

Manual Thread Cutting – Course: Technique for Manual Working of Materials. Instruction Examples for Practical Vocational Training

Table of Contents

<u>Manual Thread Cutting – Course: Technique for Manual Working of Materials. Instruction Examples for Practical Vocational Training</u>	1
<u>Introduction</u>	1
<u>Instruction example 9.1. Training workplace for internal thread cutting (tapping)</u>	1
<u>Instruction example 9.2. Thread holding clamp</u>	4
<u>Instruction example 9.3. Clamping jaws for threaded bolts</u>	7
<u>Instruction example 9.4. Stone bolt</u>	10
<u>Instruction example 9.5. Threaded bushes and threaded bolts for C-clamp</u>	13
<u>Instruction example 9.6. Rope turnbuckle</u>	16

Manual Thread Cutting – Course: Technique for Manual Working of Materials. Instruction Examples for Practical Vocational Training

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Introduction

The present documentation comprises six selected instruction examples by means of which the essential manual threading methods can be exercised. In doing so, through hole threads and blind hole threads of different diameters are tapped and external threads are threaded onto bolts.

Apart from only exercising on the training workpiece for internal thread cutting, these instruction examples can fulfill another purpose as well: the thread holding clamp and the clamping jaws for threaded bolts make the tool outfit of the trainee at the workplace complete; threaded bushes and threaded bolts are components for a C-clamp; the stone bolt can be used as a holding element for wall structures; the rope turnbuckle is a connecting and clamping element for rope fastening systems. To facilitate the preparation and execution of the work, the materials, hand tools, measuring and testing tools as well as accessories required for each instruction example are given.

Moreover, the previous knowledge is mentioned which is necessary for the individual exercises.

On the basis of the working drawing enclosed and the appertaining sequences of operations the workpieces can be manufactured.

Explanations as to material indication:

Marking of the steel is done with the value of tensile strength in the unit "Megapascal" (MPa).

Instruction example 9.1. Training workplace for internal thread cutting (tapping)

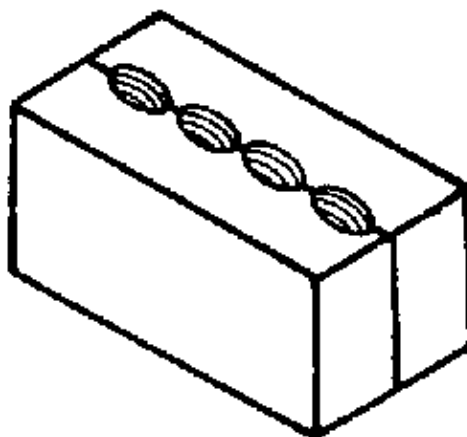
To practise tapping of through hole and blind hole threads.

Material

– 2x square material of steel (380 MPa)

Thickness: abt. 20 mm

Length: 80 mm



Hand tools

Steel scribe or marking gauge; centre punch; engineers' hammer; drill of 4.2 mm dia.; 5 mm dia.; 6.75 mm dia.; 8.5 mm dia.; countersink – 60°; nut tap M5 and M8; serial hand tap M6 and M10;

Measuring and testing tools

Steel rule, vernier caliper for depth measurement; thread cylindrical limit plug gauges M5, M6, M8 and M10

Accessories

Vice, 2x C-clamps, machine vice, tap wrench, soluble oil, cutting oil

Required previous knowledge

Reading of the drawings, measuring, testing, scribing, prick-punching, sawing, filing, drilling, countersinking/counterboring

Sequence of operations

Comments

1. Arrange the workplace, prepare working material – check for completeness

2. Checking of initial length of the workpieces, sawing to size 80 and deburring, if necessary.

3. Clamping together of the workpieces by means of clamps, scribing and punching on the center line visible through the body edges

