TRADE TRAINING
ATC PROGRAMME

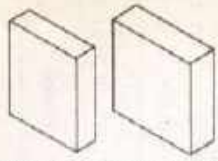
MACHINIST

DEVELOPMENT CELL
FOR SKILLED LABOUR TRAINING
DIRECTORATE OF MANPOWER & TRAINING
GOVERNMENT OF THE PUNJAB
LAHORE

Retail Price Rs. 13.00

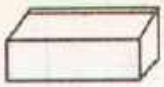
T.T.P. Series No. 17

SHAPING 2.2.2 / 0.1 – 0.6



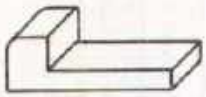
Parallel, Square-Shaping

1 → 2.3.5/3 | 1a → 2.1.2/12



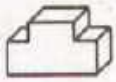
Parallel, Angular-Shaping

2 → 2.3.5/3



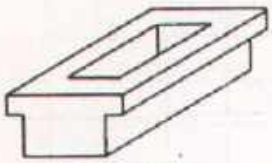
Parallel, Step-Shaping

3 → 2.2.4/4



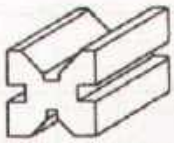
Parallel, Step-Shaping

4 → 2.2.4/5



Form Shaping

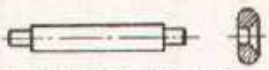
5 → 2.2.4/10



Form Shaping

6

TURNING 2.2.3 / 0.1 – 0.6

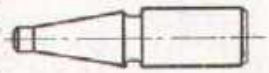


Longitudinal Turning, Drilling, Form Turning

1 → 2.3.5/3

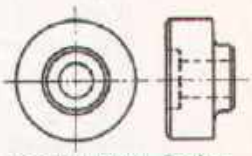
Step Turning, Threading

2 → 2.3.5/3



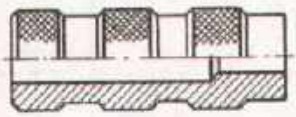
Taper Turning
Turning of ISO-Fits

3 → 3.2.2/8



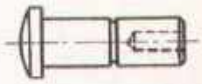
Mandrel Work, Boring

4 → 2.2.4/11



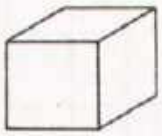
Knurling

5 → 3.3.4/1



Grooving, Reaming

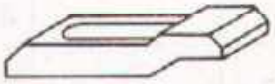
6 → 2.4.3/2



Plain and Square Milling

1 → 2.2.4/8

MILLING 2.2.4 / 0.1–12

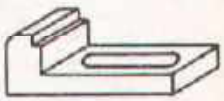


Slot Milling

2.1.3/5 → 2

Step Milling

3

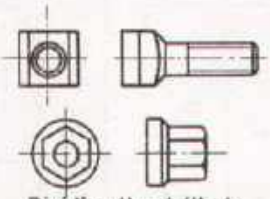


Slot Milling
Step Milling

2.2.2/3 → 4 → 2.3.5/3

Milling to High Accuracy

2.2.2/4 → 5 → 2.3.5/3



Dividing Head Work

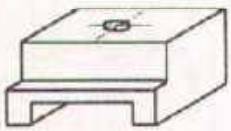
2.1.2/11 → 6

Keyway Milling

2.1.2/3 → 7 → 2.3.5/4

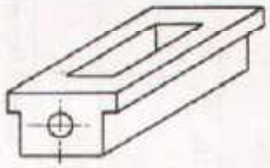
Form Milling

2.2.4/1 → 8 → 2.3.5/3



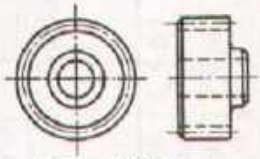
Step Milling
Slot Milling

2.1.3/4 → 9 → 3.3.4/1



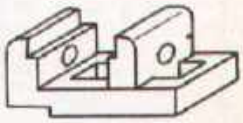
Drilling and Reaming

2.2.2/5 → 10 → 3.3.4/1



Gear Milling

2.2.3/4 → 11 → 2.3.5/4



Form Milling

2.3.5/3 → 12 → 2.3.5/3

TRADE TRAINING

LAYOUT

No. 2.2.2
No. 2.2.3
No. 2.2.4

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MACHINIST

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MACHINIST

MATERIAL REQUIRED

Trade Training for Machinist

Shaping No. 2.2.2 — Exercise No. (Length given in millimeter)	1	2	3	4	5	6	Length per trainee	Total length for a batch of 16 trainee
M/S Flat 35 x 8mm ($1\frac{1}{2}" \times \frac{3}{8}"$)	52						52mm	0,9 meter
M/S Square 50 x 50 mm ($2" \times 2"$)			106	26			132 mm	2,3 meter
Low carbon steel Flat 100 x 10 mm ($4" \times \frac{3}{8}"$)		17					17 mm	0,4 meter
Carbon steel Square 50 x 50 mm ($2" \times 2"$)						83	83 mm	1,4 meter
Cast iron according pattern					X			

Turning No. 2.2.3	1	2	3	4	5	6	Length per trainee	Total length for a batch of 16 trainee
M/S Round 10 mm ($\frac{3}{8}"$)	118						118 mm	2,0 meter
M/S Round 15 mm ($\frac{5}{8}"$)	20	12					32 mm	0,6 meter
M/S Round 25 mm ($1"$)		140					140mm	2,4 meter
M/S Round 30 mm ($1\frac{1}{4}"$)					115		115 mm	2,0 meter
M/S Round 65 mm ($2\frac{1}{2}"$)				28			28 mm	0,6 meter
Low carbon steel Round 15 mm ($\frac{1}{2}"$)						35	35 mm	0,7 meter
Low carbon steel Round 25 mm ($1"$)						90	90 mm	1,6 meter
High speed steel Round 25 mm ($1"$)			143				143mm	2,4 meter

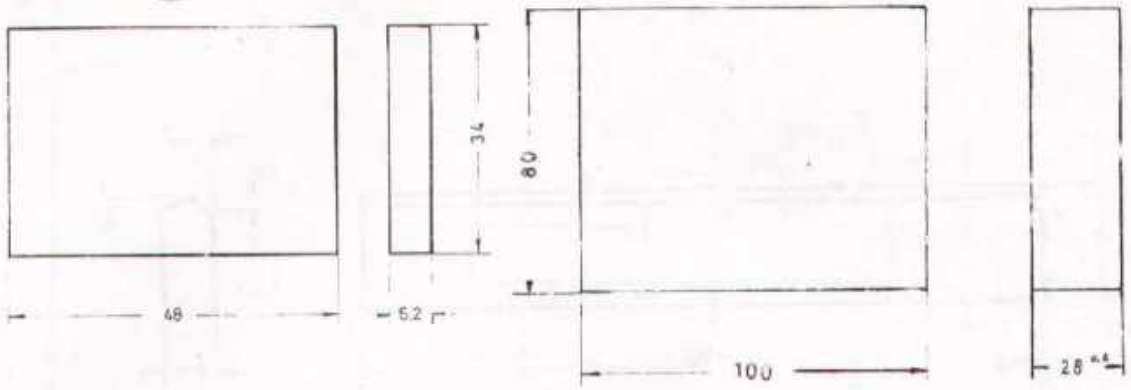
Milling No. 2.2.4	1	3	Length per trainee	Total length for a batch of 16 trainees
M/S Square 50 x 50 mm ($2" \times 2"$)	55		55mm	1,0 meter
M/S Square 35 x 35 ($1\frac{1}{2}" \times 1\frac{1}{2}"$)		45	45 mm	0,8 meter

5 ▽

Tolerance± 0.1

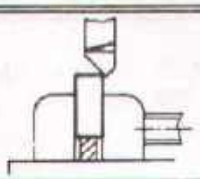
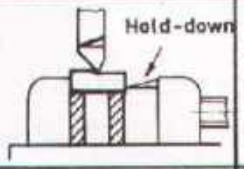
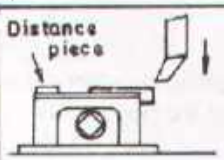
(1)

(1a)



Material Provided from TURNER 2.1.2/12 for 1a

SEQUENCE OF OPERATIONS

No.	Symbol	Tools	Descriptions
1		STRAIGHT LEFT HAND CUTTING TOOL PARALLEL BAR VERNIER CALIPER	SQUARE AND PARALLEL SHAPING OF SIZE 34 MM
2		STRAIGHT LEFT HAND CUTTING TOOL PARALLELS AND HOLD DOWN DEPTH GAUGE	CLAMPING OF A THIN PIECE WITH THE HELP OF A HOLD DOWN. PARALLEL SHAPING
3		SIDE CUTTING TOOL PARALLELS TRY SQUARE	SHAPING IN VERTICAL DIRECTION. USING A DISTANCE PIECE FOR PROPER CLAMPING
4		AFTER EACH SHAPING OPERATION DEBURR THE WORKPIECE BY USING A SMOOTH FLAT FILE. NUMBER PUNCHING.	

Ex. 1a for Tur / Turning II

SCALE 1:1	END PLATE (Ex.1 For bench vice)	No. 2.2.2/01-1a
MAT.: MILD STEEL		SHAPING II

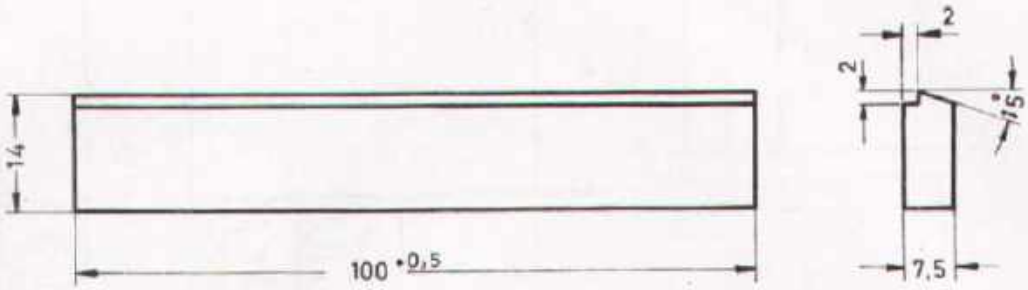
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

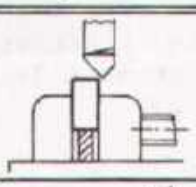
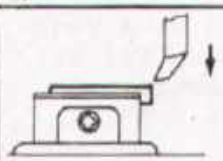
MACHINIST

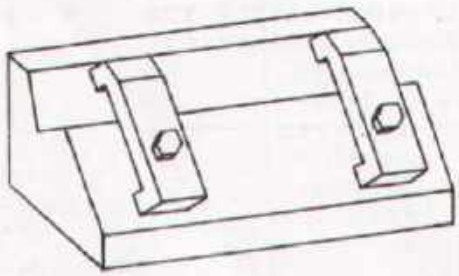
4 ▽

Tolerance ± 0,1
unless otherwise stated



SEQUENCE OF OPERATIONS

No.	Symbol	Tools	Descriptions
1		STRAIGHT LEFT HAND CUTTING TOOL	SQUARE AND PARALLEL SHAPING TO GIVEN DIMENSIONS
2		SIDE CUTTING TOOL PARALLELS TRY SQUARE	VERTICAL SHAPING
3		STRAIGHT LEFT HAND CUTTING TOOL BEVEL PROTRACTOR MARKING TOOLS	HORIZONTAL SHAPING UP TO MARKING LINE



SINCE CLAMPING AND MACHINING OF THE LONG AND THIN WORKPIECE REQUIRES MUCH EXPERIENCE, IT IS RECOMMENDED TO PROVIDE THE TRAINEE WITH A FIX-TURE AS SHOWN IN THE SKETCH.

SCALE 1:1	JAW (For bench vice)	No. 2.2.2/02
MAT.: LOW CARBON - STEEL		SHAPING II

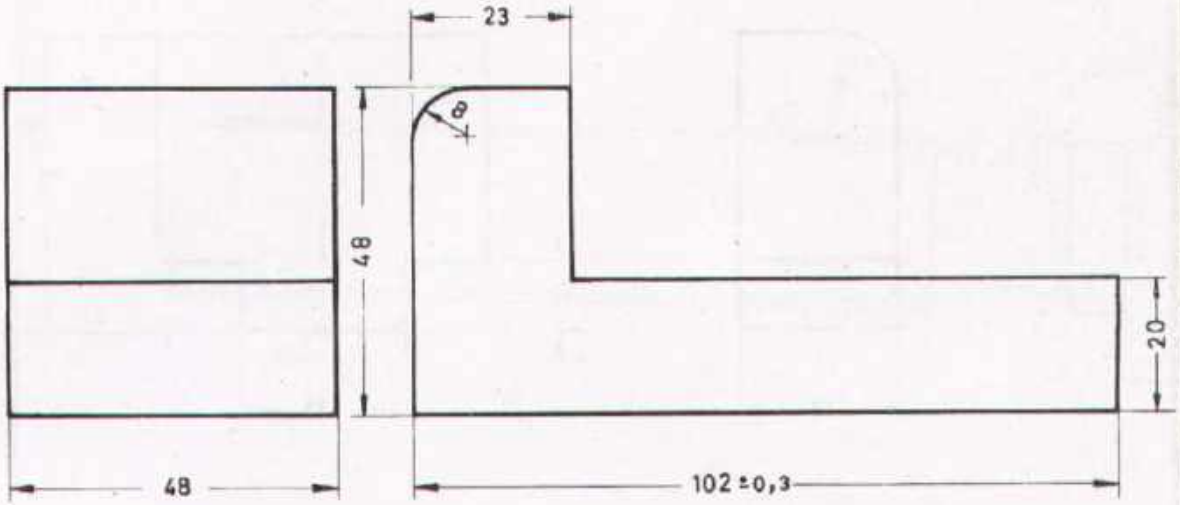
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MACHINIST

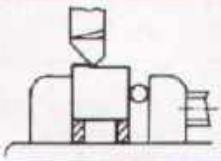
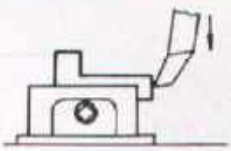
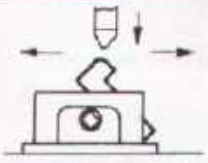
1 ▽

Tolerance ± 0,1
unless otherwise stated



See Ex. 2.2.4/4

SEQUENCE OF OPERATIONS

No.	Symbol	Tools	Descriptions
1		STRAIGHT LEFT HAND CUTTING TOOL PARALLELS ROUND BAR	SQUARE AND PARALLEL SHAPING TO GIVEN DIMENSIONS
2		SIDE CUTTING TOOL DEPTH GAUGE	STEP SHAPING
3		ROUND-NOSE ROUGHING TOOL	FORM SHAPING ACCORDING MARKING LINE

SCALE 1:1	FIXED JAW (For bench vice)	No. 2.2.2 / 03
MAT.: MILD STEEL		SHAPING II

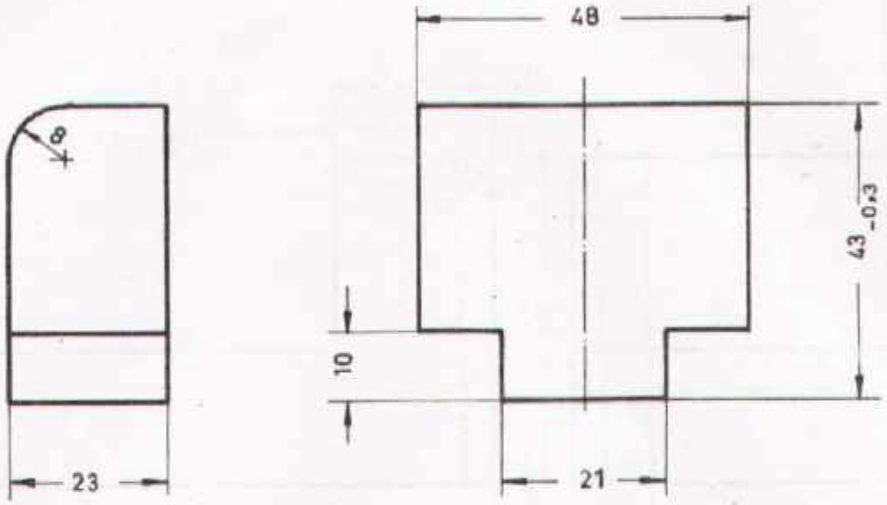
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

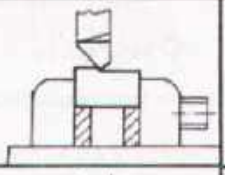
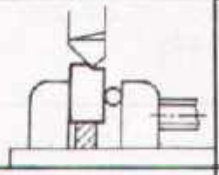
MACHINIST

2 ▽

Tolerance ± 0.1
unless otherwise stated



SEQUENCE OF OPERATIONS

No.	Symbol	Tools	Descriptions
1		STRAIGHT LEFT HAND CUTTING TOOL PARALLELS	PLAN SHAPING OF REFERENCE SURFACE
2		STRAIGHT LEFT HAND CUTTING TOOL ROUND BAR PARALLEL	SQUARE AND PARALLEL SHAPING TO GIVEN DIMENSIONS
3		LEFT AND RIGHT HAND SIDE CUTTING TOOLS DEPTH GAUGE	STEP SHAPING
4		ROUND-NOSE ROUGHING TOOL	FORM SHAPING

SCALE 1:1	MOVEABLE JAW (For bench vice)	No. 2.2.2 / 04
MAT.: MILD STEEL		SHAPING II

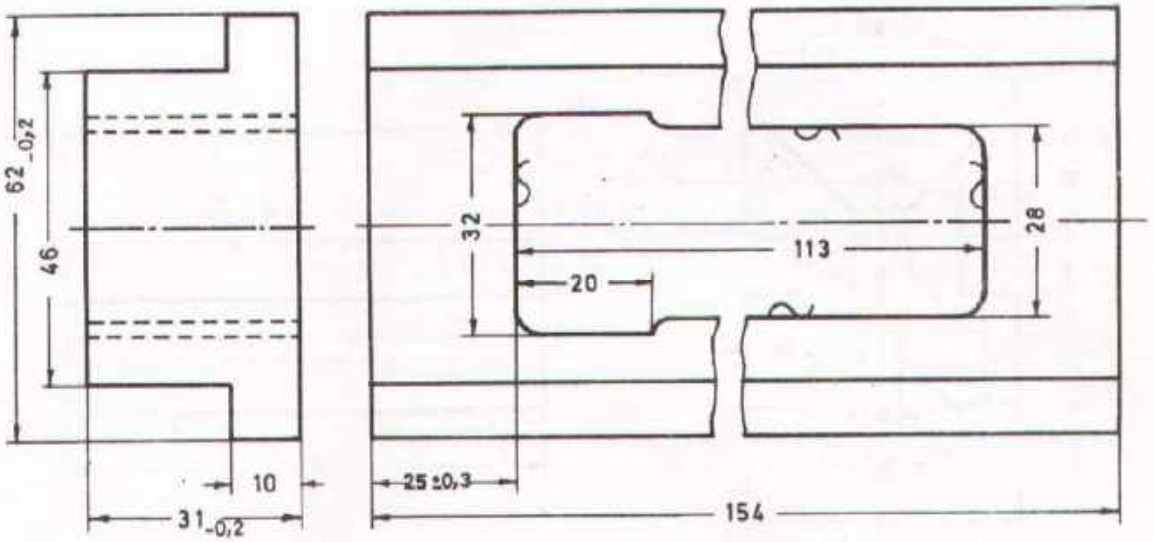
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

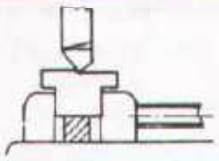
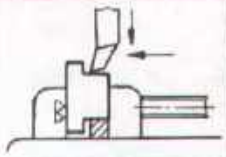
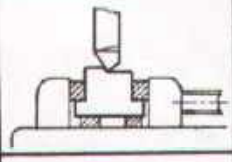
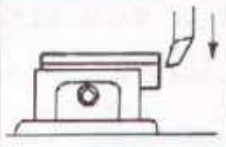
MACHINIST

2 ▽ (~)

Tolerance ±0,2
unless otherwise stated



SEQUENCE OF OPERATIONS

No.	Symbol	Tools	Descriptions
1		STRAIGHT LEFT HAND CUTTING TOOL PARALLELS	PLAN SHAPING OF REFERENCE SURFACE
2		LEFT HAND SIDE CUTTING TOOL	STEP SHAPING BOTH SIDES PARALLEL
3		STRAIGHT LEFT HAND CUTTING TOOL PARALLELS STRIPS	PARALLEL SHAPING USING STRIPS FOR PROPER CLAMPING
4		LEFT HAND SIDE CUTTING TOOL	VERTICAL SHAPING

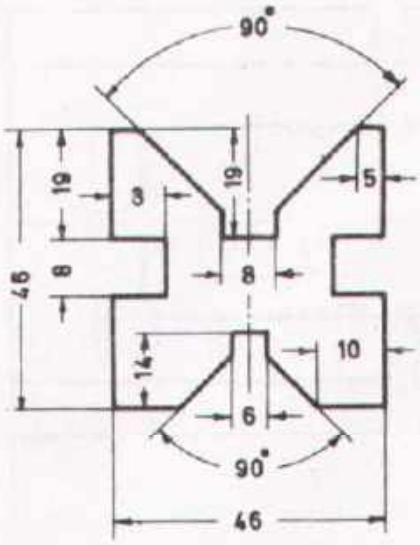
SCALE 1:1	SLIDE BASE (For machine vice)	No. 2.2.2 / 05
MAT.: CAST IRON		SHAPING II

