

Recessing, Cutting-out and Cutting-off – Course: Techniques for Machining of Material. Instruction Examples for Practical Vocational Training

Table of Contents

<u>Recessing, Cutting-out and Cutting-off – Course: Techniques for Machining of Material.</u>	
<u>Instruction Examples for Practical Vocational Training</u>	1
<u>Introduction</u>	1
<u>Instruction example 4.1.: Joint bolt</u>	2
<u>Instruction example 4.2.: Clamping bush</u>	4
<u>Instruction example 4.3.: Flange</u>	5
<u>Instruction example 4.4.: Spring plate</u>	8

Recessing, Cutting-out and Cutting-off – Course: Techniques for Machining of Material. Instruction Examples for Practical Vocational Training

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Introduction

The present booklet contains 4 selected instruction examples which are intended to help practising and consolidating knowledge and skills acquired in the working techniques "recessing, cutting-out and cutting-off".

In order to facilitate the preparation and execution of the work, the necessary materials, cutting and operating tools, measuring and testing tools, and accessories are stated for each instruction example.

For the instruction examples 2, 3, 4 the steel is specified according to the value of its tensile strength in the unit "Megapascal" (MPa).

We also recommend knowledge required in addition to the knowledge of "recessing, cutting-out and cutting-off" which should be repeated before starting with the work.

Explanations to the workshop drawings, if necessary, are given before the specification of the technological sequence of operations. The specified sequence of operations gives the steps necessary for the production of the relevant workpiece. This sequence of operations should be strictly observed if good quality is to be achieved.

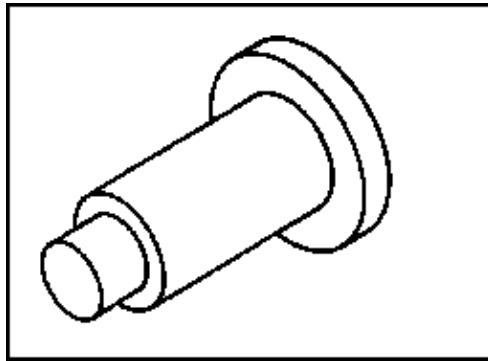
For each training example a workshop drawing is attached showing the required shapes and dimensions of the workpiece. The admissible deviations for sizes with no indication of tolerances may be taken from the table below.

Nominal size	Admissible deviation in mm
0.5 – 6	± 0.1
6 – 30	± 0.2
30 – 120	± 0.3
120 – 315	± 0.5

The admissible surface roughness Rz is specified in μm (0.001 mm)

Instruction example 4.1.: Joint bolt

This example serves to practise recessing of external grooves in circumferential surfaces in the form of a grinding recess and a thread groove on a joint bolt.



Material

16 Cr Mo 4 (low-alloy steel, alloy constituents: 0.16 % carbon, 1 % chromium, less than 1 % molybdenum, rest iron)

Dimensions

dia. 52×107 mm

Cutting and operating tools

Straight right-hand end-cut turning tool (grind to suit shape and width of recesses), chuck key, open-end wrench and box wrench

Measuring and testing tools

Vernier caliper

Accessories

Supporting plates for turning tool, soft chuck jaws, live centre

Required previous knowledge

Reading of drawings, measuring and testing, types and application of clamping tools and accessories.

Explanations to the workshop drawing

Undercut A 4×0.3: A = shape, 4 = width of recess, 0.3 = depth of recess (i.e., dia. 0.6 mm smaller)

Thread M 20: M = metric thread, 20 = nominal diameter in mm

Fit 30 h 6: 30 = nominal size, h 6 = tolerance for shaft

Sequence of operations

Remarks

- | | |
|---------------------------|--|
| 1. Dimensional inspection | Apply vernier caliper. |
| 2. Clamping of workpiece | Chuck in stepped, soft chuck jaws, use live centre as counter-support. |
| 3. Clamping of tool | Position end-cut turning tool exactly in line with centre. To avoid jamming of turning tool, make sure that tool point is tapered from front to rear and from top to |

bottom.