4. Fixing of the workpieces clamped together into a machine vice and setting up of the drilling machine

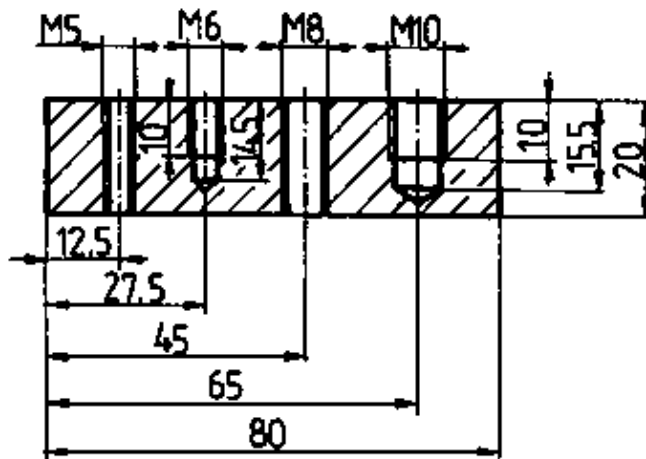
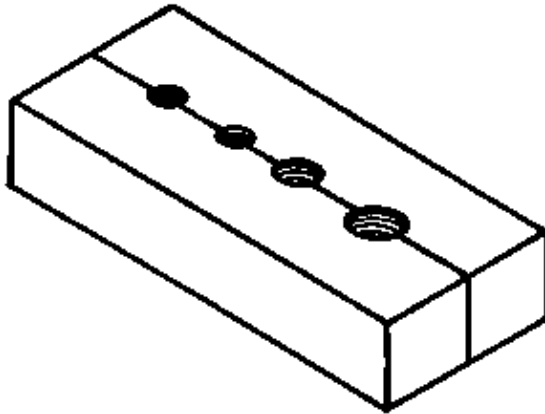
5. Producing the holes
 - 5.1. for hole M5:
 - making of a through hole of 4.2 dia. – n = 2240 r.p.m.

 - 5.2. for hole M6 x 10
 - making of the blind hole of 5 dia. to a depth of 14.5 mm – n = 2240 r.p.m.

 - 5.3. for hole M8:
 - making of the through hole of 6.75 mm – n = 1400 r.p.m.

 - 5.4. for hole M10 x 10:
 - making of the blind hole of 8.5 dia. to a depth of 15.5 mm – n a 1400 r.p.m.

6. Countersinking of all holes to the measure of the nominal dia. – countersinking of the through holes at both ends.
n = 350 r.p.m.
7. Fixing of the workpiece into the vice – Do not undo the clamps!
8. Tapping of the holes
 - 8.1. Tapping of the hole of 4.2 mm dia, by the nut tap M5 – Fix the tap firmly into the tap wrench!
 - 8.2. Tapping of the hole of 5 mm dia. by the serial hand tap M6 – Break regularly the chips!
 - 8.3. Tapping of the hole of 6.75 mm dia. by the nut tap M8 – Add cutting oil!
 - 8.4. Tapping of the hole of 8.5 mm dia. by the serial hand tap M10
9. Cleaning of the holes
10. Checking of the accuracy of fit and screwing-in depths of the threads by the appropriate thread cylindrical limit plug gauges and marked threaded bolts (slotting of the thread length)
11. Undoing of the workpieces and checking of the surfaces of the turns of the thread for tears



			9.1.
		Training workpiece for internal	3109

Training workpiece for internal thread cutting

Instruction example 9.2. Thread holding clamp

To practise tapping of short through hole threads of small sizes

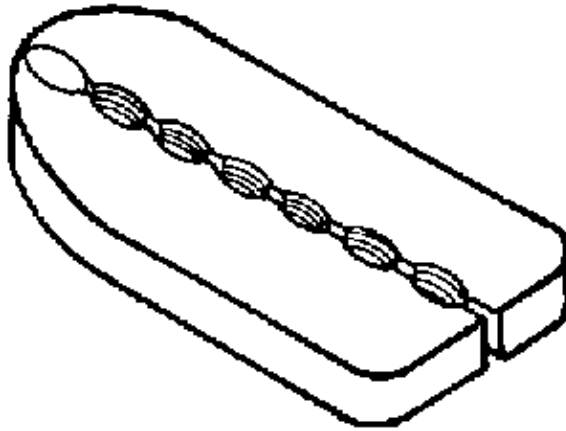
Material

– flat material of steel (420 MPa)

Thickness: 8 mm

Width: 36 mm

Length: 100 mm



Hand tools

Steel scribe, beam trammels, centre punch, engineers' hammer, drill of 2.5 mm dia., 3.3 mm dia., 4.2 mm dia., 5.0 mm dia., 6.75 mm dia., 8.5 mm dia., 12 mm dia., Countersink – 60.

