AN ANGLE OF 59° TO THE WHEEL FACE. 1.6 HOLD THE DRILL LEVEL AND TWIST IT UNTIL ONE CUTTING EDGE IS HORIZONTAL AND PARALLEL TO THE WHEEL FACE.

cont... 10.1

SCALE 1:1	TWIST DRILL SHARPENG.	No. 1.0.5/10
MAT. HIGH SPEED ST.		OFFHAND GRINDING

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

2

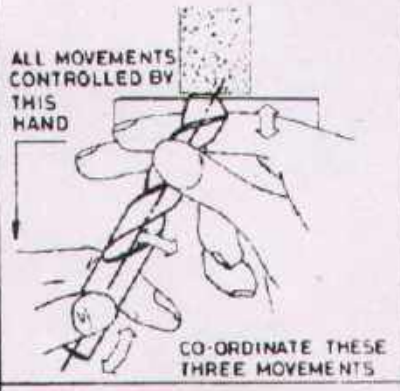


2.1 SWING THE SHANK OF THE DRILL SLIGHTLY DOWNWARDS AND TO THE LEFT (OR RIGHT) HAND. THE OTHER HAND IS SUPPORTED BY THE TOOL REST.

2.2 ROLL THE DRILL TO THE RIGHT BY TURNING IT BETWEEN THE THUMB AND FINGER, AS YOU SWING THE HAND DOWN.

2.3 APPLY A SLIGHT FORWARD MOTION TO YOUR HAND. THIS PRODUCES THE LIP CLEARANCE.

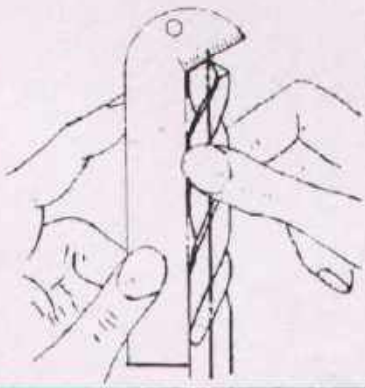
3



3.1 MOVE THE DRILL BACK CLEAR OF THE WHEEL FACE.

3.2 TURN THE DRILL OVER WITHOUT MOVING THE POSITION. THIS PRESENTS THE SECOND EDGE TO THE WHEEL FACE AT THE SAME ANGLE AS THE FIRST CUTTING EDGE.
PROCEED TO SHARPEN THE SECOND CUTTING EDGE USING THE SAME DRILL MOVEMENT AS BEFORE.

4



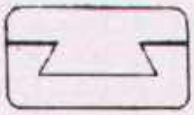
4.1 USE A DRILL GAUGE TO CHECK THAT THE CUTTING ANGLE IS CORRECT 118° FOR MILD STEEL, THE CUTTING EDGES ARE OF EQUAL LENGTH, THE LIP CLEARANCES ARE EQUAL AND CORRECT, ABOUT 10 TO 12 DEGREES.

SCALE 1:1	TWIST DRILL SHARPENING	No 1-0-5/10-1
MAT. HIGH SPEED ST.		OFFHAND GRINDING

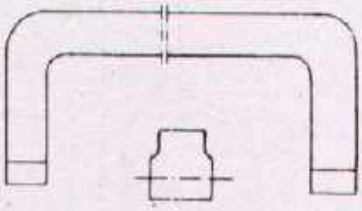
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

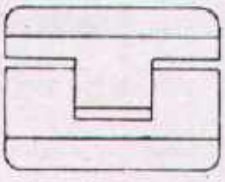
2.3.5/1 → 1



2



3 → 13



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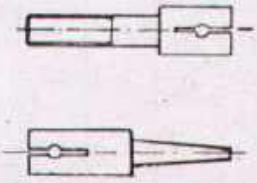
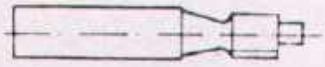
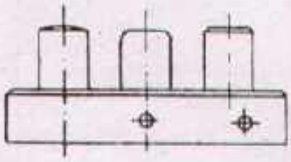


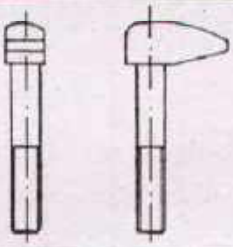
2.3.5/3,5 → 5 → 13



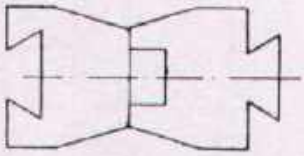
2.3.4/5 6



2.3.5/2 → 7



8 → 14



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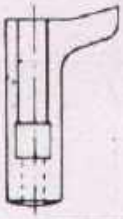
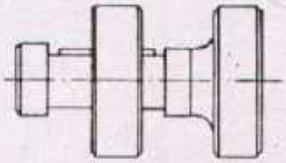


10 → 14



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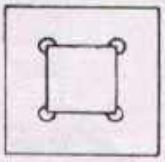
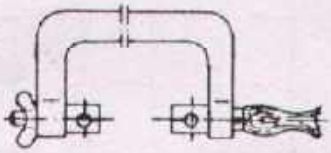
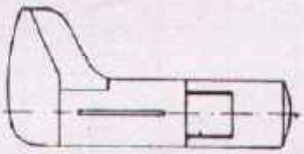


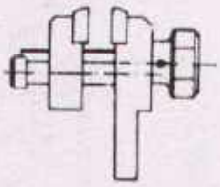
12



3, 5 → 13



8, 10 → 14



15.1 → 15

In addition to the exercises shown above, the trainees have to carry out practical work such as minor repairs or preparation of spare parts.
All additional work is to be checked and marked thoroughly.

TRADE TRAINING 1	LAYOUT	Mp/ 2.1/2.3.3
		FITTING II

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MILLWRIGHT

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

TRADE TRAINING 1

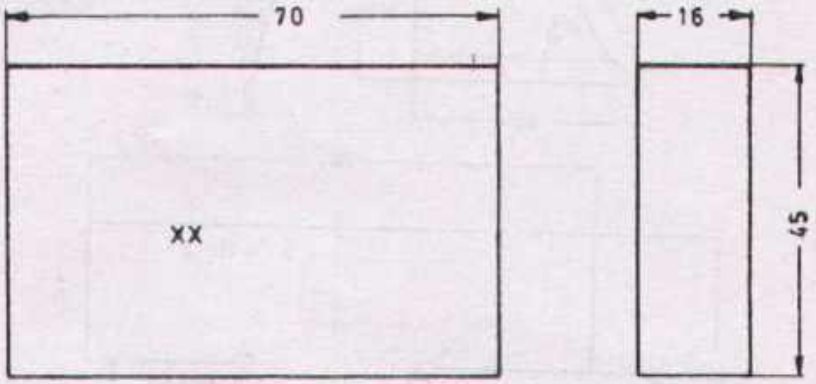
MATERIAL REQUIRED

MILL WRIGHT

FITTING II

No. 2.3.3/1 to 11 & Test	Exercise No. (Length given in Millimeter)														Length per Trainee	Total length for 16 Trainees	Total weight for 16 Trainees
	2	3,1	4	4,3	4,4	7,5	7,6	8	9,1,2	10	11,5	11,6	11,7	11,8			
M.S.Flat 43x6.4 mm (1 3/4"x1/4") 2 pcs.	80 80														160 mm	2.6 meter	6.0 kg
M.S.Flat 19x10 mm (3/4"x3/8") (part 1)		550													550 mm	8.8 meter	13.5 kg
M.S.Flat 50 x 4 mm (2"x3/16") 2 pcs.			68 68												136 mm	2.6 meter	4.0 kg
Isolating Sheet 19x4 mm (2 pcs.)				130 130											260 mm	4.2 meter	--
Alu Wire Ø 4 mm (3/16" DIA)					66										66 mm	1.1 meter	0.05 kg
M.S.Pin Ø5 x 24 mm (Ø 3/16" x 1")						-									1 No.	18 Nos.	--
M.S.Pin Ø4 x 24 mm (Ø 5/32" x 1")							-								1 No.	18 Nos.	--
L.C.Steel 50x16 mm (2"x5/8") (part 1)								125							125 mm	2 meter	12.6 kg
M.S.Flat 50 x 6 mm (2"x1/4") (2 pcs.)									64 64						128 mm	2.1 meter	5.0 kg
M.S.Flat 50 x 16 mm (2"x5/8") (part 2)										118					118 mm	1.9 meter	11.9 kg
M.S.Round Ø 32 mm (1 1/4" DIA)											8				8 mm	0.13meter	0.82 kg
M.S.Square 10 mm (3/8" Squ.)												48			48 mm	0.77meter	0.6 kg
M.S.Square 6.4 mm (1/4" Squ.)													16		16 mm	0.26meter	0.09 kg
M.S.Taper Pin Ø 4 x 30 mm															1 No	18 N os.	---

continued



SCRAPED SURFACES

Rough scraping | Smooth scraping | Fine scraping | Design scraping

Rough scraping 2 - 6 high spots
Smooth scraping 6 - 15 high spots } per square inch
Fine scraping 16 - 25 high spots

SEQUENCE OF OPERATION

1. Mark out and file workpiece to required dimension - give for all sizes +o,3 mm allowance for scraping.
2. Rough scraping of workpiece.
3. Smooth scraping workpiece.
4. Fine scraping workpiece.
5. Design scraping of one broad surface.

CAUTION

Mind the given dimension (tolerance ± o,1).
Don't use too much "Prussian blue (scraping paste).

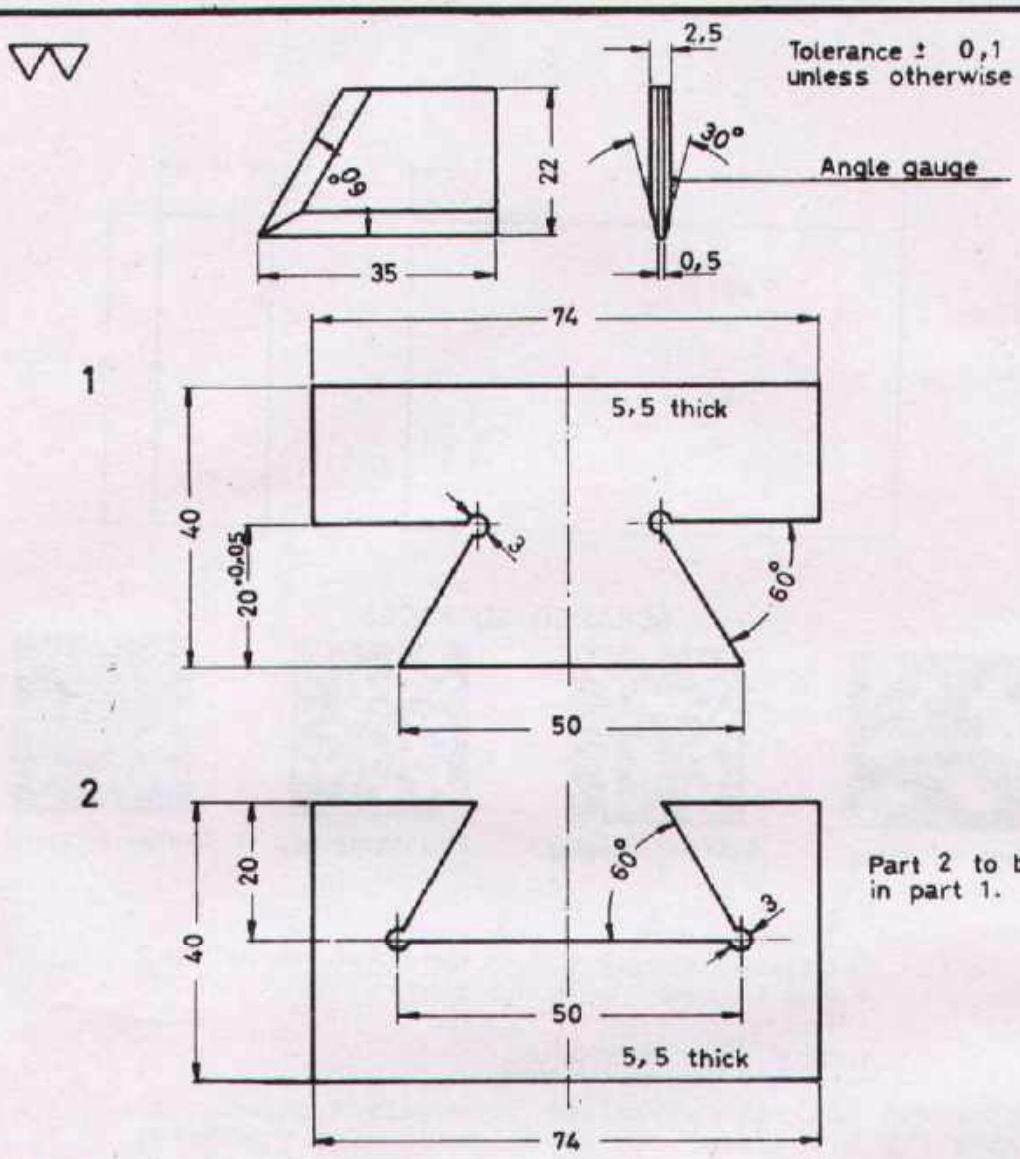
TOOLS REQUIRED

Measuring and marking instruments.
Flat scraper. Surface plate.

SCALE 1:1	SCRAPING EXERCISE	MP/2.3/2.3.3/1
MAT. MILD STEEL	from Ex 2.3.5/1	FITTING II

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MILLWRIGHT



Part 2 to be fit in part 1.

SEQUENCE OF OPERATION

Make one angle gauge according to drawing

2. File outer dimension of part 1
3. Mark out the dovetail and drill two corner holes ø 3 mm
4. Saw and file external dovetail. Check with self made angle gauge
5. File outer dimension of part 2
6. Mark out the dovetail and drill cornerhole ø 3 mm
7. Saw and file internal dovetail according to part 1

SCALE 1 : 1	DOVETAIL FITTING	Mp/2.3/2.3 3/2
MAT. MILD STEEL		FITTING II

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MILLWRIGHT

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

TRADE TRAINING I

MATERIAL REQUIRED
MILLWRIGHT

FITTING II

No. 2.3.3/11 to 14

	Exercise No. .(Length given in Millimeter)													Length per Trainee	Total length for 16 Trainees	Total weight for 16 Trainees
	11,9	11,10	12,1	12,2	13,5	13,6	13,7	13,8	13,9	14,3	14,5	14,6	3,2			
M.S.Counter Sunk Screw M5x12 mm														1 No.	20 Nos.	--
M.S.Cheese Head Screw M3x8 mm														2 Nos.	38 Nos.	
M.S.Flat 42x12.7mm (1 3/4" x 1/2")			46											46 mm	0.74meter	3.2 kg
M.S.Flat 26x15 mm (1" x 5/8")				30									34	64mm	1.1 meter	3.5 kg
M.S.Wing Nut M8														1 No.	18 Nos.	--
M.S.Washer, Ø13x2mm thick, (Hole 8.5mm)														1 No.	20 Nos.	--
M.S.Cyl. Pin Ø4 x 18 mm														4 Nos.	70 Nos.	--
Wooden Handle 100 mm (4")														1 No.	20 Nos.	--
M.S.Cyl. Pin Ø3 x 18 mm														1 No.	18 Nos.	--
M.S.Sheet 28x5 mm (1 1/8" x 3/16")										58				58 mm	0.93meter	1.0 kg
M.S.Cheese Head Screw M4 x 7.5 mm														1 No.	18 Nos.	--
M.S.Cyl. Pin Ø 2 x 17 mm														5 Nos.	90 Nos.	--

