

**Operations with Shaping Machines – Course: Mechanical  
woodworking techniques. Instruction examples for practical vocational  
training**



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# Operations with Shaping Machines – Course: Mechanical woodworking techniques. Instruction examples for practical vocational training

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## Preliminary Remarks

This material contains five selected instruction examples employing shaping machines.

Varying possibilities of tool utilisation feature equally differing degrees of difficulty. The required materials, machines, tools, aids and devices are given for each instruction example.

Preliminary expertise necessary to prepare and implement the instruction examples is cited.

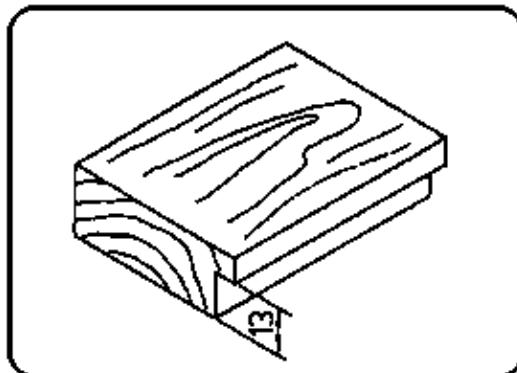
The instruction examples also dwell on wood connections and how these are obtained.

The cited work sequence must be adhered to stepwise in order to ensure optimal work safety of the work–piece being processed. Labour safety provisions must be observed throughout when undertaking instruction example operations.

Each instruction example has attached a workshop drawing showing the dimensions and shape of the work–pieces. Test pieces are selected as instruction examples. Following completion these test pieces yield usable workpieces.

## Instruction Example 4.1.: Workpiece with Fold

Sawing a throughgoing fold in two work sequences employing a circular saw blade.



## Material

Solid wood piece, levelled and milled to 20 mm thickness, small surfaces rectangularly abutted

Dimensions:

minimum length 350 mm  
minimum width 100 mm

## Machines and Tools

Shaping machine, one circular saw blade – diameter about 100 mm, bore 25 mm, two chucking disk – diameter about 40 mm, bore 25 mm