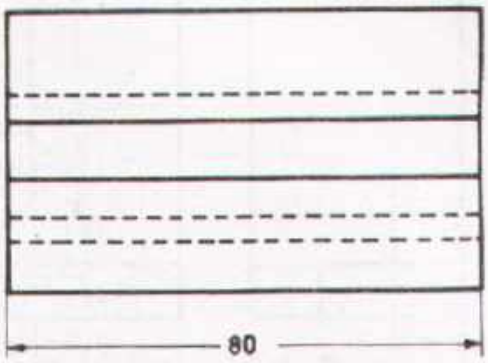
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

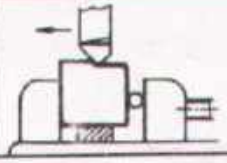
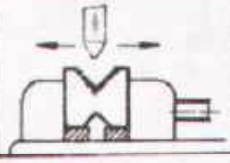
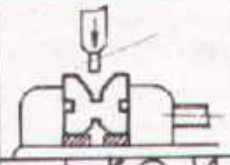
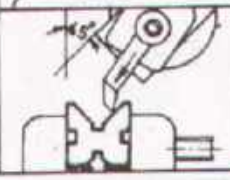
MACHINIST

Tolerance ± 0.1
Unless otherwise stated





SEQUENCE OF OPERATIONS

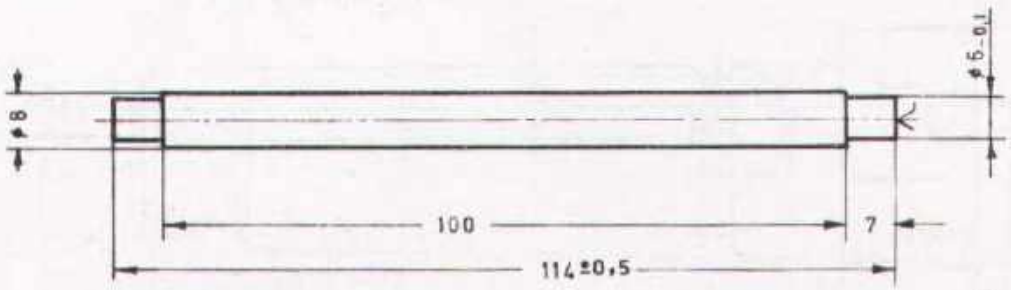
No.	Symbol	Tools	Descriptions
1		STRAIGHT LEFT HAND CUTTING TOOL PARALLELS ROUND BAR	SQUARE AND PARALLEL SHAPING TO GIVEN DIMENSIONS
2		MARKING. TOOLS ROUND-NOSE ROUGHING TOOL	MARKING ROUGHING OF V-GROOVE ACCORDING TO MARKING LINE
3		PARTING TOOL DEPTH GAUGE	GROOVING
4		SIDE CUTTING TOOL BEVEL PROTRACTOR	SETTING OF TOOL HEAD AT 45° SMOOTH SHAPING OF V-GROOVES

SCALE 1:1	V-BLOCK	No. 2.2.2/06
MAT.: CARBON STEEL		SHAPING II

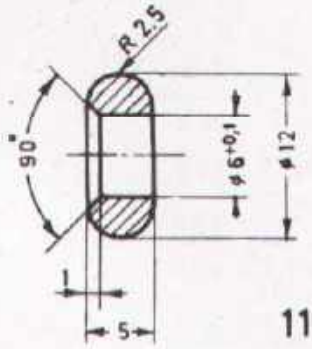
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MACHINIST

Tolerance ±0,1
unless otherwise stated.



9

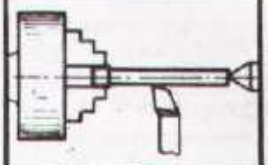
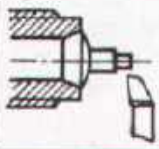
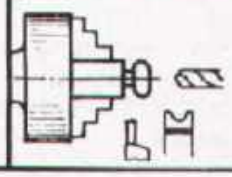


11

2 pieces

Scale 2:1

SEQUENCE OF OPERATIONS

No.	Symbol	Tools	Descriptions
1		3 - JAW CHUCK RIGHT HAND FACING TOOL CENTRE DRILL CENTRE POINT	LONGITUDINAL TURNING
2		COLLET CHUCK ø 8 MM RIGHT HAND FACING TOOL	CLAMPING IN COLLET CHUCK FACING SHOULDER TURNING
3		3 - JAW CHUCK RADIUS TOOL 2,5 MM PARTING TOOL DRILL ø 6 MM COUNTERSINK 90°	FORM TURNING DRILLING AND COUNTER-SINKING PARTING

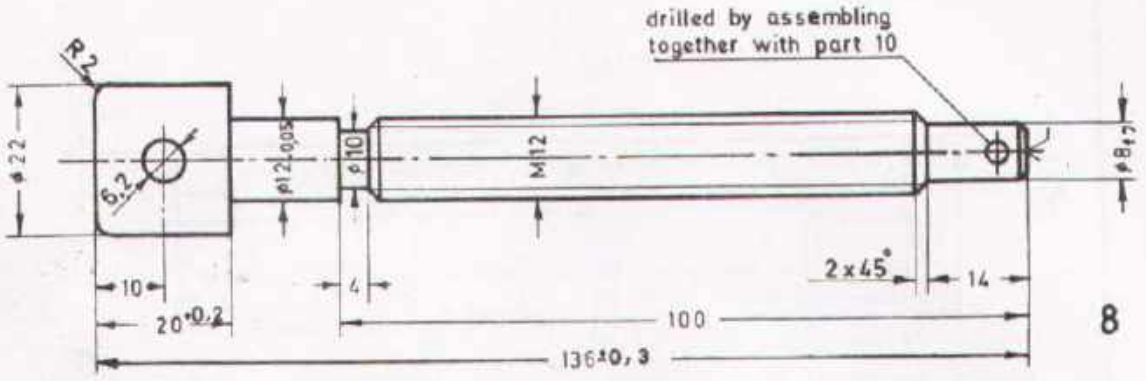
SCALE 1:1 , 2:1	TOGGLE (For bench vice)	No. 2.2.3/01
MAT. : MILD-STEEL		TURNING II

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

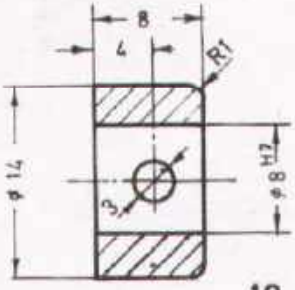
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MACHINIST

Tolerance ±0,1
unless otherwise stated



8

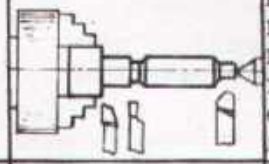
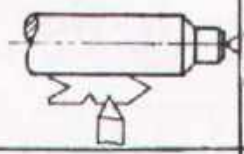
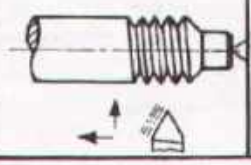


Scale 2:1

10

8^{H7}	+0 015 0
8_{f7}	-0,013 -0,028

SEQUENCE OF OPERATIONS

No.	Symbol	Tools	Descriptions
1		RIGHT AND LEFT HAND ROUGHING TOOLS RIGHT HAND FACING TOOL PARTING TOOL CENTRE DRILL MICROMETER	LONGITUDINAL TURNING TO MICROMETER SIZE NECKING
2		THREAD CUTTING TOOL CENTRE GAUGE 60°	SETTING OF THE MACHINE FOR THE REQUIRED PITCH SETTING OF THE THREAD - TOOL
3		THREAD RING GAUGE M12	CHECKING OF THE PITCH CUTTING OF THREAD CHECKING WITH THREAD RING GAUGE

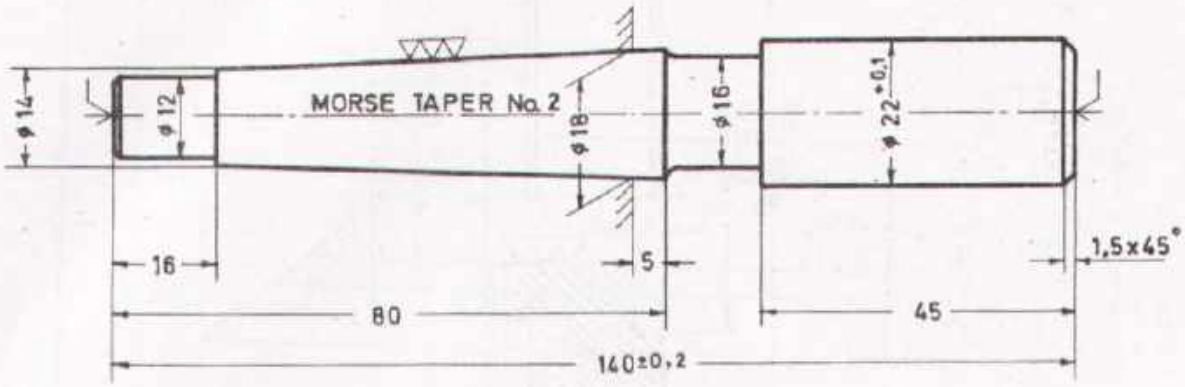
SCALE 1:1 , 2:1	SPINDLE - & BUSH (For bench vice)	No. 2.2.3 / 02
MAT. : MILD STEEL		TURNING II

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

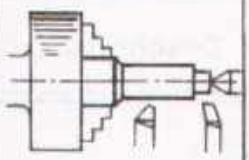
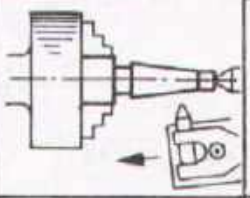
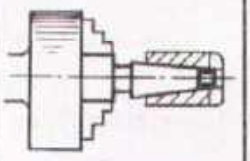
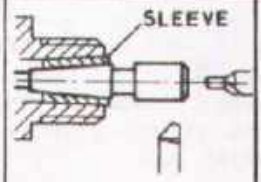
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MACHINIST

Tolerance ±0,1
unless otherwise stated

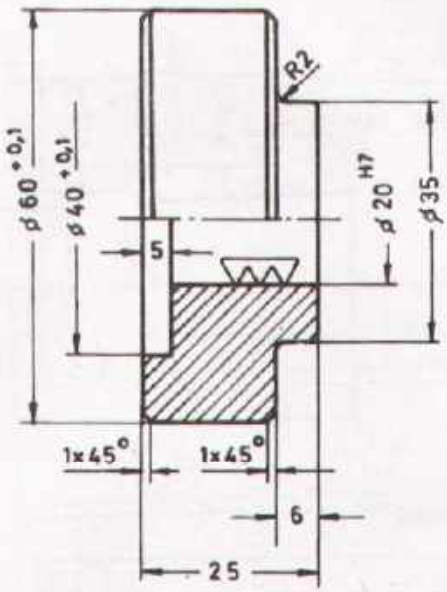


SEQUENCE OF OPERATIONS

No.	Symbol	Tools	Descriptions
1		3-JAW CHUCK RIGHT HAND ROUGHING TOOL RIGHT HAND FACING TOOL CENTRE DRILL	LONGITUDINAL ROUGH TURNING
2		ROUND NOSE SMOOTHING TOOL	SETTING OF COMPOUND REST TO REQUIRED ANGLE TAPER TURNING NECKING
3		TAPER GAUGE MORSE 2	CHECKING OF TAPER BY GAUGE
4		RIGHT HAND ROUGHING TOOL CENTRE DRILL HEADSTOCK TAPER SLEEVE	HOLDING OF THE WORKPIECE IN THE HEADSTOCK SPINDLE BY USING A SLEEVE AS AN ADAPTER. CENTERING, FACING TURNING OF Ø 22.

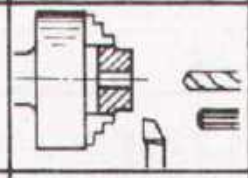
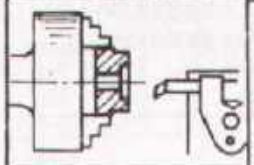
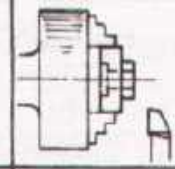
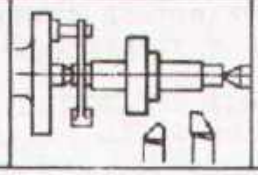
SCALE 1:1	CIRCULAR CUTTER	No. 2.2.3 / 03
MAT.: HIGH SPEED STEEL		TURNING II

Tolerance ± 0,1
unless otherwise stated



20^{H7}	$+0{,}021$ 0

SEQUENCE OF OPERATIONS

No.	Symbol	Tools	Descriptions
1		4-JAW INDEPENDENT CHUCK RIGHT-H.FACING TOOL DRILL ø19,5, REAMER 20^{H7} PLUG GAUGE 20^{H7}	FACING CENTERING DRILLING REAMING
2		GROUND BORING TOOL	TURNING OF RECESS ø 40
3		RIGHT HAND FACING TOOL	RECHUCKING Rough Turning to ø 36x5.5 mm Length
4		MANDREL ø 20 MM RIGHT HAND FACING TOOL RIGHT HAND ROUGHING TOOL	FITTING OF THE WORKPIECE ON A MANDREL. SETTING THE MANDREL AND LATHE DOG BETWEEN CENTRES SMOOTH TURNING

SCALE 1:1	GEAR- BLANK	No. 2.2.3 / 04
MAT.: CASE HARDENING STEEL		TURNING II

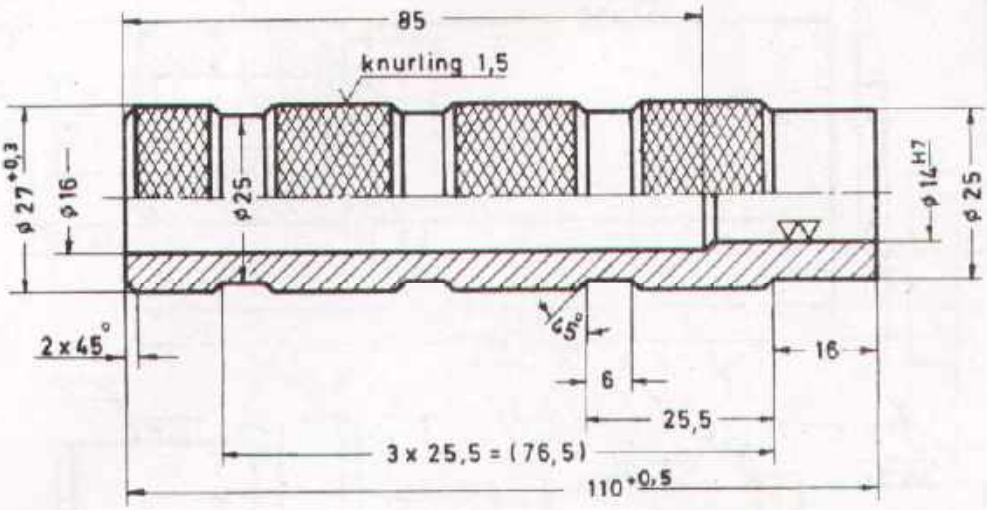
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MACHINIST

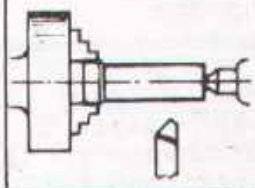
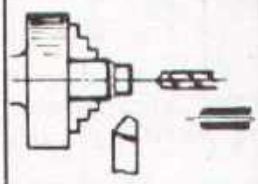
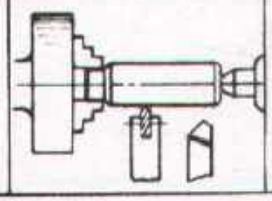
6 ▽ (▽)

Tolerance ±0,1
unless otherwise stated



14^{H7}	$+0{,}018$ 0

SEQUENCE OF OPERATIONS

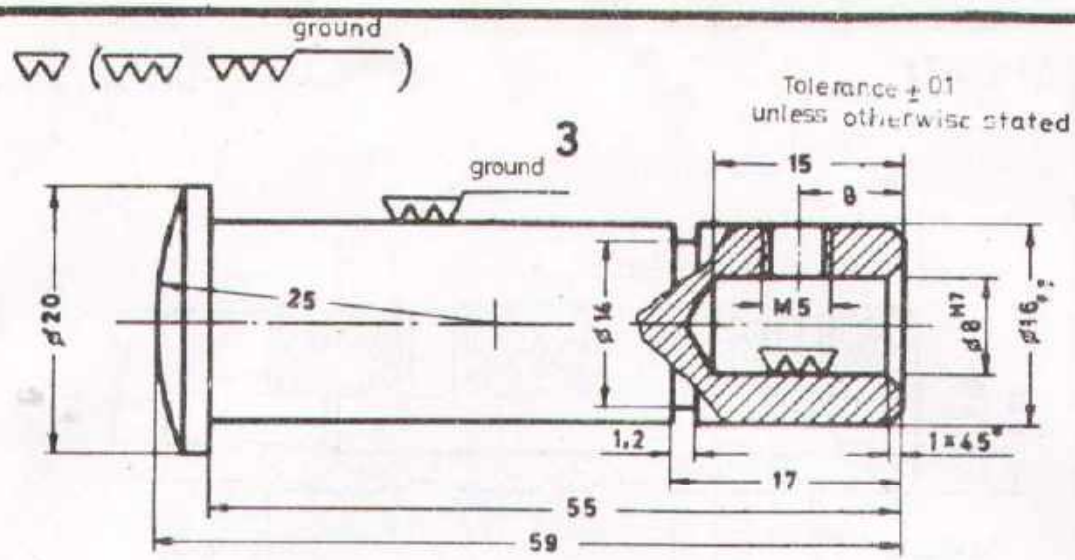
No.	Symbol	Tools	Descriptions
1		3-JAW CHUCK RICHT HAND FACING TOOI RIGHT HAND ROUGHING TOOL CENTRE DRILL	FACING, CENTERING LONGITUDINAL TURNING APPROXIMATELY TO ø 28 (1 MM MACHINING ALLOWANCE FOR OPERATION NO. 3)
2		RIGHT HAND FACING TOOL RIGHT HAND ROUGHING TOOL CENTRE DRILL DRILL ø 13.5 REAMER 14^{H7}	RECHUCKING, FACING CENTERING, DRILLING AND REAMING OF HOLE 14^{H7} TURNING OF ø 25
3		DRILL ø 16 KNURLING TOOL RIGHT HAND ROUGHING TOOL	CHUCKING IN 3-JAW CHUCK DRILLING OF HOLE ø 16 HOLDING BETW.CHUCK & TAIL-STOCK CENTRE, FINISHING ø27 KNURLING GROOVING

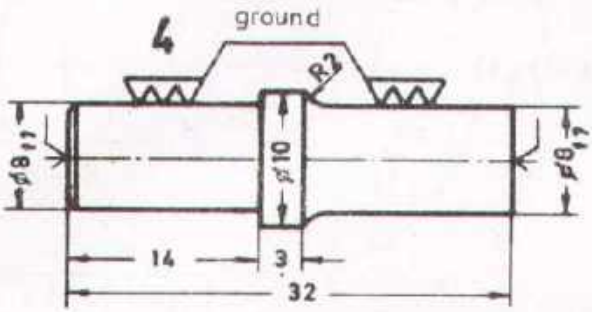
SCALE 1:1	**HANDLE for Mach. vice**	No. 2.2.3/05
MAT.: MILD STEEL		TURNING II

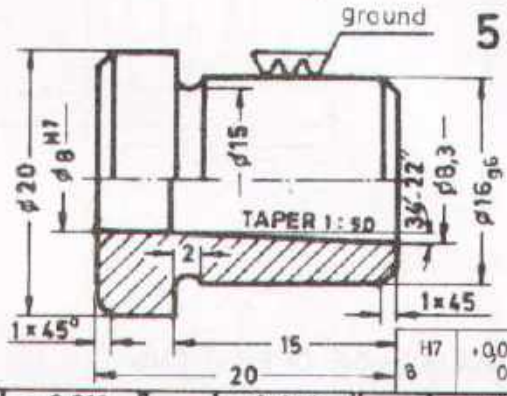
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MACHINIST



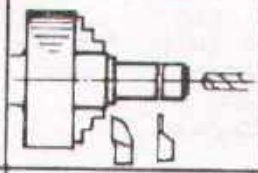
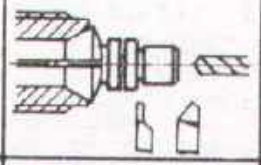
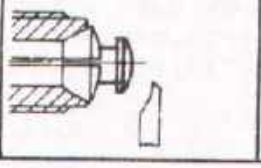




8	H7	+0.015 0

8_{f7}	- 0.013 - 0.028	16_{f7}	- 0.016 - 0.034	16_{g6}	- 0.006 - 0.017

SEQUENCE OF OPERATIONS

No.	Symbol	Tools	Descriptions
1		R.-HAND FACING TOOL GROOVING TOOL R.-HAND ROUGHING TOOL DRILL 7,8 ø REAMER 8^{H7}	THE GUIDE BOLT AND THE BUSH ARE MACHINED OUT FROM ONE PIECE OF RAW MATERIAL. TURNING TO MICROMETER SIZE. GROOVING, DRILLING AND REAMING PART NO. 3
2		RADIUS TOOL R1 PARTING TOOL TAPER REAMER 1:50 DRILL 7,8 ø	RECHUCKING IN COLLET CHUCK TURNING OF ø 16_{g6} MIND GRINDING ALLOWANCE DRILLING, REAMING OF TAPER. PARTING
3		RADIUS TOOL R25	FACING RADIUS TURNING