continued

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MATERIAL REQUIRED

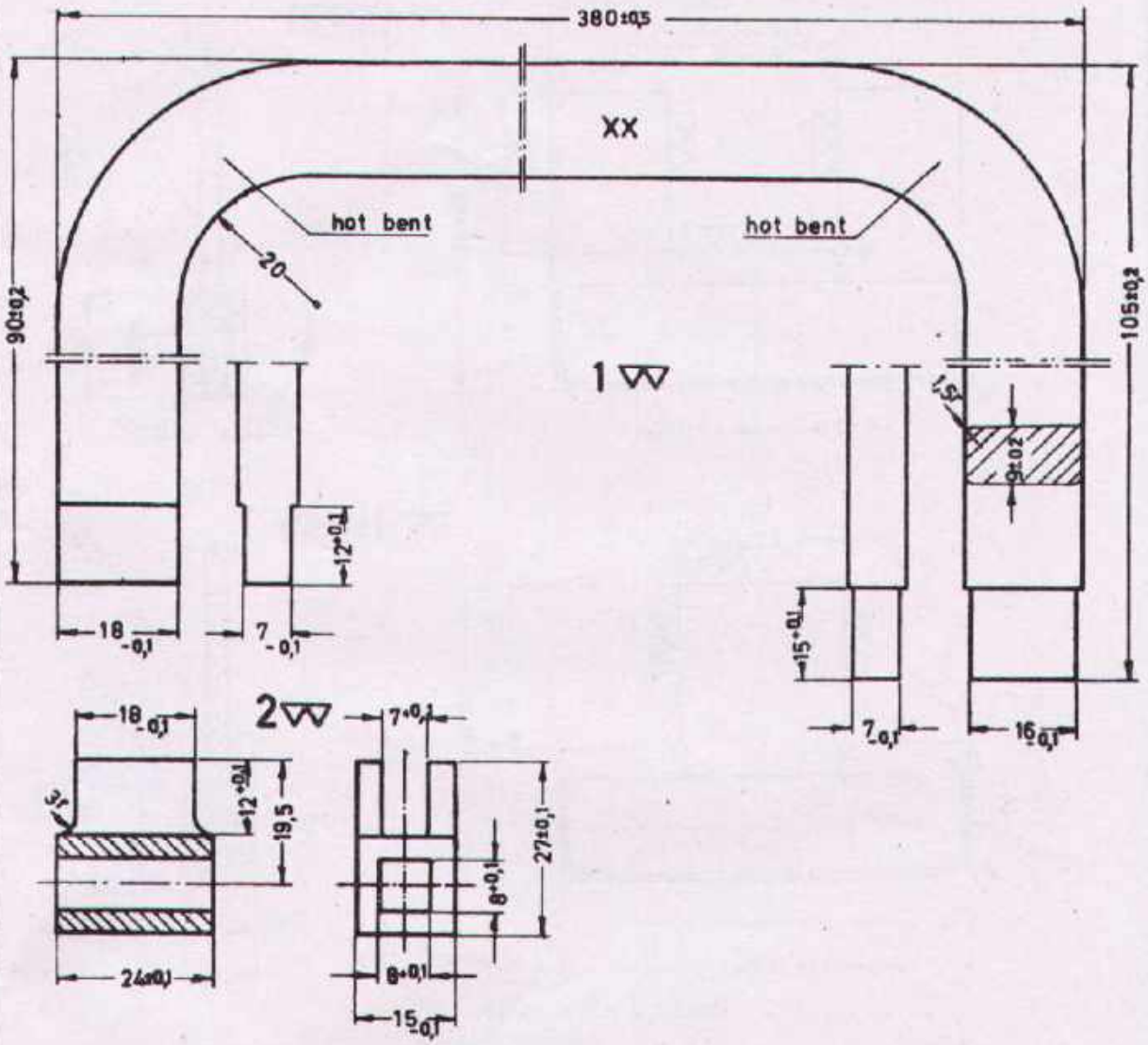
TRADE TRAINING 1

MILLWRIGHT

FITTING II

No. 2.3.3/15	Exercise No. 15,9	15,10	15,11	15,12	15,13	15,14	(Length given in Millimeter)	Total Nos. per Trainee	Total Nos. for 16 Trainees	
M.S.Socket Head Screw M4 x 10 mm	-							4 Nos.	70 Nos.	--
M.S.Cheese Head Screw M4 x 8 mm		-						2 Nos.	36 Nos.	--
M.S.Washer Ø17x1.5 bore 6.5 mm			-					2 Nos.	36 Nos.	--
M.S.Hexagon Nut M6				-				2 Nos.	36 Nos.	--
M.S.Pivot Point Set Screw,M3 x 5 mm					-			1 No.	18 Nos.	--
M.S.Taper Pin Ø 3 mm						-		1 No.	18 Nos.	--

No. 2.3.3 / Test	T,1	T,2,3	T,5	T,6				Length per Trainee	Total length for 16 Trainees	Total weight for 16 Trainees
M.S.Flat 50x10 mm (2" x 3/8")	52							52 mm	0.84meter	3.3kg
M.S.Flat 24x6.4 mm (1 3/4" x 1/4") 2pcs		24 24						50 mm	0.8 meter	1.1kg
M.S.Parallel Pin Ø 4 x 13 mm			-					2 Nos.	36 Nos.	--
M.S.Cheese Head Screw M4 x 12 mm				-				2 Nos.	36 Nos.	--



SEQUENCE OF OPERATION

1. Heat up workpiece by means of torch and bend according to drawing.
2. Saw to length and file both ends to size.
3. Mark drill and file part 2 according to given dimensions.

CAUTION

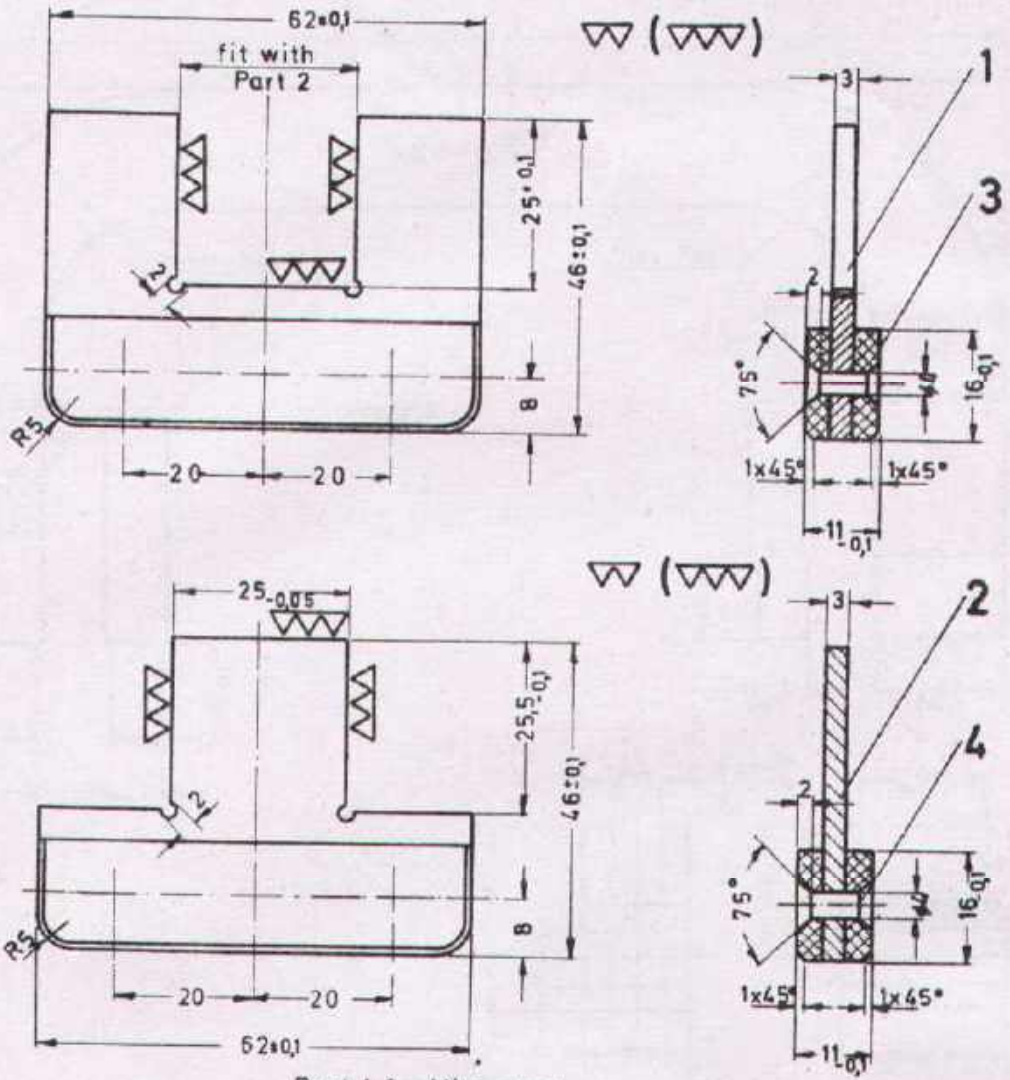
Mark out portion to be heated with chalk.

SCALE 1	HAND HACKSAW	MP/2.3/2.3.3/3
MAT. MILD STEEL	Part 2 from 2.36/2 PART 1 & 2	FITTING II

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MILLWRIGHT



Part 1, 2 = Mild steel
Part 3 = Insulating-sheet
Part 4 = Aluminium

SEQUENCE OF OPERATION

1. File the outer surfaces of parts 1 and 2.
2. Rivet the parts 3 and 4 together with parts 1 and 2.
3. Fit part 2 into part 1.

CAUTION

Never use a hammer for fitting work.

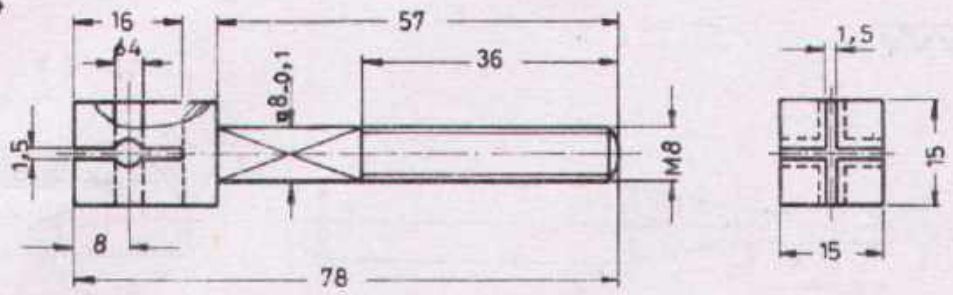
SCALE 1:1	FITTING GAUGE	MP/2.3/2.3.3/4
MAT.		FITTING 11

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

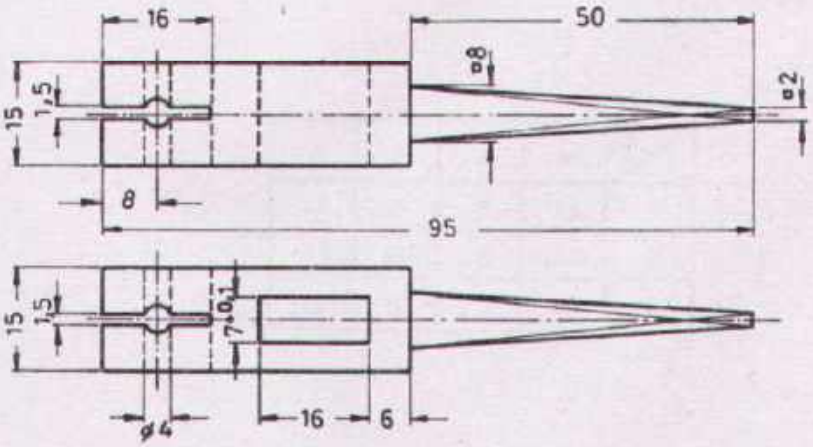
MILLWRIGHT

Tolerance ± 0,1
unless otherwise stated

4



3



SEQUENCE OF OPERATION

1. Cut the external thread M 8 with a die.
2. Mark out the holes ϕ 4 on both pieces and drill.
3. Saw the cross slots by hand hack saw.
4. Drill and file the internal recess 16 x 7.
5. File the tappered end.

CAUTION

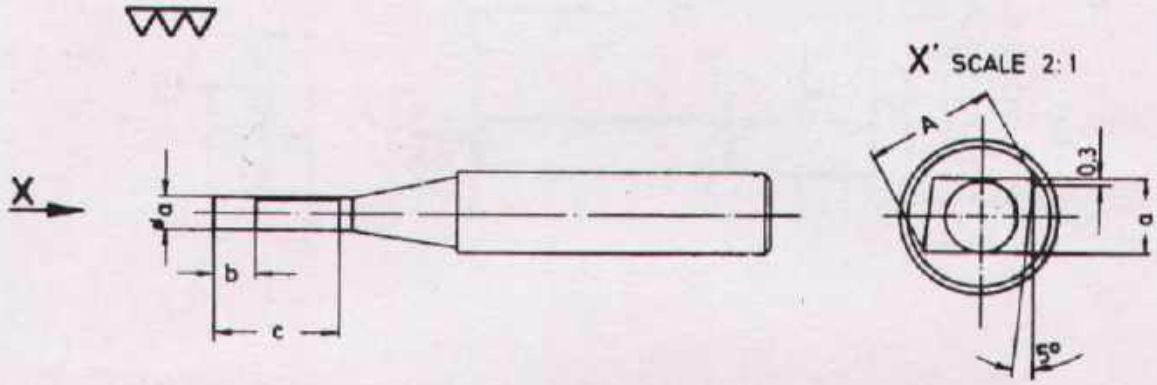
The internal recess and the cross-cuts must be aligned correctly, otherwise the sawblade will be bend.

SCALE 1:1	HAND HACKSAW	Mp/2.3/2.3.3/5
MAT. MILD STEEL	from Ex. 23.5/3/5 PART 3 & 4	FITTING II

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MILLWRIGHT



	a	b	c	A
I	4,2	5	15	7,4
II	5,2	6	18	9,4
III	6,3	7	20	10,4

SEQUENCE OF OPRATION

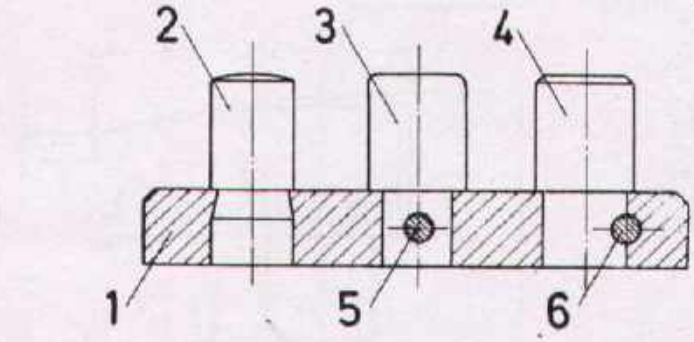
1. File the two surfaces concentrically and parallel to the size a.
2. File the cutting face to an angle of 5°.

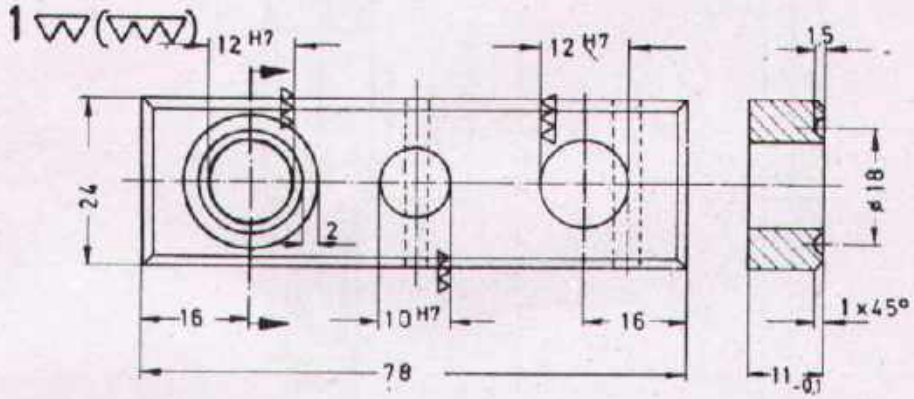
CAUTION

Observe that the cutting faces are running concentrically to the pilot pin.

