

**Straightening – Course: Technique of Working Sheet Metals, Pipes and Sections. Instruction Examples for Practical Vocational Training**



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# **Straightening – Course: Technique of Working Sheet Metals, Pipes and Sections. Instruction Examples for Practical Vocational Training**

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## **Preliminary Remarks**

This material contains 5 selected instruction examples by which different ways of straightening metal sheets, pipes and sections can be practised.

These exercises consist in straightening bent and buckled metal sheets, flat materials and square sections, distorted flat materials and square sections, bent angle sections and pipes as well as bulged and corrugated metal sheets.

The basic materials may be prepared in any size by being deformed according to the defects indicated in the working drawings.

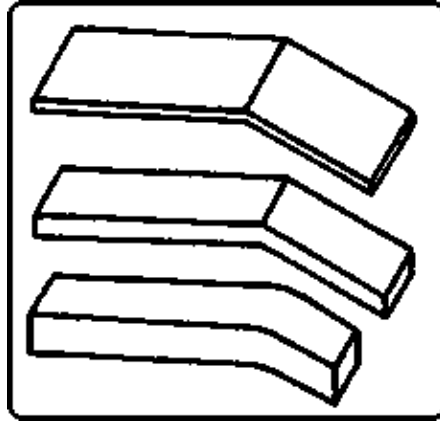
In order to facilitate the preparation for and carrying out of the work, the required materials, tools, devices, measuring and testing instruments as well as auxiliary means are specified for each instruction example.

Moreover, the basic knowledge is mentioned which is required for the implementation of the tasks. On the basis of the working drawings and the relevant sequence of operations the exercises can be done independently.

## **Instruction Example 15.1. Bendings and Bucklings**

Practise the straightening of buckled metal sheets and flat material as well as bent square sections by means of the hand screw press, the locksmith's hammer and the welding torch.

### **Material**



– Steel sheet (300 MPa) (1)

thickness: 2 mm

width: 80 mm

length: 250 mm

– Flat material (380 MPa) (2)

thickness: 8 mm

width: 30 mm

length: 250 mm

– Square section (380 MPa) (3)