Nut taps M3, M4, M5, M6, M8, M10, Smooth file 200 mm (flat), hand hacksaw

Measuring and testing tools

Steel rule, vernier caliper, thread cylindrical limit plug gauges M3, M4, M5, M6, M8, M10, try square, radius gauge 18 mm;

Accessories

Vice, machine vice, saw sharpening vice, tap wrench, soluble oil, cutting oil

Required previous knowledge

Reading of the drawings, measuring, testing, scribing, prick-punching, sawing, filing, drilling, countersinking/counterboring

Sequence of operations

Comments

- | | |
|---|--------------------------------|
| 1. Arrange the workplace, prepare working material | – Check for completeness |
| 2. Smoothing of the flat material at all sides, providing it with radius and chamfer according to the drawing | – File and saw sharpening vice |
| 3. Scribing of the holes and prick-punching | |
| 4. Drilling, subsequently countersinking at both ends (to the nominal diameter) | |

5. Tapping as per drawing

6. Checking of the tapped holes for accuracy of fit

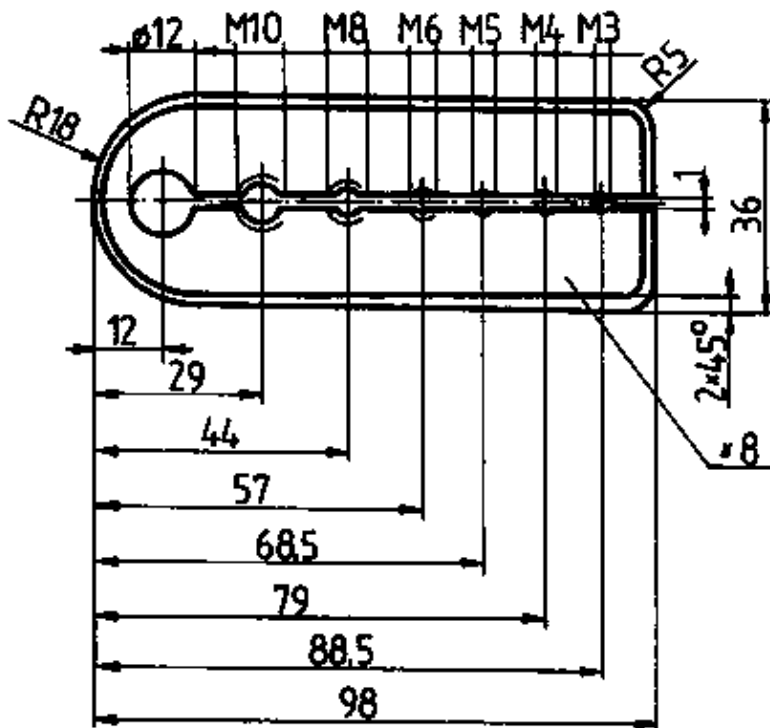
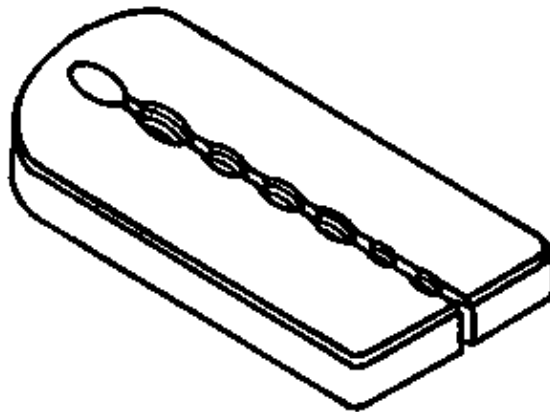
– Use appropriate thread
cylindrical limit plug gauges!

7. Sawing of the slot

– Vertical position of the saw!

8. Final check

– Accuracy to size,
appearance



			9.2.
		Thread holding clamp	3109

Tread holding clamp

Instruction example 9.3. Clamping jaws for threaded bolts

To practise tapping of through-hole threads of bigger diameters

Material

– 2x steel plate (380 MPa)

Thickness: 2.5 mm

Width: 82 mm

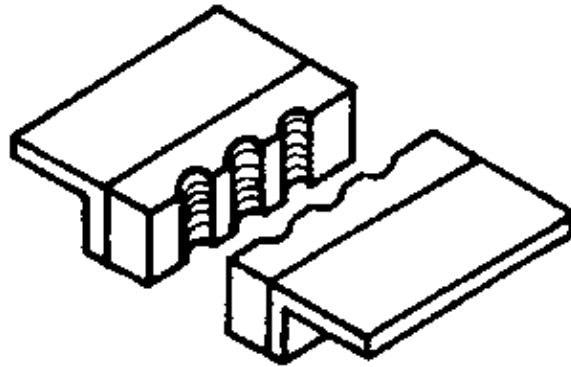
Length: 104 mm

– 2x square material of steel (420 MPa)