4. Setting of cutting values

Use existing tables of cutting values.

5. Recessing of grinding recess A 4x0,3 on dia. 30 h 6

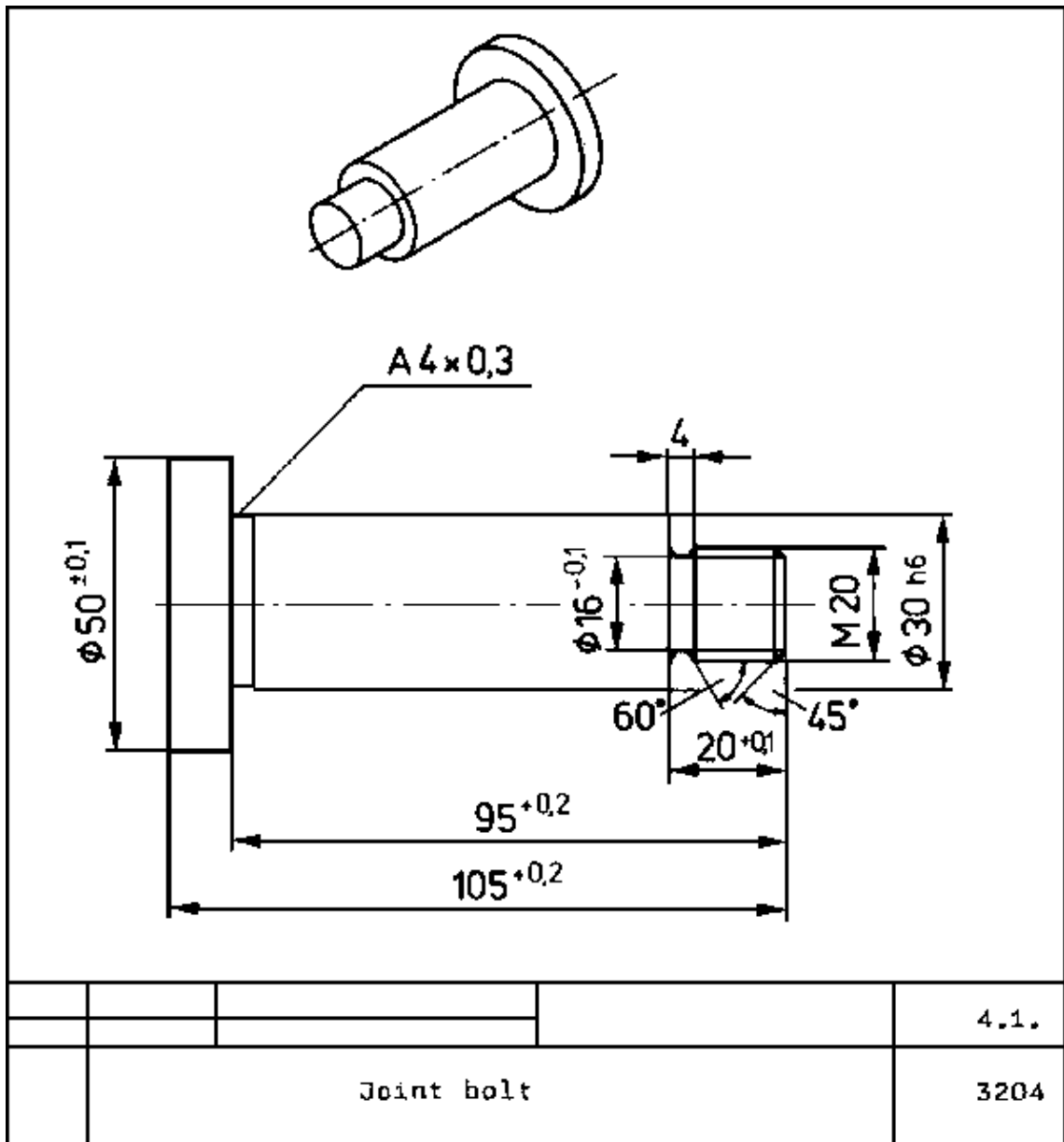
Switch on lathe. End-cut turning tool to take first cut on circumferential surface 30 mm dia. of rotating part. Set cross slide scale to "0". Set depth of cut. Return tool carrier to initial position, switch off machine for dimensional inspection.