thickness: 15 mm

length: 250 mm

### Tools and devices

Locksmith's hammer, hand screw press, welding torch with accessories

### Measuring and testing means

Surface plate, workshop ruler, steel rule

### Auxiliary means

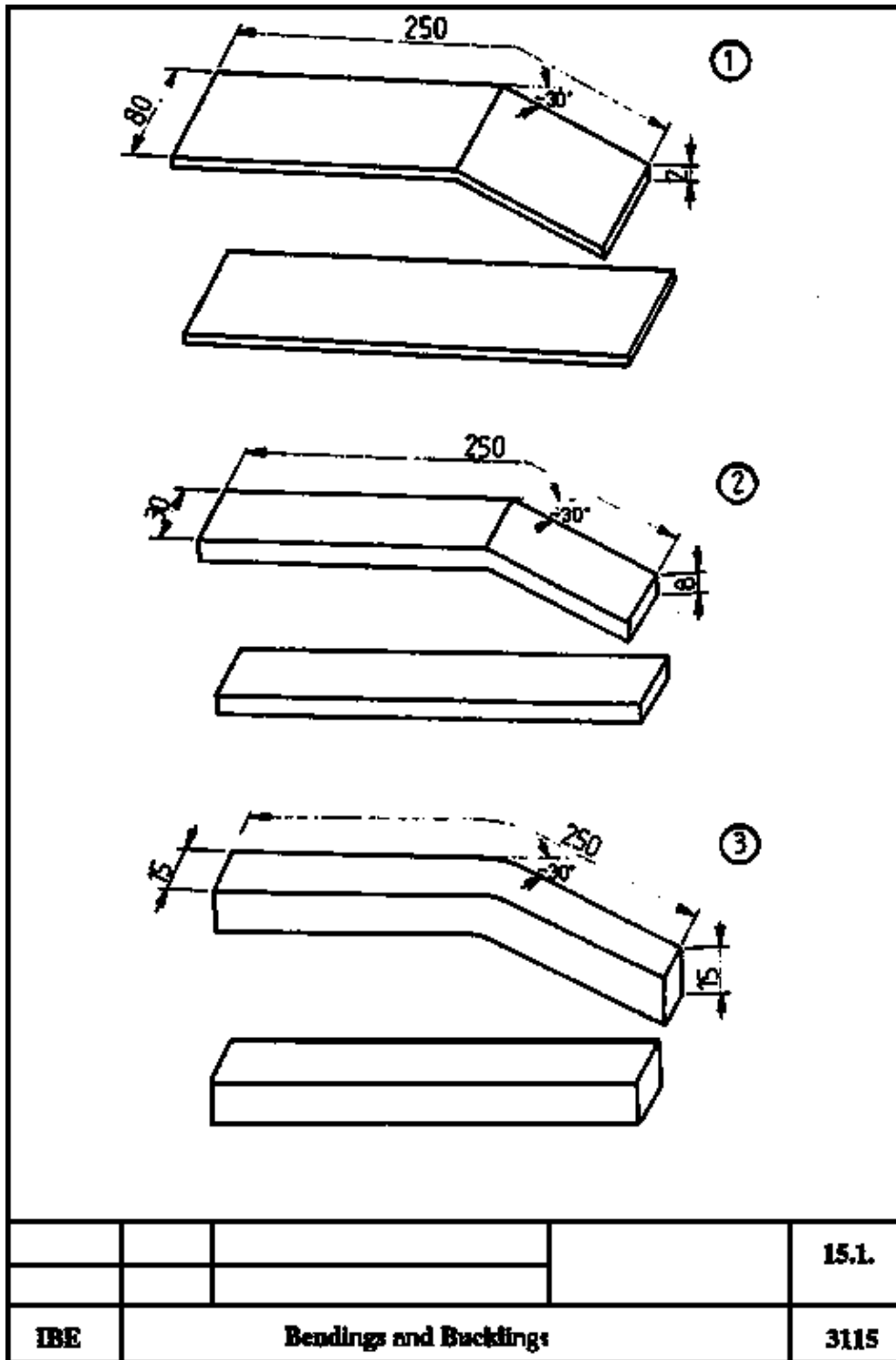
Straightening plate or anvil, vice

### Required previous knowledge

Manual working of materials: testing, hammering

Sequence of operations	Comments
1. Prepare the working place; make available the working material.	– Check for completeness.
2. Put the buckled steel sheet (1) under the flat punch of the hand screw press, then let the screw move down by a powerful swing.	– Protect hands and head when the screw gets down.
3. Put the straightened steel sheet on the surface plate and check its evenness – if necessary straighten it again.	– When touching the corners of the metal sheet with the finger, the sheet

	metal must not wobble.
4. Clamp the buckled flat material (2) vertically in the vice and straighten the projecting end opposite to the direction of the buckling; by means of hammer blows with the locksmith's hammer then flatten it on the straightening plate by even hammer blows.	– The buckling must be exactly above the jaws of the vice.
	Do not strike too many hammer blows – embrittlement
5. Check the straightened flat material for evenness by means of the workshop ruler on the surface plate.	
6. Clamp the bent square section (3) laterally in the vice; heat up the bent end by the welding torch and straighten it with the help of the locksmith's hammer.	– Attention! Danger of fire!
	– The welding torch is allowed to be operated only after instruction by the instructor.
7. Check evenness of the straightened square section by means of the workshop ruler.	