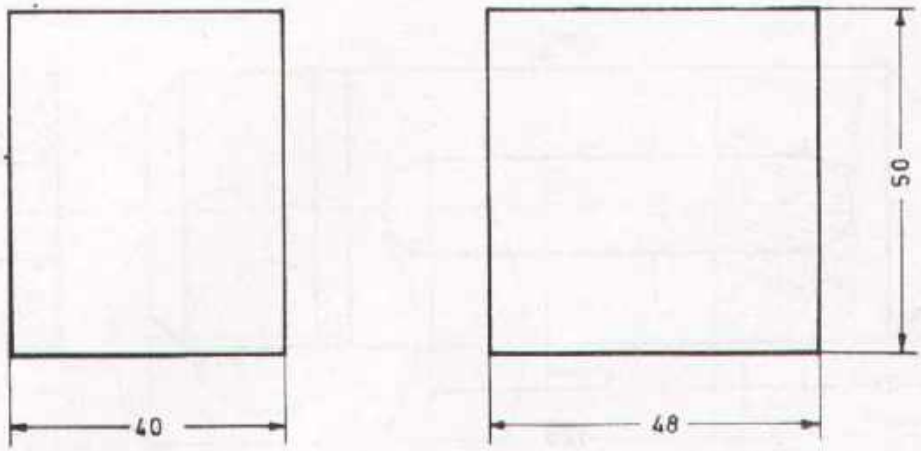
SCALE 2:1 MAT.: LOW CARBON STEEL	GUIDE BOLT, PUNCH AND BUSH (For punching device)	No. 2.2.3/06 TURNING II

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

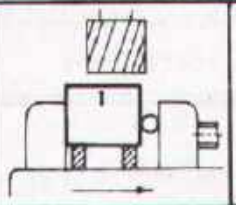
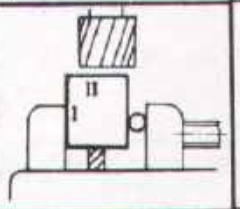
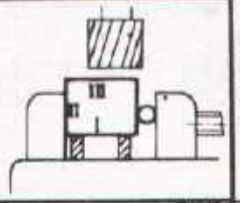
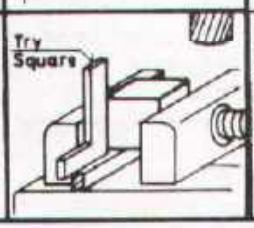
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MACHINIST

Tolerance ± 0,1



SEQUENCE OF OPERATIONS

No.	Symbol	Tools	Descriptions
1		MACHINE VICE PARALLEL BARS ROUND BAR SHELL END MILL CUTTER	SET THE WORKPIECE ON PARALLELS, USE A ROUND ROD BETWEEN THE WORK AND MOVABLE JAW OF THE VICE FACING OF SURFACE NO. I.
2		MACHINE VICE PARALLEL BARS ROUND BAR SHELL END MILL CUTTER	PLACE SURFACE NO. I AGAINST THE SOLID JAW USE THE ROUND ROD. FACING OF SURFACE NO. II.
3		MACHINE VICE PARALLEL BARS ROUND BAR SHELL END MILL CUTTER	REPEAT THE OPERATIONS TO FACE SURFACE NO. III AND IV.
4		MACHINE VICE PARALLEL BARS TRY SQUARE SHELL END MILL CUTTER	CHECK THE RIGHT ANGLE BY USING A TRY SQUARE FOR MILLING SURFACE NO. V AND VI.

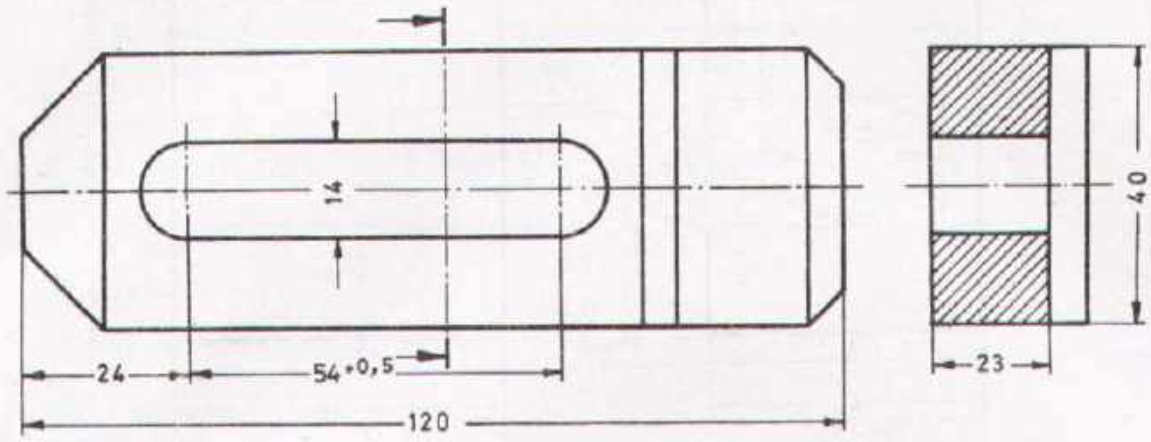
SCALE 1 : 1	CLAMPING PIECE (VICE)	No. 2.2.4 / 1
MAT.: MILD STEEL		MILLING I

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

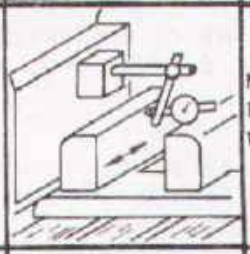
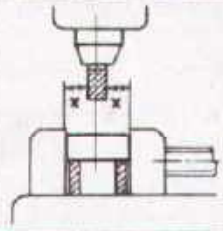
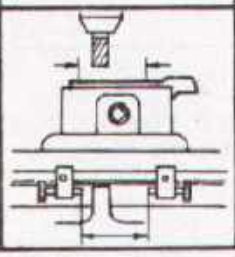
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MACHINIST

Tolerance ± 0.1
unless otherwise stated



SEQUENCE OF OPERATIONS

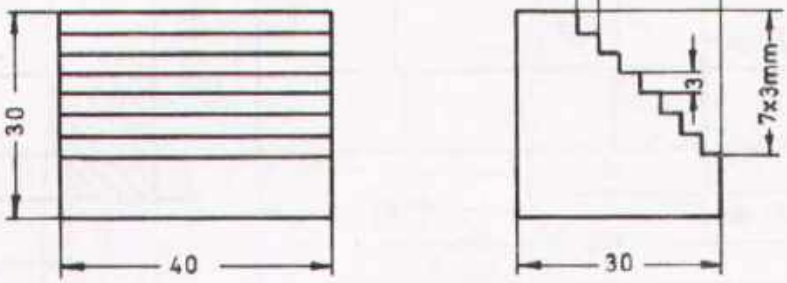
No.	Symbol	Tools	Descriptions
1		MACHINE VICE DIAL TEST INDICATOR WITH STAND	ALIGNING OF THE SOLID VICE JAW USING A DIAL TEST INDICATOR
2		PARALLEL BARS STRAIGHT-OR TAPER-SHANK MULTIPLE-FLUTE END MILL CUTTER	MOUNTING OF THE VERTICAL HEAD. CLAMPING OF THE CUTTER AND WORKPIECE. LOCATING THE CUTTER TO THE CENTRE OF THE WORKPIECE.
3			ADJUSTING OF THE STOPS ACCORDING TO THE LENGTH OF THE SLOT. MILLING OF THE KEYSLOT.

SCALE 1:1	CLAMP	No. 2.2.4/2
MAT.: MILD STEEL	from Turner / Shop. II	MILLING I

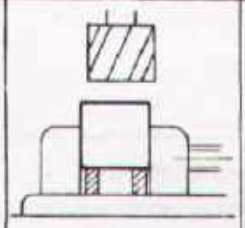
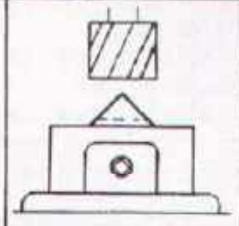
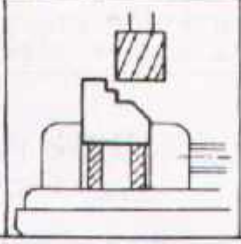
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MACHINIST

Tolerance ± 0.1



SEQUENCE OF OPERATIONS

No.	Symbol	Tools	Descriptions
1		MACHINE VICE PARALLEL BARS SHELL END MILL CUTTER	MILLING OF THE DIMENSIONS 30x30x40 IN THE SAME WAY AS DONE IN EX. 1
2		BEVEL PROTRACTOR MARKING TOOLS SHELL END MILL CUTTER	MARKING OF THE 45° LINE ROUGH MILLING TO THE REQUIRED ANGLE
3		MACHINE VICE PARALLEL BARS SHELL END MILL CUTTER	RECLAMPING OF THE WORKPIECE MILLING OF THE STEPS BY DISPLACING THE MACHINE TABLE IN VERTICAL AND HORIZONTAL DIRECTION BY 3 MM FOR EACH STEP.

SCALE 1:1	STEP BLOCK	No. 2.2.4 / 3
MAT.: MILD STEEL		MILLING 1

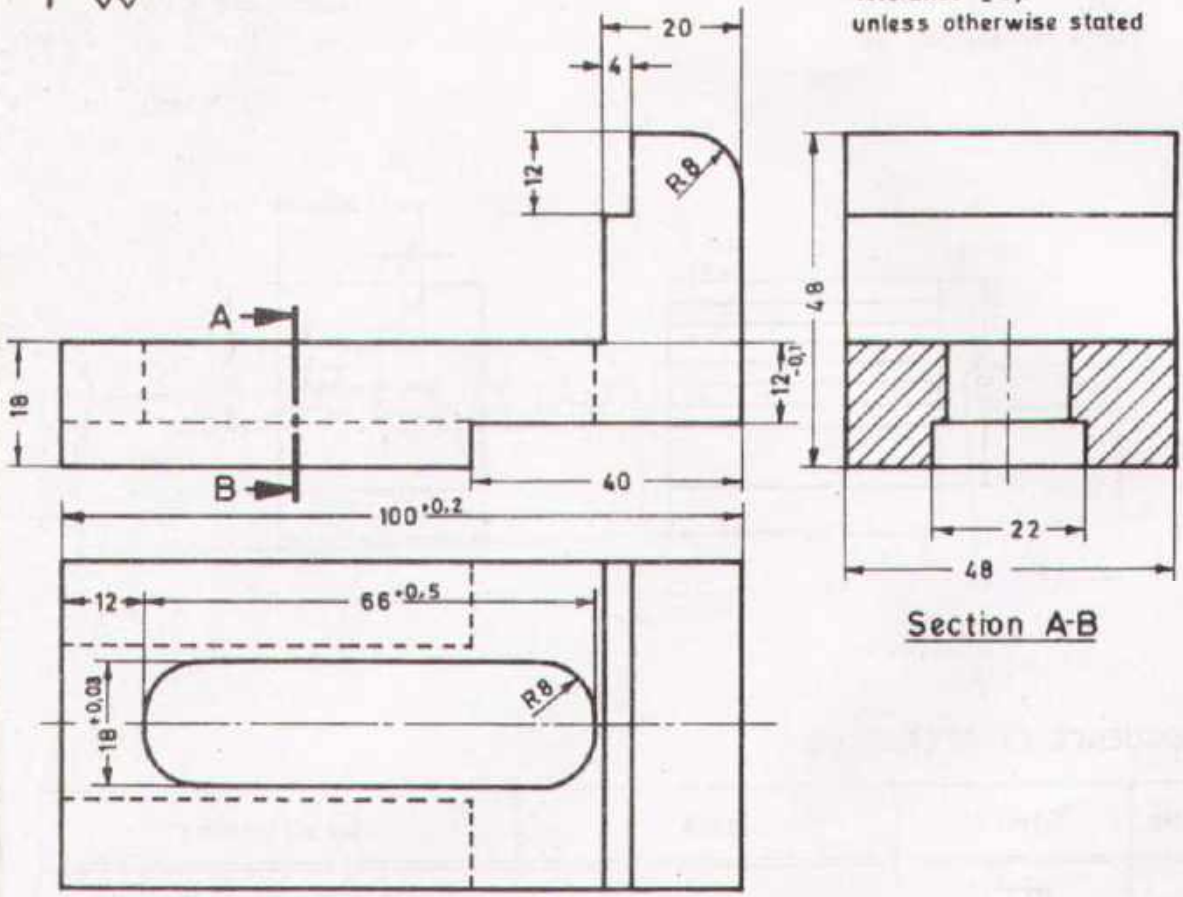
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MACHINIST

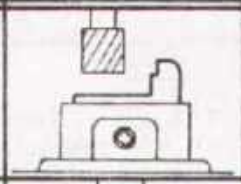
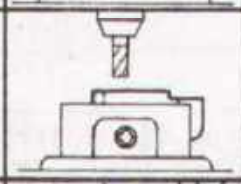
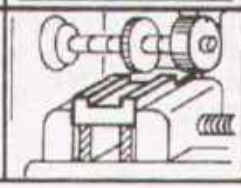
1 ▽

Tolerance ± 0,1
unless otherwise stated



Section A-B

SEQUENCE OF OPERATIONS

No.	Symbol	Tools	Descriptions
1		MACHINE VICE PARALLEL BARS SHELL END MILL CUTTER DEPTH GAUGE	FACING BOTH SIDES TO THE LENGTH OF 100 MM. MILLING OF THICKNESS 18 AND DIMENSION 20 MM MILLING OF STEP 12x4 MM
2		MACHINE VICE PARALLEL BARS STRAIGHT OR TAPER SHANK END MILL CUTTER	MILLING OF KEYSLOT AND STEP 40x6 MM MAKE SURE THAT THE SADDLE OF THE MACHINE IS FIXED DURING MILLING OPERATION
3		MACHINE VICE PARALLEL BARS SIDE MILLING CUTTER DEPTH GAUGE	MILLING OF THE SLOT 22x6 MM

SCALE 1:1	FIXED JAW	No. 2.2.4/4
MAT.: MILD STEEL	from Mach./Shop. II (For bench vice)	MILLING I

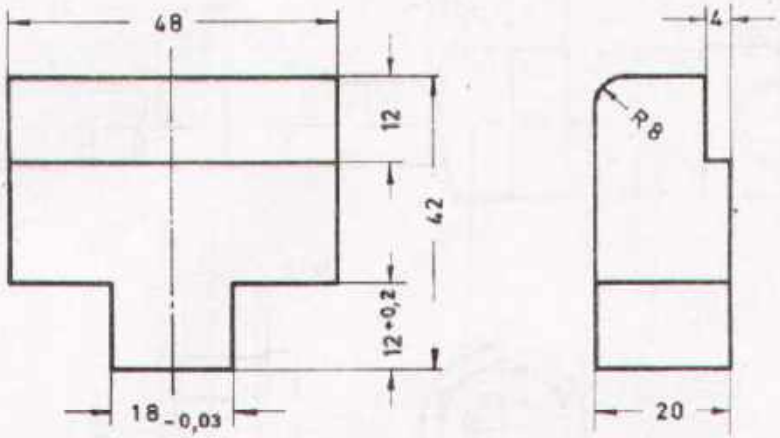
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

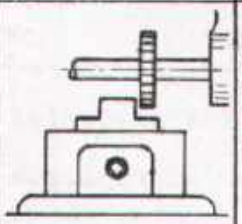
MACHIINIST

2 ▽

Tolerance ±0,1
unless otherwise stated



SEQUENCE OF OPERATIONS

No.	Symbol	Tools	Descriptions
1		MACHINE VICE PARALLEL BARS SHELL END MILL CUTTER	PLANE MILLING OF THE BASE SURFACE
2		STRAIGHT-TOOTH SIDE MILLING CUTTER MICROMETER 0 - 25 MM DEPTH GAUGE	MOUNTING OF THE SIDE MILLING CUTTER MILLING OF THE DIMENSION $18^{\cdot}_{-0,03}$ AND DEPTH $12^{+0,2}$
3		PARALLEL BARS SHELL END MILL CUTTER	RECLAMPING OF THE WORKPIECE MILLING OF THE THICKNESS 20 AND STEP 4 x 12 MM

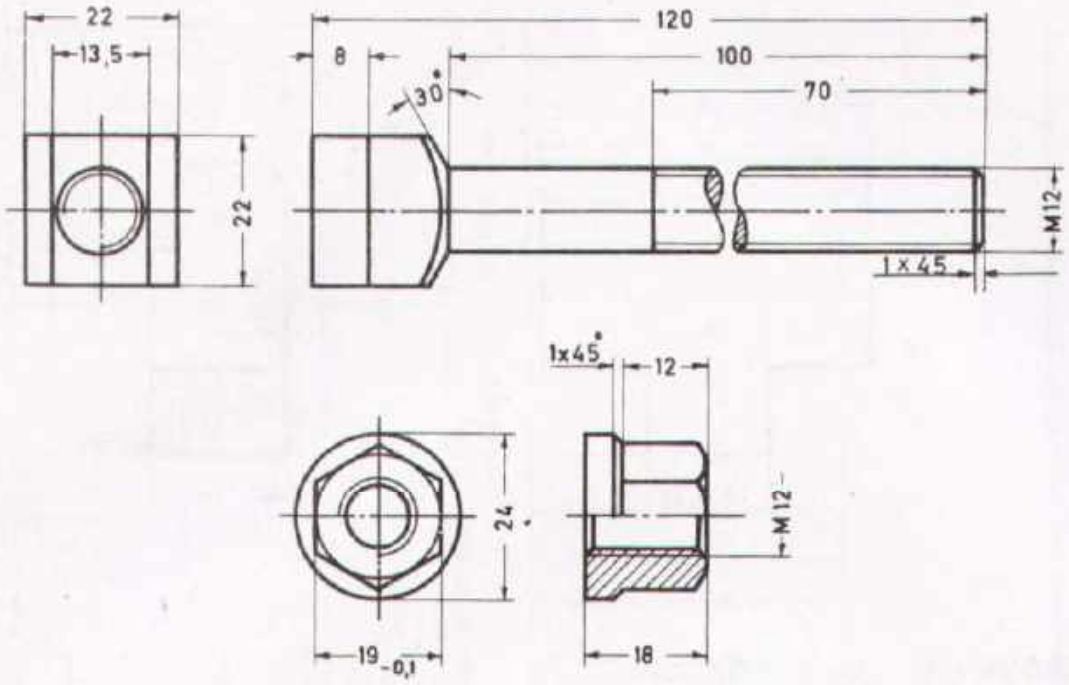
SCALE 1:1	MOVEABLE JAW	No. 2.2.4/5
MAT.: MILD STEEL	from Mech. / Shop. II (For bench vice)	MILLING I

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

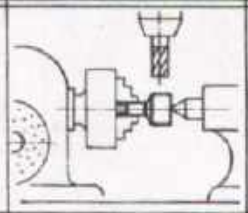
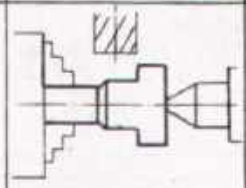
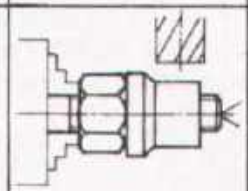
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MACHINIST

Tolerance ± 0,1



SEQUENCE OF OPERATIONS

No.	Symbol	Tools	Descriptions
1		DIVIDING HEAD AND TAIL STOCK STRAIGHT OR TAPER SHANK END MILL CUTTER	MOUNTING OF THE DIVIDING HEAD AND TAIL STOCK. MILLING OF THE SQUARE 22MM
2		DIVIDING HEAD AND TAIL STOCK STRAIGHT OR TAPER SHANK END MILL CUTTER	MILLING OF THE DIMENSION 13,5 MIND THE CENTRE POSITION
3		THREADED MANDREL WITH HEX. NUT M12 STRAIGHT OR TAPER SHANK END MILL CUTTER	HOLDING THE NUT ON A THREADED MANDREL WITH A COUNTERNUT MILLING OF THE HEXAGON $19_{-0,1}$

SCALE 1:1	BOLT AND NUT	No. 2.2.4 / 6
MAT. : MILD STEEL	from Turner / Turn.II	MILLING I