6. Recessing of thread groove on dia. M 20

Switch on lathe. End-cut turning tool to take first cut on circumferential surface 20 mm dia. of rotating part. Set depth of cut. Return tool carrier to initial position, switch off machine for dimensional inspection. Inspect surface finish. Cover turning tool for any measuring done on the lathe.

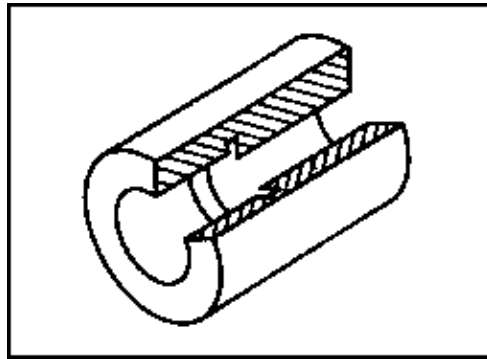
7. Unloading of workpiece

8. Dimensional and surface inspection



Instruction example 4.2.: Clamping bush

This example serves to practise recessing of internal grooves in hollow parts in the form of a thread groove in a clamping bush.



Material

St 34 b – 2 (St = steel, 34 = tensile strength 340 MPa, b = deoxidizing degree: dead, 2 = grade 2)

Dimensions

dia. 70×105 mm

Cutting and operating tools

Hook tool (grind to suit shape and width of recess), chuck key, open–end wrench and box wrench

Measuring and testing tools

Vernier caliper. inside caliper, dial gauge

Accessories

Supporting plates for turning tool, soft chuck jaws, stop, 60 mm block gauge

Required previous knowledge

Reading of drawings, measuring and testing, types and application of clamping tools and accessories

Explanations to the workshop drawing

Thread M 40×1.5: M = metric thread, 40 = nominal dia. in mm,

1.5 = pitch in mm

Fit 30 H 6: 30 = nominal size, H 6 = tolerance for hole

Sequence of operations

Remarks

- | | |
|------------------------------|--|
| 1. Clamping of workpiece | Type of clampings chucking in soft chuck jaws, check for true running. |
| 2. Clamping of tool | Ensure central position with respect to axis of rotation. Short and firm clamping is essential (to avoid chatter marks). |
| 3. Setting of cutting values | Work with low cutting speed since hook tool cannot withstand high forces because of weak cross section. |
| 4. First cut on end face | Set stop and insert 60 mm block gauge. Tool to take first cut on the end face of the rotating part. Remove block gauge, return tool carrier. |