SCALE 1:1	COUNTER BORE DRILL	MP/2.3/2 3.3/6
MAT.: TOOL STEEL	from Ex. 2.3.4/5	FITTING II
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING		MILLWRIGHT
PAK-GERMAN TECHNICAL TRAINING PROGRAMME		

Tolerance ± 0.1
Unless otherwise stated





NOTE:

1. Part 1 has to be drilled togeather with part 3&4.
2. The taper pin must have 2-3 mm batter

SIZE	TOLERANCE
10 H7	+0.015 0
12 H7	+0.018 0

P-No.	Qty.	DENOMINATION	REMARKS
6	1	TAPER PIN 4 x 24 mm	
5	1	PARALLEL PIN 5 x 24 mm	
4	1	BOLT WITH CHAMFER	Turning Exercise 7
3	1	BOLT WITH RADIUS	Turning Exercise 7
2	1	BOLT WITH BALL-HEAD	Turning Exercise 7
1	1	BASE PLATE	Shaping Exercise 2

SCALE 1:1

MAT. MILD STEEL

CONNECTING EXERCISE

MP/2.3/2.3.3/7

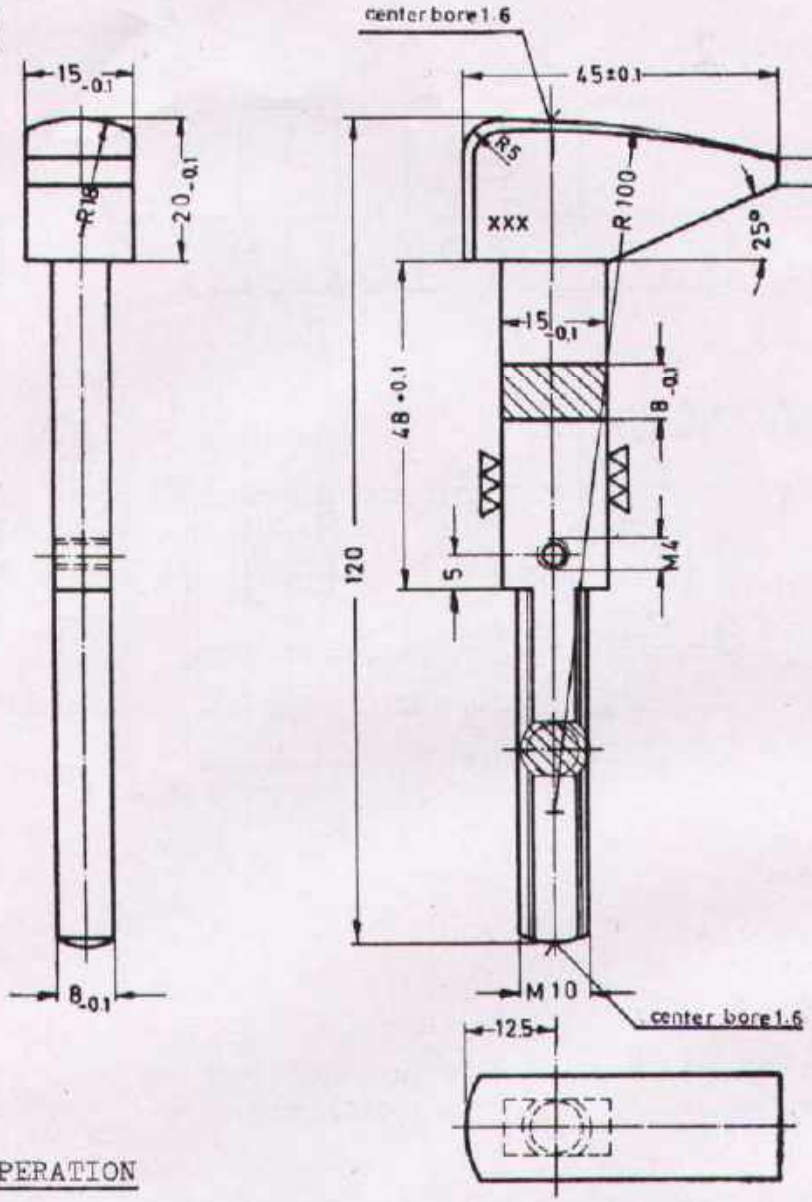
FITTING II

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MILLWRIGHT

▽ (▽▽)



SEQUENCE OF OPERATION

1. File to reference surfaces in right angle to each other.
2. Mark out the spanner.
3. Cut out by means of hand hacksaw.
4. Centre drill on a drilling machine and turn to ø 9,8 x 52.
5. File to size according to drawing.
6. Cut thread M 1o with die and diestock.
7. Drill hole for M 4 and tap.

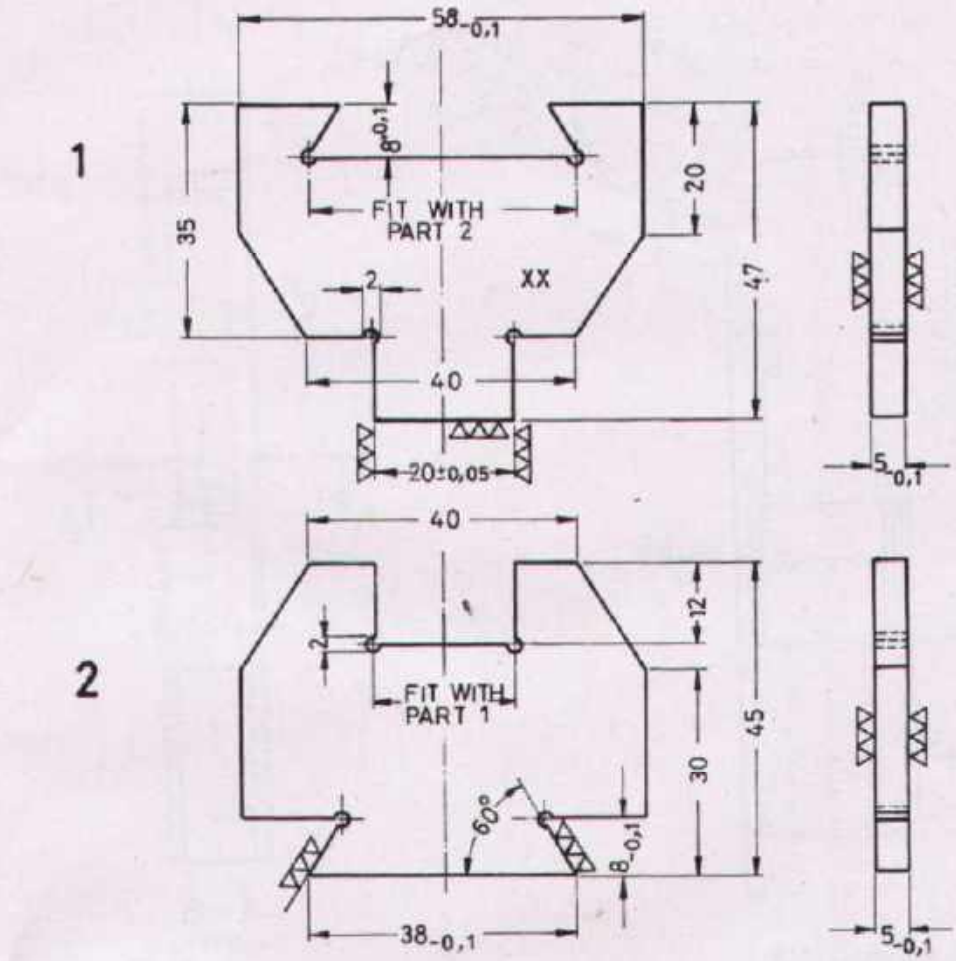
SCALE 1:1	ADJUSTABLE SPANNER (PART 1)	MP/2.3/2.3.3/8
MAT. L. C. STEEL		FITTING II

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MILLWRIGHT

Tolerance ± 0,1
unless otherwise stated



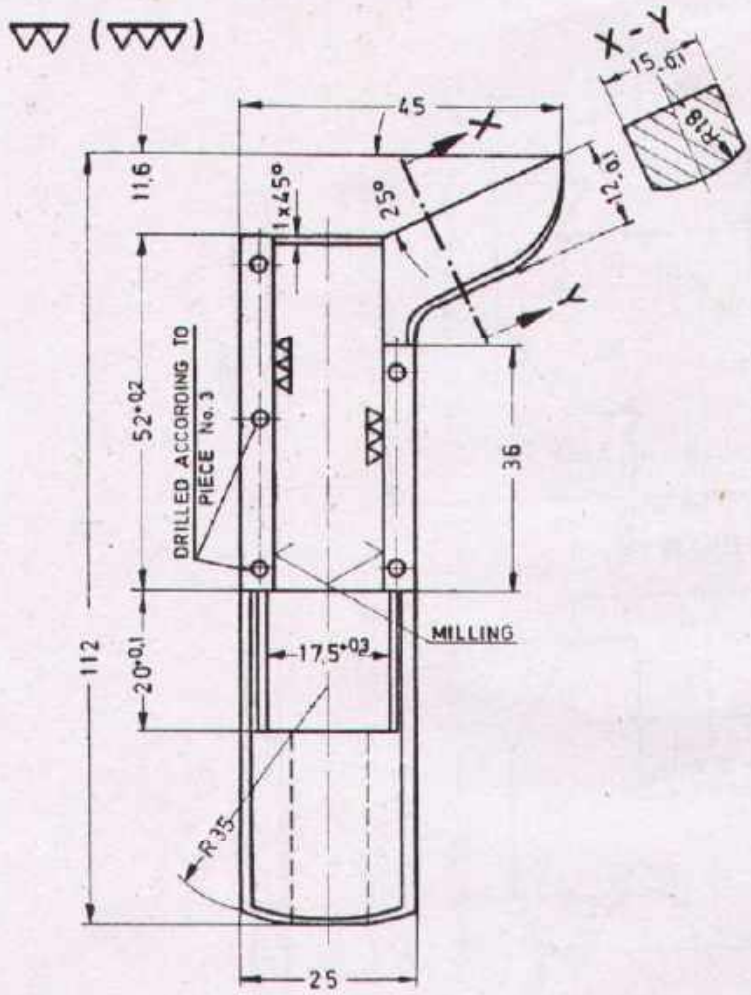
SCALE 1:1	FITTING EXERCISE I	MP/2.3/2.3.3/9
MAT: MILD STEEL		FITTING II

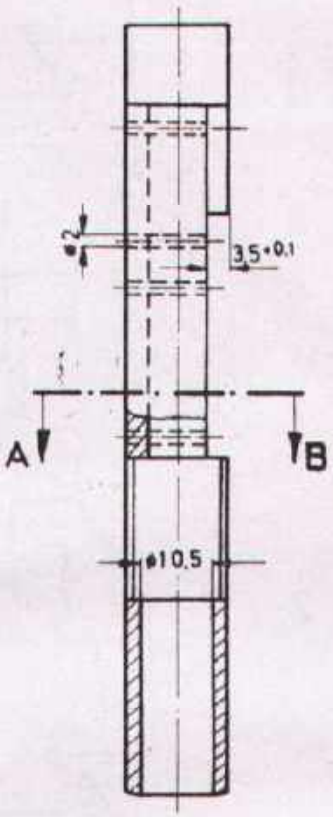
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

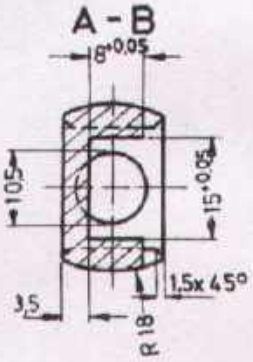
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MILLWRIGHT

TOLERANCE ±0.1 UNLESS OTHERWISE STATED

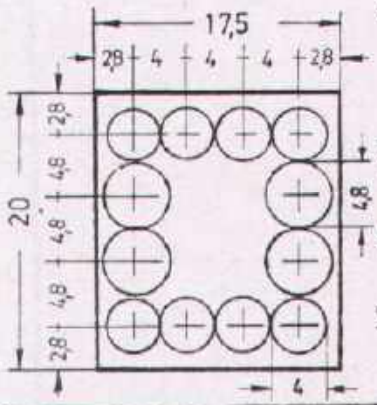






SEQUENCE OF OPERATION

1. File two surfaces plane and in right angle to use them as reference surfaces.



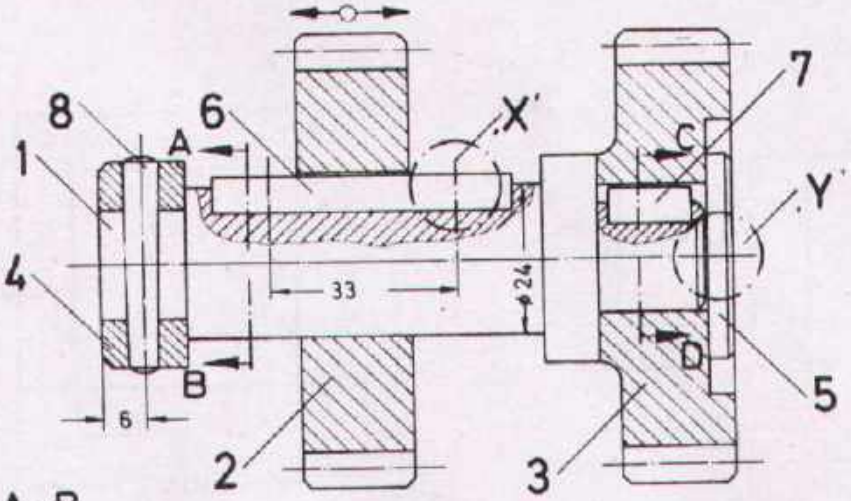
2. Mark the workpiece as shown in the drawing and cut the raw shape of the workpiece with the hand hacksaw.
3. File the saw-cut sides and the thickness to given dimensions.
4. Mark the break through and work it out as it is shown in the sketch.
5. Send the workpiece to the milling machine, for machining the guiding notch, the 3,5 mm recess and the hole 10,5

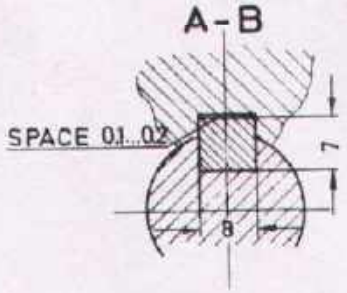
SCALE 1:1	ADJUSTABLE SPANNER (PART 2)	MP/2.3/2.3.3/10
MAT. MILD STEEL		FITTING II

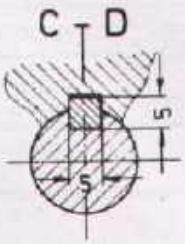
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

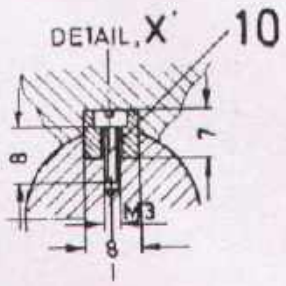
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

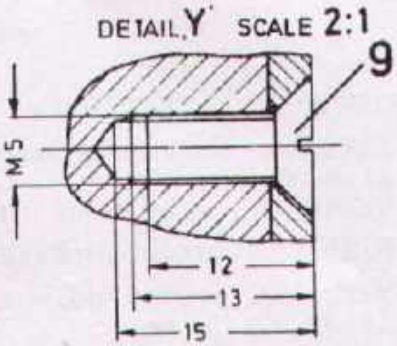
MILLWRIGHT











NOTE:
Part 2 must be moveable without any lateral (side) play.

P.NO.	Qty.	DENOMINATION	REMARKS
10	2	CHEESE HEAD SCREW M3 x 8 mm	
9	1	COUNTER SUNK SCREW M5 x 12 mm	
8	1	TAPER PIN 4 x 30 mm	Drill with part 1 & 4
7	1	FITTING KEY 5x12 mm	
6	1	FITTING KEY 8x43 mm	Drill with part 1
5	1	WASHER	
4	1	STOP	Turning Exercise 10
3	1	FIXED GEAR	From 4.2.1/4
2	1	MOVEABLE GEAR	From 4.2.1/5
1	1	SPLINE SHAFT	Turning Exercise 11

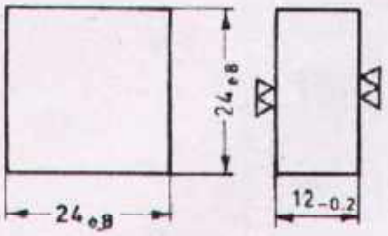
SCALE 1:1	KEY FITTING EXERCISE	MP/2.3/2.3.3/11
MAT. MILD STEEL		FITTING II

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

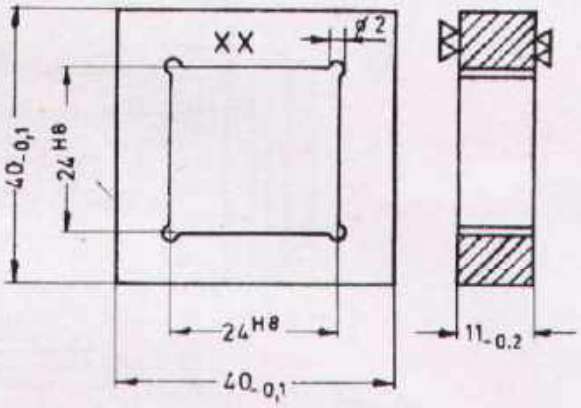
MILLWRIGHT

▽▽▽ (▽▽)

1



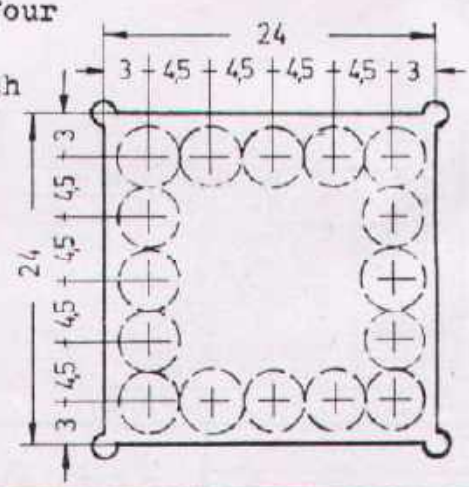
2



SIZE	TOLERANCE
24 e8	-0.040 -0.073
24 H8	+0.033 0

SEQUENCE OF OPERATION

1. File the outer surfaces of part No. 1 according to given dimensions.
   Check the square of 24 with master-try square and micrometer.
2. File the outer surfaces of part No. 2
3. Mark the square hole and drill the four holes of 2 mm.
4. Mark and drill as shown in the sketch to get the raw shape of the hole.
5. File the square hole and check the dimensions with the slip-gauge.