Thickness: 20 mm

Length: 104 mm

– 4x countersunk bolt M4 x 22



Hand tools

Steel scribe, centre punch, engineers' hammer, aluminium hammer, hand hacksaw, bastard and smooth files 200 mm (flat), drill of 3.3 mm dia., 4.3 mm dia., 10.25 mm dia., 14 mm dia., 17.5 mm dia.;

Nut taps M4, M12, M16, M20

Countersinks – 60° and 90°;

Measuring and testing tools

Steel rule, vernier caliper, try square, thread cylindrical limit plug gauges M12, M16, M20

Accessories

Vice, machine vice. 2 x clamps, spacer (2 mm plate), tap wrench, soluble oil, cutting oil

Required previous knowledge

Reading of the drawings, measuring, testing, scribing, prick-punching, sawing, filing, drilling, countersinking/counterboring

Sequence of operations

Comments

1. Arrange the workplace, prepare working material

– Check for completeness

2. Working of steel plate to size, smoothing of edges

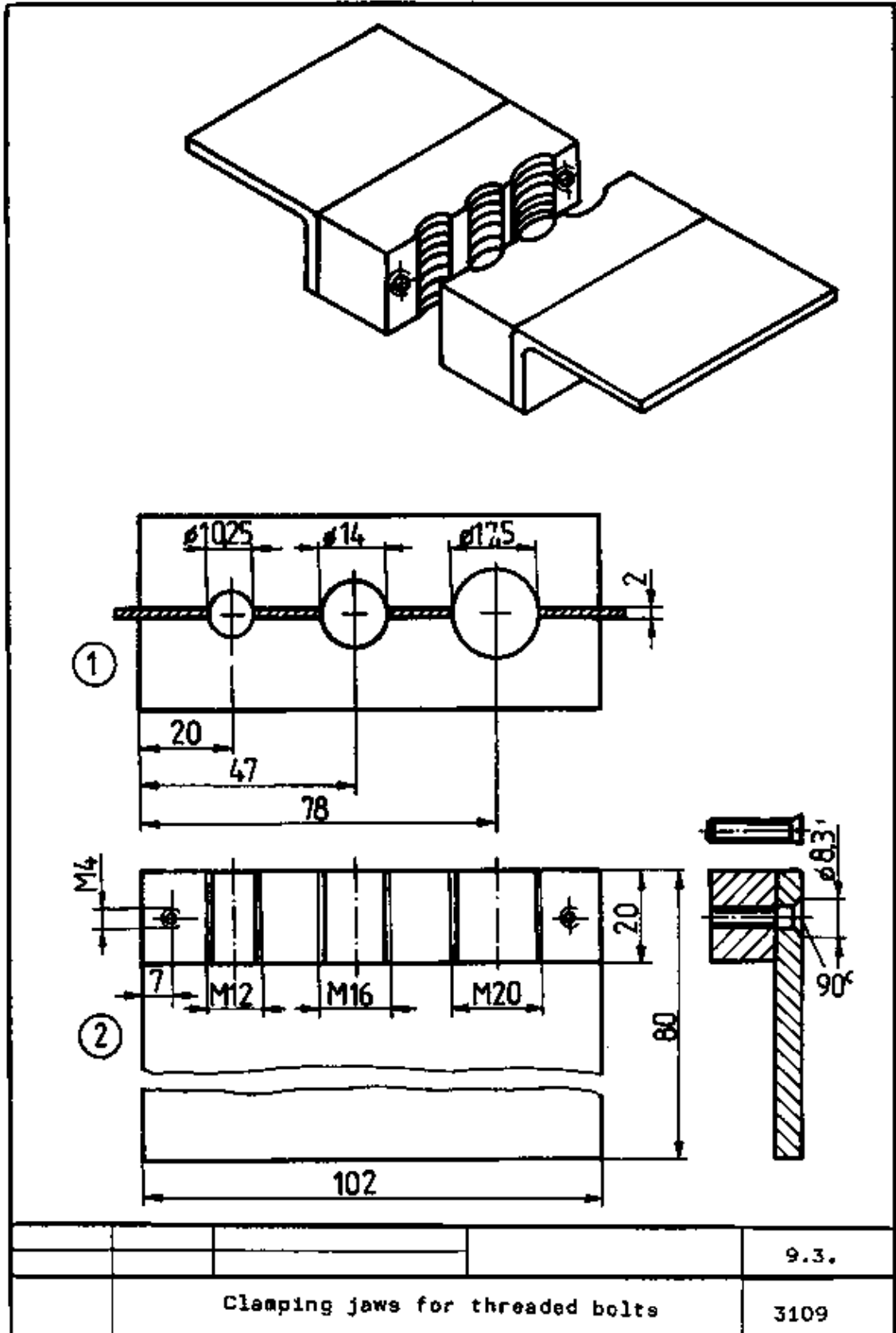
– Filing Observe angular accuracy

3. Sawing of square material to the required length, smoothing of end faces

- | | |
|---|--|
| 4. Securing in place of square material in clamps with spacer, scribing and punching of holes | – Hammer the punch marks |
| 5. Fixing of fastened workpieces into the machine vice and drilling and countersinking as per drawing | – Stage (1) |
| 6. Tapping with nut taps, subsequently cleaning | – Do not undo the fastening! |
| 7. Checking of tapped holes for accuracy of fit | – Use the appropriate cylindrical limit plug gauges! |
| 8. Undoing of the workpieces, checking of the turns of the thread for tears | – |
| 9. Clamping together of one plate and one square material each time and providing them with a hole for screwing, subsequently tapping of thread M4 into the square material | – Stage (2) Square material to be provided with a hole of 3.3 mm dia.