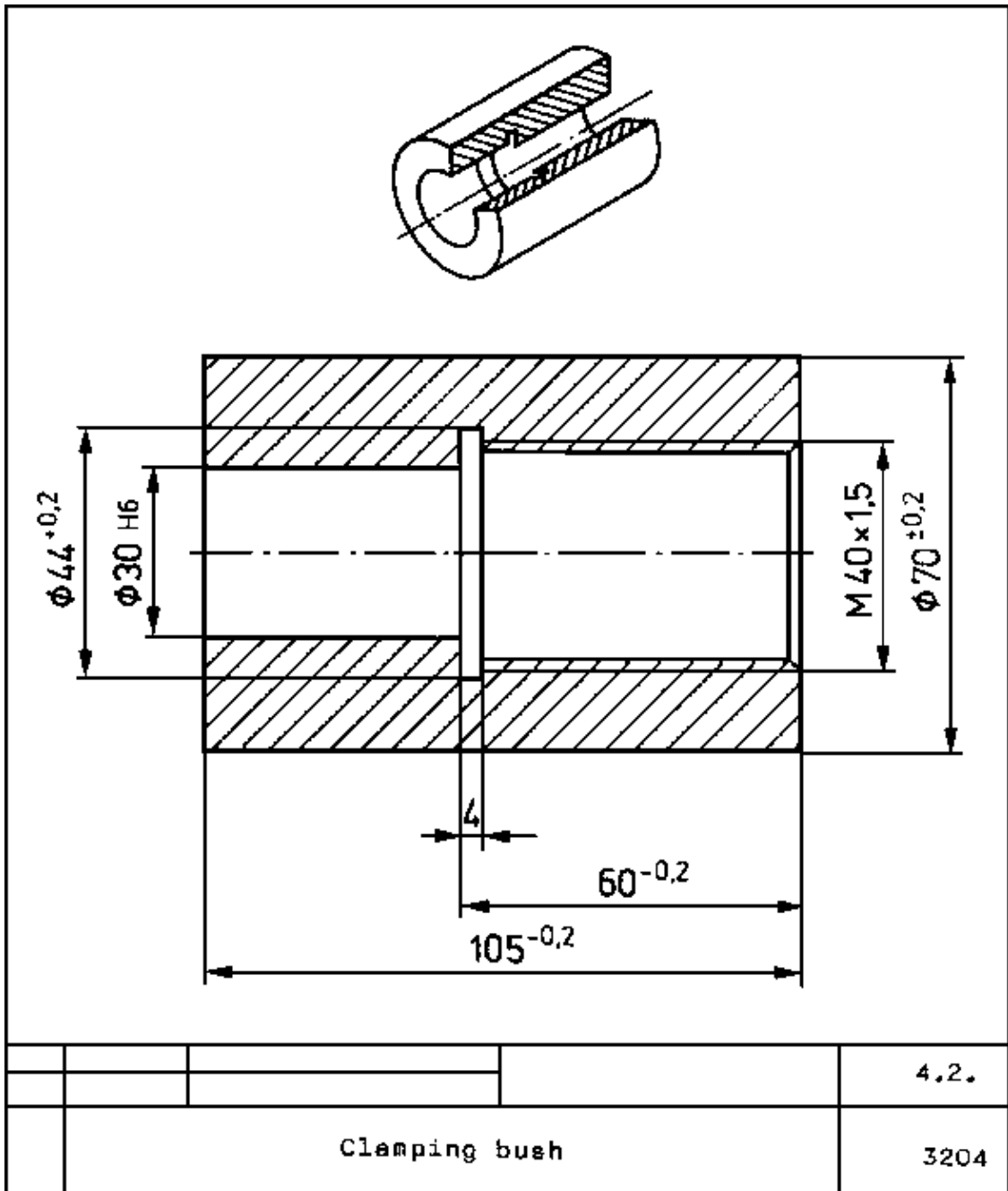
5. Recessing dia. 44

Move tool carrier to stop, take first cut on circumferential surface. Set cross slide scale to "0" and finish turning diameter 44. Return tool carrier to initial position.

6. Unloading of workpiece

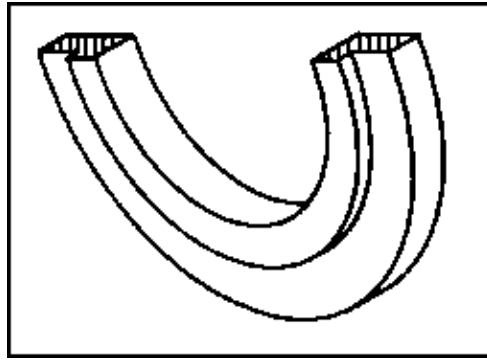
Cover hook tool to avoid accidents.

7. Dimensional and surface inspection



Instruction example 4.3.: Flange

This example serves to practise cutting-out of disks and rings.