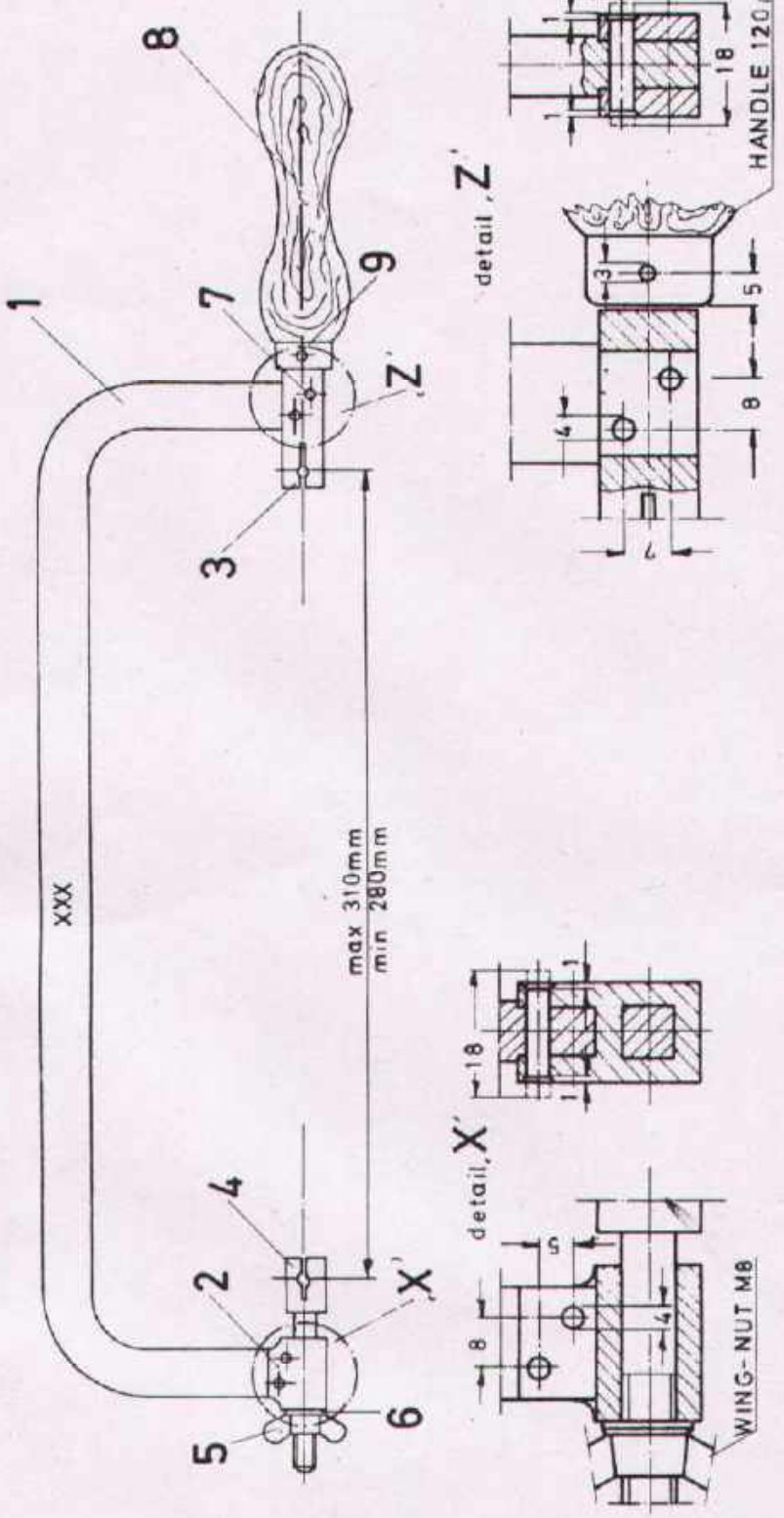
Use a drill of ϕ 4,5

SCALE 1:1	FITTING EXERCISE	MP/2.3/2.3.3/12
MAT. MILD STEEL		FITTING II

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MILLWRIGHT



P. No	Qty.	DENOMINATION	REMARKS
9	1	ZYLINDER PIN 3 x 18 mm	slightly rivet
8	1	WOODEN HANDLE 100 mm	drill with part 3
7	4	ZYLINDER PIN 4x18 mm	
6	1	WASHER	
5	1	WING NUT M8	
4	1	MOVEA. BLADE HOLDER	Fitting Exercise 5
3	1	FIXED BLADE HOLDER	drill with part 1 & 8
2	1	GUIDE PIECE	drill with part 1
1	1	HACKSAW BOW	drill with part 1 & 2

SCALE 1:2.5

MAT. MILD STEEL

HAND HACKSAW

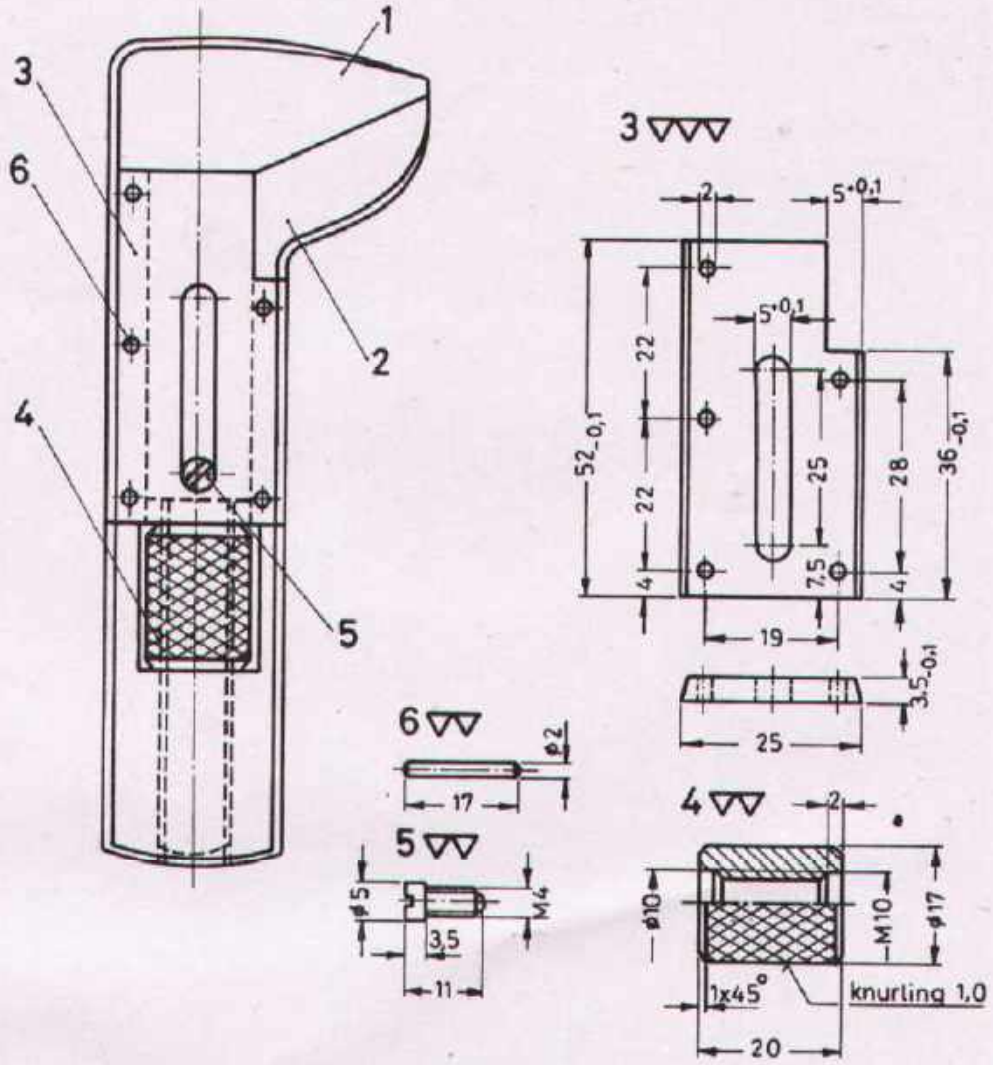
MP/2.3/2.3.3/13

FITTING II

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MILLWRIGHT



Part No	Qty.	Denomination	Remarks
6	5	Cylindrical Pin. 2 x 17 mm	slightly rivet
5	1	Cheese head screw M4 x 7,5	
4	1	Knurled nut M 10	
3	1	Cover	drilled with part 2
2	1	Fixed part (from Ex. 10)	drilled with part 3
1	1	Movable part (from Ex. 8)	

SCALE 1:1

ADJUSTABLE SPANNER

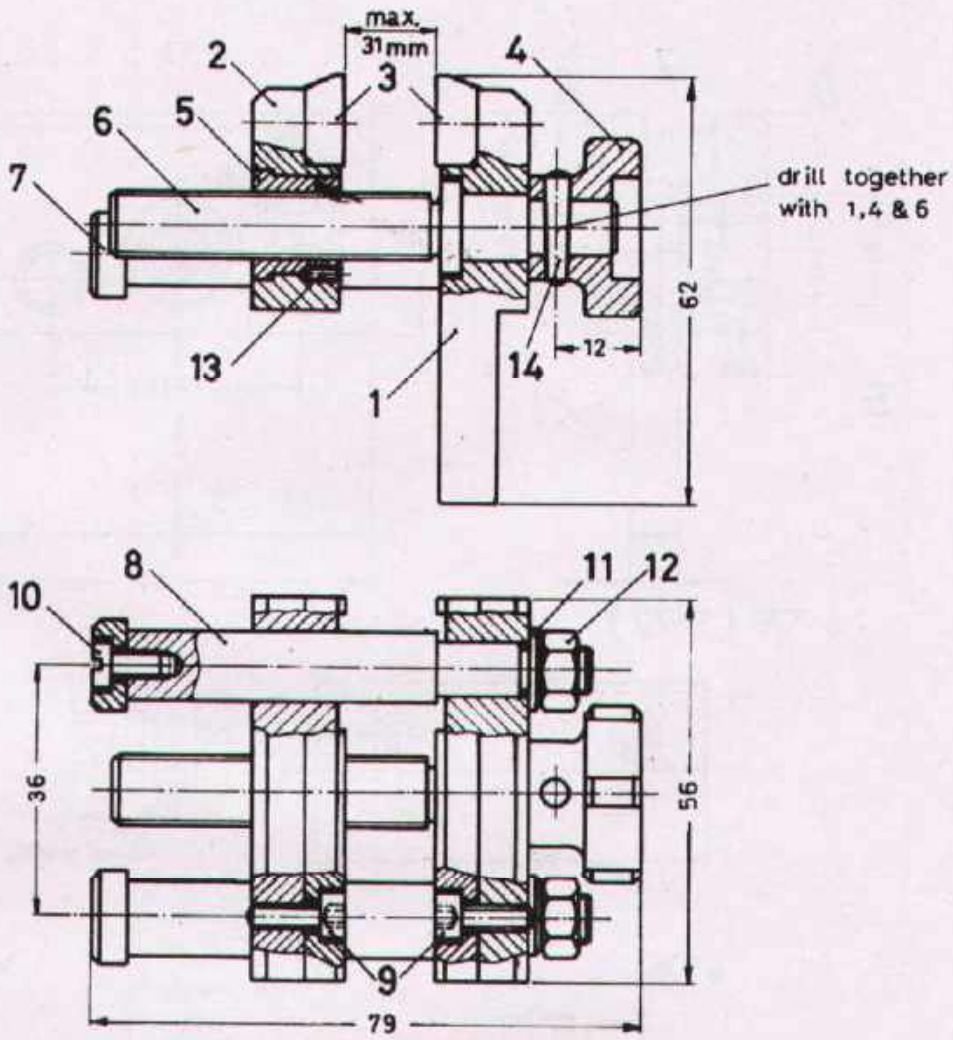
MP/2.3/2.3.3/14

FITTING II

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MILLWRIGHT



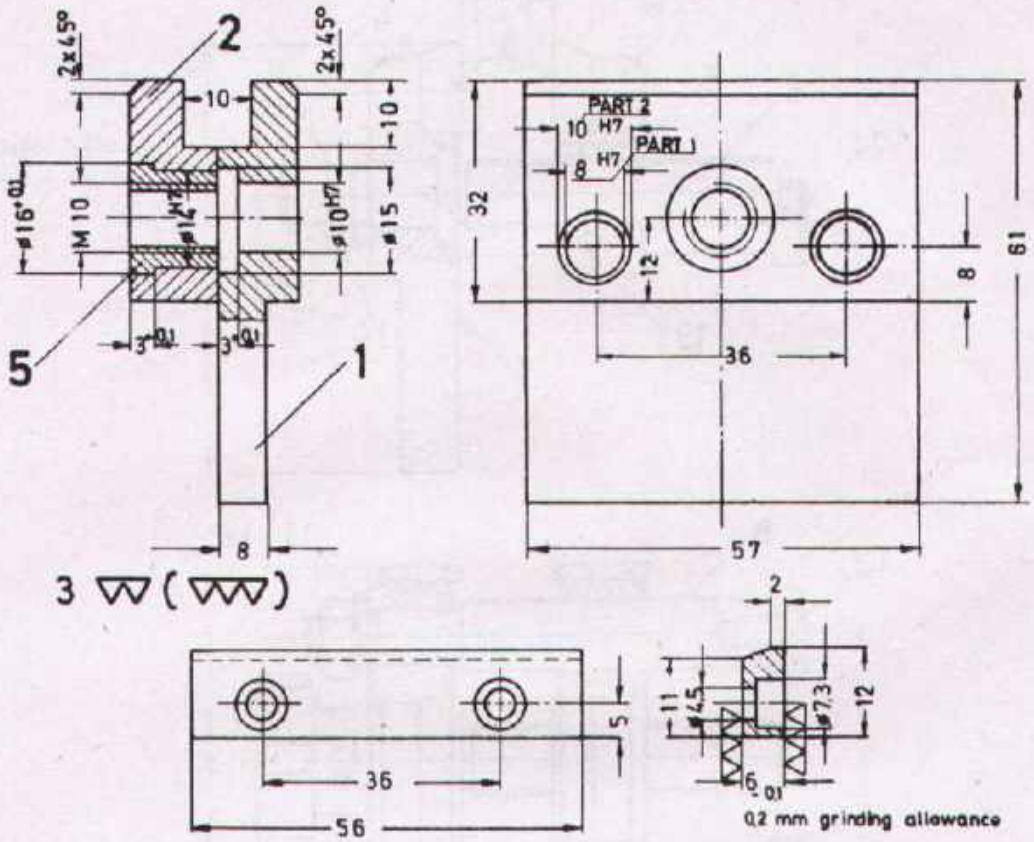
Part No	Qty.	Denomination	Remarks
14	1	Taper pin ⌀3 mm	
13	1	Threaded pin M3 x 5	
12	2	Hexagon nut M6	
11	2	Bright washer 6,5 x 17 x 1,5	
10	2	Cheese head screw M4 x 8	
9	4	Internal hexagon screw M4 x 10	
8	2	Sliding rod	from Turning Ex. 2.3.4/6
7	2	Stop	from Turning Ex. 2.3.4/4
6	1	Spindle M10	from Turning Ex. 2.3.4/9
5	1	Threaded bush M10	from Turning Ex. 2.3.4/8
4	1	Handle	from Turning Ex. 2.3.4/12
3	2	Jaw inserts	from Shaping Ex. 2.3.5/7
2	1	Movable jaw	from Milling Ex. 2.3.6/3
1	1	Fixed jaw	from Milling Ex. 2.3.6/3

SCALE 1:1	PARALLEL VICE	MP/2.3/2.3.3/15
		FITTING II

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MILLWRIGHT



SIZE	TOLERANCE
8 H7	+0,015 0
10 H7	+0,015 0
14 H7	+0,018 0

Part 1 = Mild steel (from Milling 2.3.6/3)
Part 2 = Mild steel (from Milling 2.3.6/3)
Part 3 = Carbon steel (from Shaping 2.3.5/7)
Part 4 = Mild steel (from Turning 2.3.4/12)
Part 5 = Cast iron (from Turning 2.3.4/8)

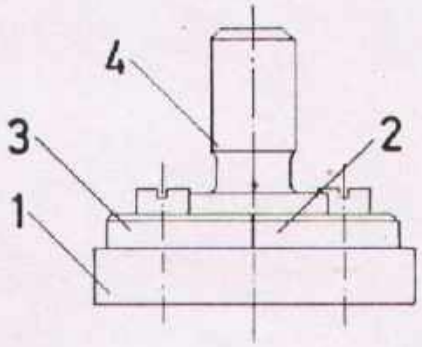
SCALE 1:1	PARTS FOR PARALLEL VICE	MP/2.3/2.3.3/151
MAT.		FITTING II

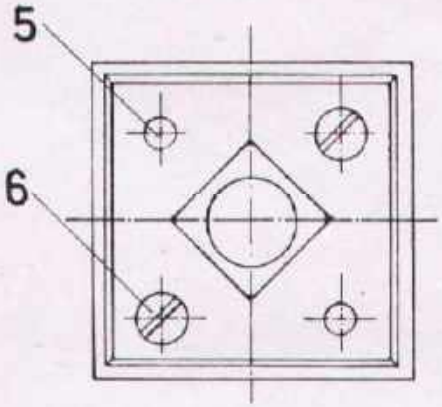
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

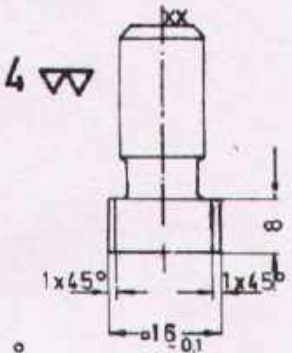
MILLWRIGHT

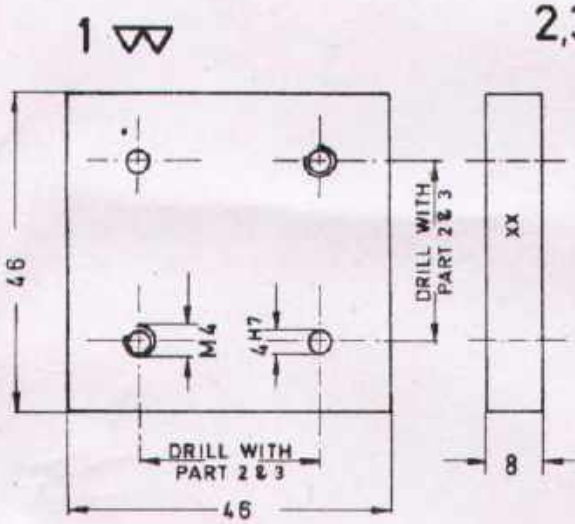
PRORATED
TIME 12 hrs.