– Steel plate to be provided with a hole of 4,3 mm dia, and a countersinking 90° to 8.3 mm dia. |
| 10. Checking of the thread by screwing in of the counter-sunk bolt | |
| 11. Final check | – Accuracy to size, appearance |

Completion

Tangent bending of the plates behind the square material by means of an aluminium hammer (90)



Clamping jaws for thread bolts

Instruction example 9.4. Stone bolt

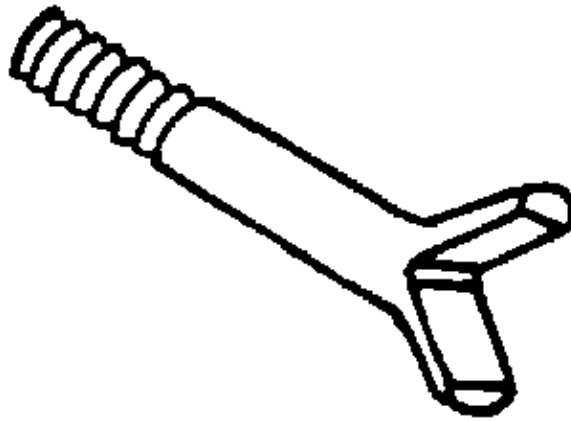
To practise threading of short external threads

Material

– Round steel (380 MPa)

Diameter: M6 to M12

Length: 100 mm



Hand tools

Steel scriber or marking gauge, hand hacksaw, smooth file 200 mm (flat), threading dies M6 up to M12, flat chisel, engineers' hammer

Measuring and testing tools

Vernier caliper, ring thread gauges M6 up to M12

Accessories

Vice, clamping jaws for round material, cutting oil

Required previous knowledge

Reading of the drawings, measuring, testing, scribing, sawing, filing

Sequence of operations

Comments

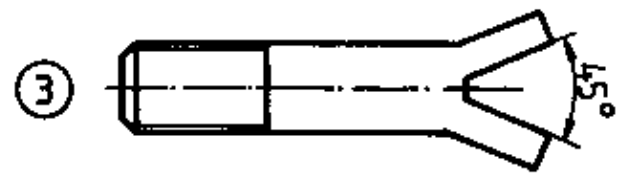
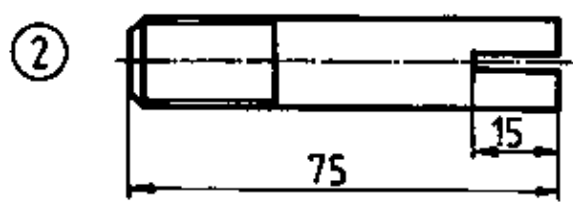
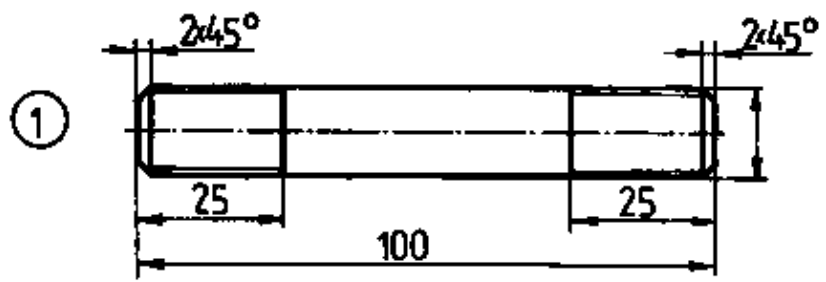
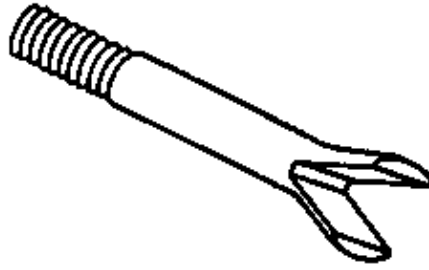
- | | |
|---|--|
| 1. Arrange the workplace, prepare working material | – Check for completeness |
| 2. Checking of initial length, sawing to the required length, if necessary | |
| 3. Chamfering of the round material | – Fixing into clamping jaws for round material |
| 4. Cutting of a thread at both ends 25 mm long | – Stage (1) |
| 5. Checking of the threads for accuracy of fit, tears and straightness | |
| 6. Sawing off of the worse part of the thread and sawing in of a slot at this end of the bolt | – Stage (2) |