## Measuring and testing means

Folding rule

## Aids and labour safety facilities

Steel strip deflector, pressure comb

## Necessary preliminary knowledge

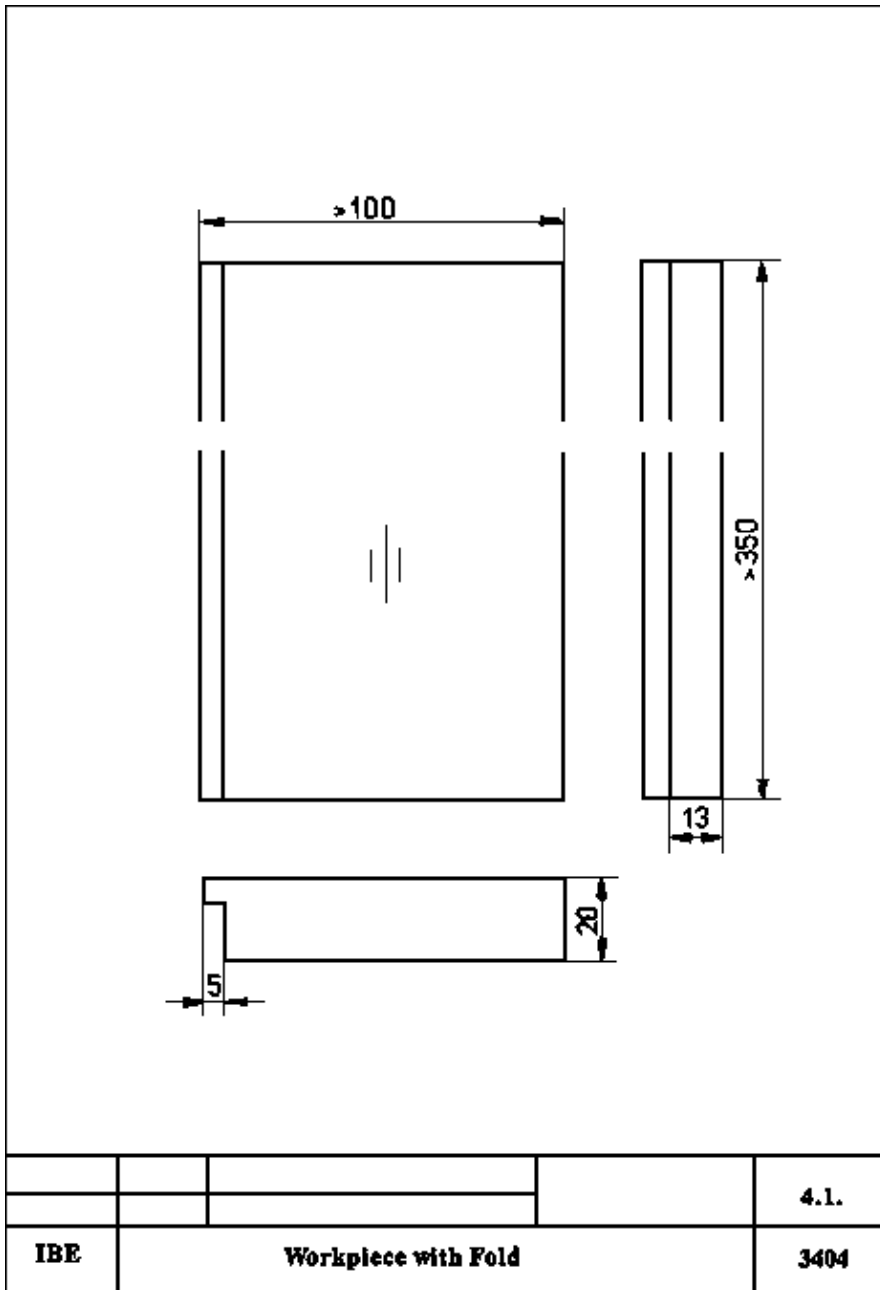
Assembly and function of a shaping machine, labour safety provisions when using a shaping machine, chucking processes whilst engaging in circular sawing operations, reading drawings, measuring and testing

Sequence of operations	Comments
1. Preparing work materials, position reference faces to workpiece.	Check the completeness and sound condition of the workpieces, aids and machine.
2. Arrest the cutter arbor and fix the circular saw blade between two chucking disks to the milling arbor, subsequently remove the catch.	Use a milling arbor (without top bearing tenon) of 25 mm.
3. Fold width = 13 mm to be set, following setting again lock the milling support.	Tool running direction must ensue counter to direction of feed (counter rotation); use sharp tools only!
4. Set the stops of the guide rule in line with the machine tool diameter.	Loosen milling support and set the spindle height at 13 mm between machine table and saw blade top edge.
5. Fold depth = 5 mm to be set, arrest the guide rule after setting.	Set the workpiece in parallel position to the guide rule by the saw blade. Ensure a fold depth of 5 mm.
6. Steel strip deflector is attached to the guide rule.	Position the steel strip deflector about 8 mm above the workpiece. The steel strip deflector should prevent hand contact with the turning workpiece.
7. Check the machine in respect of labour safety requirements.	Ensure that the work table is in a clean condition. Check once again that the tool, stop and steel strip deflector are properly secured. Check the unimpeded running of the spindle.
8. Switch on the exhaust device, switch on the main switch of the machine. Preselect a spindle speed of 3000 min <sup>-1</sup> and then switch on the machine.	Ensure the correct rotational direction of the spindle. A wrong rotational direction can cause serious accidents!
9. Saw the first indentation for the fold.	Place the workpiece with the wide reference face onto the machine table and position the tool in line with the stop rule. Ensure that the hands are kept clear of the tool working area.