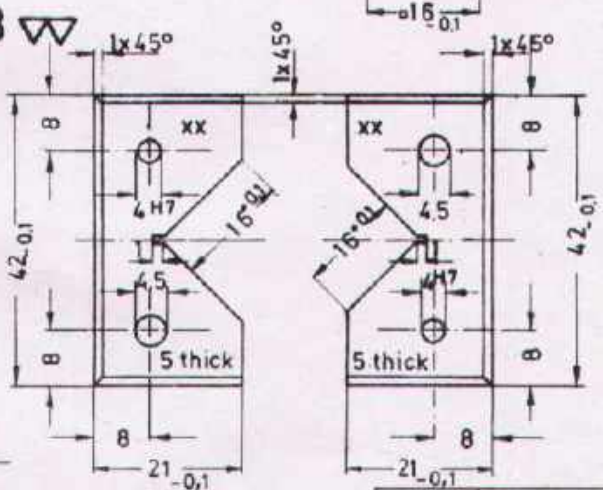
Tolerance ± 0,1
unless otherwise stated











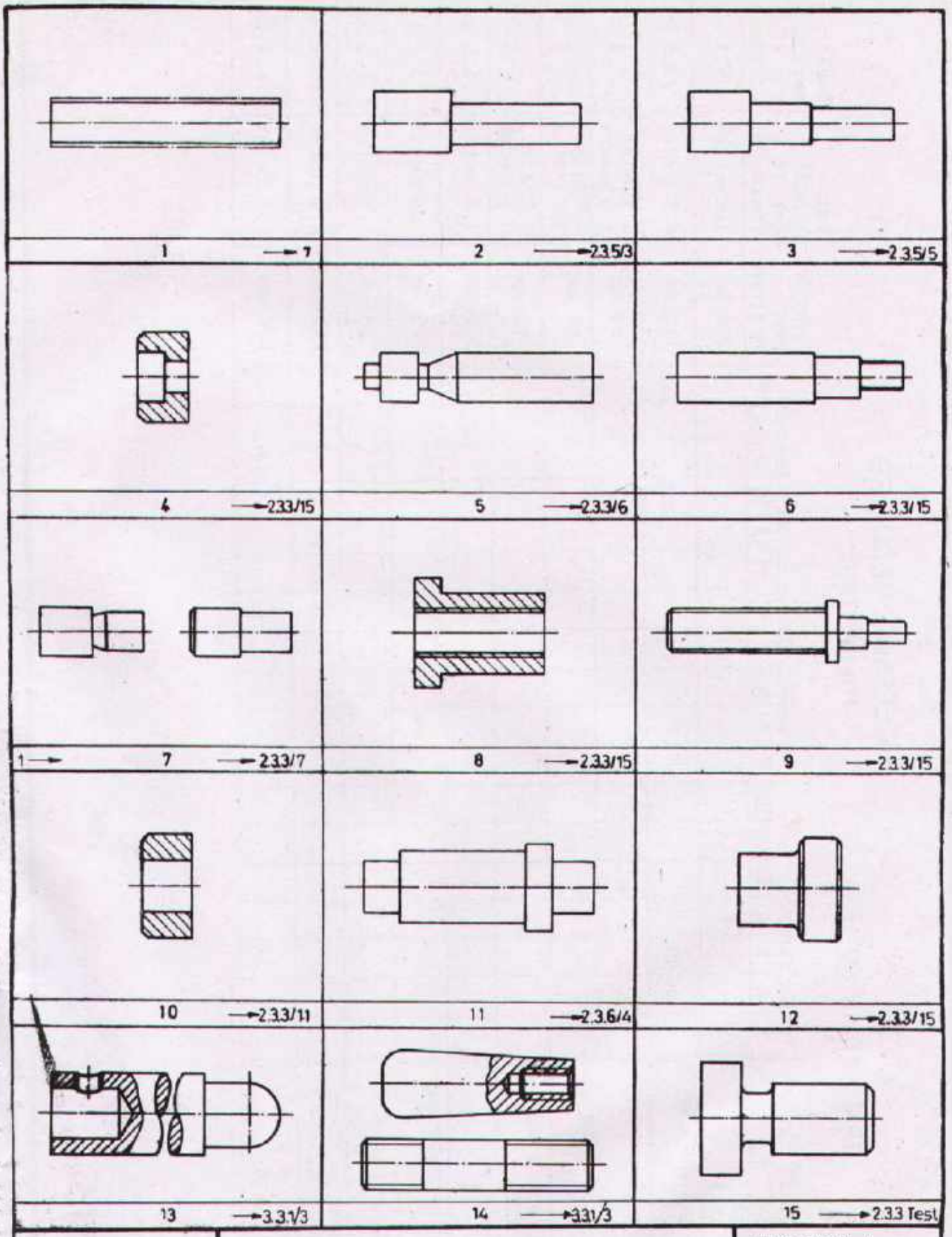
SIZE	TOLERANCE
4 H7	+0,012 0

P.No.	Qty.	DENOMINATION	REMARKS
6	2	CHEESE - HEAD SCREW M4x12	
5	2	PARALLEL PIN 4x13	
4	1	PUNCH	READY TURNED (from 234/15
3	1	GUIDE PLATE	DRILLED WITH PART 1
2	1	GUIDE PLATE	" " " 1
1	1	BASE PLATE	" " " 2 & 3 "

SCALE 1:1	PUNCH FITTING	MP/2.3/2.3.3/Test
MAT. MILD STEEL		FITTING II

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MILLWRIGHT



TRADE TRAINING I	LAYOUT	Mp/2.1/2.3.4 TURNING
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING PAK-GERMAN TECHNICAL TRAINING PROGRAMME		MILLWRIGHT

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

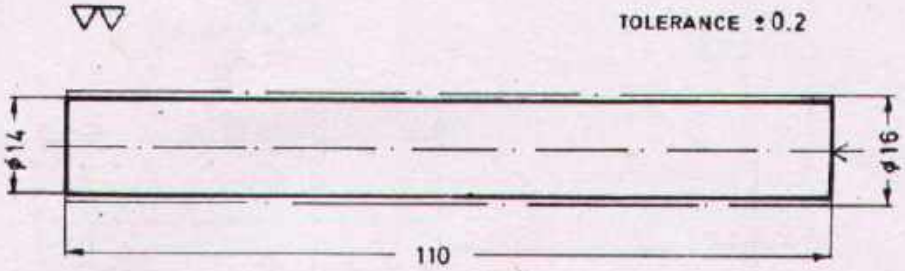
MATERIAL REQUIRED

TRADE TRAINING 1

MILLWRIGHT

TURNING

No. 2.3.4/1 to 15	Exercise No. (Length given in Millimeter)																		Length per Trainee	Total length for 16 Trainees	Total weight for 16 Trainees
	1	2	3	4	5,1	5,2	5,3	6	8,1	8,2	9	10	11	12	13	14,1	14,2	15			
M.S.Round Ø 16 mm (5/8" DIA)	116			8							80								204 mm	3.3 meter	5.2 kg
M.S.Round Ø 25 mm (1" DIA)		100	84												156			40	380 mm	6.1 meter	23.5 kg
Tool Steel Ø 16 mm					94														94 mm	6 Train. o.57meter	1.4 kg
Tool Steel Ø 14 mm (9/16" DIA)						84													84 mm	5 Train. 0.43meter	0.6 kg
Tool Steel Ø12.7 mm (1/2" DIA)							74												74 mm	5 Train. 0.37meter	0.4 kg
M.S.Round Ø12.7 mm (1/2" DIA)								72									130		202 mm	3.3 meter	3.2 kg
M.S.Round Ø 19 mm (3/4" DIA)									25										25 mm	0.4 meter	0.9 kg
Cast Iron Round Ø25 mm, (1" DIA)										20									20 mm	0.32meter	1.3 kg
M.S.Round Ø 32 mm (1 1/4" DIA)												16	92	24					132 mm	2.2 meter	13.9 kg
M.S.Round Ø 37 mm (1 1/2" DIA)																106			106 mm	1.7 meter	14.4 kg



SEQUENCE OF OPERATION

1. Hold the material in three jaw chuck.
2. Face and centre drill one side.
3. Rechuck face to length 11o mm and centre drill.
4. Hold workpiece between centre.
5. Turn to ø 16 mm.
6. Check size and parallism.
7. Finish to ø 14 mm.
8. Deburr and check.

CAUTION.

Deburr before chucking.

Set the tool at centre hight.

TOOLS REQUIRED

Right hand side tool

Centre drill 1.6 mm

Drill chuck

Driving plate

Dog carrier

Vernier caliper

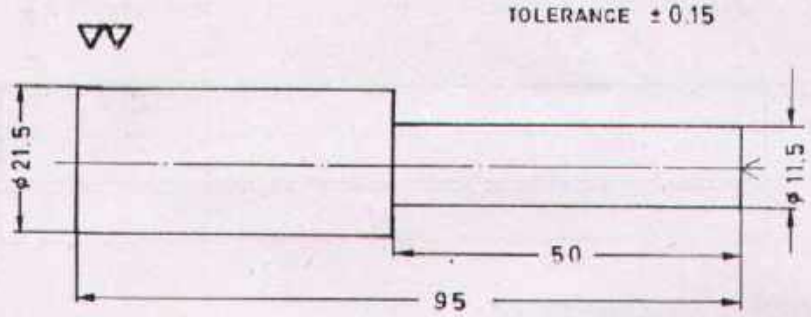
SCALE 1:1	ROUND - IRON	MP/2.3/2.3.4/1
MAT. MILD STEEL		TURNING

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MILLWRIGHT

TOLERANCE ± 0.15



SEQUENCE OF OPERATION

1. Hold the material in three jaw chuck
2. Face one side and turn to ø 21,5 at a length of about 5o mm
3. Rechuck and face to length 95 mm
4. Turn the step to ø 11.5 and length 5 mm
5. Remove sharp edges

CAUTION

Hold the cutting tool as short as possible to eliminate vibration.

Always apply coolant.

TOOLS REQUIRED

Right hand roughing tool

Right hand side tool

Vernier caliper

Three jaw chuck

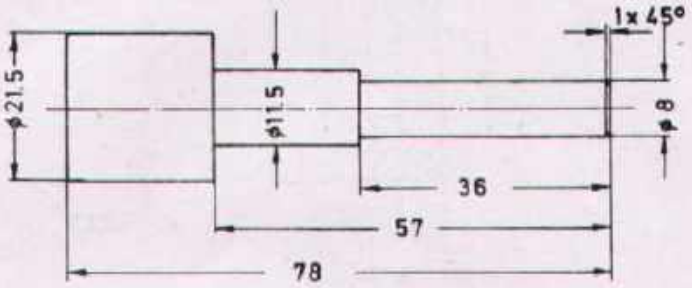
SCALE 1:1	BLADE HOLDER	MP/2.3/2.3.4/2
MAT. MILD STEEL		TURNING

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MILLWRIGHT

Tolerance ± 0,1
unless otherwise stated



SEQUENCE OF OPERATION

1. Hold the material in three jaw chuck
2. Face and turn to ø 21,5 mm
3. Rechuck and face to length 78 mm
4. Centre drill and set the tailstock
5. Turn the steps according to drawing
6. Chamfer 1 x 45°
7. Deburr and number punch

TOOLS REQUIRED

Right hand side tool

Right hand cranked tool

Centre drill 1,6 mm

Drill chuck

Vernier caliper

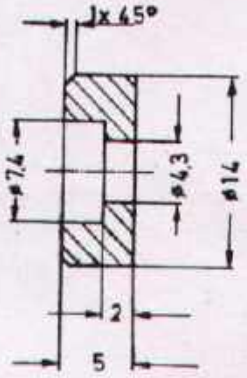
SCALE 1:1	BLADE HOLDER	MP/2.3/2.3.4/3
MAT. MILD STEEL		TURNING

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MILLWRIGHT

Tolerance ± 0,1
unless otherwise stated



2 PIECES

SEQUENCE OF OPERATION

1. Hold a longer round bar in three jaw chuck
2. Face and centre drill
3. Drill hole ø 4.3 about 8 mm deep
4. Counter bore M 4
5. Turn the outer ø 14 mm at a length of about 8 mm
6. Chamfer 1 x 45°
7. Parting off
8. Deburr

TOOLS REQUIRED

Right hand side tool
Twist drill ø 4.3 mm
Centre drill 1.6 mm
Counter bore M 4
Drill chuck
Parting tool
Vernier caliper

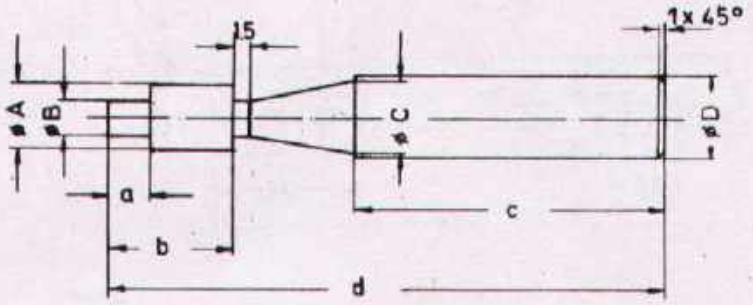
SCALE 2 : 1	STOP	MP/2.3/2.3.4/4
MAT. MILD STEEL		TURNING

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MILLWRIGHT

▽▽

Tolerance ± 0,1
unless otherwise stated



	A	B	C	D	a	b	c	d
I	7.6	4.2	8	10	5	15	42	70
II	9.6	5.2	10	12	6	18	46	80
III	10.6	6.3	12	14	7	20	50	90

SEQUENCE OF OPERATION

1. Face raw material to the required length.
2. Centre drill both sides of each piece.
3. Remove three jaw chuck and mount driving plate.
4. To ensure true running of all diameters turn the counter bore drill between centres.

CAUTION

Material is tool steel - adjust correct r.p.m.

TOOLS REQUIRED

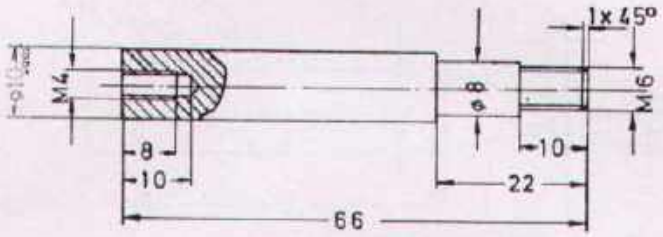
Right hand side tool
Dog carrier
Parting tool
Centre drill 1.6 mm
Driving plate
Drill chuck
Vernier caliper

SCALE 1:1	COUNTER-BORE DRILL	MP/2.3/2.3.4/5
MAT. TOOL STEEL		TURNING

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MILLWRIGHT

Tolerance ± 0,1
unless otherwise stated



2pieces

SEQUENCE OF OPERATION

1. Hold workpiece in three jaw chuck
2. Face one side and turn to ø 1o at a length of about 46 mm
3. Centre drill and drill hole ø 3.2 mm - 1o mm deep
4. Tap M 4
5. Rechuck-use collet chuck
6. Turn ø 8 and 6 mm according to drawing
7. Die thread M 6

CAUTION

When tapping M 4 mind the depth of hole.