7. Bending part of the slot to 45°

– Stage (3)
By means of a flat chisel and
a hammer

8. Final check

– Accuracy to size,
appearance



				9.4.
			Stone bolt	3109

Stone bolt

Instruction example 9.5. Threaded bushes and threaded bolts for C-clamp

To practise cutting of centric internal threads in round material as well as of long external threads

Material

– 3 x round steel (420 MPa)

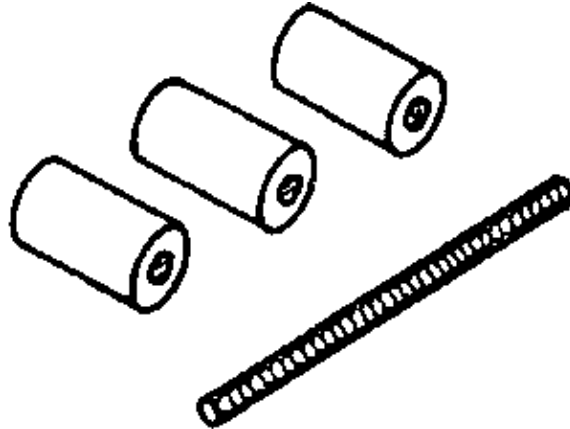
Diameter: 15 mm

Length: 20 mm

– 1 x round steel (600 MPa)

Diameter: 10 mm

Length: 108 mm



Hand tools

Steel scribe or marking gauge, centre punch, engineers' hammer, drill of 8.5 mm dia., countersink – 60°, nut tap M10, smooth file 200 mm (flat), threading die M10

Measuring and testing tools

Vernier caliper, centre square, try square, thread cylindrical limit plug gauge M10, ring thread gauge M10

Accessories

Vice, machine vice, V-block, clamping jaws for round material, soluble oil, cutting oil, tap wrench

Required previous knowledge

Reading of the drawings, measuring, testing, scribing, prick-punching, sawing, filing, drilling, countersinking/counter-boring

Sequence of operations

Comments

1. Arrange the workplace, prepare working material

– Check for completeness

2. Checking of the initial length of the workpieces sawing of them to the required size and filing, if necessary

3. Scribing of the centres on the end faces of the parts (1) by a marking gauge or steel scribe and a centre square

4. Punching, drilling and counter sinking at both ends

5. Tapping with nut tap, subsequently cleaning

– Fix into V–block!

6. Checking of the threads for accuracy of fit and parallelism to the outer edge

– Screw in the thread cylindrical limit plug gauge and compare alignment!

7. Providing of part (2) with a chamfer $1 \times 45^\circ$, subsequently threading; cleaning of the bolt

– Fix into clamping jaws for round material!
– Place threading die horizontally!
– Break regularly the chips!