10. Switch off the machine and the exhaust facility.	
11. Set up the machine for cutting out the fold depth.	Remove the steel strip deflector. Setting ensues are for the work steps 3., 4. and 5., whereby at the milling support the fold depth is set at 5 mm between the top edge of the saw blade and the machine table. The fold width of 13 mm is set at the guide rule.
12. Fix the pressure comb to the machine table.	The workpiece shall be lightly and evenly pressed to the stop face of the guide rule.
13. Check the machine in respect of adherence to labour safety requirements.	Ensure that the work table is in a clean condition. Check once again that the tool, stop and pressure comb are properly secured. Check the unimpeded running of the spindle.
14. Switch on the machine.	
15. Saw the second indentation for the gold.	Place the workpiece with the narrow reference face onto the machine table and position the tool in line with the stop rule. Ensure that the hands are kept clear of the tool working area. Watch out! Do not remove residue material manually. Danger of accidents.
16. Switch off the machine, main switch and exhaust device.	
17. Check the fold dimensions and control quality parameters.	

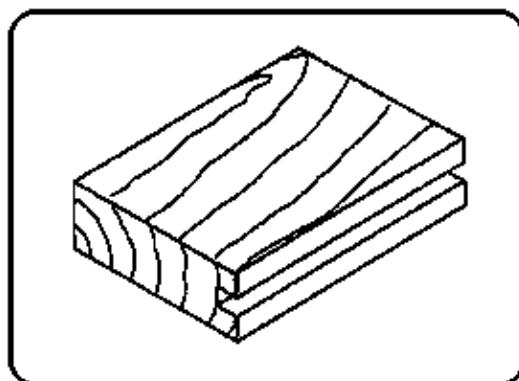
Possible additions

All work steps can be repeated on the opposite narrow faces of the workpiece.



### Instruction Example 4.2.: Workpiece with Groove

Practise the accurate and sound setting up of a shaping machine and become acquainted with the work technique "slot milling" on solid wood pieces.





## Material

Solid wood, levelled and milled to a thickness of 20 mm, small faces rectangularly abutted

Dimensions:

Minimum length 350 mm  
Minimum width 80 mm

## Machines and tools

Shaping machine, slot mill with 6 mm working width

## Measuring and testing means

Folding rule

## Aids and labour safety knowledge

Steel strip deflector

## Necessary preliminary knowledge

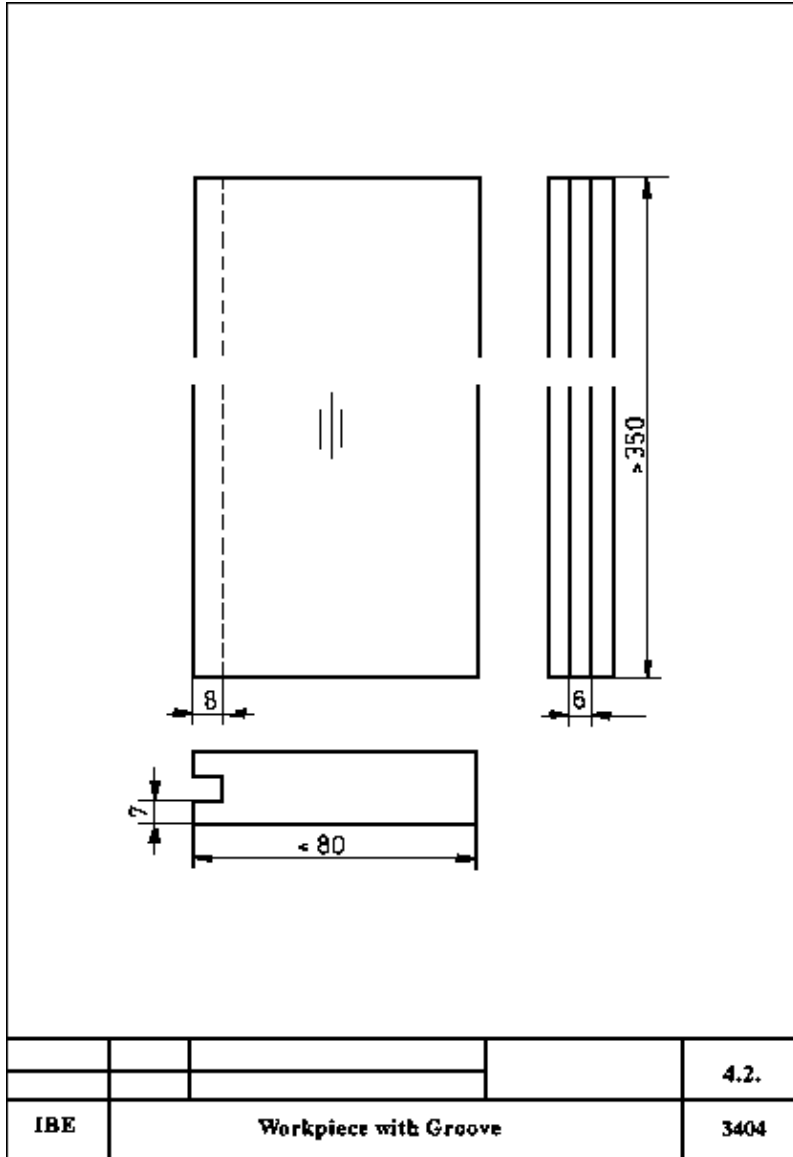
Assembly and function of the shaping machine, basic labour safety provisions when using the shaping machine, knowledge and expertise when setting up a shaping machine, knowledge of chucking processes when handling solid wood, reading drawings, measuring and testing.