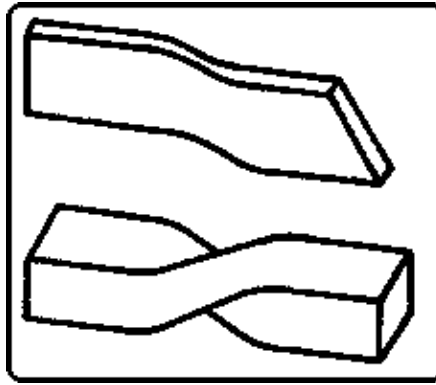


Bendings and Bucklings

### Instruction Example 15.2. Twistings

Practise the straightening of twisted flat material and square sections by means of moving irons and tap wrenches.





### Material

– Flat material (380 MPa) (1)

thickness: 5 mm

width: 30 mm

length: 250 mm

– Square section (380 MPa) (2)

thickness: 10 mm

length: 250 mm

### Tools

Moving iron, tap wrench, locksmith's hammer

### Measuring and testing means

Surface plate, workshop ruler, steel rule

### Auxiliary means

Vice

### Required previous knowledge

Manual material working: testing, hammering

Sequence of operations	Comments
1. Prepare the working place; make available the working material.	– Check for completeness.
2. Clamp the twisted flat material laterally in the vice – the twisted end must project.	– Part (1)
3. Undo the torsion with the help of the moving beginning directly at the vice; in doing so, the moving iron is shifted step by step in outward direction.	– Consider the elastic recovery when turning backwards.
4. Take the flat material out of the vice and rework it by hammering on the straightening plate if it is not even enough.	– Strike even hammer blows towards the end.
5. Check evenness of the material on the surface plate or by the workshop ruler.	
	– Part (2)

6. Clamp the distorted square section laterally in the vice – the twisted end must project.	
7. Apply an appropriate tap wrench to the beginning of the twisting and move it in the opposite direction of the twisting.	– When turning backwards, do not bend the square section to the side.
	– Consider the elastic recovery.
8. Check evenness on the surface plate or by means of workshop ruler.	

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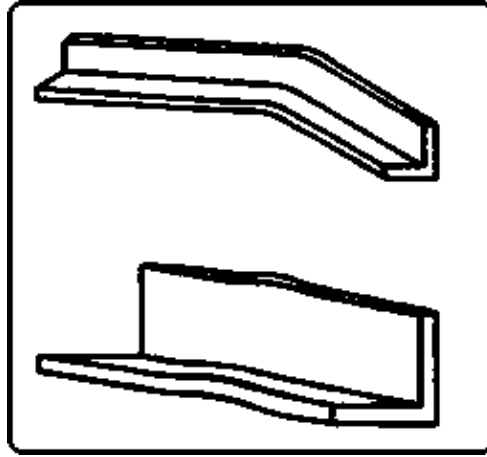
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		<b>15.2.</b>
<b>IBE</b>	<b>Twistings</b>	<b>3115</b>

Twistings

### Instruction Example 15.3. Bent Angle Section

Practise the straightening of bent angle sections with the help of the locksmith's hammer and the welding torch.



**Material**

Angle section (380 MPa) (1)

width of leg: 20 mm

length: 300 mm

Angle section (380 MPa) (2)