8. Checking of the thread for accuracy of fit, tears of the thread as well as for straightness

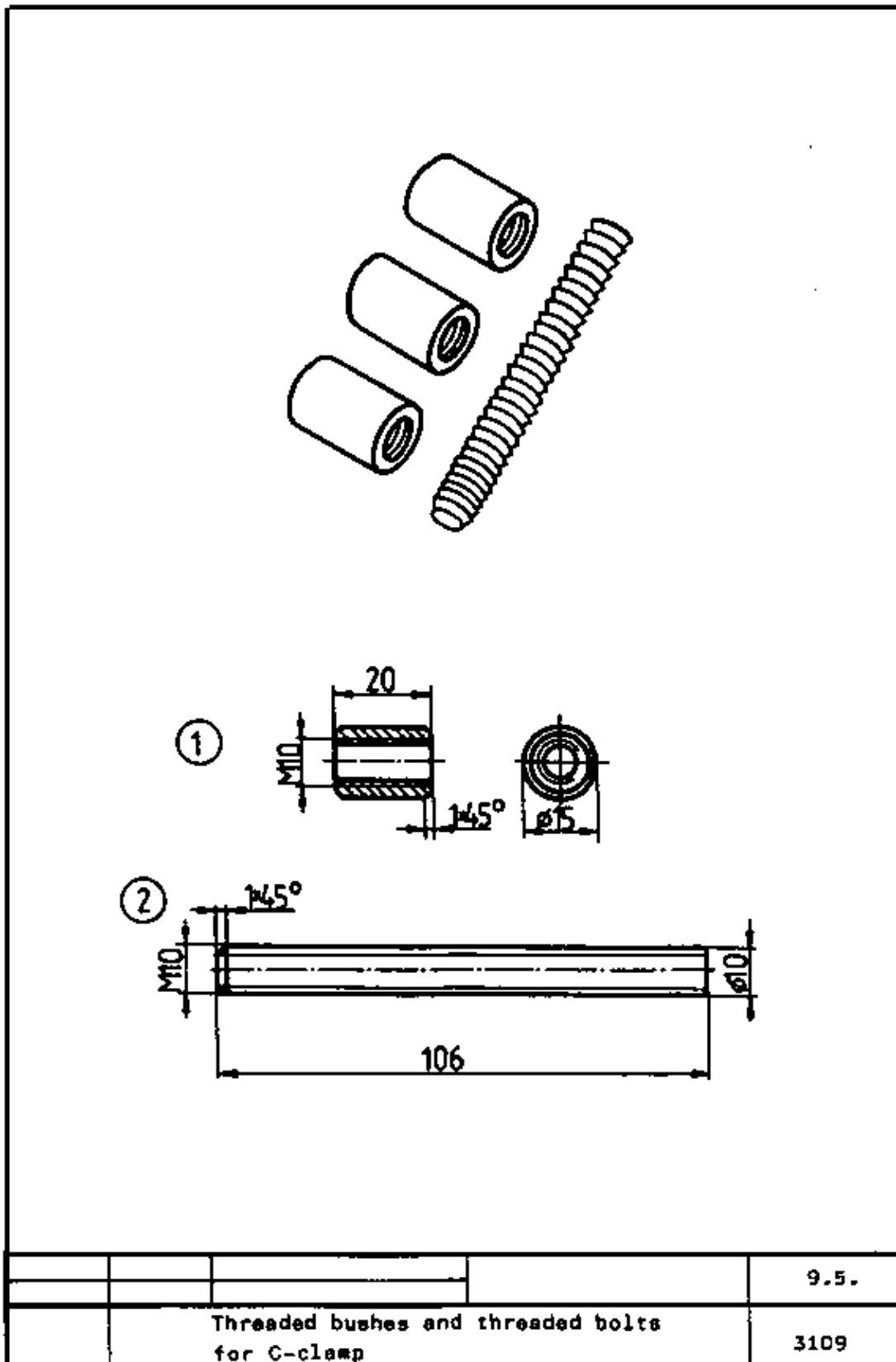
Note:

These parts form a complete C–clamp for the use in a workshop together with the parts produced as per instruction examples

2.5. (frame for clamp)

7.6. (rotary head for threaded spindle)

8.2. (screw lock).



Treaded bushes and treaded bolts for C-clamp

Instruction example 9.6. Rope turnbuckle

To practise cutting of a centric internal thread and of two mating external threads

Material

– round steel (600 MPa)

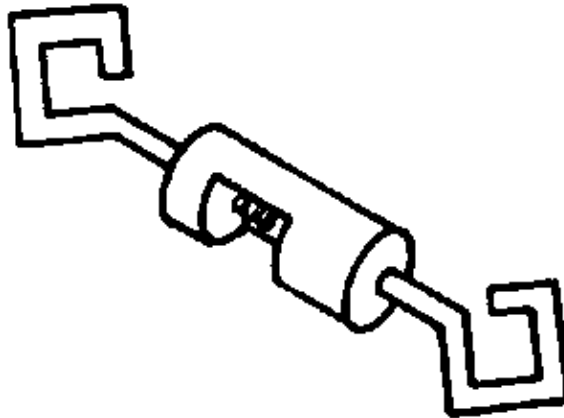
Diameter:20 mm

Length:70 mm

– 2x round steel (600 MPa)