Sequence of operations	Comments
1. Position work material and tools. Place the reference faces firmly along the work-piece.	Check for completeness and proper condition.
2. Chuck the tool firmly to the lower part of the cutter arbor, subsequently remove the locating pin from the spindle.	Rotational direction of the tool must be directed against feed motion of the workpiece (counter rotation), otherwise high risk of accidents!
3. Set the measure (7 mm) of the slot cheek between machine table and lower tool edge.	Untighten the milling support, set the measure, then again arrest the milling support.
4. Set the slot depth.	Workpiece is positioned parallel to the stop faces by a fully turned out cutting edge of the tool and the required measure is set on the guide rule. Next arrest the guide rule and align the stop faces to the tool diameter.
5. Tighten the steel strip.	The steel strip deflector is so positioned that there is no manual contact with the tool, however the work process – milling – is not impeded.
6. Check the machine in respect of labour safety stipulations.	Ensure work-table cleanliness. Once again check tool, stop and steel strip deflector for sound positioning and spindle as regards true running.
7. Switch on the exhaust and the main machine switch, preselect the spindle speed (4500 min <sup>-1</sup> ) and switch on the machine.	Ensure correct rotational direction of the spindle, incorrect rotational movement can cause serious accidents!
8. Milling a groove.	Position the workpiece with the broad reference face on the machine table and the narrow reference face to the guide rule and slowly and evenly bring the tool into place.

9. Switch on machine, main switch and exhaust facility.	
10. Dimensional control and checking of the groove quality.	Watch out for chipped edges. These may be caused by blunt tools or a too rapid rate of feed!

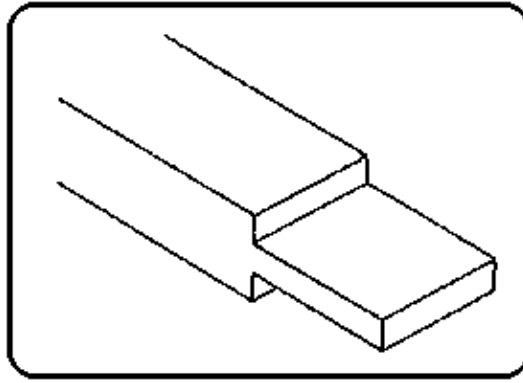
Possible addition

A slot can also be milled into the opposite narrow face.



**Instruction Example 4.3.: Workpiece with Tenon**

Yielding a tenon by means of a circular saw blade, employing a shaping machine in two work steps.



### Material

Solid wood piece, levelled to 30 mm thickness and a width of 50 mm.

Workpiece cut rectangularly at the grain ends

Minimum length: 350 mm

### Machines and tools

Shaping machine, circular saw blade of some 160 mm diameter and a bore fitting the cutting arbor, two chucking disks of some 50 mm diameter.

### Measuring and testing means

Folding rule, try square (scratch), pencil

### Aids and labour safety facilities

One stop board with longitudinal holes and holding screws, one stop strip about 10 mm thick to attach to the guide rule, one guiding facility for processing upright positioned workpieces, one guard spacer or guard cap with a diameter greater than the saw blade.