width of leg: 45 mm

length: 300 mm

**Tools and devices**

Locksmith's hammer, welding torch with accessories

**Measuring and testing means**

Surface plate, workshop ruler, steel rule

**Auxiliary means**

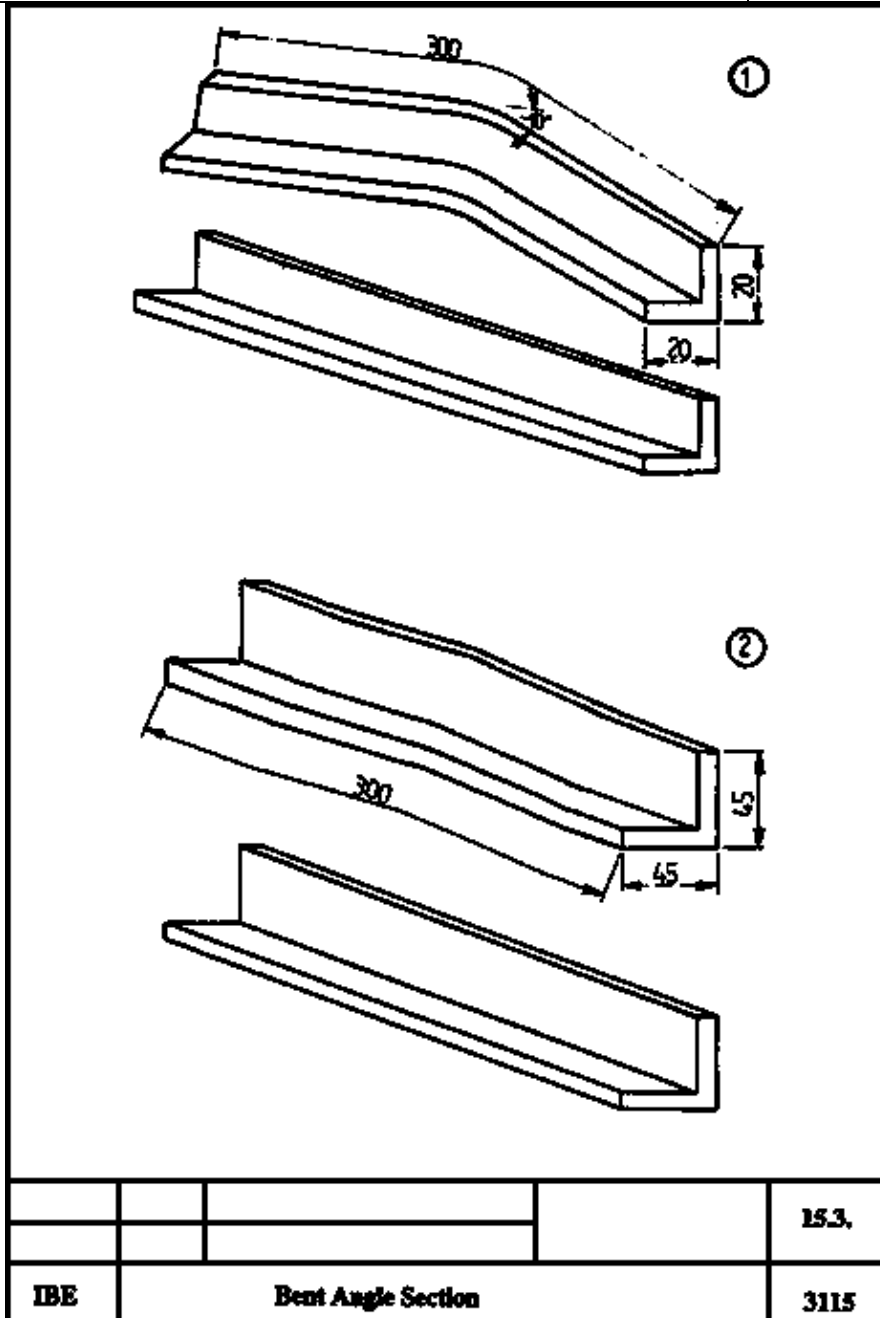
Straightening plate or anvil, bucket with cold water, a number of wool rags

**Required previous knowledge**

Manual material working: testing, hammering

Sequence of operations	Comments
1. Prepare the working place. Make available the working material.	– Check for completeness.
2. Put the unilaterally bent angle section on the straightening plate. Then, strike even hammer blows by the peen of the hammer on the upset side of the straight part to the end of the angle section.	– Part (1)
3. Check evenness on the surface plate or by the workshop ruler.	
4. Put the angle section which is bent on both sides on a non-inflammable support with water-soaked wool rags on either side of the bent part.	– Part (2)
	– Pay attention to fire protection!