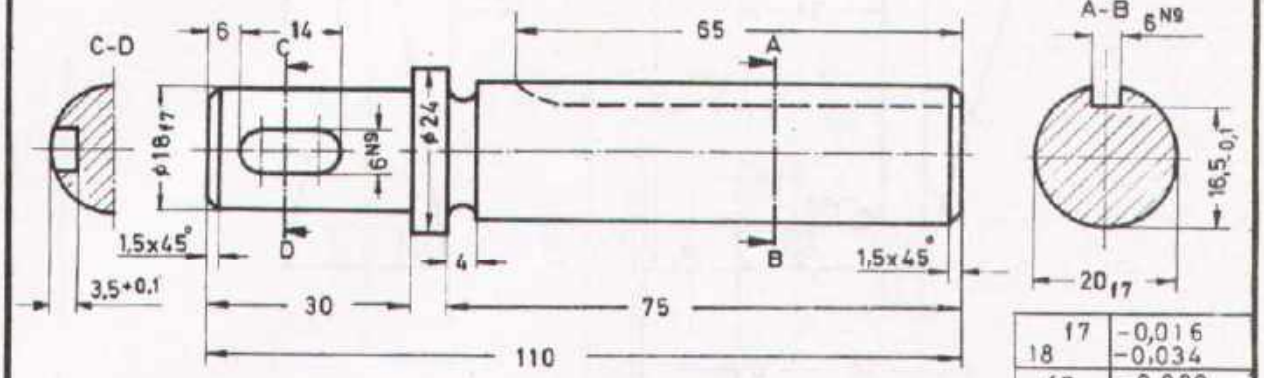
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MACHINIST

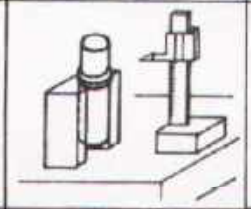
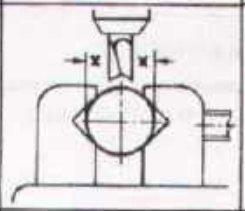
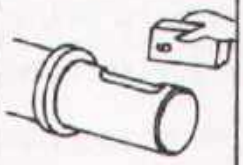
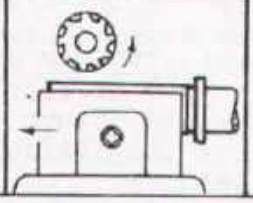
1 ▽

Tolerance ±0,1
unless otherwise stated



18 f7	-0,016 -0,034
20 f7	-0,020 -0,041
6N9	0 -0,03

SEQUENCE OF OPERATIONS

No.	Symbol	Tools	Descriptions
1		MARKING PLATE HEIGHT GAUGE V-BLOCK	MARKING THE POSITION AND LENGTH OF THE KEYWAY
2		MACHINE VICE WITH V-SHAPE JAWS TWO-LIP END MILL CUTTER DEPTH GAUGE	ALIGNING OF THE MACH. VICE AND CLAMPING OF THE SHAFT LOCATING THE CUTTER TO THE CENTRE OF WORKPIECE SETTING OF THE STOPS MILLING OF THE KEYWAY
3		LIMIT GAUGE	CHECKING OF THE WIDTH 6N9 WITH A LIMIT GAUGE
4		PLAIN MILLING CUTTER 6 MM WIDTH	MOUNTING OF THE PLAIN MILLING CUTTER LOCATING THE CUTTER TO THE CENTRE OF WORKPIECE MILLING OF THE LONG KEYWAY

SCALE 1:1	SHAFT	No. 2.2.4/7
MAT.: MILD STEEL	from Turner / Turn. II	MILLING I

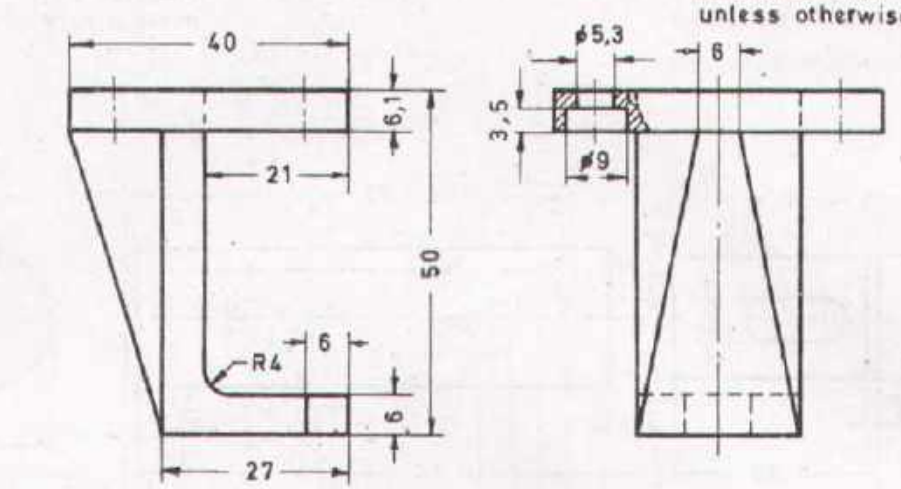
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

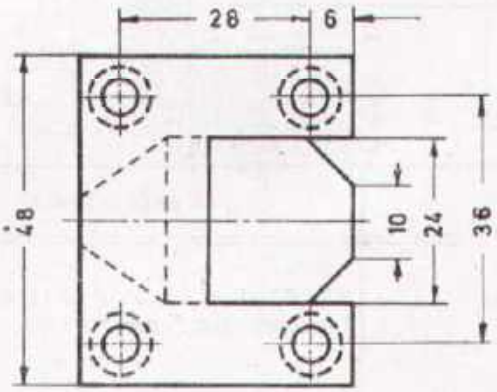
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MACHINIST

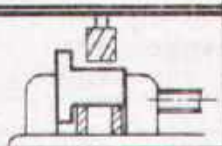
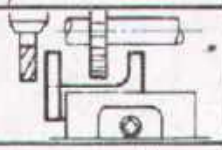
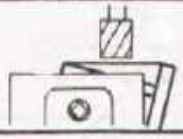
3 ▽▽

Tolerance ±0,1
unless otherwise stated





SEQUENCE OF OPERATIONS

No	Symbol	Tools	Descriptions
1		MACHINE VICE PARALLEL BARS SHELL END MILL CUTTER	MILLING OF THE T-SHAPE DIMENSION 24
2		MARKING TOOLS TWIST DRILL 8 MM SIDE MILLING CUTTER SHANK END MILL CUTTER	MARKING AND DRILLING OF THE HOLE FOR THE RADIUS 4 MILLING OF THE RECESSES
3		BEVEL PROTRACTOR SHELL END MILL CUTTER	MARKING OF THE INCLINATIONS CLAMPING OF THE WORKPIECE SO THAT THE MARKING LINES ARE PARALLEL WITH THE JAW
4		SHELL END MILL CUTTER	RECLAMPING OF WORKPIECE SO THAT THE END POINTS OF THE BACKSIDE INCLINATION ARE IN LEVEL

SCALE 1:1	CLAMP PIECE	No. 2.2.4/8
MAT.: MILD STEEL	from Mach/Mill. I (For bench vice)	MILLING I

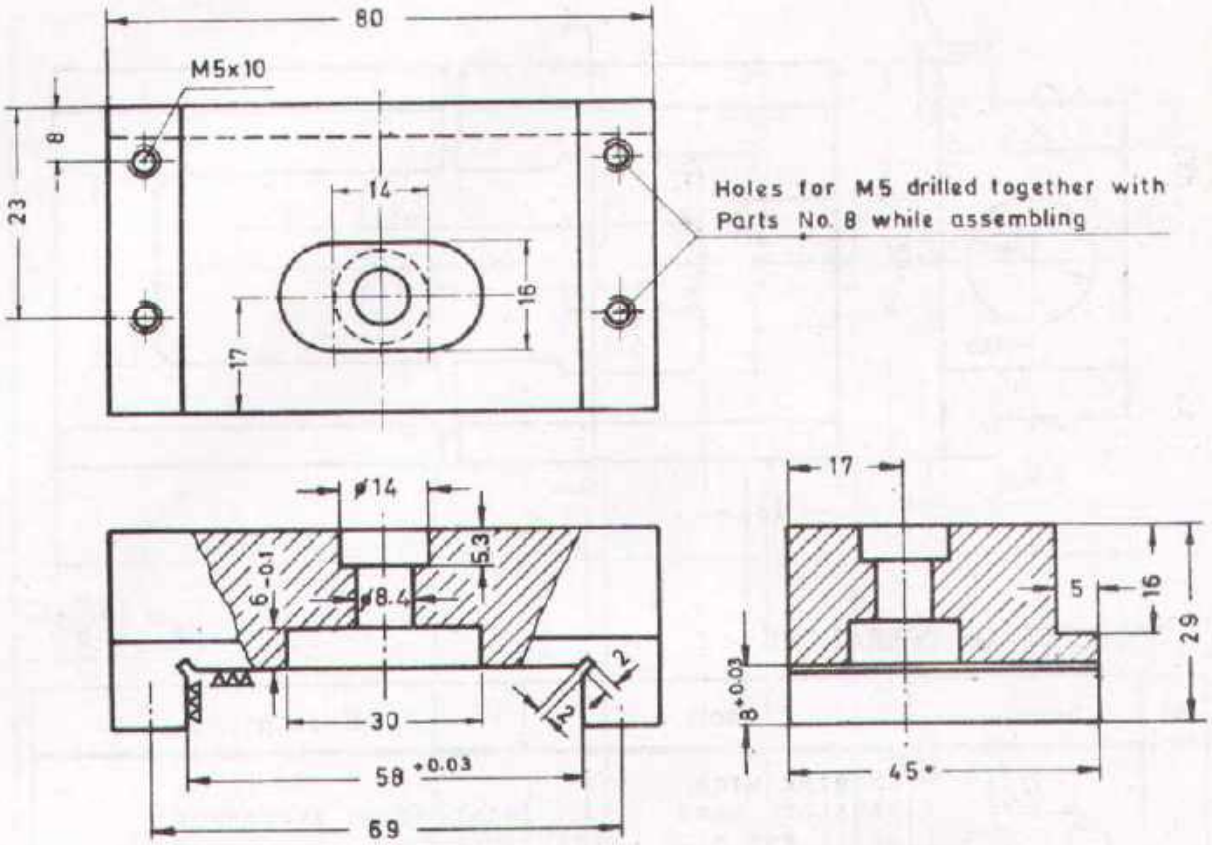
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

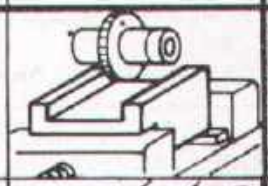
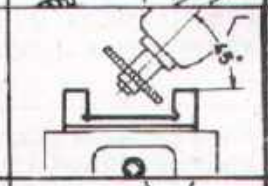
MACHINIST

3 $\sqrt{}$ ($\sqrt{\sqrt{}}$)

Tolerance ± 0.1
unless otherwise stated



SEQUENCE OF OPERATIONS

No.	Symbol	Tools	Descriptions
1		MACHINE VICE PARALLEL BARS SIDE MILLING CUTTER LIMIT GAUGE SET DEPTH MICROMETER	MILLING OF THE SLOT $58^{+0,03}$ x $8^{+0,03}$
2		PLAIN METAL SLITTING SAW 2 MM WIDTH	MOUNTING OF THE VERTICAL HEAD AND SETTING TO AN ANGLE OF 45° CUTTING FREE OF THE EDGES
3		CENTRE DRILL, TWIST DRILLø8,4 MM COUNTER BORE 14 MM SHANK END MILL CUTTER	MARKING AND DRILLING OF THE HOLEø8,4 MILLING OF KEYSLOT RECLAMPING AND COUNTER-BORING

SCALE 1:1	MOVEABLE JAW	No. 2.2.4 / 9
MAT.: CAST IRON	from Turn/Shop. II (For machine vice)	MILLING I

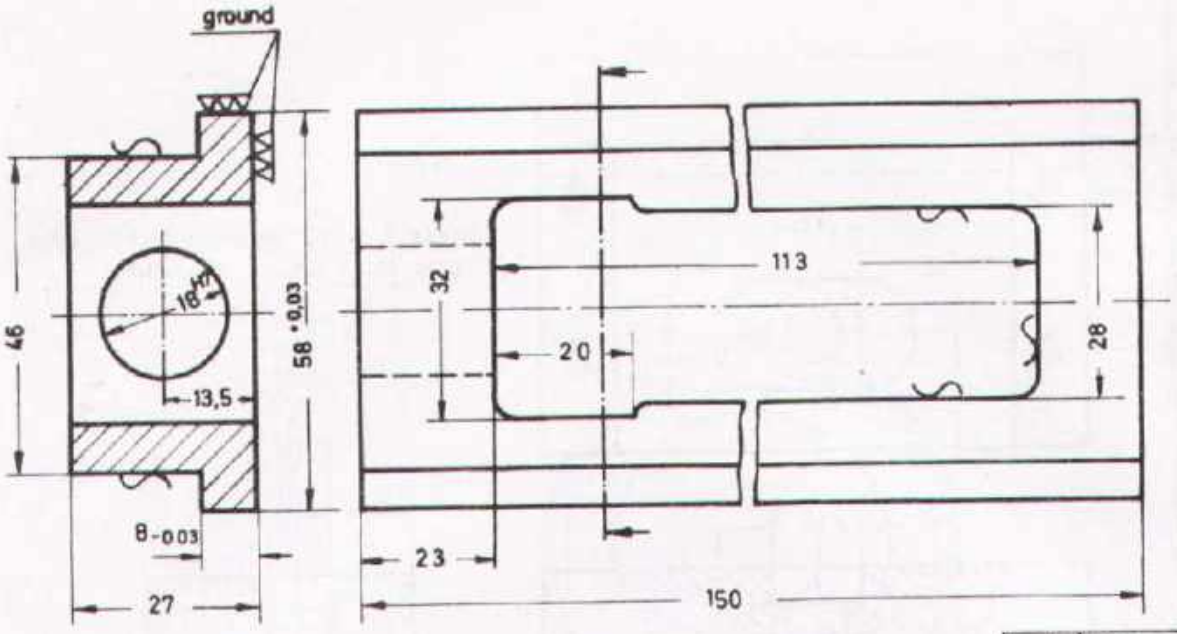
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MACHINIST

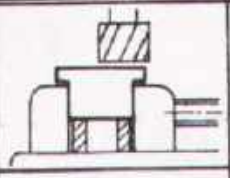
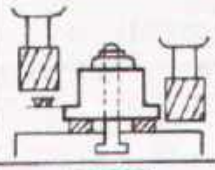
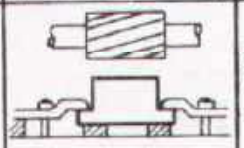
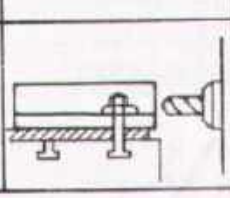
2 ground

Tolerance ± 0,1
unless otherwise stated



18^{H7}	$^{+0,018}_{0}$

SEQUENCE OF OPERATIONS

No.	Symbol	Tools	Descriptions
1		MACHINE VICE PARALLEL BARS SHELL END MILL CUTTER	MILLING OF REFERENCE SURFACE
2		PARALLEL BARS CLAMPS WITH SCREWS SHELL END MILL CUTTER	CLAMPING ON THE MACH.-TABLE BY THE HELP OF CLAMPS MILLING OF WIDTH 58 AND THICKNESS 8 MIND THE GRINDING ALLOWANCE
3		COARSE TOOTH HELICAL CUTTER	RESETTING OF THE CLAMPS MILLING OF THICKNESS 27 MIND THE GRINDING ALLOWANCE
4		CENTRE DRILL TWIST DRILL 17,5 MM MACH. REAMER 18^{H7} DIAL TEST INDICATOR	CLAMPING OF THE WORKPIECE PARALLEL TO THE ARBOR FACING OF THE LENGTH DRILLING AND REAMING OF THE HOLE 18^{H7}

SCALE 1:1	SLIDE	No. 2.2.4 / 10
MAT : CAST IRON	from Mach./Shop.II (For machine vice)	MILLING 1

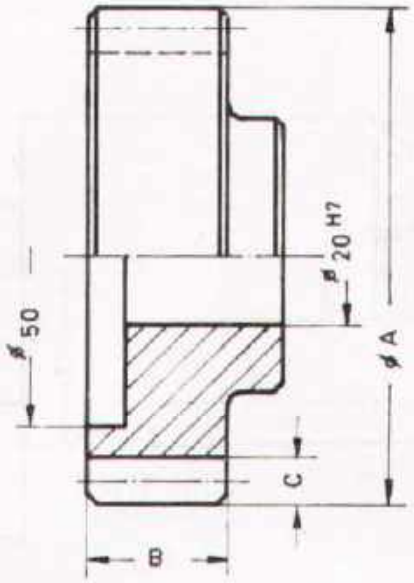
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MACHINIST

2 ▽

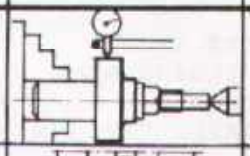
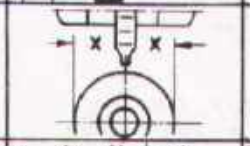
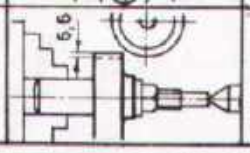
Tolerance ± 0,1



20^{H7}	$^{+0,021}_{0}$

A	B	C	Module	No. of teeth
78 mm	20 mm	6.6 mm	3	24
60 mm	19 mm	6.6 mm	3	18

SEQUENCE OF OPERATIONS

No.	Symbol	Tools	Descriptions
1		DIVIDING HEAD AND TAIL STOCK MILLING MANDREL DIAL TEST INDICATOR	MOUNTING OF DIVIDING HEAD CLAMPING OF THE GEAR BLANK CHECKING OF TRUE RUNNING
2		SPUR GEAR CUTTER MODUL 3 NO. 3 OR 4 ACCORDING TO THE NUMBER OF TEETH	LOCATING THE GEAR CUTTER TO THE CENTRE OF THE GEAR BLANK CALCULATION OF INDEX STEP
3		TOOTH FLANK MICROMETER	SETTING OF THE REQUIRED INDEX PLATE MILLING OF THE TEETH CHECKING OF PROPER DIVIDING

SCALE 1:1	GEAR	No. 2.2.4 / 11
MAT.. CASE HARDENING STEEL	From Machinist and T. & D. Maker/Turning II	MILLING I

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MACHINIST

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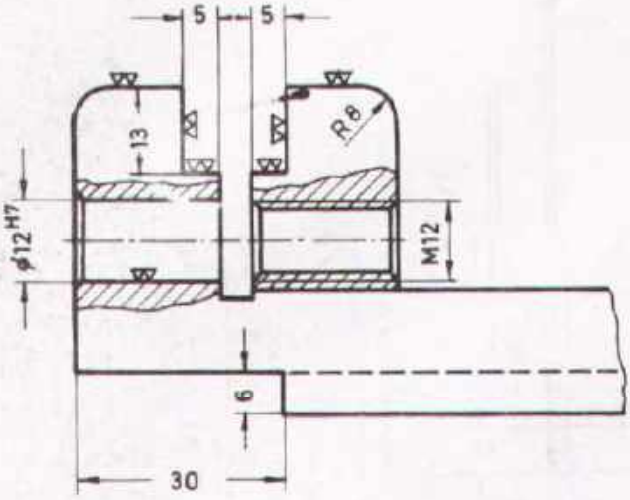
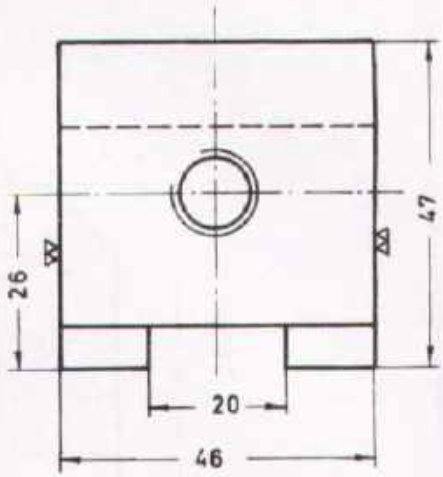
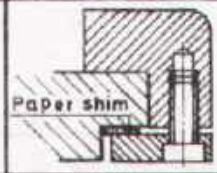
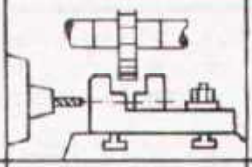
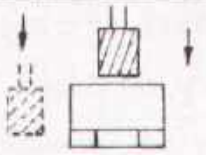
Tolerance ± 0,1
unless otherwise stated





12^{H7}	$^{+0,018}_{0}$

SEQUENCE OF OPERATIONS

No.	Symbol	Tools	Descriptions
1			SCREW PART I AND II TOGETHER. CLAMP BETWEEN THE SLIDE AND THE SLIDE-PLATE, PAPER SHIM AS SHOWN.
2		SIDE MILLING CUTTER DRILL ø 9.8 ø11.9 TO REAM THE HOLE	FINISH THE STEPS START DRILLING WITH A ø9.8 MM DRILL. PART I DRILL LATER WITH ø 11.9 MM.
3		SHELL END MILL CUTTER	FINISH TOP AND THE REMAINING SURFACES.