### Necessary preliminary knowledge

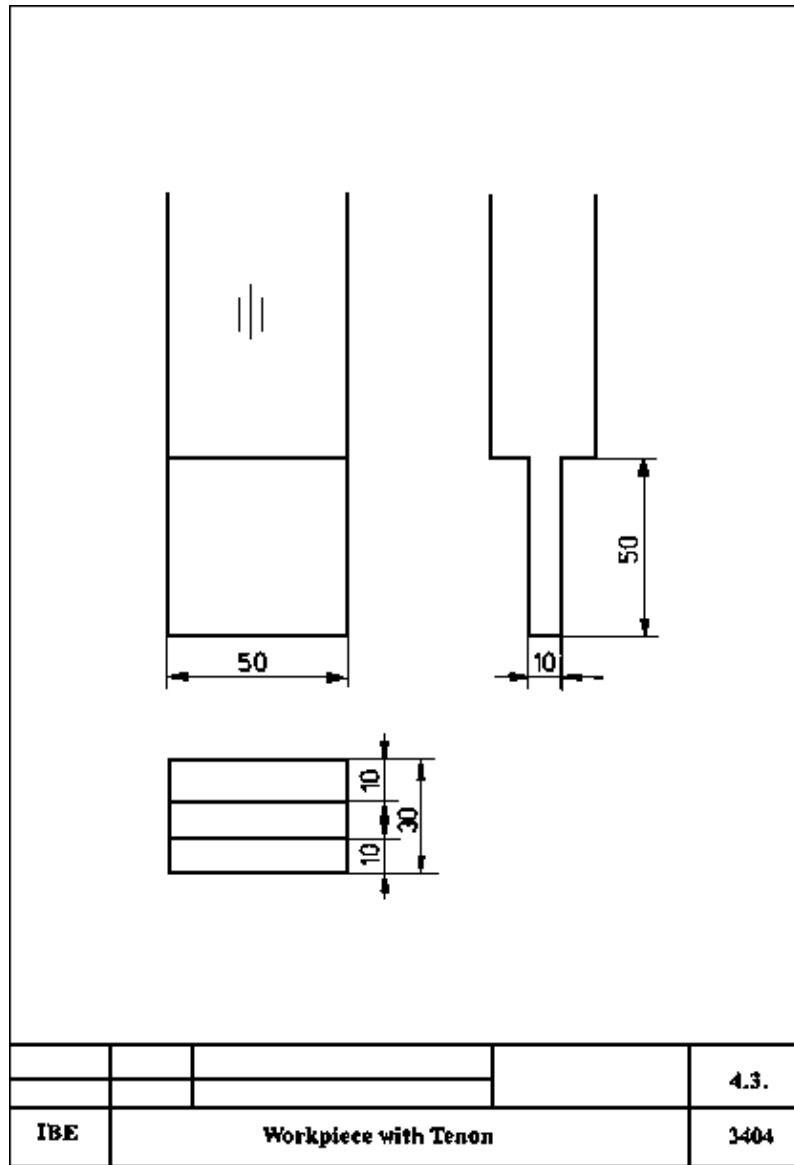
Assembly and function of a shaping machine, labour safety provisions enumerated for various shaping machines, chipping processes whilst circular sawing, reading a drawing, marking a journal, measuring and checking.

Sequence of operation	Comments
1. Position the work materials.	Check for completeness and proper condition.
2. Mark the tenon length = 50 mm with a folding rule and pencil.	
3. Transfert the fissure by means of the try square to all four longitudinal faces of the workpiece.	Use a sharp pencil and ensure accurate marking.
4. Mark the tenon thickness as a scratch or using a pencil.	As opposed to tenon cutting with a hand saw, the tenon need not be completely marked.
5. Position the saw blade onto the cutting arbor, arrange the guard spacer 25 mm above the saw blade and chuck tightly together with the saw blade.	Kerf direction of the saw blade must run counter to the feed direction!  Guard spacer must be bigger than the saw blade. A guard cap may be used instead of a guard spacer.
6. Set the saw blade height on the machine.	Set the spindle with saw blade according to scratch or pencil fissure on the workpiece.