TOOLS REQUIRED

Right hand side cutting tool

Die M 6 with die stock

Set of taps M 4

Vernier caliper

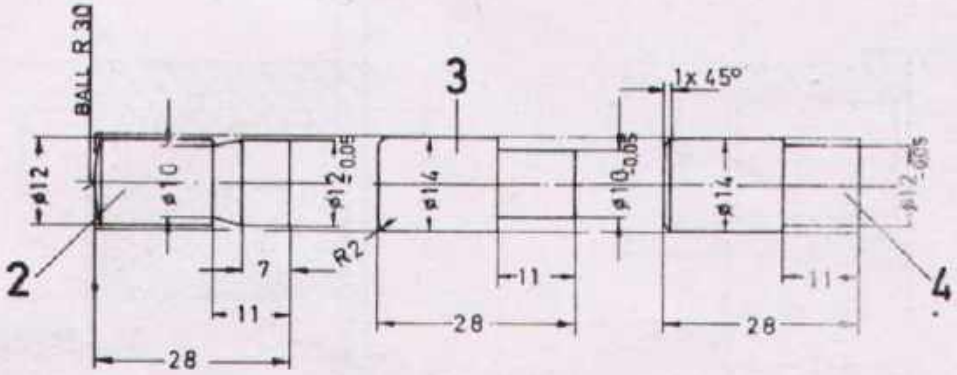
SCALE 1:1	SLIDING ROD	MP/2.3/2.3.4/6
MAT. MILD STEEL		TURNING

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MILLWRIGHT

Tolerance ± 0,1
unless otherwise stated



SEQUENCE OF OPERATION

1. Hold workpiece in three jaw chuck at about 35 mm overhang.
2. Turn to ø 12 mm at a length of 11 mm (part 4).
3. Part off to a length of 28 mm.
4. Chamfer part 4, 1 x 45°.
5. Repeat the operations for part 3 and part 2 accordingly.

TOOLS REQUIRED

Right-hand side tool

Parting tool

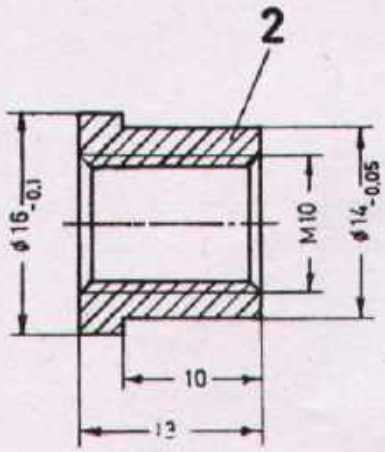
Vernier caliper

SCALE 1:1	BOLTS	MP/2.3/2.3.4/7
MAT. MILD STEEL	from Ex.1	TURNING

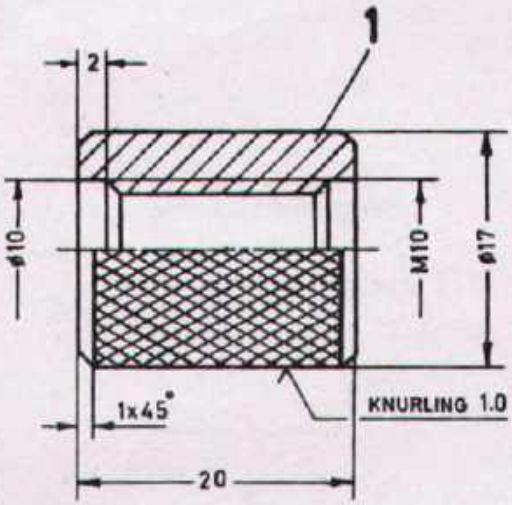
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MILLWRIGHT

Tolerance ± 0,1
unless otherwise stated



MATERIAL:CAST IRON



MATERIAL:MILD STEEL

SEQUENCE OF OPERATIONS

1. Chuck the raw material in three jaw chuck.
   Face one side, centre drill and drill hole ø 8.2 x 25.
2. Cut the thread M 10 by guiding the tap with the centre point.
3. Turn the outer ø to 16.7 and knurl.
4. Part off, face to length 20 mm and chamfer.
5. Chuck raw material (cast iron) in three jaw chuck and turn outer and inner diameters.
6. Cut thread M 10 and part to length.

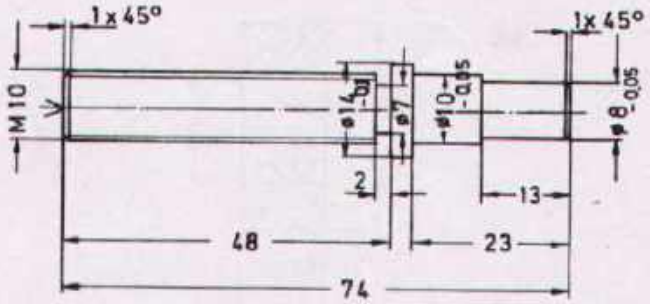
SCALE 2:1	THREAD BUSHES	MP/2.3/2.3.4/8
MAT.		TURNING

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MILLWRIGHT

▽▽

Tolerance ± 0,1
unless otherwise stated



SEQUENCE OF OPERATION

1. Set the machine, chuck the material and set the tool.
2. Drill the centre-hole and turn the dia 14 mm.
3. Turn the dia 1omm. Mind the length and the tolerances.
4. Turn the dia 8 mm. Mind the length and the tolerances.
5. Clamp turned portion in the collet_chuck and set the tail_stock.
6. Turn the dia for M 1o thread. Mind the length.
7. Cut external thread M 1o with die-stock.

TOOLS REQUIRED

Side-cutting tool

Right-hand tool

Die M 1o

Vernier caliper

SCALE 1:1	SPINDLE	MP/2.3/2.3.4/9
MAT. MILD STEEL		TURNING

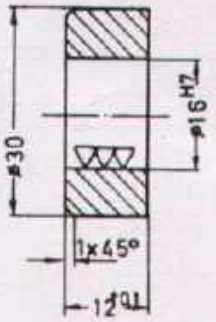
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MILLWRIGHT

▽▽ (▽▽▽)

Tolerance ± 0.1
unless otherwise stated



SEQUENCE OF OPERATION

1. Turn the outside dia 3o mm.
2. Drill the hole with twist drill 15,5 mm.
3. Set the machine reamer 16^{H7} in tail-stock and ream the hole.
4. Chamfer 1 x 45.
5. Part off workpiece to the given length.

TOOLS REQUIRED

Right-hand tool

Side_cutting tool

Twist drills

Reamer 16^{H7}

Vernier caliper

Parting tool

SIZE	TOLERANCE
16^{H7}	$+0.018$ 0

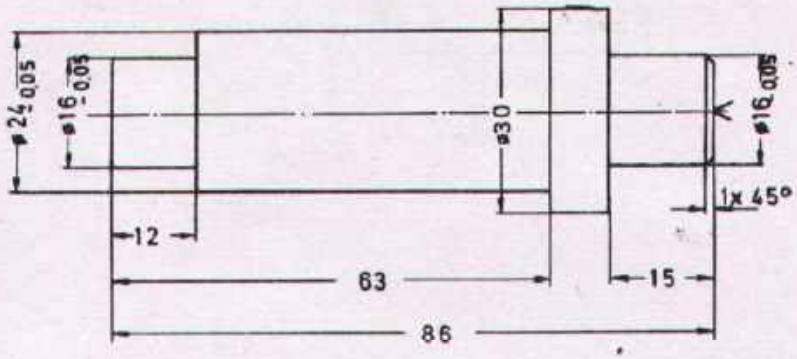
SCALE 1:1	STOPPER	MP/2.3/2.3.4/10
MAT. MILD STEEL		TURNING

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MILLWRIGHT

Tolerance ± 0,1
unless otherwise stated



SEQUENCE OF OPERATION

1. Chuck the material and drill the centre hole.
2. Turn the outside dia 3o mm.
3. Turn the outside dia 16 mm. Mind tolerances and length.
4. Turn outside dia 24 mm. Mind length and tolerances.
5. Turn outside dia 16 mm. Mind length and tolerances.

TOOLS REQUIRED

Side-cutting tool

Right-hand tool

Centre-drill

Vernier caliper

SCALE 1:1	SPLINE SHAFT	MP/2.3/2.3.4/11
MAT. MILD STEEL		TURNING

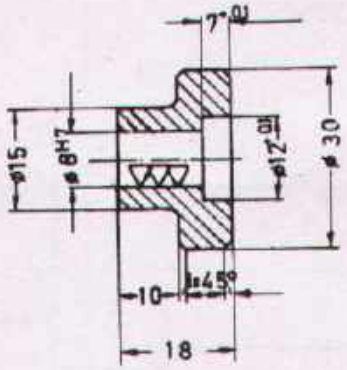
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MILLWRIGHT

▽▽ (▽▽▽)

Tolerance ± 0,1
unless otherwise stated



SEQUENCE OF OPERATION

1. Turn the outside dia 3o.
2. Drill the hole with twist drill ø 7,5 mm.
3. Set the machine-reamer ø 8 ^{7} and ream the hole.
4. Counter-bore the hole.
5. Turn the dia 15 mm.
   Mind the length and tolerances.
6. Part off to length 18 mm.

TOOLS REQUIRED

Side-cutting tool.

Right-hand tool.

Twist drills.

Reamer.

Vernier caliper.

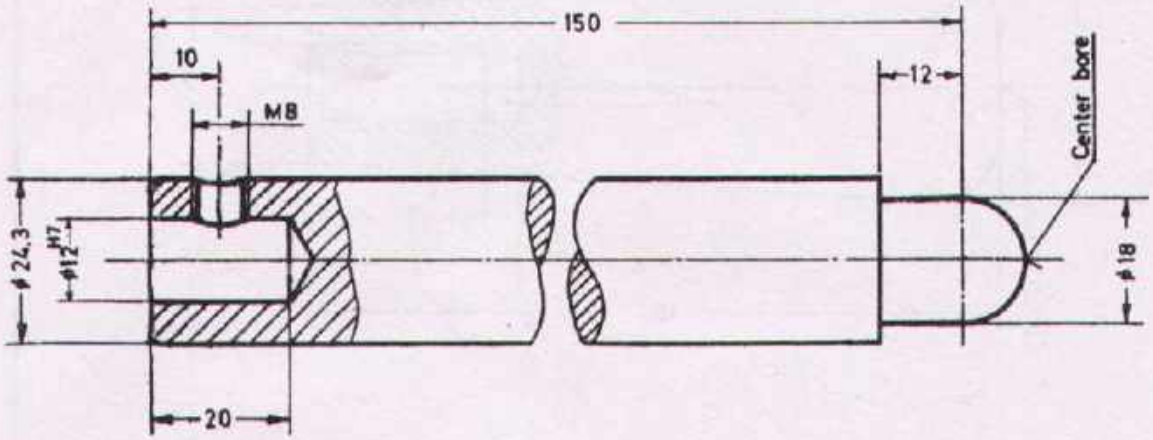
Parting tool.

SIZE	TOLERANCE
8 H7	+0,015 0

SCALE 1:1	HANDLE	MP/2.3/2.3.4/12
MAT. MILD STEEL		TURNING
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING PAK-GERMAN TECHNICAL TRAINING PROGRAMME		MILLWRIGHT

4 ▽▽

Tolerance ± 0,1
unless otherwise stated



SEQUENCE OF OPERATION

1. Face one side and centre drill.
2. Drill and ream blindhole ø 12 x 2o.
3. Face to length and turn step and radius R= 9mm.
4. Re-chuck and turn outside ø 24,3.

CAUTION

Rough the radius with a cutting tool first.

For finishing use a smooth file and low r.p.m.

Check the radius with a radius gauge.

SIZE	TOLERANCE
12^{H7}	$^{+0.018}_{0}$

SCALE 1:1	RAM	MP/2.3/23.4/13
MAT.MILD STEEL		TURNING

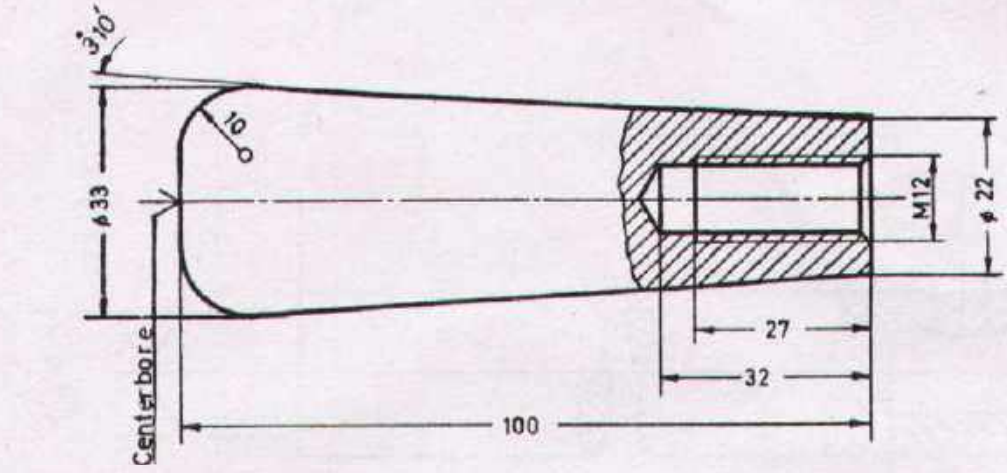
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

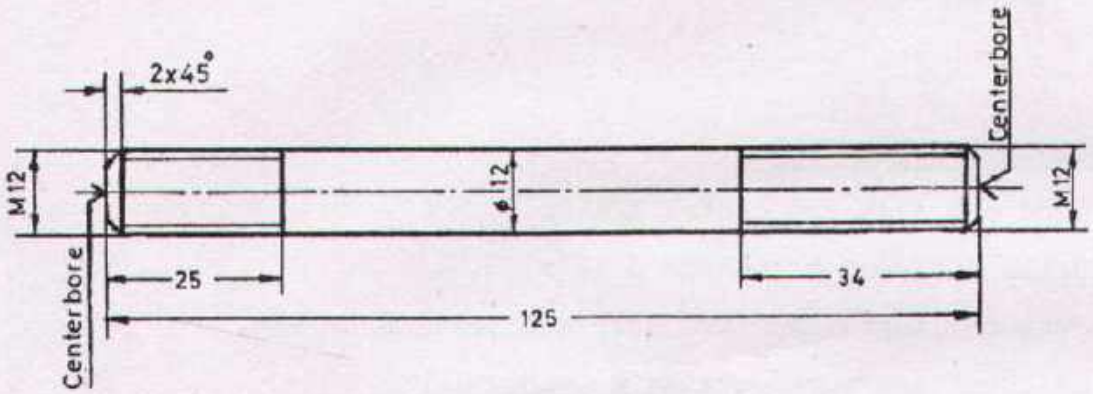
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MILLWRIGHT

▽▽

Tolerance ± 0,1
unless otherwise stated





SEQUENCE OF OPERATION

1. Face the spindle to length and centre drill both sides.
2. Turn to ø 12 mm
3. Cut thread on both sides M 12 x 34
4. Face handle to length and centre drill both sides
5. Drill hole for M 12 and tap M 12 x 27
6. Screw handle and spindle together and hold spindle in three jaw chuck
7. Set tailstock and turn outside shape of handle

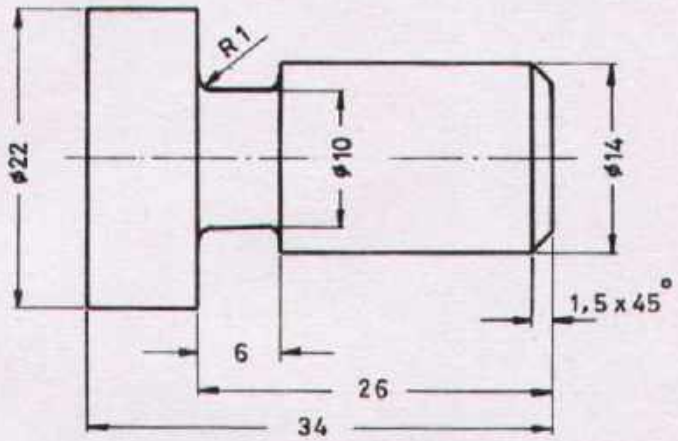
SCALE 1:1	TOGGLE PRESS/DETAILS	MP/2.3/2.3.4/14
MAT. MILD STEEL		TURNING

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MILLWRIGHT

Tolerance ± 0,1
unless otherwise stated



SEQUENCE OF OPERATION

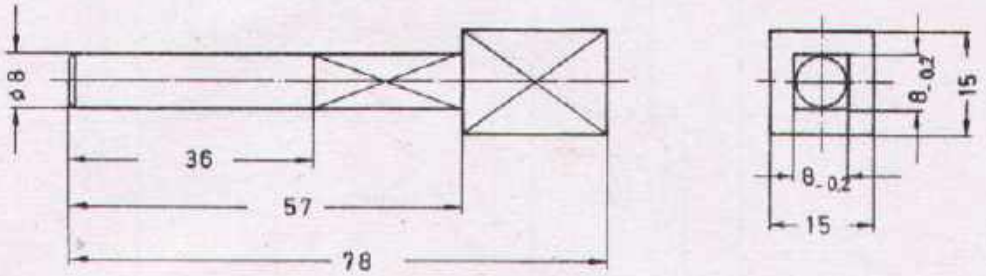
1. Hold round bar in three jaw chuck - about 4o mm over-hanging
2. Turn to ø 22 x 38
3. Turn to ø 14 x 26
4. Turn groove ø 1o x 6
5. Chamfer 1.5 x 45
6. Part off to 34,3
7. Face to length 34
8. Deburr

SCALE 2 :1	PUNCH (For test Fitter)	Mp/2.3/2.3.4/15
MAT. MILD STEEL		TURNING

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MILLWRIGHT

Tolerance ± 0,1
unless otherwise stated



SEQUENCE OF OPERATION

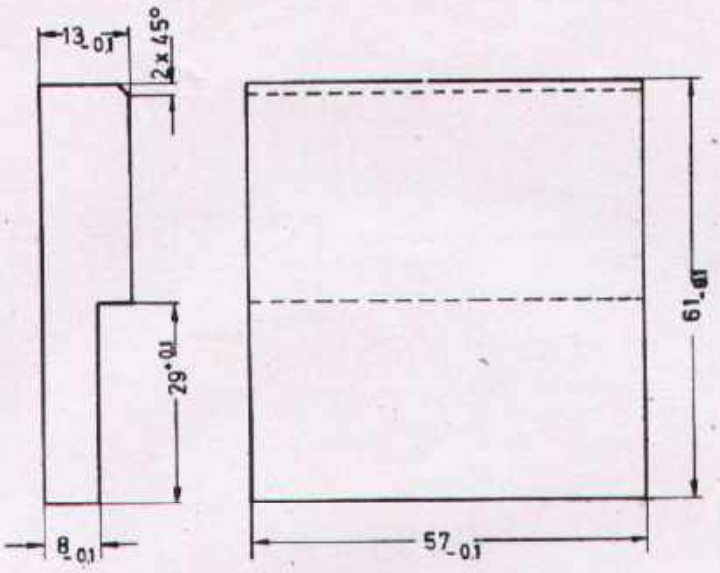
1. Mark out the square 15 x 15 mm.
2. Shape the first side up to the marked line.
3. Shape in the same clamping position the first side of the 8 mm square.
4. Rotate the workpiece 90° and shape the 2nd side of both the squares.
5. Repeat the operations until the remaining sides are complete.