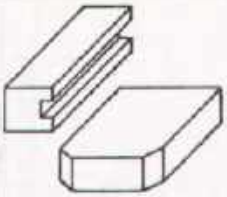
SCALE 1:1	FIXED & MOVEABLE JAW	No. 2.2.4 / 12
MAT. MILD STEEL	From 2.2.4/4&5 (For bench vice)	MILLING I

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

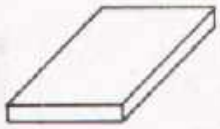
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MACHINIST

SHAPING 3.2.1

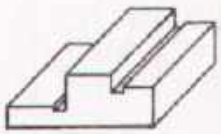


Parallel & square shap.
1 / 2 → 3.2.2/4

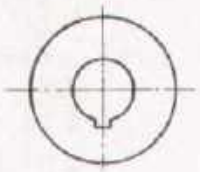


Parallel & square shap.
3 → 3.2.4/2

Form shaping
4

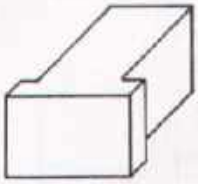


Step shaping, Grooving
5 → 3.2.4/3



Slotting
2.2.4/11 → 6

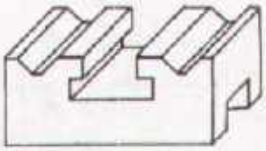
MILLING 3.2.2



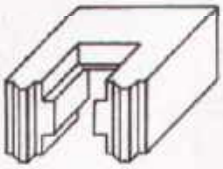
Step milling
1 3.4.4/1

Slotting with side mill
2 3.3.4/2

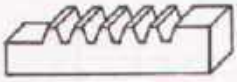
Form milling
3 3.4.4/4



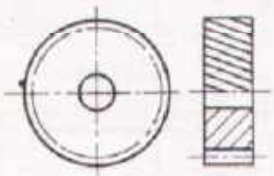
V-Groove & T-Slot milling
3.2.1/1 4 3.4.4/1



Form milling
3.2.1/2 → 5 → 3.4.4/1



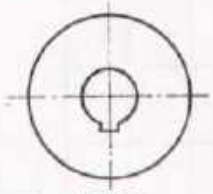
Rack milling
6



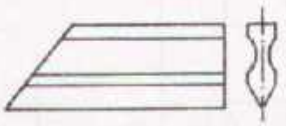
Helical gear milling
3.1.1/3 / 3.4.1/4 → 7

Helical flute milling
3.3.1/5 → 8

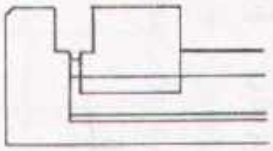
Work with rotary table
3.2.4/2 → 9



Keyway slotting
2.1.2/6 → 10

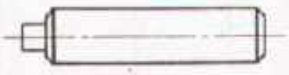


Radii milling
11

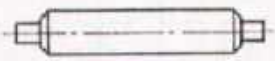


Parallel milling
3.3.4/1 → 12

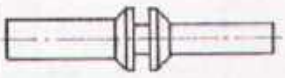
CIRCULAR GRINDING 3.2.3



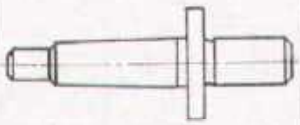
Cylindrical grinding
1



Cylindrical grinding
2.1.2/1 → 2

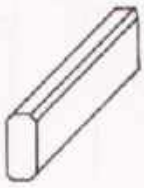


Shoulder grinding
2.1.2/11 → 3 → 3.4.4/2

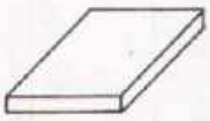


Taper grinding
2.1.2/10 → 4

SURFACE GRINDING 3.2.4

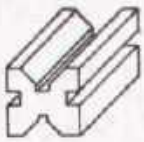


2 1 3/1 → 1

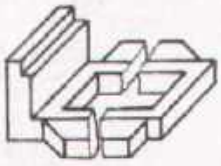


3 2 1/3 → 2 → 3 2 2/9

3 2 1/5 → 3



2 2 2/6 → 4



3 3 4/1 → 5

TRADE TRAINING	LAYOUT	No. 3.2.1 No. 3.2.2 No. 3.2.3 No. 3.2.4

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MACHINIST

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

Machinist

MATERIAL REQUIRED

TRADE TRAINING for Machinist

Shaping No. 3.2.1 — Exercise No. (Length given in millimeter)	1	2	3	4	5	Length per trainee	Total length for a batch of 16 trainees
M/S Square 50 mm (2")	115			25		140 mm	2,4 meter
Cast iron according to pattern		X					
M/S Flat 90 x 10 mm (4" x 3/8")			110			110 mm	1,9 meter
M/S Flat 100 x 20 mm (4" x 3/4")					65	65 mm	1,2 meter

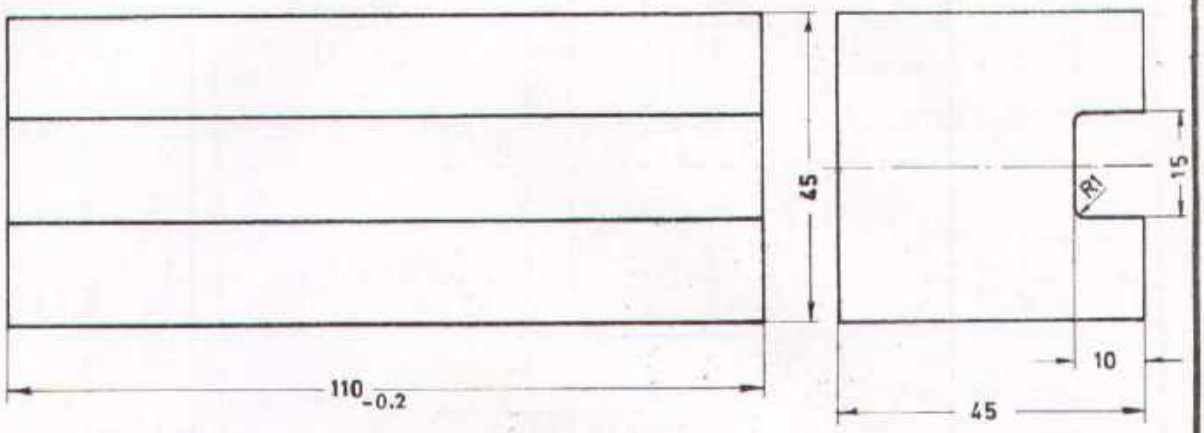
Milling No. 3.2.2	1	2	3	6	11		
M/S Square 50 mm (2")	70					70 mm	1,2 meter
M/S Square 25 mm (1")		60		115		175 mm	3,0 meter
Low carbon steel 30 x 20 mm (1 1/4" x 3/4")			75			75 mm	1,3 meter
Low carbon steel 35 x 10 mm (1 1/4" x 3/8")					105	105 mm	1,8 meter

Circular Gr. No. 3.2.3	1						
M/S Round 25 mm (1")	135					135 mm	2,3 meter

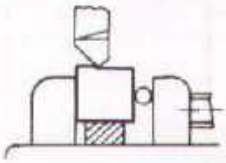
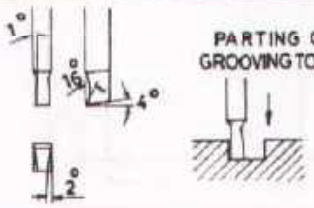
For details please see Layout

2 ▽▽

Tolerance ± 0.1
unless otherwise stated



SEQUENCE OF OPERATIONS

No	Symbol	Tools	Description
1		STRAIGHT LEFT-HAND ROUGHING AND FINISHING TOOL	SHAPING TO THE DIMENSION 45 x 45 AND LENGTH 110
2		GROOVING TOOL GRINDING GAUGE	GRINDING OF THE GROOVING TOOL TO THE CORRECT ANGLES AND 1 MM RADIUS ON BOTH CUTTING POINTS. SHAPING OF THE GROOVE.

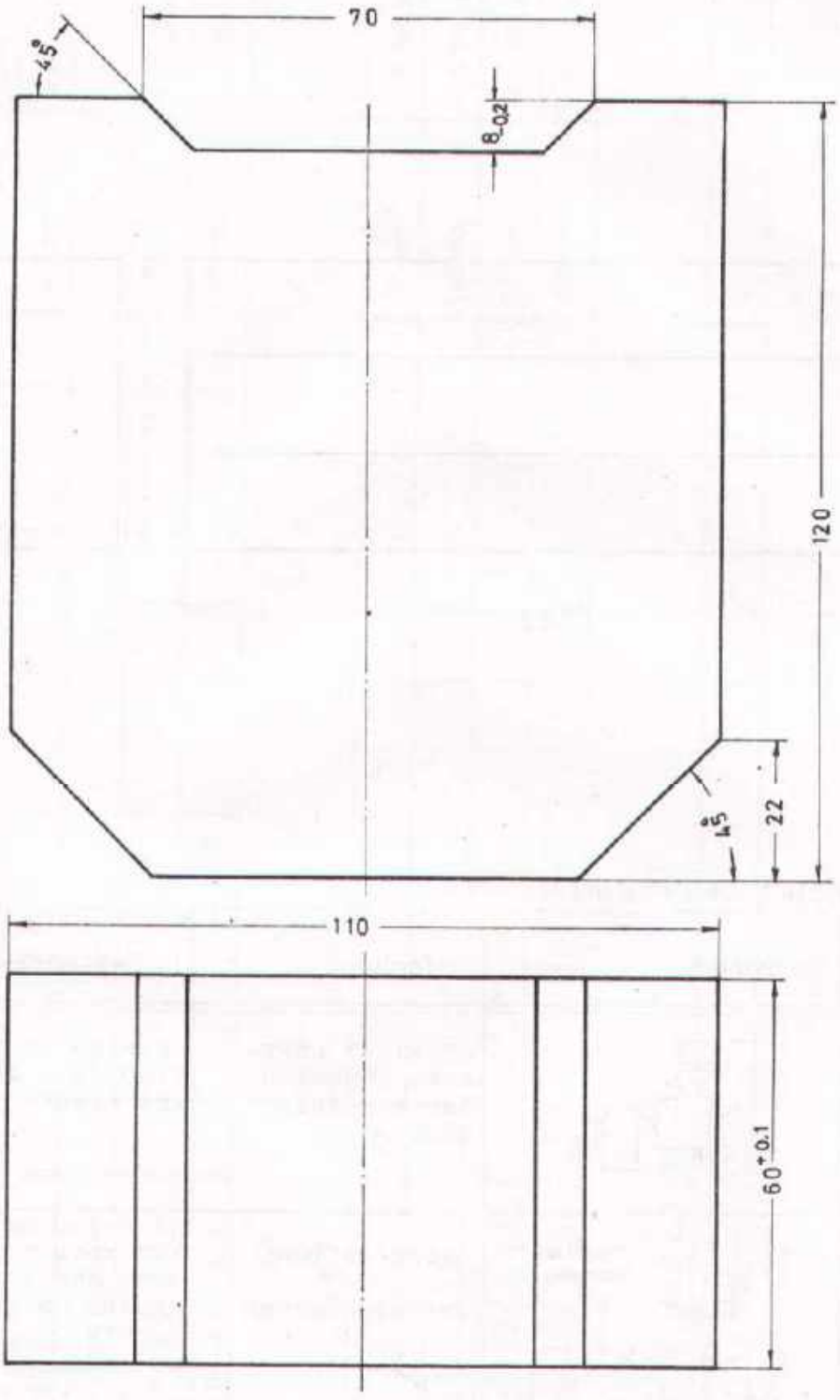
SCALE 1:1	TOOL HOLDER (For tool post)	No. 3.2.1/1
MAT: MILD STEEL		SHAPING III

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

MACHINIST

1 ▽

Tolerance ± 0.1
unless otherwise stated.



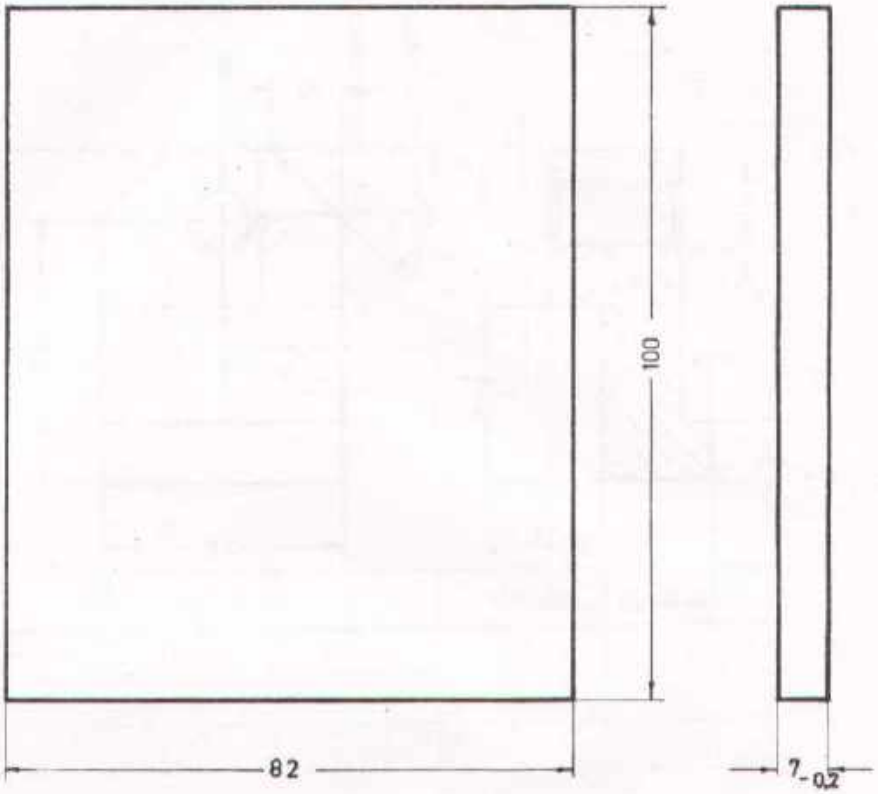
SCALE 1 : 1	BASE PLATE (For tool post)	No. 3.2.1/2
MAT: CAST IRON		SHAPING III

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MACHINIST

Tolerance ± 0,2 mm
unless otherwise stated



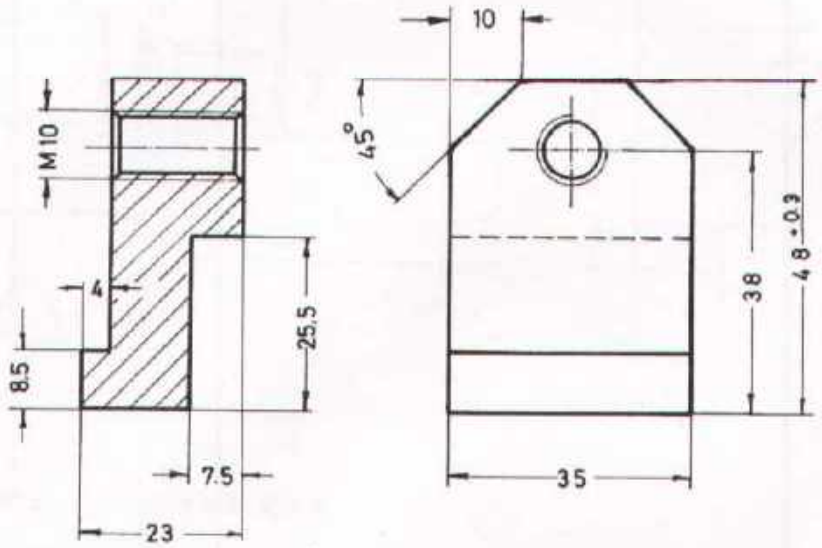
SCALE 1:1	PLATE (for disk cam)	No. 3.2.1/3
MAT. MILD-STEEL		SHAPING III

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MACHINIST

Tolerance ± 0.1
unless otherwise stated



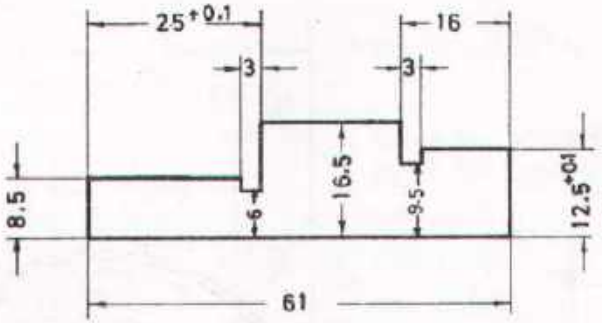
SCALE 1:1	CLAMPING PIECE	No. 3.2.1/4
MAT. MILD-STEEL		SHAPING III

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MACHINIST

Tolerance ± 0,1
unless otherwise stated.



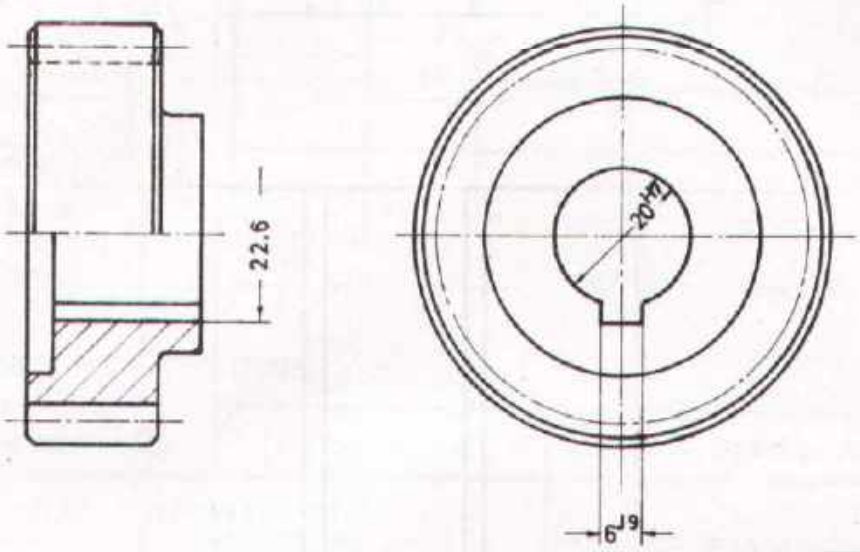
SCALE 1 : 1	SLIDE RAIL	No. 3.2.1/5
MAT. MILD STEEL		SHAPING III

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

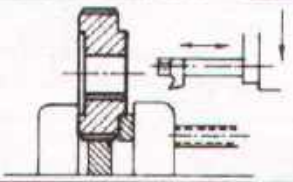
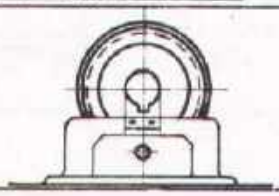
MACHINIST

Tolerance ± 0.1
unless otherwise stated.



20 H7	+0,021 0
6^{J9}	+0.021 -0.022

SEQUENCE OF OPERATIONS

No	Symbol	Tools	Description
1		KEYWAY TOOL-HOLDER PARALLEL BARS GAUGE BLOCKS	MARK OUT THE KEY-WAY CLAMP THE GEAR AS SHOWN IN THE SKETCH
2		CUTTING TOOL TRY SQUARE VERNIER CALIPER	MAKE SURE THAT THE RADIAL LINE IS PER-PENDICULAR AND IN CENTRE OF TOOL BIT

SCALE 1 : 1	GEAR	No. 3.2.1/6
MAT. MILD STEEL	From Machinist / Milling II	SHAPING III

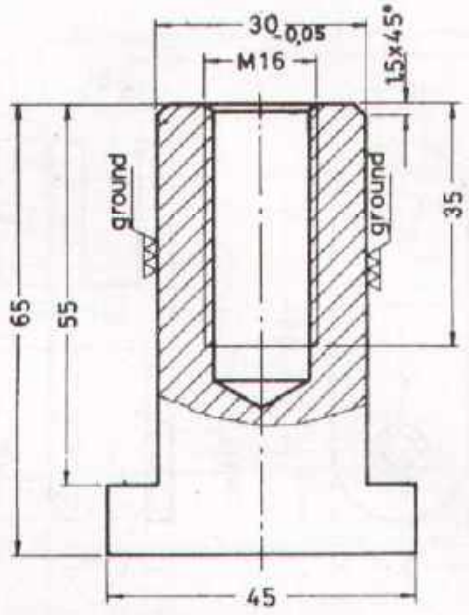
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

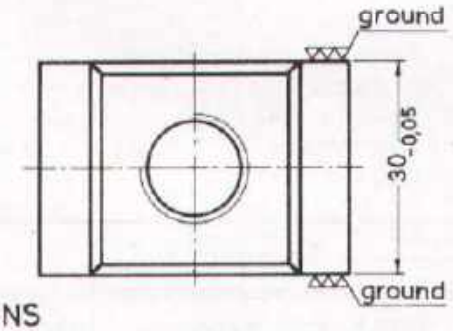
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MACHINIST

3 ▽ (▽▽▽ ground)

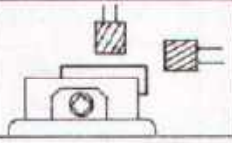
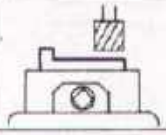
Tolerace ± 0.1
Unless otherwise stated





The thread hole will be made in Fitter section during assembling.