7. Attach the stop board by means of two screws in the through holes of the machine table.	The stop board must be so fixed that the envisaged middle line of the workpiece is directed to the spindle middle.
8. Check the milling spindle for free running, control the stop and the labour safety facility for proper positioning and secure holding.	
9. Switch on the exhaust facility and the main switch of the machine, preselect spindle rotational speed (3000 min <sup>-1</sup> ) and switch on the machine.	
10. Notch the workpiece 2–3 mm both sides in the tenon area and control the measure.	Given measuring inaccuracy the spindle setting can be corrected.
11. Cut a slot.	The tenon length should only be notched to the fissure on the workpiece narrow face.
12. Turn the workpiece and notch the second tenon side.	
13. Switch off the machine, remove the stop board and dismantle guard spacer and saw blade from the cutter arbor.	
14. Set up the saw blade some 50 mm above the machine table.	Guard spacer is not required in the following work sequences.
15. Set the spindle height at 50 mm between machine table and saw blade top edge.	
16. Bring the guide rule into position, align the stop face to the tool diameter and fix the stop strip to the stop faces.	Following alignment of the stop faces to the saw blade, the guide rule is again moved far enough away from the spindle that the saw blade no longer rises above the stop face.
17. Control the unimpeded running of the spindle, check the tool for firm positioning.	
18. Switch on the machine and move the guide rule carefully towards the spindle whereby the saw blade must penetrate the stop strip and extend some 12 mm beyond it.	Select a rotational speed = 3000 min <sup>-1</sup> , ensure correct rotational direction. Move the guide rule slowly and evenly.
19. Switch off the machine.	
20. Set the guide rule.	The rule is set according to the dimensions of the workpiece. The sawn kerf must completely displace the tenon which must not be notched.
21. Switch on the machine (3000 min <sup>-1</sup> ).	
22. Displace the tenon by means of a guide facility, turn the workpiece and also displace the tenon on the rear side.	Kerf direction is lateral to the grain, therefore select a low speed rate. If no guide facility is on hand the tenon must be displaced using the hand saw.
23. Switch off the machine.	
24. Control size consistency and quality parameters attained.	

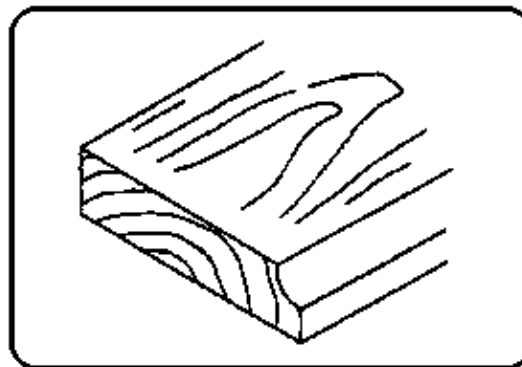
#### Possible additions

The workpiece can have a further tenon fitted at the other end. A tenon can be produced as part of a frame comer joint in conjunction with a slot or a cutting hole.



### Instruction Example 4.4.: Workpiece with Quarter Chamfer

Milling a profile within the area accounted for by the workpiece narrow face, employing a chamfer milling machine.



#### Material

Solid wood piece, levelled and milled to a thickness of 20 mm with narrow faces abutted.

Dimensions:

Minimum length: 350 mm  
 Minimum width: 100 mm

### Machines and tools

Shaping machine, chamfer milling machine

Diameter about 80 mm  
 Radius about 8 mm

(according to tool set at the machine)