Material

St 45 (St = steel, 45 = 450 MPa tensile strength)

Dimensions

dia. 150×15 mm

Cutting and operating tools

Straight right-hand/left-hand end-cut turning tool (width approx. 10 mm), internal side-cutting tool (boring tool) for through holes, chuck key, open-end wrench and box wrench

Measuring and testing tools

Vernier caliper, depth gauge

Accessories

Supporting plates for turning tools, stepped, soft chuck jaws, 14.8 mm block gauge

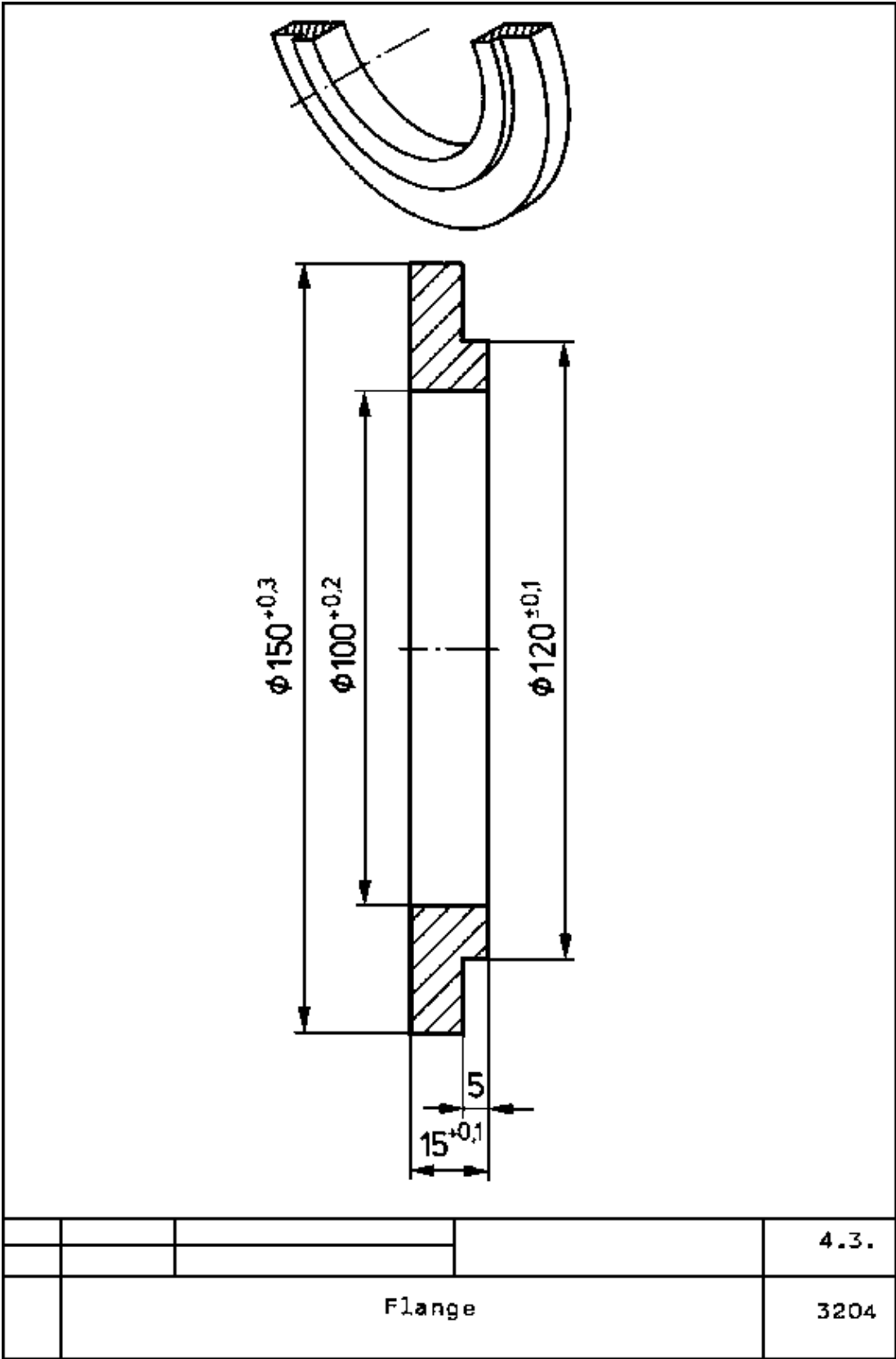
Required previous knowledge

Reading of drawings, measuring and testing, types and application of clamping tools and accessories