TOOLS REQUIRED

Vernier caliper
Try square
Marking tools
Shaping tool

SCALE 1:1	BLADE HOLDER	Mp/2.3/2.3.5/5
MAT. MILD STEEL	from Ex 2.3.4/3	SHAPING

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING
PAK-GERMAN TECHNICAL TRAINING PROGRAMME
MILLWRIGHT



SEQUENCE OF OPERATION

1. Shape the outer surfaces as done in previous exercises.
2. Mark out the chamfer and slot.
3. Shape the recess to the marked line. Mind the dimensions and right angles.
4. Set the swivel-head in a 45° position.
5. Shape the chamfer.

TOOLS REQUIRED

Vernier caliper

Marking tools

Try square

Shaping tool

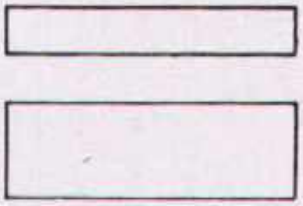
SCALE 1:1	FIXED JAW	Mp/2.3/2.3.5/6
MAT. MILD STEEL		SHAPING

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

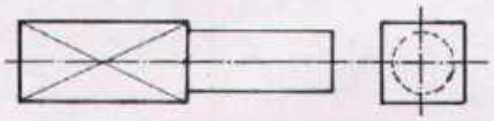
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MILLWRIGHT

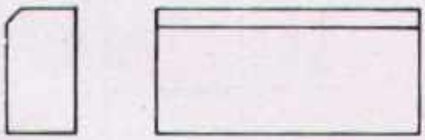
1 → 2.3.3/1



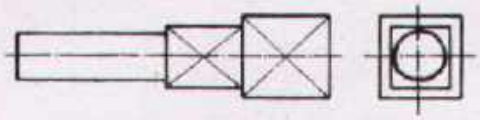
2 → 2.3.3/7



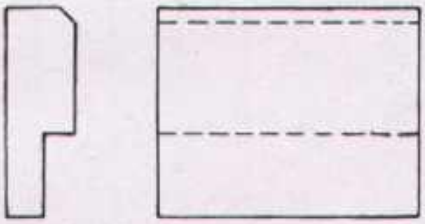
2.3.4/2 → 3 → 2.3.3/5



4 → 2.3.6/3

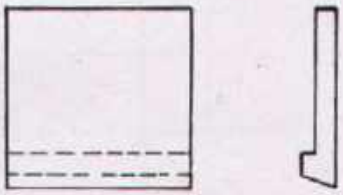


2.3.4/3 → 5 → 2.3.3/5



6 → 2.3.6/3

7 → 2.3.3/15



8 → 3.3.1/1

IN ADDITION TO THE EXERCISES SHOWN ABOVE, THE TRAINEES HAVE TO CARRY OUT PRACTICAL SHAPING WORK WHICH IS NEEDED FOR THE TRAINING CENTRE.
ONE OF THIS ADDITIONAL ORDERS SHOULD NOT EXEED 10 WORKING HRS.
ALL ADDITIONAL WORK IS TO BE CHECKED AND MARKED THOROUGHLY.

TRADE TRAINING 1	LAY OUT	Mp/2.1/2.3.5 SHAPING
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING PAK-GERMAN TECHNICAL TRAINING PROGRAMME		MILLWRIGHT

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

TRADE TRAINING 1

MATERAL REQUIRED

MILLWRIGHT

MILLING

No. 2.3.6/1 to 8

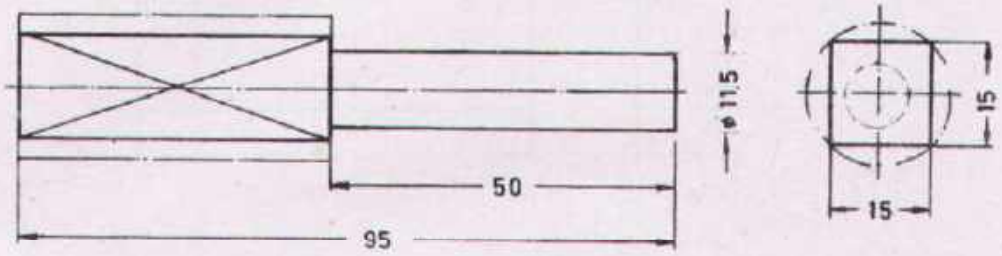
	Exercise No. 1	2	5	6.1	6.2	8	(Length given in Millimeter)	Length per Trainee	Total length for 16 Trainees	Total weight for 16 Trainees
M.S.Square 32x32 mm (1 1/4" squ.)	76							76 mm	1.2 meter	9.7 kg
M.S.Flat 25x16 mm (1" x 5/8")		33						33 mm	0.53meter	1.7 kg
M.S.Flat 38x16 mm (1 1/2" x 5/8")			82					82 mm	1.32meter	6.3 kg
M.S.Flat 38x12.7mm (1 1/2" x 1/2")				54	28			82 mm	1.32meter	4.8 kg
M.S.Square 32x32 mm (1 1/4" squ.)						58		58 mm	0.93meter	7.5 kg

SHAPING

No. 2.3.5/1 to 8

	1	2	4	6	7	8			
M.S.Flat 50x18 mm (2" x 3/4")	76						76 mm	1.3 meter	9.2 kg
M.S.Flat (1"x1/2") 25.4x12.7mm		84					84 mm	1.35meter	3.6 kg
M.S.Flat 38x15 mm (1 1/2" x 5/8")			63				63 mm	1.1 meter	5.0 kg
M.S.Flat 63x15 mm (2 1/2" x 5/8")				63			63 mm	1.1 meter	2.0 kg
Carbon Steel 15x8mm (5/8"x5/16") (2 pcs)					63 63		126 mm	2.1 meter	2.5 kg
Carbon Steel 32x8mm (1 1/4" x 5/16")						40	40 mm	0.64meter	1.3 kg

TOLERANCE ±0.1



SEQUENCE OF OPERATION

1. Mark out the square 15 x 15 mm.
2. Shape the first side to the marked line.
3. Shape the 2nd side in right angle to the first.
4. Continue with the remaining two sides to complete the square. Mind the dimensions.

CAUTION

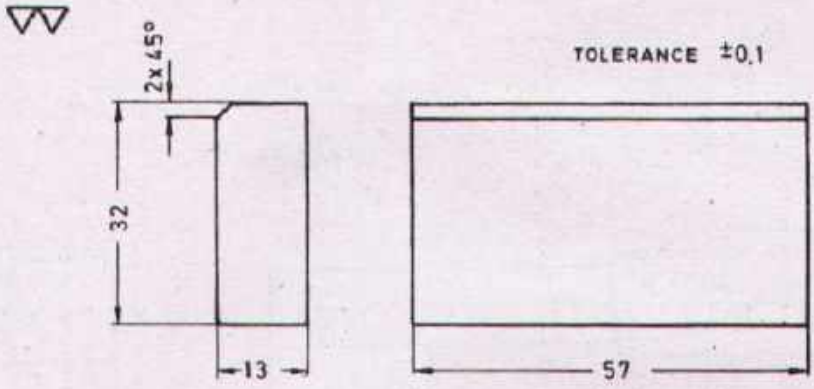
Use accurately ground parallels only.

TOOLS REQUIRED

Vernier caliper
Try square
Marking tools
Shaping tool

SCALE 1:1	BLADE HOLDER	Mp/2.3/2.3.5/3
MAT. MILD STEEL	from Ex. 2.3.4/2	SHAPING

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING
PAK-GERMAN TECHNICAL TRAINING PROGRAMME
WILWRIGHT



SEQUENCE OF OPERATION

1. Shape the outer surfaces as done in the previous exercises.
2. Set the swivel head in 45° position.
3. Shape the chamier.

TOOLS REQUIRED

Vernier caliper

Try square

Shaping tool

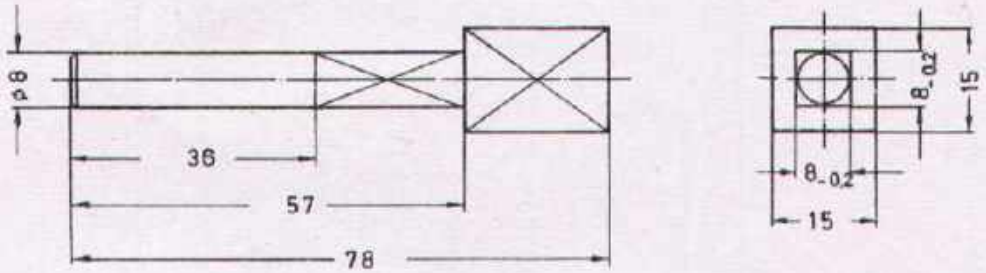
SCALE 1:1	MOVEABLE JAW	Mp/2.3/2.3.5/4
MAT. MILD STEEL		SHAPING

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MILLWRIGHT

Tolerance ± 0.1
unless otherwise stated



SEQUENCE OF OPERATION

1. Mark out the square 15 x 15 mm.
2. Shape the first side up to the marked line.
3. Shape in the same clamping position the first side of the 8 mm square.
4. Rotate the workpiece 90° and shape the 2nd side of both the squares.
5. Repeat the operations until the remaining sides are complete.

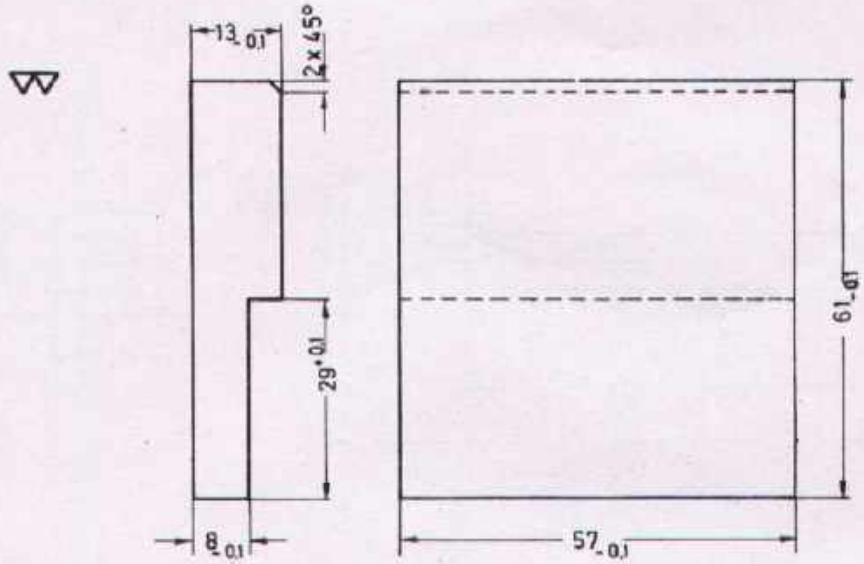
TOOLS REQUIRED

Vernier caliper
Try square
Marking tools
Shaping tool

SCALE 1:1	BLADE HOLDER	Mp/2.3/2.3.5/5
MAT. MILD STEEL	from Ex 2.3.4/3	SHAPING

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MILLWRIGHT



SEQUENCE OF OPERATION

1. Shape the outer surfaces as done in previous exercises.
2. Mark out the chamfer and slot.
3. Shape the recess to the marked line. Mind the dimensions and right angles.
4. Set the swivel-head in a 45° position.
5. Shape the chamfer.

TOOLS REQUIRED

Vernier caliper

Marking tools

Try square

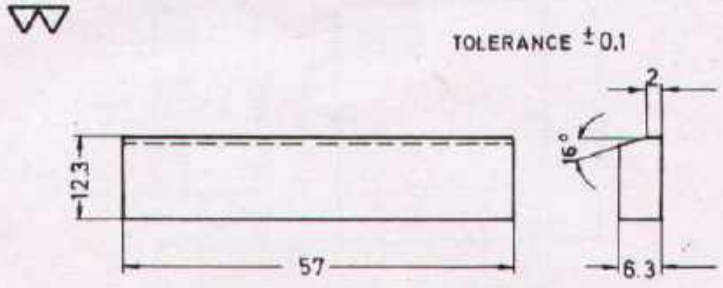
Shaping tool

SCALE 1:1	FIXED JAW	Mp/2.3/2.3.5/6
MAT. MILD STEEL		SHAPING

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MILLWRIGHT



2 pieces

SEQUENCE OF OPERATION

1. Shape the outer surfaces as done in previous exercises. Mind the dimensions and right angles.
2. Mark out the inclination.
3. Clamp the workpiece and set the swivel-head to 74°.
4. Shape the inclination.

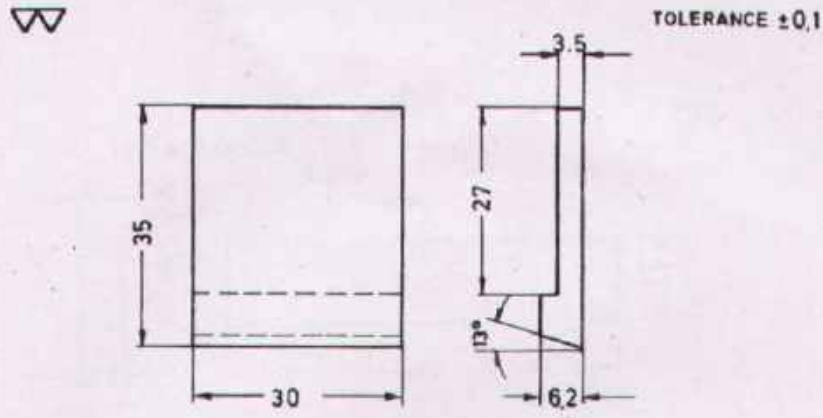
TOOLS REQUIRED

Vernier caliper
Marking tool
Try square
Shaping tool

SCALE 1:1	JAW INSERTS	Mp/2.3/2.3.5/7
MAT. CARBON STEEL		SHAPING

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MILLWRIGHT



SEQUENCE OF OPERATION

1. Shape the outer surfaces to the dimensions 34 x 30 x 6.2 mm.
2. Mark out the workpiece.
3. Shape therecess. Mind the dimensions and right angles.
4. Shape the inclination according to marked lines.