### Measuring and testing means

Folding rule

### Aids and labour safety facilities

Spring-loaded comb

### Necessary preliminary knowledge

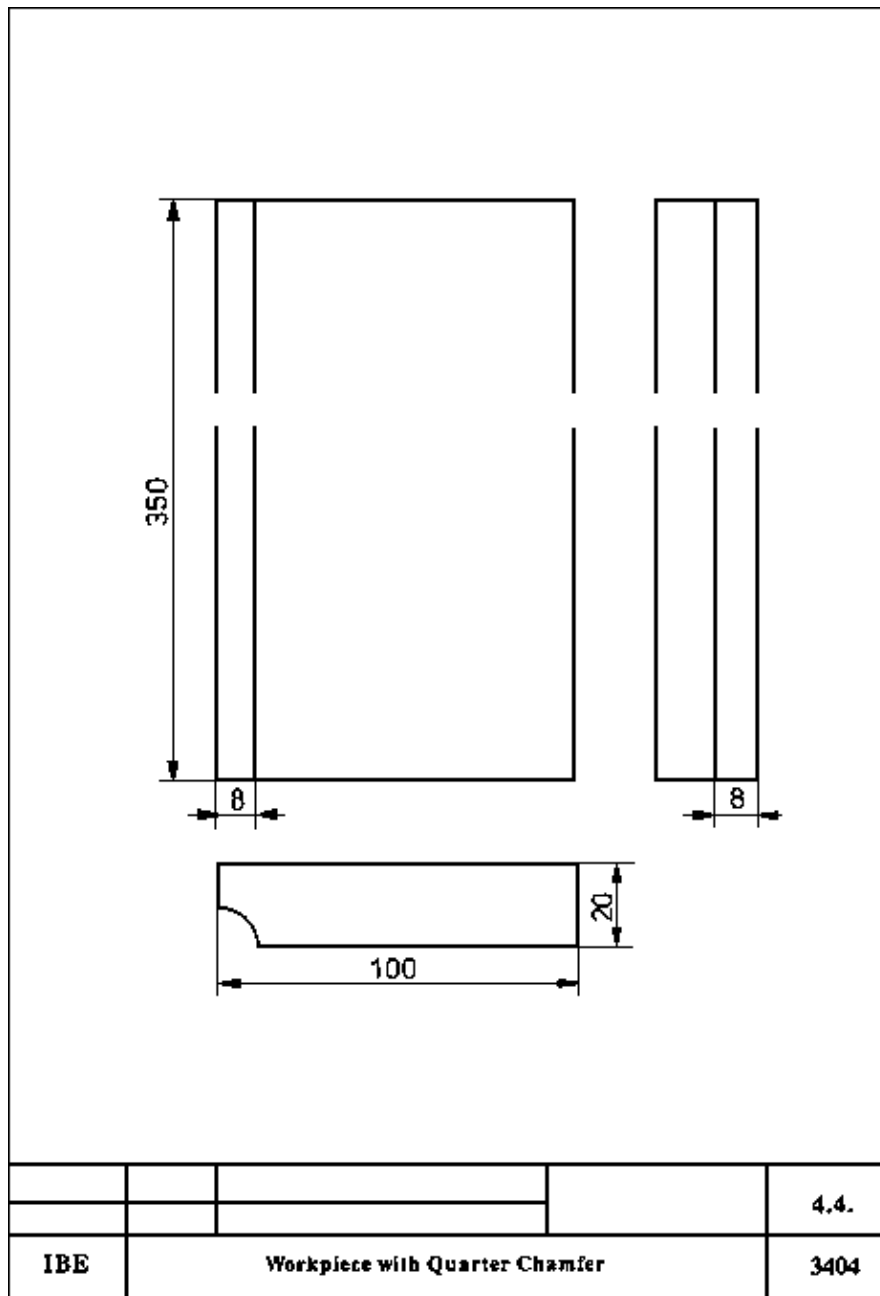
Extensive knowledge of the assembly and function of a shaping machine besides all the essential labour safety measures whilst milling. Read drawings, measuring and testing.

Sequence of operations	Comments
1. Position the work materials and check tools and machines in respect of sound technological condition.	Workpiece length and width are determined by labour safety requirements and must not fall below these dimensions!
2. Mark the rest and bearing surfaces on the work-piece by means of a square sign.	The face of the workpiece to be worked should not feature any knots or knot ends.
3. Attach the tool to the cutter arbor and employ table spacers in line with the tool diameter.	The tool is attached in counter direction to the lower part of the cutter arbor.  The spindle arrest is removed following firm chucking.
4. Set the spindle height at 8 mm between tool top side and machine table.	Position a short, straight strip onto the cylindrical cutter and control the measure of the spindle setting by means of a folding rule.
5. Set the guide rule at 8 mm to the knife cutting circle and arrest.	A tool cutting edge is turned to the maximum engagement size vis-a-vis the stop face.  Position the workpiece parallel to the guide rule on the tool cutting edge and control the measure.
6. Align the stop faces to the knife circle.	
7. Attach the pressure comb to the stop faces of the guide rule.	The pressure comb should completely enclose the tool vis-a-vis the stop faces.
8. Check the proper functioning of the machine.	Ensure that the machine table is clean.  Ascertain that the tool, stop and spring-loaded comb are firmly positioned and check the spindle for unimpeded running.
9. Switch on the exhaust, switch on the main machine switch, preselect the spindle (3000 min <sup>-1</sup> ) and switch on the machine.	Ensure the correct rotational direction (counter running) of the spindle as an incorrect rotational direction can lead to serious accidents!