<u>Sequence of operations</u>	<u>Remarks</u>
1. Clamping of workpiece	Type of clamping: chucking in soft, stepped chuck jaws.
2. Clamping of tool	Ensure central position and short and firm clamping of tool. Pay attention to proper relief-grinding.
3. Setting of cutting values	Work with low cutting speed since tool cannot withstand high forces because of weak cross section.
4. First cut on end face	Set stop and insert 14.8 block gauge. Turning tool to take first cut on end face of the rotating part. Remove block gauge.
5. Cutting-out dia. 100 mm to 99.5 mm	Since tool cannot withstand high forces because of weak cross section, work with low feed rate and ensure sufficient supply of coolant. Cutting through would imply danger of tool breakage (therefore depth of recess 0.2 mm before cutting through).
6. Unloading of workpiece and tool	Remove core by hammer blows.
7. Clamping of workpiece	
8. Clamping of tool	For round shank use Vee support .

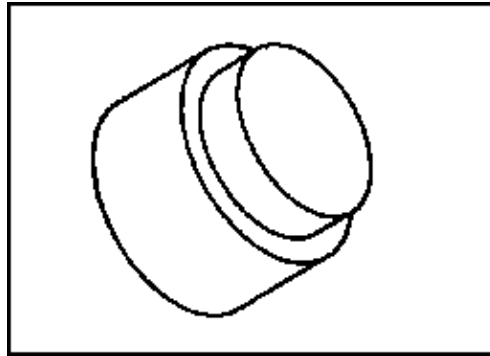
9. Turning dia. 100 mm Primary cutting edge to take first cut on dia. 99.5 mm and set required size. Use internal side-cutting tool.
10. Deburring Chamfer edges.
11. Unloading of workpiece
12. Dimensional and surface inspection.

For batches of workpieces repeat sequence of operations until operation 5 and continue with operation 6 at the end of the batch.



Instruction example 4.4.: Spring plate

This example serves to practise cutting-off.



Material

St 37 (CSt = steel. 37 a 370 MPa tensile strength)

Dimensions

dia. 18 (bars)

Cutting and operating tools

Straight right-hand end-cut turning tool (4 mm), chuck key, open-end wrench and box wrench

Measuring and testing tools

Vernier caliper, steel tape-rule

Accessories

Supporting plates for turning tools, chuck jaws, stop. 9.5 mm and 11 mm block gauges

Required previous knowledge

Reading of drawings, measuring and testing, types and application of clamping tools and accessories

Explanations to the workshop drawing

Rz 20: Description of surface finish

Rz = roughness, 20 = roughness height in μm (finished)

Sequence of operations

Remarks

- | | |
|--|--|
| 1. Clamping of workpiece | Type of clamping: chucking in hard chuck jaws. |
| 2. Clamping of tool | Locate tool exactly in central position. |
| 3. Setting of cutting values | Set low cutting speed since tool cannot withstand high forces because of weak cross section. |
| 4. Moving of tool carrier in working position | Move end-cut turning tool as close to chuck as possible. Fix stop. |
| 5. Set length of workpiece | Set workpiece to 12 mm length by means of steel tape-rule. Move tool carrier to stop. |
| 6. Turning of shoulder 17 mm dia. | |
| 7. Turning of shoulder dia. 13×2 mm and facing of end face 13 dia. | Insert 9.5 mm block gauge. Recess to dia. 13 mm. Insert 11 mm block gauge and face end face. |
| 8. Cutting-off the part | Remove block gauges. Use end-cut turning tool with |

oblique grind to remove cutting-off flash.

For batches of workpieces repeat operations 5 to 8. Face and deburr at the end of the batch with chuck, soft chuck jaws and right-bent roughing tool.