TOOLS REQUIRED

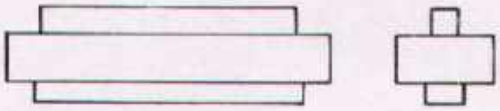
Vernier caliper
Try square
Marking tools
Shaping tool

SCALE 1:1	BLADE	Mp/2.3/2.3.5/8
MAT. CARBON STEEL		SHAPING

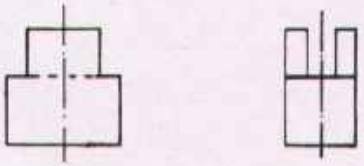
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

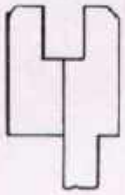
MILLWRIGHT



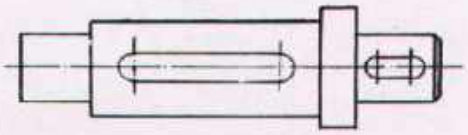
1



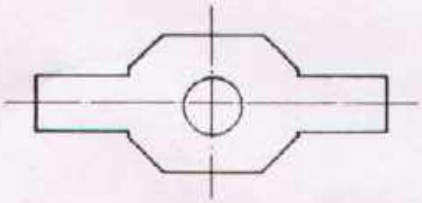
2 → 2.3.3/3



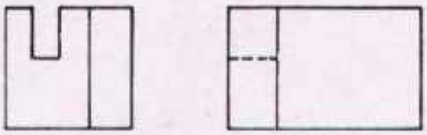
2.35/4.6 → 3 → 2.3.3/15



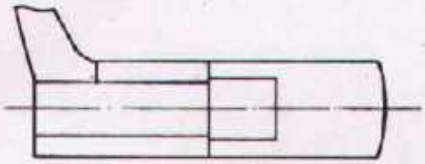
2.3.4/11 → 4 → 2.3.3/11



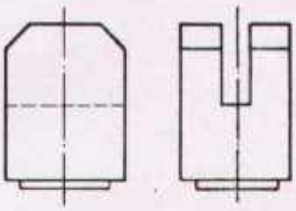
5 3.1.1/8



6 → 3.3.1/1



7 → 2.3.3/14

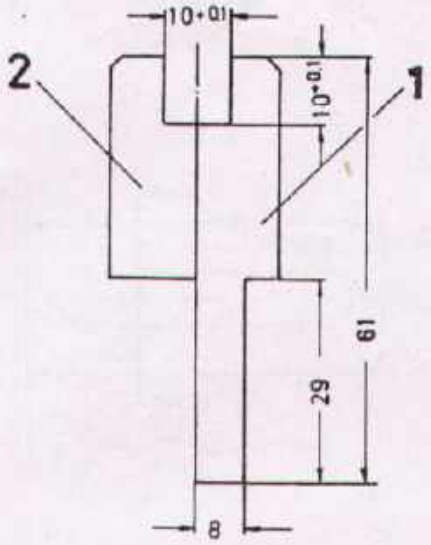


8 → 3.3.1/1

IN ADDITION TO THE EXERCISES SHOWN ABOVE, THE TRAINEES HAVE TO CARRY OUT PRACTICAL MILLING WORK WHICH IS NEEDED FOR THE TRAINING CENTRE.
ONE OF THIS ADDITIONAL ORDERS SHOULD NOT EXEED 10 WORKING HRS.
ALL ADITIONAL WORK IS TO BE CHECKED AND MARKED THOROUGHLY.

TRADE TRAINING I	LAY OUT	Mp/2.1/2.3.6 MILLING
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING PAK-GERMAN TECHNICAL TRAINING PROGRAMME		MILLWRIGHT

Tolerance ± 0,1
unless otherwise stated



SEQUENCE OF OPERATION

1. Clamp both pieces in a machine vice.
2. Mount side milling cutter 10 mm.
3. Mill the slot 10 x 10mm.

CAUTION

Mill the slot in such a way that both pieces will have a step of 5 x 10mm.

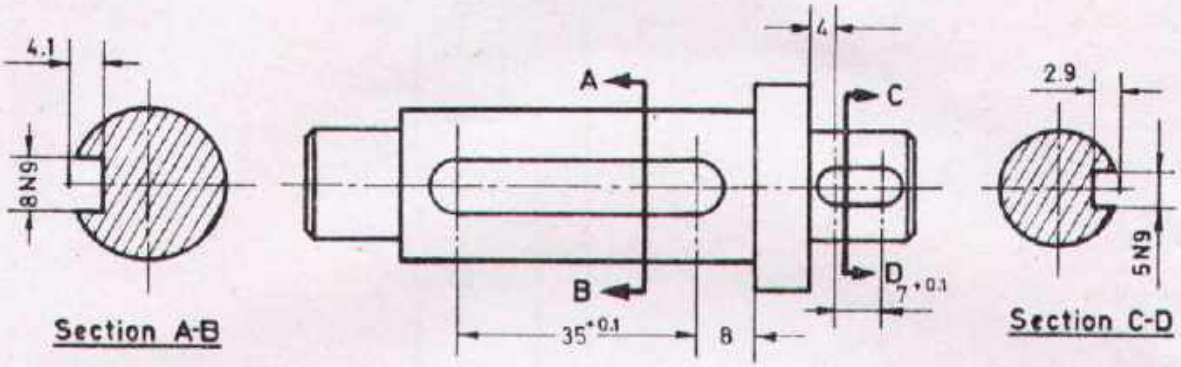
SCALE 1:1	JAWS	Mp/2.3/2.3.6/3
MAT. MILD STEEL	from 2.3.5/4,6	MILLING

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MILLWRIGHT

Tolerance ± 0,1
unless otherwise stated



SEQUENCE OF OPERATION

1. Mark out the workpiece.
2. Set the machine vice on the machine table. Check the alignment of the fixed vice jaw with the machine table by using a dial test indicator.
3. Clamp the workpiece and check the level.
4. Set the stop dogs on the machine table according to the marking points on the workpiece.
5. Mill the keyways and check the sizes 8^{N9} and 5^{N9} with the slip gauges.

   To mill the keyways use the two-lip end mill cutter.

SIZE	TOLERANCE
5^{N9}	0 / -0,030
8^{N9}	0 / 0,036

SCALE 1:1	AXLE WITH KEY WAYS	Mp/2.3/2.3.6/4
MAT. MILD STEEL	from Ex. 2.34/11	MILLING

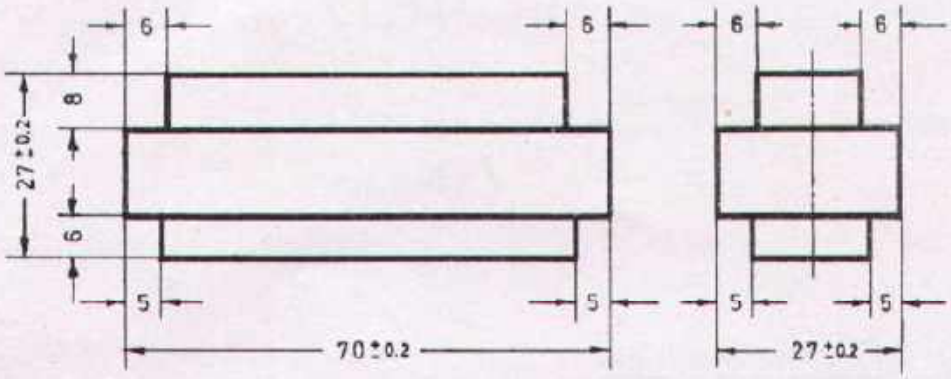
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MILLWRIGHT

▽▽

Tolerance ± 0,1
unless otherwise stated



SEQUENCE OF OPERATION

1. Mill the workpiece to the outer dimensions 27 x 27 x 70, use shell end mill cutter Ø 30 - 40 mm.
2. Mill the step 6 mm x 8 mm deep.
3. Mill the step 5 mm x 6 mm deep.

CAUTION

Take care, that the workpiece is clamped in correct horizontal position by using parallel pieces.

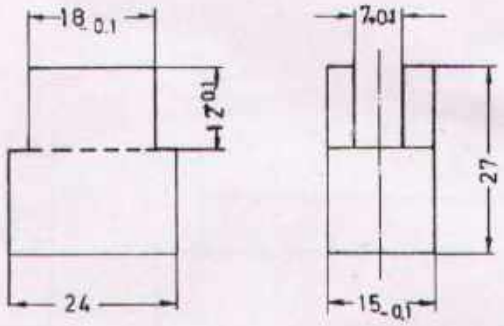
SCALE 1:1	MILLING EXERCISE	Mp/2.3/2.3.6/1
MAT. MILD STEEL		MILLING

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MILLWRIGHT

Tolerance ± 0.1
unless otherwise stated



SEQUENCE OF OPERATION

1. Mill the workpiece to the outer dimensions 24 x 15 x 27.
2. Mount side milling cutter on arbor and mill the slot 7 x 12.
3. Mill the step by using a shank end mill.

CAUTION

The slot must be concentrically.
The depth of steps and slot is to be equal.

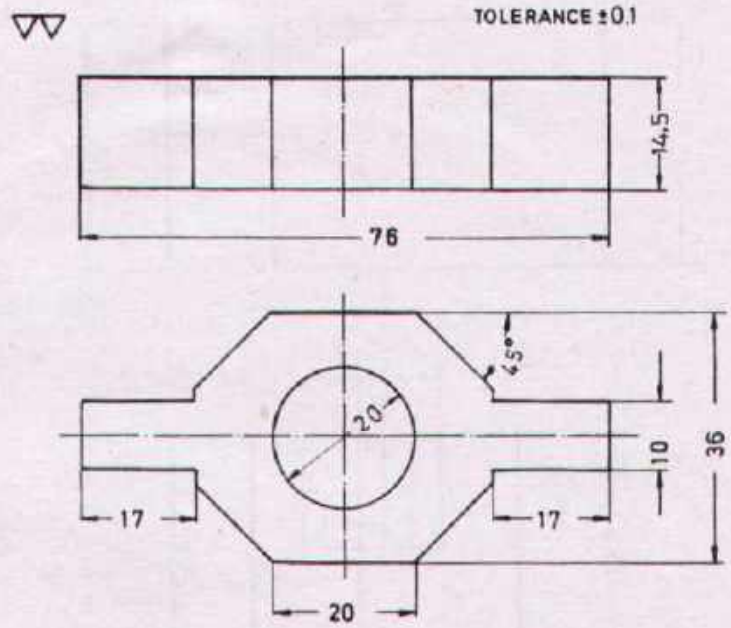
TOOLS REQUIRED

Vernier caliper
Try square
Marking tools
Side milling cutter ø63 x 7mm.
Shell end mill cutter Ø 25 mm.

SCALE 1.1	GUIDING PIECE	Mp/2.3/2.3.6/2
MAT.MILD STEEL		MILLING

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MILLWRIGHT



SEQUENCE OF OPERATION

1. Mill the workpiece to the dimensions 36 x 14,5 x 76 mm.
2. Mark out the guiding nut.
3. Mill to the thickness 10 x 17 mm.
4. Adjust vertical head to 45°.
5. Mill the four inclinations.

TOOLS REQUIRED

Vernier caliper
Try square
Marking tool
Shell end mill cutter Ø 35 mm.

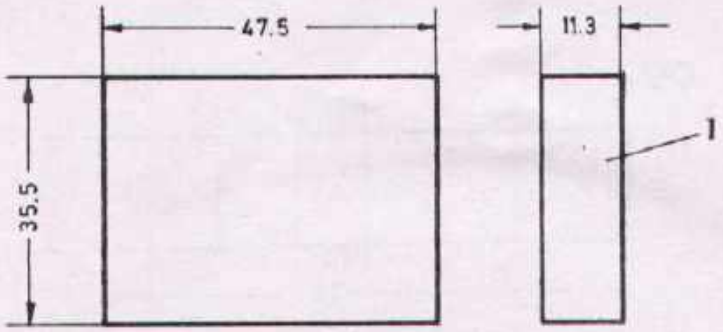
SCALE 1:1	GUIDING NUT	Mp/2.3/2.3.6/5
MAT. MILD STEEL		MILLING

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

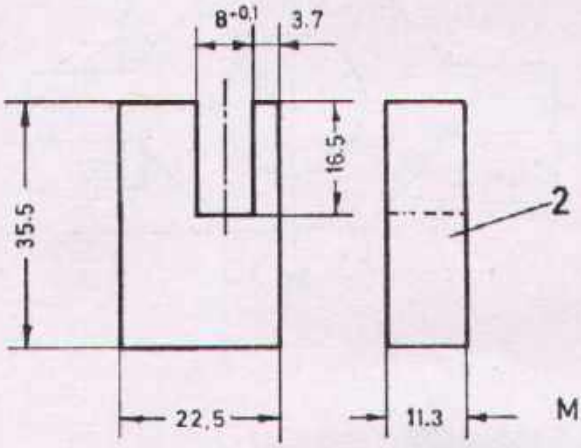
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MILLWRIGHT

Tolerance ± 0,1
unless otherwise stated



Mat. Low Carbon steel



Mat. Mild steel

SEQUENCE OF OPERATION

1. Mill both pieces to the outside dimension.
2. Mill a 8 mm slot in part 2 by using an 8 mm side milling cutter.

CAUTION

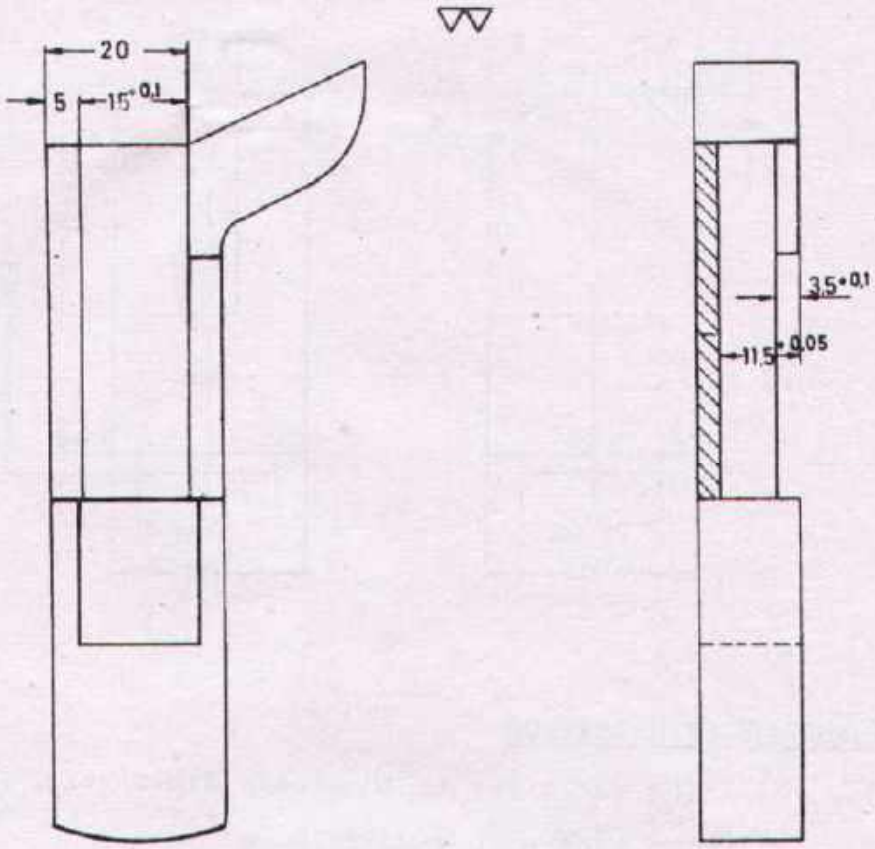
Part No. 1 is low carbon steel and Part 2 is mild steel therefore adjust proper r.p.m. and feed.

SCALE 1:1	SUPPORT	Mp/2.3/2.3.6/6
MAT.		MILLING

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MILLWRIGHT



SEQUENCE OF OPERATION

1. Clamp workpiece in machine vice supported by parallel bars.
2. Mount shank end mill cutter Ø 12 mm.
3. Mill groove 15 x 11.5 mm.
4. Mill the recess 3.5 mm deep.

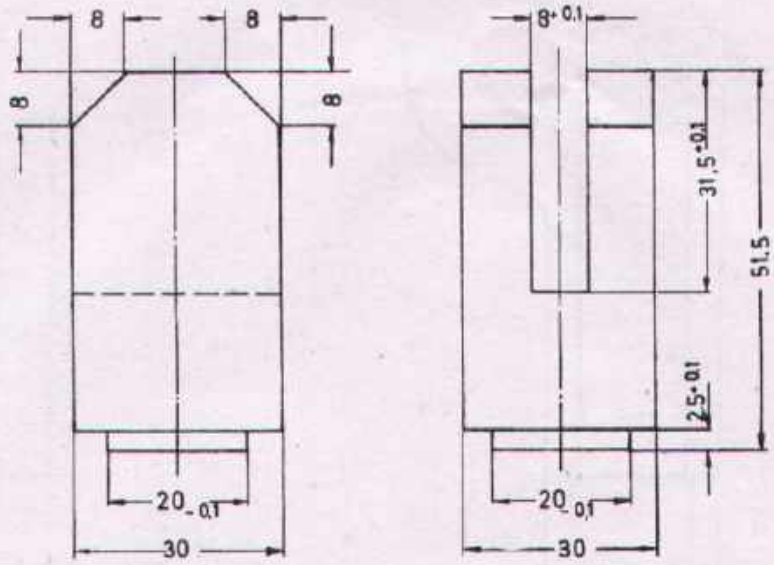
SCALE 1:1	FIXED PART (adjustable) (spanner)	Mp/2.3/2.3.6/7
MAT. MILD STEEL	from Ex. 2.3.3/10	MILLING

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MILLWRIGHT

Tolerance ± 0,1
unless otherwise stated



SEQUENCE OF OPERATION

1. Mill the workpiece to the outer dimensions.
2. Mill the square 20 x 20 x 25mm.
3. Mill the slot 8 x 31.5mm.
4. Mill the inclinations 8 x 45°

TOOLS REQUIRED

Vernier caliper
Marking tools
Try square
Side milling cutter
Shell end mill cutter.

SCALE 1:1	PEDESTAL	MP/2.3/2.3.6/8
MAT. MILD STEEL		MILLING

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MILLWRIGHT