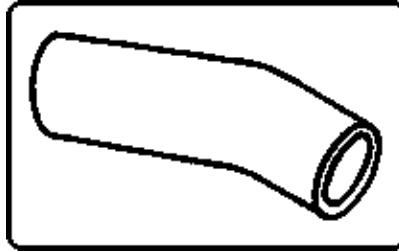
	– The wool rags prevent thermal diffusion.
5. Heat the bent part quickly to red-hot condition, then let it cool down slowly–the bending disappears automatically.	– Keep the wool rags wet!
	– The welding torch is allowed to be operated only after instruction by the instructor.
6. Check evenness on the surface plate or by the workshop ruler, restraighthen if required.	



Bent Angle Section

### Instruction Example 15.4. Bent Pipe

Practise the straightening of a bent pipe with the help of a locksmith's hammer.



**Material**

- Steel pipe (380 MPa)
- diameter: 1 inch
- length: 300 mm

**Tools**

Locksmith's hammer, knife

**Measuring and testing means**

Surface plate, steel rule

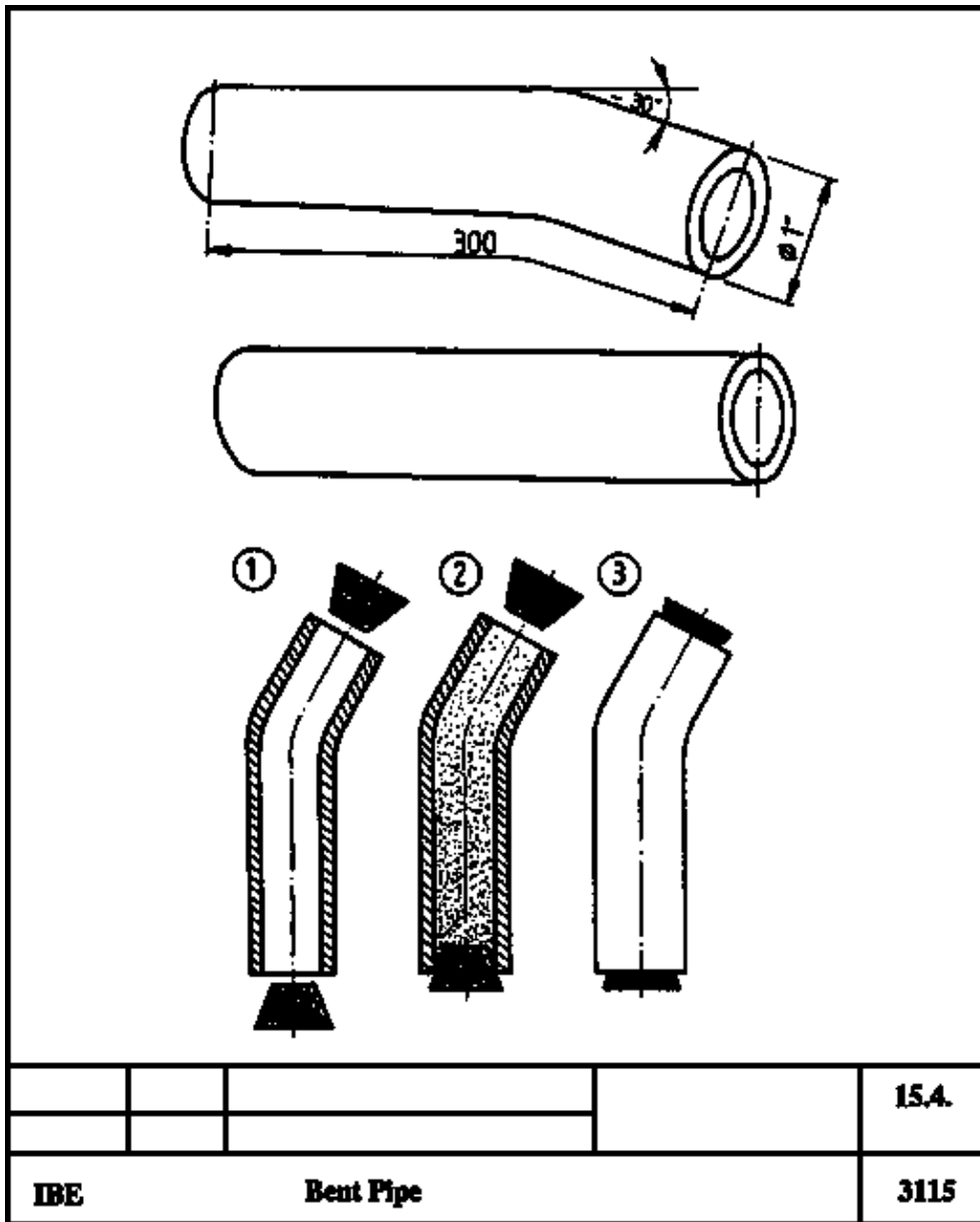
**Auxiliary means**

Vice with prism jaws, box with fine grained sand, 2 wooden plugs, funnel

**Required previous knowledge**

Manual material working: testing, hammering

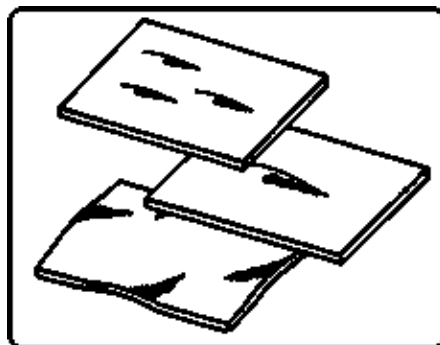
Sequence of operations	Comments
1. Prepare the working place. Make available the working material.	- Check for completeness.
2. Check the steel pipe on both ends burr, cut two wooden plugs of truncated cone shape and adapt them to the internal diameter of the pipe.	- Stage (1)
	- The pipe should be firmly closed when the wooden plug is put in by half its length.
3. Close one end of the pipe firmly with the wooden plug, then fill the pipe completely with sand.	- Stage (2)
4. Strike the pipe shortly on the floor several times.	- The sand filling becomes compact by jolting.
5. Take off some sand and knock the second wood plug firmly into the pipe.	- Stage (3)
6. Clamp the pipe into the vice and straighten it with the help of the locksmith's hammer or by bending.	- Do not slip off!