SEQUENCE OF OPERATIONS

No.	Symbol	Tools	Descriptions
1		SHELL END MILL PARALLEL BARS MEASURING INSTRUMENTS	MILL TO THE OUTSIDE DIMENSIONS 65 x 45 x 30.4
2			RECLAMP AND MILL THE STEP MIND THE GRINDING ALLOWANCE

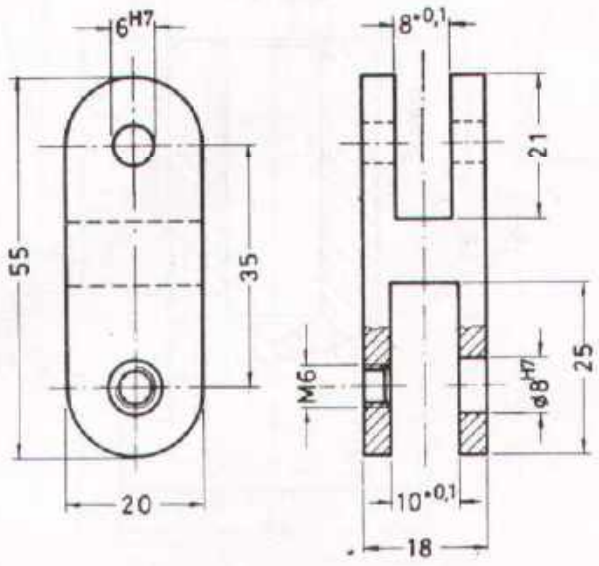
SCALE 1:1	CLAMPING PIECE (For tool post)	No. 3.2.2/1
MAT. MILD STEEL		MILLING II

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

MACHINIST

5 ▽

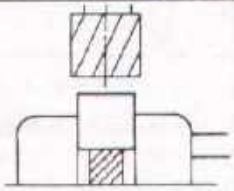
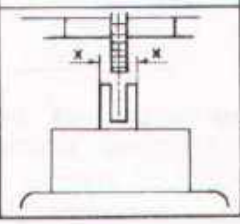
Tolerance ± 0,1 mm
unless otherwise stated.



The holes and radii have to be made in Fitter-section during assembling.

6^{H7}	$+\frac{0,012}{0}$
8^{H7}	$+\frac{0,015}{0}$

SEQUENCE OF OPERATIONS

No.	Symbol	Tools	Descriptions
1		SHELL END MILL PARALLEL BARS MEASURING INSTRU-MENTS	MILL TO THE DIMENSION 55 x 20 x 18 DEBURR MARK OUT THE SLOTS
2		SIDE MILLING CUTTER	MILL THE TWO SLOTS BY USING A SIDE MILLING CUTTER

SCALE 1:1	LINK (For lever press)	No. 3.2.2/2
MAT. MILD STEEL		MILLING II

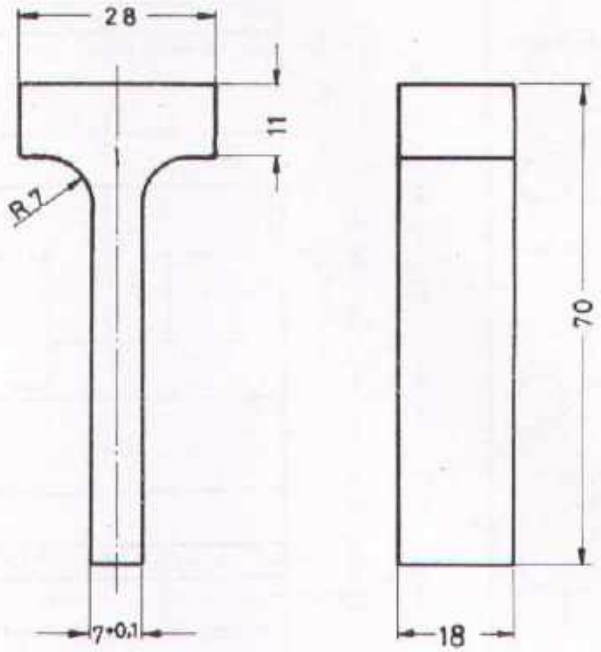
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

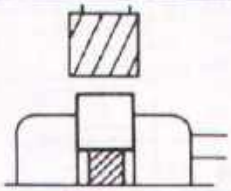
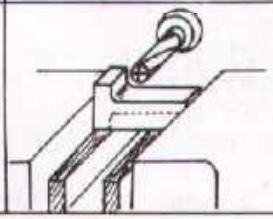
MACHINIST

5 ▽▽

Tolerance ± 0,1
unless otherwise stated



SEQUENCE OF OPERATIONS

No.	Symbol	Tools	Descriptions
1		SHELL END MILL PARALLEL BARS MEASURING INSTRU-MENTS	MILL THE WORKPIECE TO THE DIMENSION 70 x 28 x 18
2		SHANK END MILL ø 14 MM	RECLAMP THE WORKPIECE MOUNT A 14 MM SHANK END MILL AND CUT TO THE REQUIRED SIZE

SCALE 1:1	JAW (For hand vice)	No. 3.2.2 / 3
MAT. L.C.STEEL		MILLING II

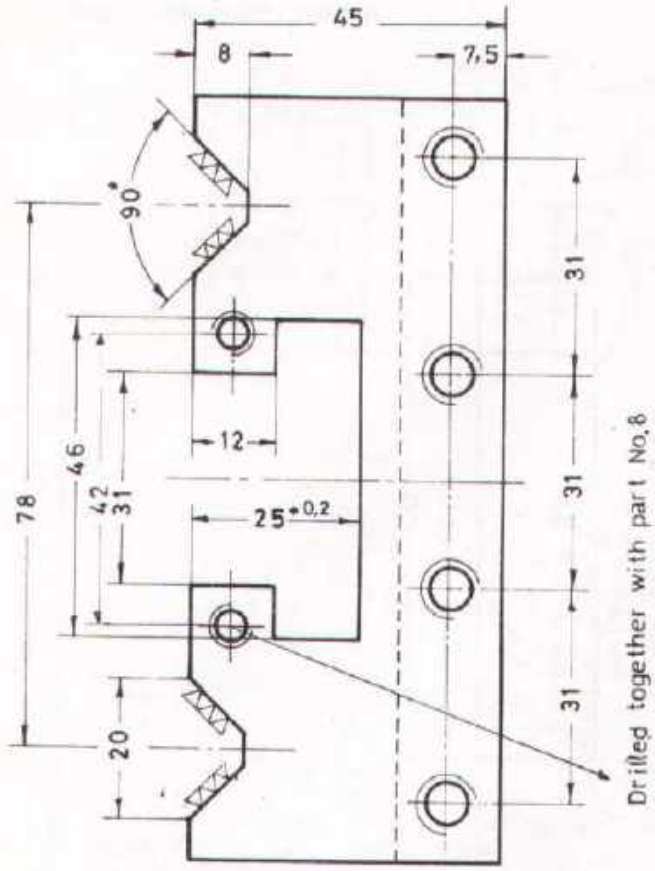
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

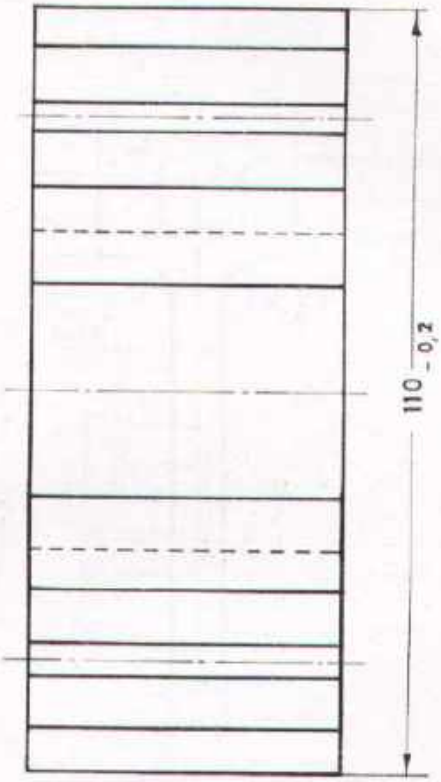
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

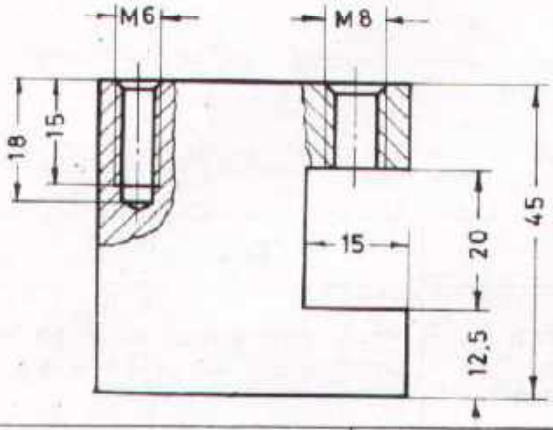
MACHINIST

2 ▽ (▽▽)

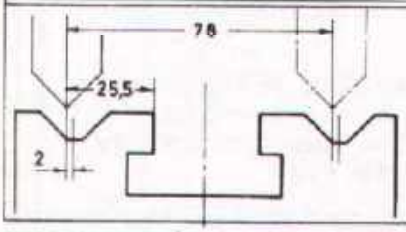
Tolerance ±0,1
unless otherwise stated







Holes and threads have to be done by Tool & Die Maker during assembling.

Symbol	Description
	MARKING OF THE T- AND V-SLOTS. MILLING OF T-SLOT, BY USING A STRAIGHT SIDE AND T-SLOT MILLING CUTTER. MOUNTING A 90° DOUBLE ANGLE CUTTER. MILLING OF THE V-SLOTS AS SHOWN IN THE SKETCH. MILLING OF THE SLOT 15 x 20 MM.

SCALE 1:1	TOOL HOLDER	No. 3.2.2/4
MAT. MILD STEEL	From Machinist/Shaping III (For tool post)	MILLING II

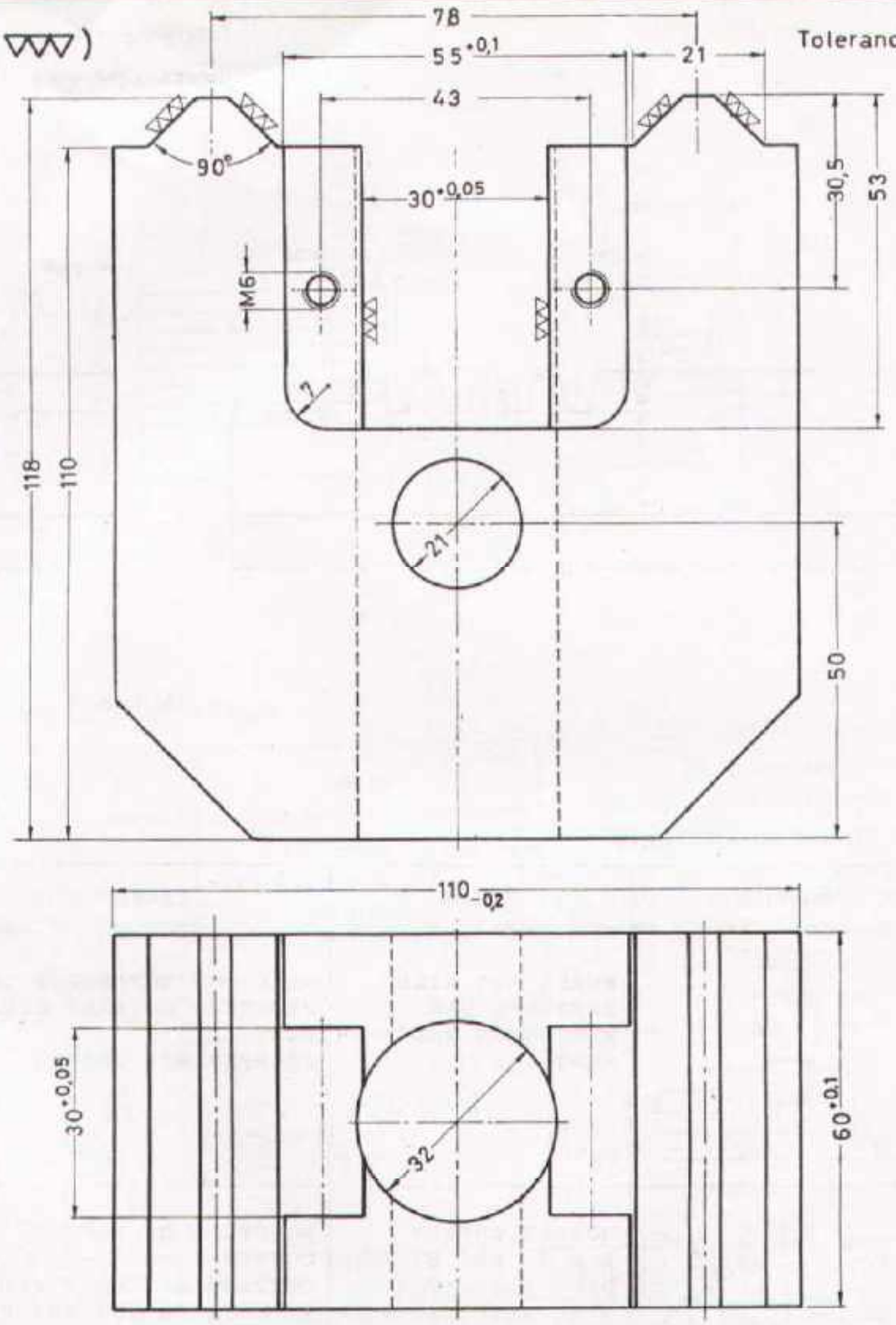
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MACHINIST

1 ▽ (▽▽)

Tolerance± 0,1mm



Holes and threads have to be done by Tool & Die Maker during assembling.

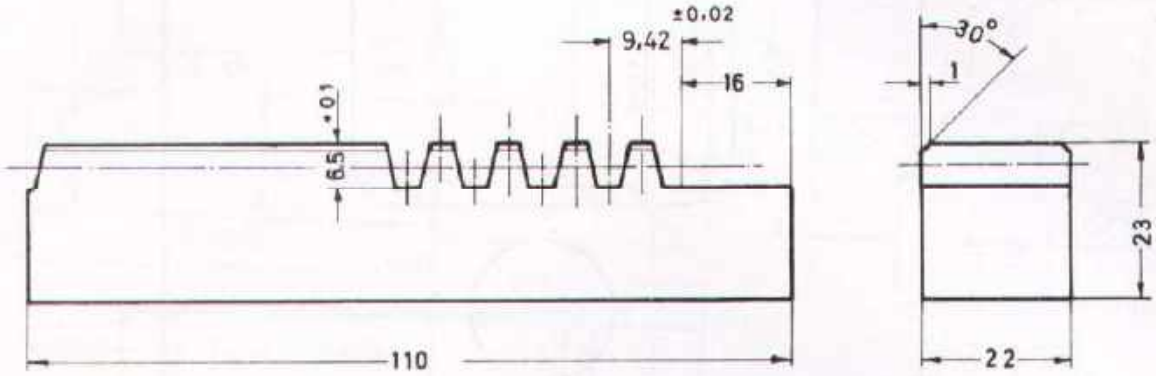
SCALE 1:1	BASE PLATE	No. 3.2.2 / 5
MAT. CAST IRON	From Machinist / Shaping III (For tool post)	MILLING II

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

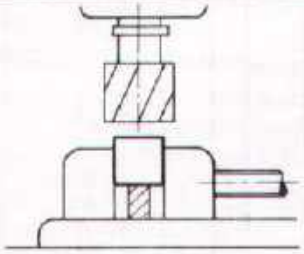
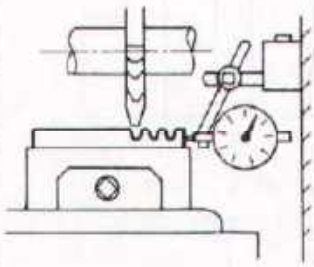
MACHINIST

Tolerance ± 0.1
unless otherwise stated



Module 3

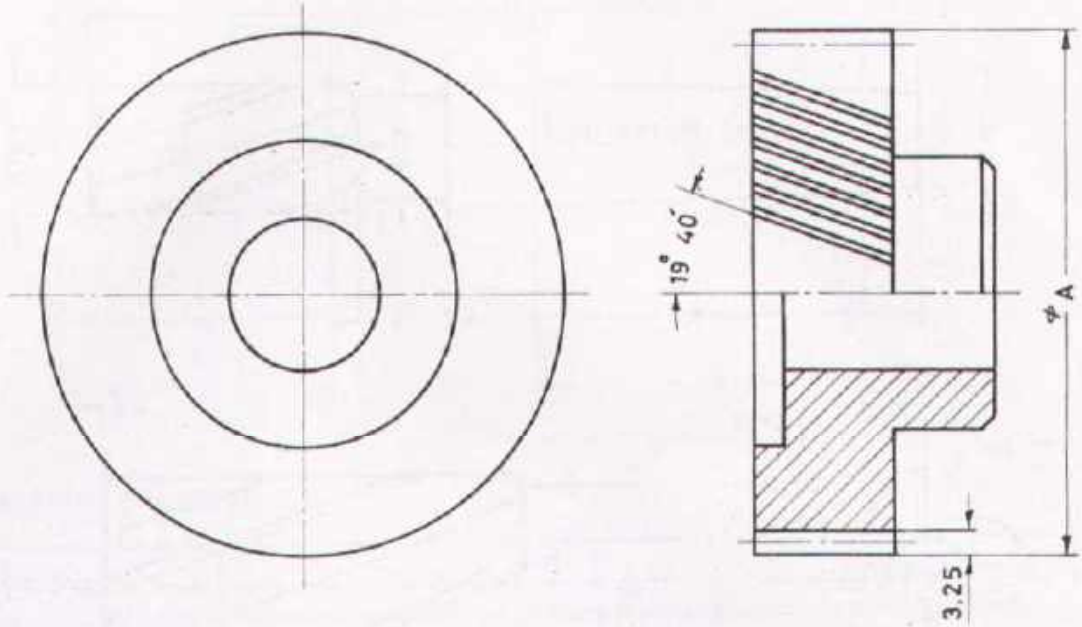
SEQUENCE OF OPERATIONS

No.	Symbol	Tools	Descriptions
1		SHELL END MILL PARALLEL BAR MEASURING EQUIP-MENT	MILL THE WORKPIECE TO THE REQUIRED OUTSIDE DIMEN-SIONS CHAMFER AND DEBURR
2		MODULE CUTTER M = 3 NO. 8 DIAL INDICATOR WITH MAGNETIC STAND	MOUNTING OF MODULE CUTTER CUTTING OF TOOTH PROFILE AFTER EACH CUT ADJUST THE DIAL INDICATOR TO ZERO BEFORE MOVING THE TABLE

SCALE 1:1	RACK	No. 3.2.2/6
MAT. MILD-STEEL		MILLING II

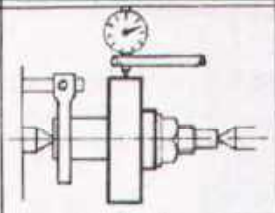
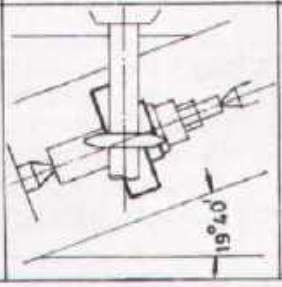
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MACHINIST



A = ϕ 66,7	No. of teeth = 40	Mod. 1,5	Lead 560 mm
A = ϕ 95,2	No. of teeth = 58	Mod. 1,5	Lead 810 mm

SEQUENCE OF OPERATIONS

No.	Symbol	Tools	Descriptions
1		GEAR CUTTING ATTACHMENT TAIL STOCK DIAL INDICATOR	MOUNTING AND ALIGNING OF INDEXING HEAD AND TAILSTOCK HOLD WORKPIECE BETWEEN CENTRES CHECK TRUE RUNNING
2		MODULE CUTTER M = 1.5 NO. 6 M = 1.5 NO. 7	ADJUSTING THE TABLE TO 19°40' SETTING THE WORKPIECE TO THE CENTRE OF THE CUTTER SETTING TO THE REQUIRED LEAD

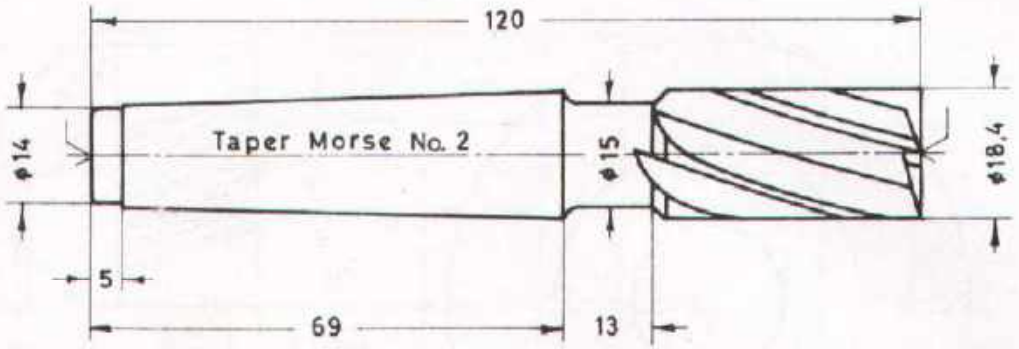
SCALE 1:1	HELICAL GEAR WHEELS	No. 3.2.2/7
MAT. MILD STEEL CAST IRON	From Turner/Turning III - Tool & Die Maker/Turning II	MILLING II

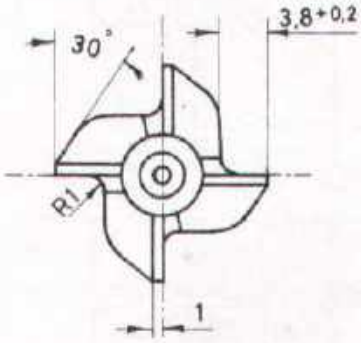
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