10. Mill a chamfer. Move the workpiece slowly and evenly towards the tool.	Position the workpiece with the broad reference face onto the machine table and with the envisaged narrow face to the right rule face.
11. Remove the processed workpiece and switch off the machine, main switch and exhaust facility.	
12. Control the measure and attained quality.	Watch out for chipped edges. The chamfer should not evidence any unevenness as hollow chamfers can only be reworked by means of extensive manual operations.

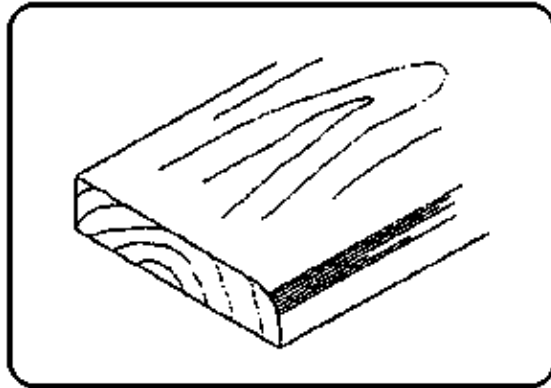
Possible addition

Further chamfers can be milled along the remaining longitudinal edges of the workpiece. Thereby, heed possible slight changes in the workpiece grain sequence and reduce the rate of speed accordingly.



## Instruction Example 4.5.: Workpiece with Quarter Round Chamfer

Milling a quarter round profile.



### Material

Solid wood, levelled and milled to a thickness of 20 mm. Narrow faces rectangularly abutted.

Dimensions:

Minimum length 350 mm  
Minimum width 100 mm

### Machines and tools

Shaping machine, quarter round cutter – diameter about 80 mm, working width approx. 20 mm (according to tool set at the machine)

Measuring and testing means

None

### Aids and labour safety devices

Spring-loaded comb

### Necessary preliminary knowledge

Extensive knowledge concerning the assembly and functioning of a shaping machine, similarly in regard to the necessary labour safety measures when milling by means of cylindrical cutters. Knowledge of chipping processes whilst milling, reading drawings.

### Explanation regarding workshop drawing

The sign “ “ is a square sign and is used to designate reference faces.

Sequence of operations	Comments
1. Position work material and check the proper working order of both tool and machine.	Length and width of the workpiece are determined by labour safety considerations and must not fall below the cited values!
2. Mark the support and bearing surfaces of the workpiece by means of a square sign.	
3. Attach the workpiece to the cutter arbor, employ table rings in line with the tool diameter, the cutting profile points upwards.	Tool is attached in counter running direction to the lower part of the cutter arbor. The spindle is removed following firm chucking.



<p>4. Set the spindle height and arrest the spindle.</p>	<p>Position the workpiece with the support surface on the machine table and the wood grain end to be processed facing the cutting profile.</p> <p>Set the spindle height so that the profile is evenly imprinted into the working face.</p>
<p>5. Set and arrest the guide rule.</p>	<p>Position the workpiece for processing to the right stopstrip. The wood grain end is facing the cutting profile. Set the guide rule so that the curve is evenly imprinted into the bearing surface.</p>
<p>6. Attach the pressure comb to the stop faces of the guide rule.</p>	<p>Pressure comb should completely enclose the tool vis-à-vis the stop faces.</p>
<p>7. Functionality control of the machine.</p>	<p>Ensure that the machine table is clean and that tool, stop and spring-loaded comb are firmly positioned. Check the spindle for unimpeded running.</p>