Diameter: 8 mm

Length: abt. 150 mm



Hand tools

Steel scribe or marking gauge, centre punch, hammer, drill of 6.75 mm dia., countersink – 60, serial hand tap M8 for right-hand and left-hand threads, threading die M8 for right-hand and left-hand threads, smooth file of 200 mm (flat)

Measuring and testing tools

Vernier caliper, try square, centre square, thread cylindrical limit plug gauge M8 for right-hand and left-hand threads, ring thread gauge M8 for right-hand and left-hand threads

Accessories

Vice, machine vice, V-block, soluble oil, cutting oil, tap wrench, spacer made of square steel 20 mm for bending

Required previous knowledge

Reading of the drawings, measuring, testing, scribing, prick-punching, sawing, filing, drilling, countersinking/counterboring, bending

Sequence of operations

Comments

1. Arrange the workplace, prepare working material

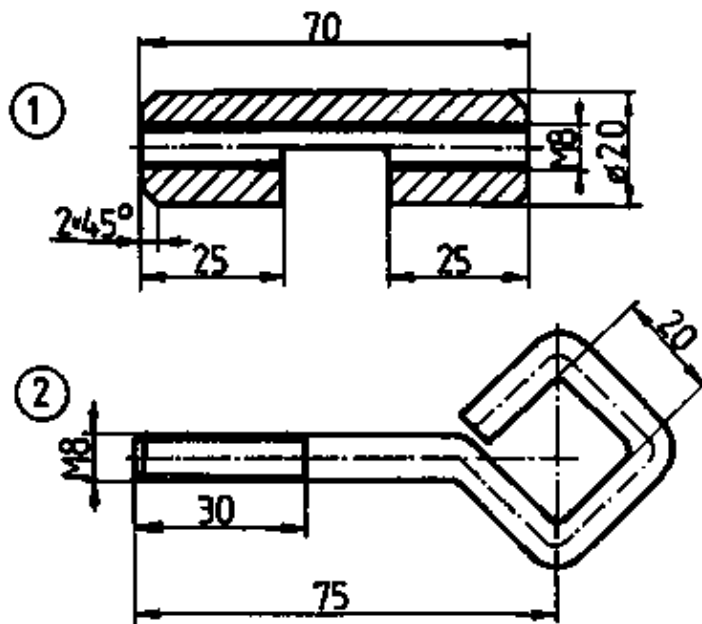
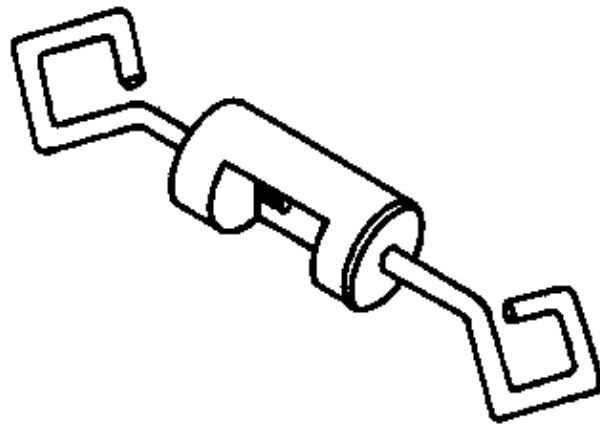
– Check for completeness

2. Checking of the initial length of the workpieces, sawing them to the required size and filing, if necessary

3. Scribing of the bore centre on part (1); punching, drilling and countersinking

– Marking gauge or steel scribe and centre square

4. Tapping from both end faces of the part (1) (one end right-hand thread, the other end left-hand thread)
 - Screw in the tap only up to the middle
 - Do not intersect!
5. Filing of the chamfers at the end faces, filing of the opening in the middle of part (1) and deburring of it
6. Checking of the threads for accuracy of fit and straightness
7. Bending of the eyes at part (2) by means of a spacer
 - Provide the spacer with a radius of 2 mm at the bending points
8. Sawing of 2x parts (2) to the final length, chamfering and cutting of a 30 mm thread (providing one part (2) with a right-hand thread and one part (2) with a left-hand thread)
9. Checking of the external threads for accuracy of fit and straightness
10. Screwing in of the parts (2) into part (1)
 - Screw in external right-hand thread into internal right-hand thread
11. Final check
 - Functional test: When turning the part (7), the parts (2) have to move simultaneously either towards outside or towards inside.



				9.6.
			Rope turnbuckle	3109

Rope turnbuckle