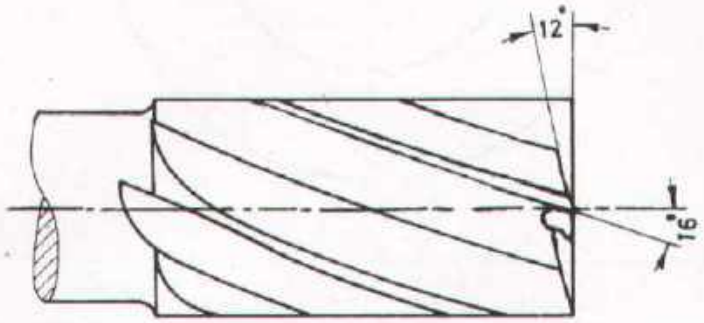
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MACHINIST

Tolerance ±0,1
unless otherwise stated

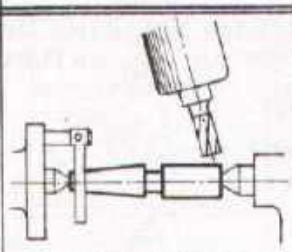
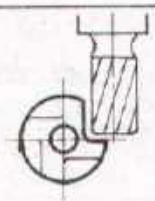






Lead = 195 mm

SEQUENCE OF OPERATIONS

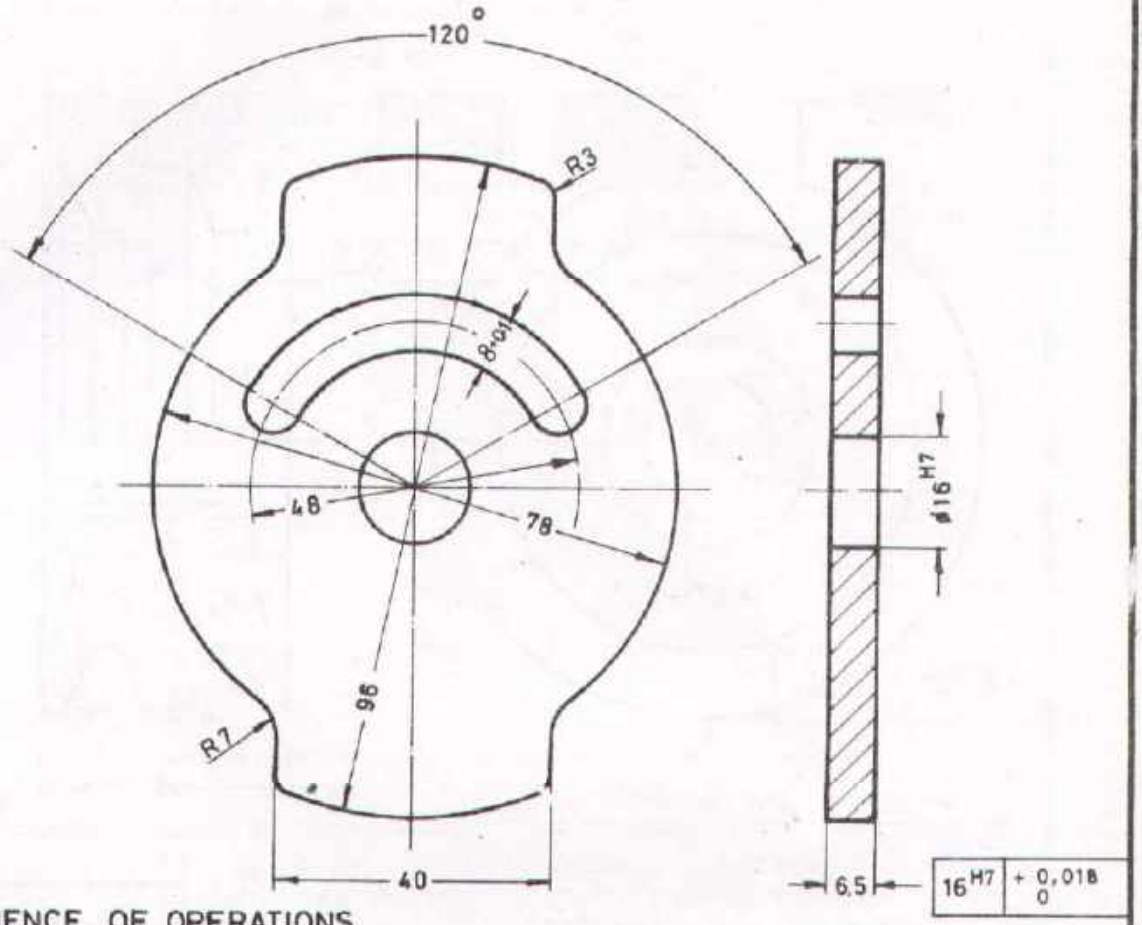
No	Symbol	Tools	Descriptions
1		INDEXING HEAD TAILSTOCK SHANK END MILL Ø 12 - 14 MM	MOUNTING OF THE INDEXING HEAD AND TAILSTOCK AS WELL AS GEARS FOR HELICAL MILLING LEAD 195 MM
2			TO GET A PROPER CLEARANCE CUT, SWIVEL THE VERTICAL HEAD TO AN ANGLE OF 18° AS SHOWN IN THE SKETCH. MILLING OF THE FLUTE AND CLEARANCE ANGLE 30°

SCALE 1:1 2:1	TAPER SHANK END MILL	No. 3.2.2 / 8
MAT. HIGH SPEED STEEL	From M/W.Turn II • Tool & Die Maker / Turning II	MILLING II

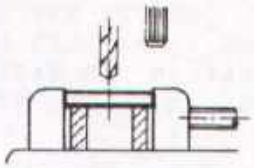
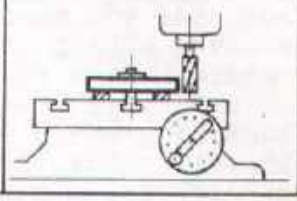
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MACHINIST

Tolerance ±0,1
Unless otherwise stated



SEQUENCE OF OPERATIONS

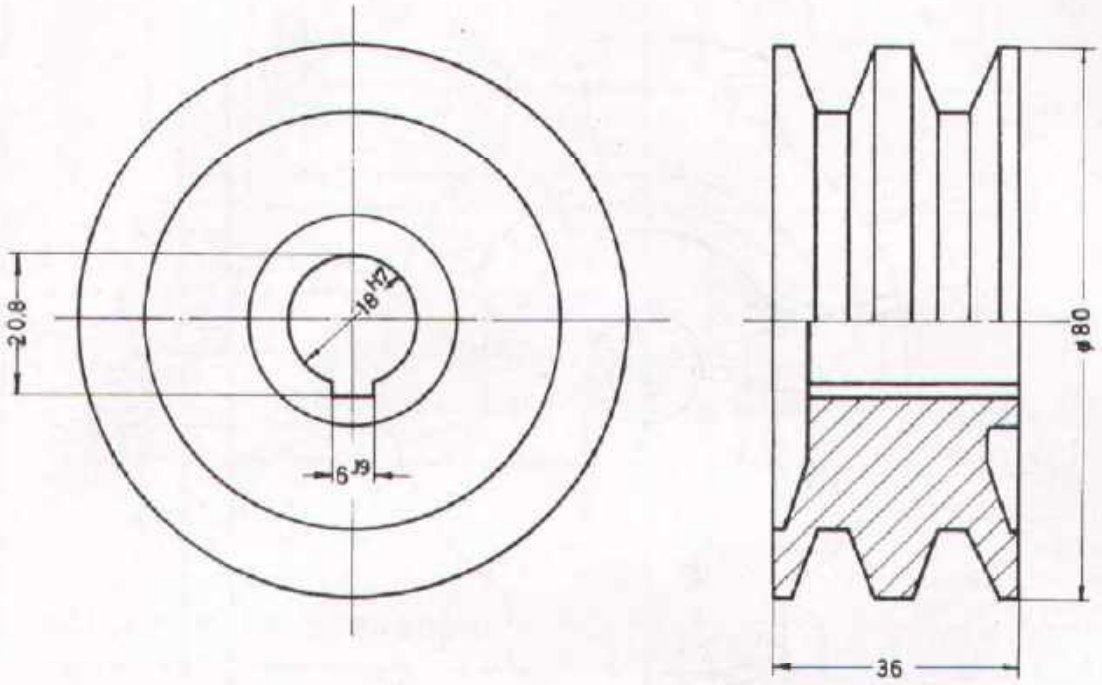
No.	Symbol	Tools	Descriptions
1		TWIST DRILL REAMER PARALLEL BARS MARKING EQUIPMENT	MARK OUT THE CENTRE HOLE AND RADII DRILL AND REAM THE CENTRE HOLE
2		ROTARY TABLE SHANK END MILL ø 14 MM TWO FLUTE END MILL ø 8 MM	MOUNT THE ROTARY TABLE & CLAMP THE WORKPIECE CONCENTRICALLY. USE A CENTRE BOLT. MACHINE THE DISK CAM ACCORDINGLY.

SCALE 1:1	DISK CAM	No. 3.2.2 / 9
MAT. MILD STEEL	From Machinist / Surface grinding	MILLING II

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

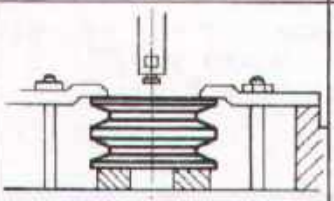
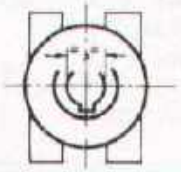
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MACHINIST



6^{J9}	$^{+0,021}_{-0,022}$

SEQUENCE OF OPERATIONS

No.	Symbol	Tools	Descriptions
1		SLOTTING ATTACHMENT CLAMPS MARKING EQUIPMENT	MARK OUT THE KEYWAY CLAMP THE PULLEY DIRECTLY ON THE TABLE AS SHOWN IN THE SKETCH
2			ADJUST THE WORKTABLE UNTIL THE RADIAL LINE IS CENTRAL WITH THE TOOL BIT. TAKE ONE STROKE BY HAND TO BE SURE THAT THERE IS NO INTERFERENCE.

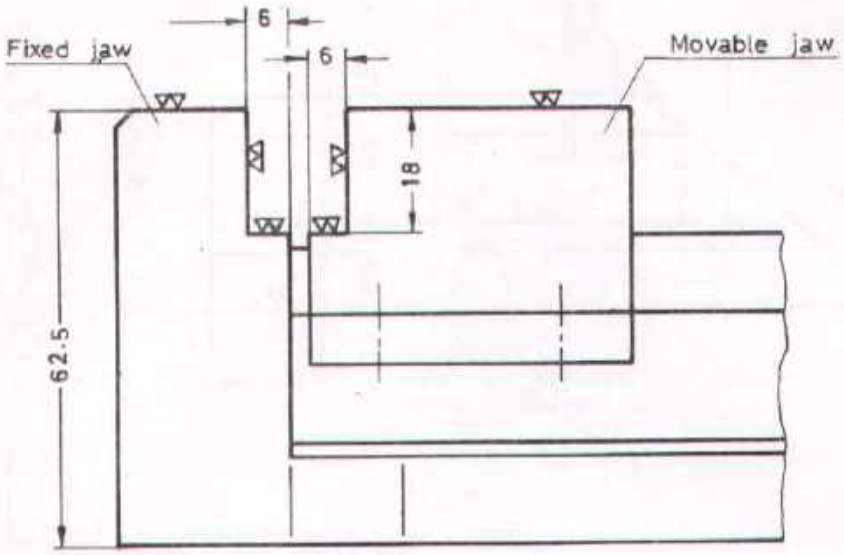
SCALE 1:1	PULLEY	No. 3.2.2/10
MAT. MILD STEEL	From Turner / Turning II	MILLING II

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

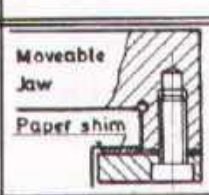
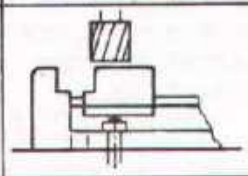
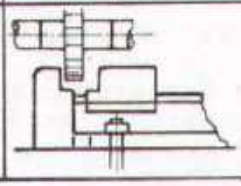
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MACHINIST

Tolerance ± 0.1



SEQUENCE OF OPERATIONS

No	Symbol	Tools	Descriptions
1			FIXING OF THE MOVABLE JAW BY THE HELP OF A SHIM WHICH HAS TO BE CLAMPED BETWEEN THE SLIDE AND THE SLIDE PLATE
2		SHELL END MILL CUTTER	PLAN MILLING OF THE TOP TO THE DIMENSION OF 62,5 MM
3		SIDE MILLING CUTTER	FINISHING OF THE STEPS FOR THE JAWS

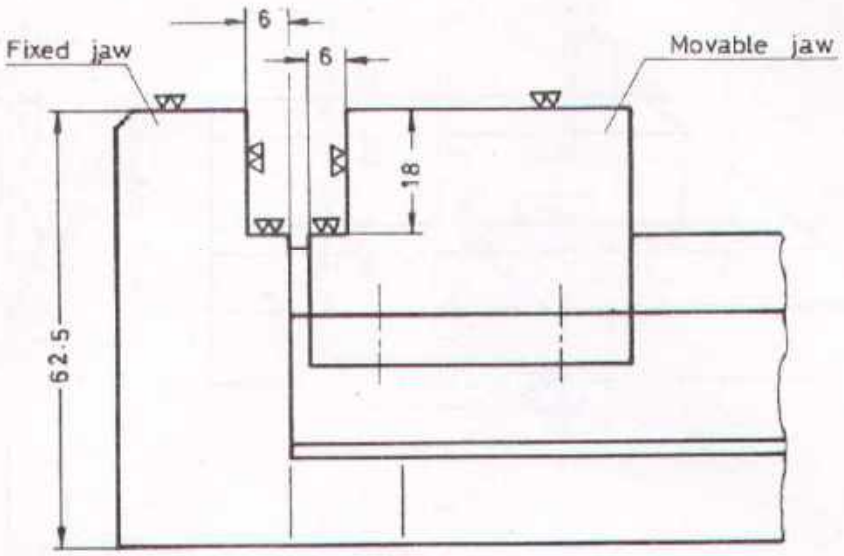
SCALE 1:1	MACHINE VICE	No. 3.2.2/12
MAT.: CAST IRON	From: Millwright / Fitting III	MILLING II

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

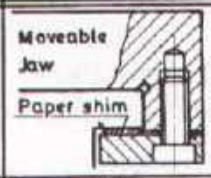
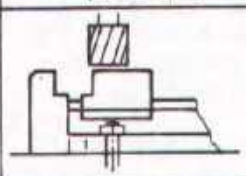
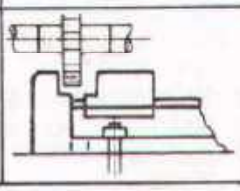
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MACHINIST

Tolerance ± 0.1



SEQUENCE OF OPERATIONS

No	Symbol	Tools	Descriptions
1			FIXING OF THE MOVABLE JAW BY THE HELP OF A SHIM WHICH HAS TO BE CLAMPED BETWEEN THE SLIDE AND THE SLIDE PLATE
2		SHELL END MILL CUTTER	PLAN MILLING OF THE TOP TO THE DIMENSION OF 62,5 MM
3		SIDE MILLING CUTTER	FINISHING OF THE STEPS FOR THE JAWS

SCALE 1:1	MACHINE VICE	No. 3.2.2/12
MAT.: CAST IRON	From Millwright / Fitting III	MILLING II

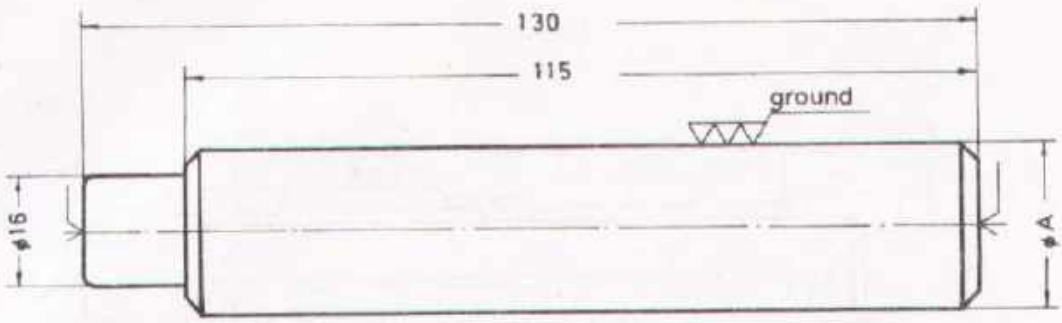
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MACHINIST

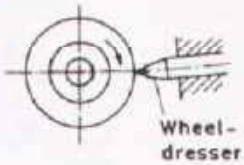
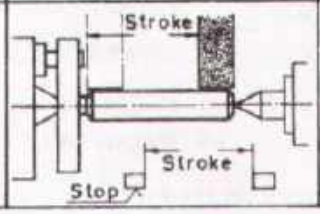
ground

Tolerance ± 0.1
unless otherwise stated.



	ϕ A	MARKS GIVEN BY THE INST
1.	ϕ 23.7 ± 0.05	
2.	ϕ 23.4 ± 0.03	
3.	ϕ 23.2 ± 0.03	
4.	ϕ 23.0 ± 0.02	
5.	ϕ 22.8 ± 0.02	
6.	ϕ 22.7 ± 0.01	

SEQUENCE OF OPERATIONS

No	Symbol	Tools	Description
		GRINDING WHEEL WHEEL DRESSER	SELECTING OF A GRINDING WHEEL SUITABLE FOR UN-HARDENED STEEL MOUNTING AND DRESSING OF THE GRINDING WHEEL
2		MICROMETER 0 - 25 MM	HOLDING THE WORKPIECE BETWEEN CENTRES. ADJUSTING THE STOPS AND SPEED FOR THE WORKPIECE GRINDING TO THE RE-QUIRED DIAMETER.

SCALE 1 : 1	GRINDING EXERCISE	No. 3.2.3/ 1
MAT : MILD STEEL		CIRCULAR GRIND

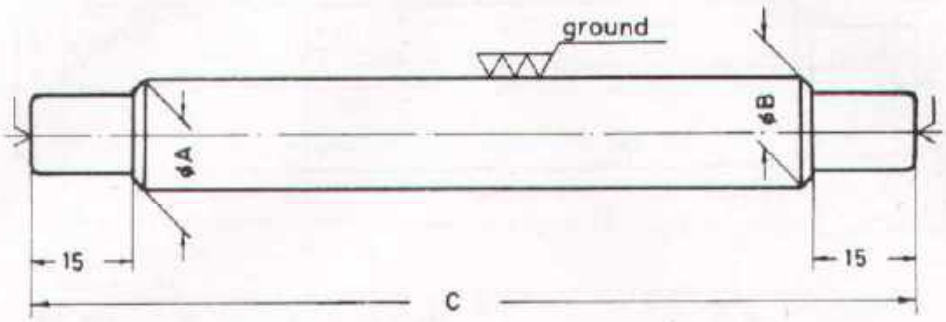
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MACHINIST

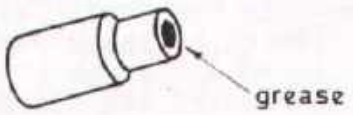
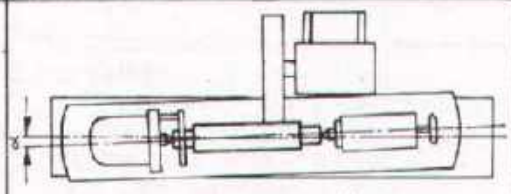
ground

Tolerance ± 0.1
unless otherwise stated.



NOMINAL ϕ	ϕA	ϕB	C
10	$10.03^{+0.01}$	$9.98_{-0.01}$	95
12	$12.04^{+0.01}$	$11.98_{-0.01}$	115
14	$14.04^{+0.01}$	$13.98_{-0.01}$	115
16	$16.04^{+0.01}$	$15.98_{-0.01}$	130
18	$18.05^{+0.01}$	$17.98_{-0.01}$	130
20	$20.05^{+0.01}$	$19.98_{-0.01}$	160
22	$22.05^{+0.01}$	$21.98_{-0.01}$	160

SEQUENCE OF OPERATIONS

No.	Symbol	Descriptions
1		CLEANING AND GREASING THE CENTRE-HOLES.
2		HOLDING BETWEEN CENTRES AND ADJUSTING THE STOPS. ROUGH GRINDING TO AN OVERSIZE 15/100 MM. SWIVEL THE TABLE SLIGHTLY BEFORE FINISHING TO GET THE REQUIRED TAPER.

SCALE 1:1	MANDRELS	No. 3.2.3/2
MAT: LOW CARBON-STEEL.	From Turner / Turning II	CIRC. GRINDING

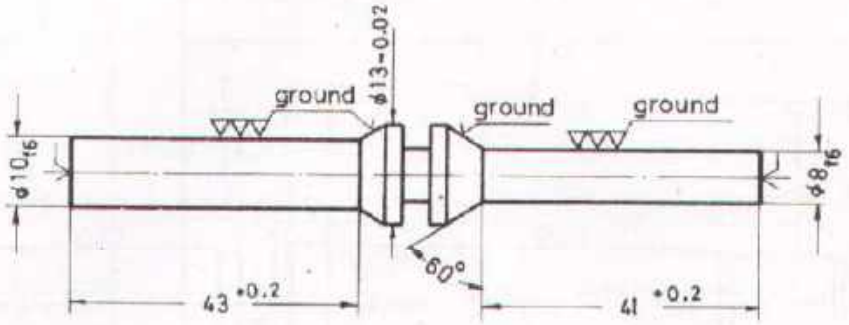
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MACHINIST

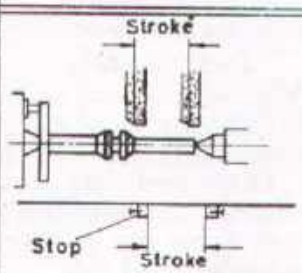
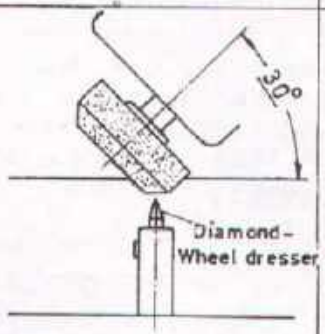
ground

Tolerance ± 0.1
unless otherwise stated.



8_{f6}	-0,013
10_{f6}	-0,022

SEQUENCE OF OPERATIONS

No	Symbol	Tools	Description
1		GRINDING WHEEL . WITH 30° CHAMFER MICROMETER 0-25 MM	MOUNTING OF THE GRINDING WHEEL PROVIDED WITH A CHAMFER OF 30°. ROUGH GRINDING OF ALL DIAMETERS AND CHAMFERS.
2		DIAMOND-WHEEL DRESSER	DRESSING THE GRINDING WHEEL. SWIVEL THE HEADSTOCK TO 30° FOR DRESSING THE CHAMFER. FINISH GRINDING.

SCALE 1 : 1	PUNCH	No. 3.2.3/3
MAT: CARBON ST.	From Turner / Turning II	CIRC. GRINDING

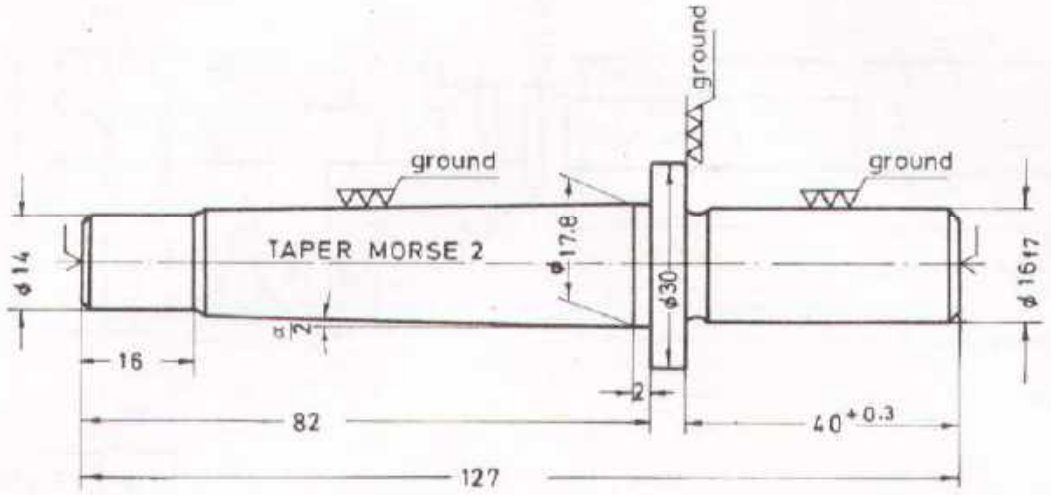
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MACHINIST

(ground)

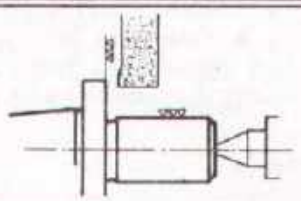
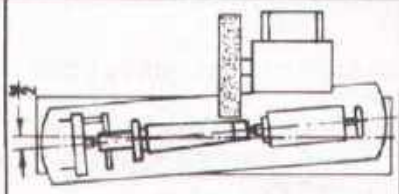
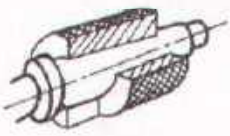
Tolerance ± 0.1
unless otherwise stated.



$\frac{\alpha}{2} = 1^\circ 25'$

16_{f7}	$^{-0,016}_{-0,034}$

SEQUENCE OF OPERATIONS

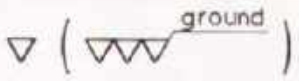
No	Symbol	Tools	Descriptions
1		ONE SIDE RELIEVED GRINDING WHEEL MICROMETER	DRESSING OF A SLIGHTLY CONCAVED CLEARANCE ON THE LEFT SIDE OF THE WHEEL TO ENSURE THE PRODUCTION OF A FLAT SHOULDER
2			SWIVELING THE TABLE FOR THE REQUIRED TAPER. GRINDING UNTIL THE TAPERED SECTION JUST CLEANS UP
3		TAPER RING GAUGE MORSE NO. 2	CHECK THE TAPER FOR ACCURACY AND READJUST THE TABLE IF NECESSARY. FINISH GRINDING ACCORDING TO TAPER GAUGE.

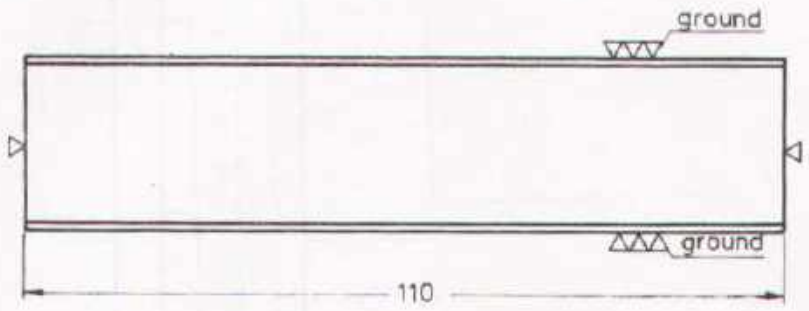
SCALE 1:1	ARBOR	No. 3.2.3/4
MAT. LOW CARBON STEEL.	From Turner/ Turning II	CIRC. GRINDING

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MACHINIST

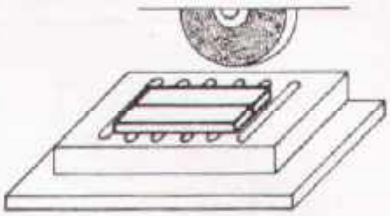
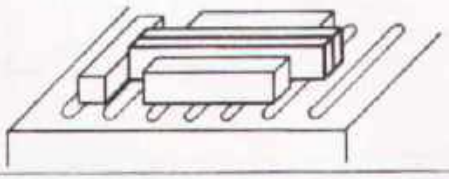




2 Pieces

	B	B	B	A	Marks given
1	19.5 ±0,03	24.5 ±0.03	29,5 ± 0,03	7,5 ± 0.03	
2	19.2 ± 0.02	24,2 ± 0.02	29,2 ± 0.02	7.2 ± 0.02	
3	19.0 ± 0,01	24.0 ± 0.01	29.0 ± 0.01	7.0 ± 0.01	

SEQUENCE OF OPERATIONS

No	Symbol	Descriptions
1		REMOVING OF ALL BURRS FROM THE WORKPIECES. CLEANING OF THE MAGNETIC CHUCK. PLACING A PAIR OF WORKPIECES ON THE MAGNETIC CHUCK. GRINDING TO THICKNESS OF 7.5 MM WITH A TOLERANCE ± 0.03 MM. CHECKING BY YOUR INSTRUCTOR AFTER EACH WORKSTEP.
2		HOLDING THE WORKPIECE AS SHOWN. PLACING OF STEEL PARALLELS AGAINST THE EDGES OF THE WORK TO PREVENT IT FROM MOVING UNDER THE GRINDING FORCE. GRINDING TO WIDTH "B" AS REQUIRED IN THE WORKSTEPS. MIND THE TOLERANCES.

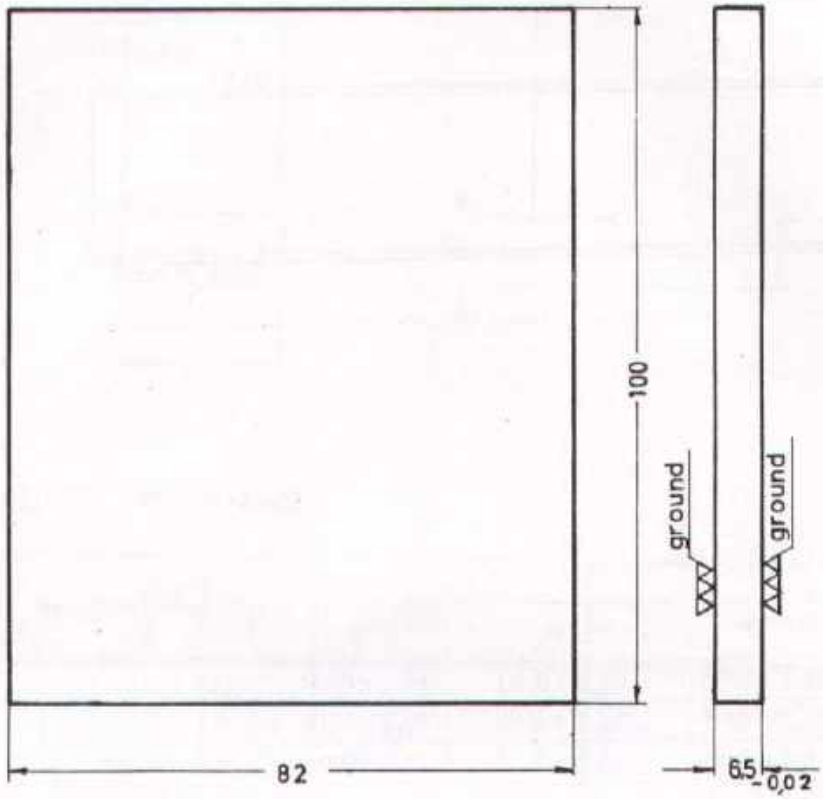
SCALE 1:1	PARALLELS	No. 3.2.4/1
MAT. CASE HARDENING STEEL	From Turner / Shaping II	SURFACE - GRINDING

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MACHINIST

▽(ground)



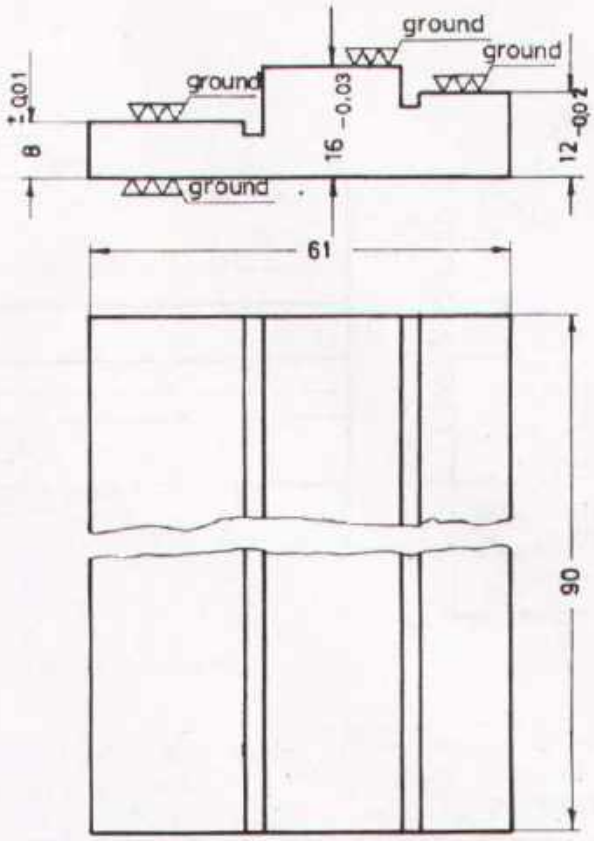
SCALE 1:1	PLATE	No. 3.2.4/2
MAT. MILD-STEEL	From Machinist / Shaping III (For disk cam)	SURFACE-GRINDING

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

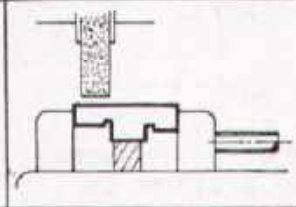
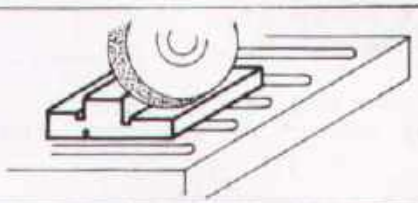
PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MACHINIST

ground (ground)



SEQUENCE OF OPERATIONS

No.	Symbol	Descriptions
1		CLAMPING OF THE WORKPIECE IN A GRINDING VICE - SUPPORTED BY MEANS OF PARALLEL BAR. MOUNTING OF THE VICE ON THE MAGNETIC CHUCK. GRINDING OF THE BASE SURFACE. DEBURRING OF WORKPIECE. CLEANING OF MAGNETIC CHUCK.
2		PLACING OF WORKPIECE ON MAGNETIC CHUCK. GRINDING TO THICKNESS 16 MM. PLACING OF THE WORKPIECE PARALLEL TO THE TABLE MOVEMENT. GRINDING OF THE STEPS 12 MM& 8 MM.

SCALE 1:1	SLIDE RAIL	No. 3.2.4/3
MAT. MILD STEEL	From Machinist / Shaping III	SURFACE - GRIN.

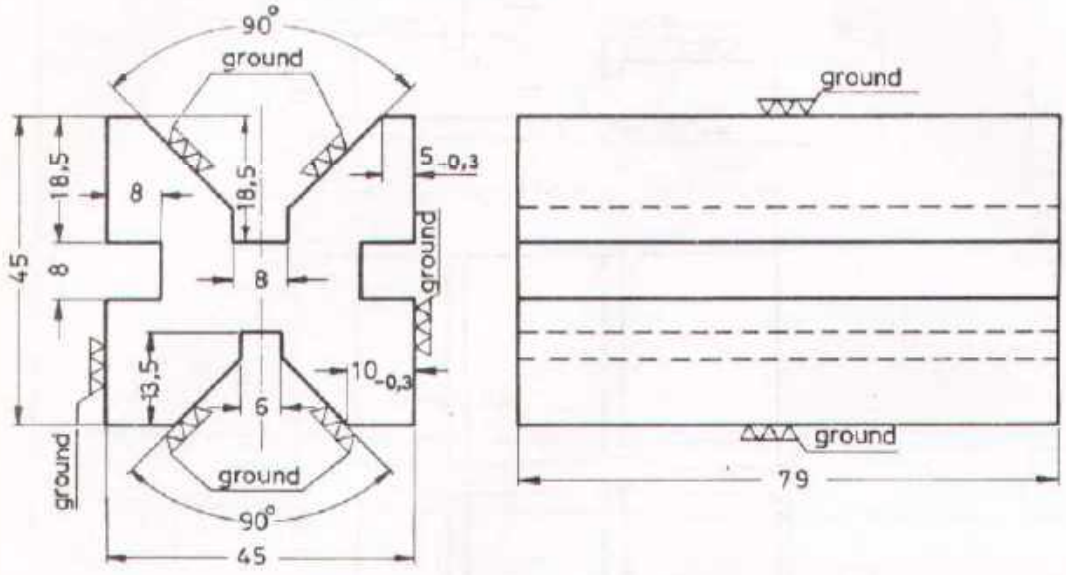
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

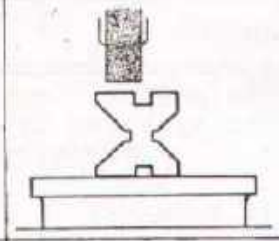
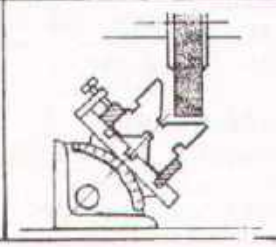
MACHINIST

ground

Tolerance ± 0,1
unless otherwise stated



SEQUENCE OF OPERATIONS

No.	Symbols	Descriptions
1		GRINDING OF THE 4 OUTER SURFACES IN A PROPER SEQUENCE BY USING AN ANGLE PLATE TO ASSURE RIGHT ANGLES AND PARALLEL SURFACES. DEBURRING OF THE V-BLOCK. SWIVELING OF THE ANGLE PLATE TO 45°. CLAMPING OF THE WORKPIECE AS SHOWN. HOLDING THE ANGLE PLATE WITH HELP OF MAGNETIC CHUCK. MAKE SURE THAT THE ANGLE PLATE IS PARALLEL TO THE TABLE MOVEMENT. GRINDING OF ONE SIDE OF THE V. RECLAMPING OF V-BLOCK. GRINDING OF THE SECOND SIDE OF THE V. REPEATING OF THE SAME PROCEDURE FOR THE OPPOSITE V-FORM.
2		

SCALE 1:1	V-BLOCK	No. 3.2.4/4
MAT. CARBON STEEL	From Machinist / Shaping II	SURFACE-GRINDING

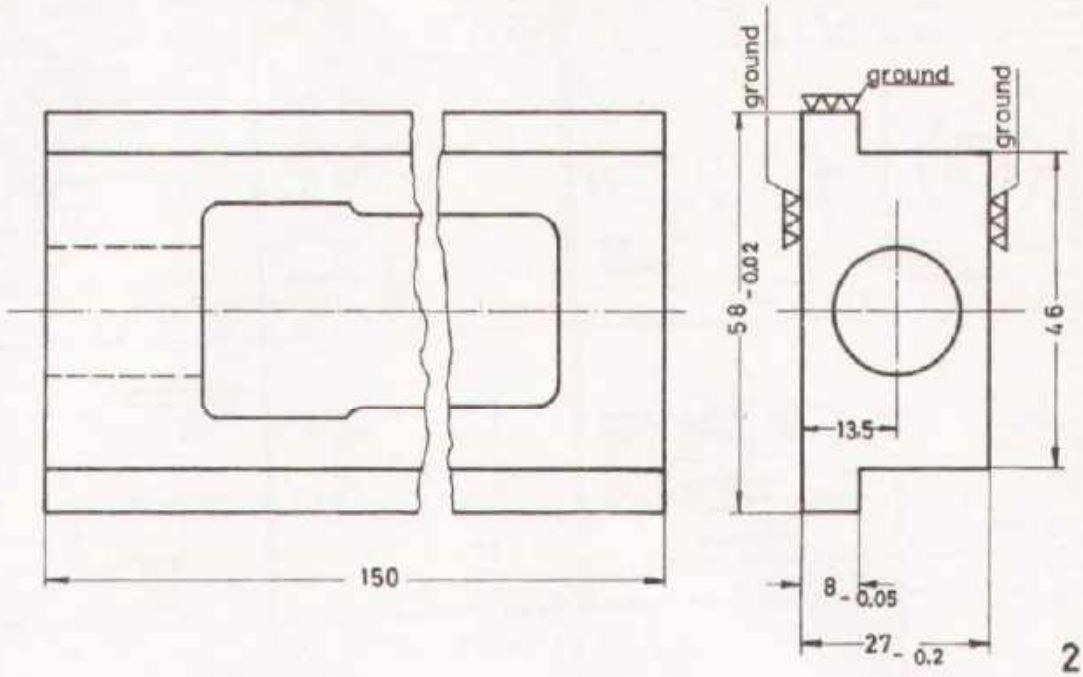
DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

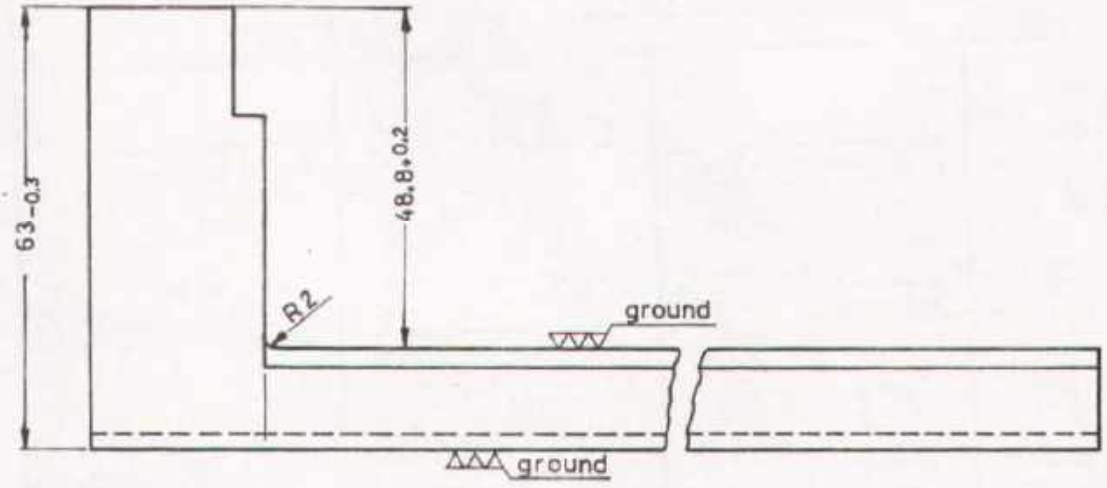
MACHINIST

▽ (▽▽▽ ground)

Tolerance ± 0,01
unless otherwise stated



2



1

SCALE 1:1	SLIDE AND BASE OF VICE	No. 3 2.4 /5
MAT. CAST-IRON	From Machinist / Milling I & Turner / Shaping II	SURFACE-GRINDING

DEVELOPMENT CELL FOR SKILLED LABOUR TRAINING

PAK-GERMAN TECHNICAL TRAINING PROGRAMME

MACHINIST