7. Check evenness by rolling the pipe on the surface plate.	
8. Remove the wooden plugs and the sand filling.	



Bent Pipe

### Instruction Example 15.5. Dented and Corrugated Metal Sheets

Practise the straightening of dented and corrugated sheet metal by means of the straightening hammer or the roller straightening machine.



Material

3 pieces (1) (2) (3)  
of steel sheet (380  
MPa)

thickness: 3 mm

width: 300 mm

length: 400 mm

### Tools and machines

Straightening hammer, roller straightening machine

### Testing means

Surface plate

### Auxiliary means

Straightening plate

### Required previous knowledge

Manual material working: testing, hammering

Sequence of operations	Comments
1. Prepare the working place, make available the working material.	– Check for completeness.
2. Put the steel sheet which is damaged by small dents on the straightening plate and straighten the dents with the help of the straightening hammer.	– Part (1)
	– Place the hammer blows directly on the dents.
3. Check the steel sheet for evenness.	
4. Put the steel sheet that has a large dent on the straightening plate and place hammer blows around the dent in outward direction.	– Part (2)
	Place the hammer blows closer together towards the rim of the steel sheet
5. Check the steel sheet for evenness.	
6. Put the corrugated sheet on the straightening plate and strike hammer blows from the rim of the steel sheet inwards.	– Part (3)
	– Place the hammer blows closer together towards the centre of the steel sheet.
7. Check the steel sheet for evenness.	

If a roller straightening machine is available:

Shove the steel sheets that show deformations as mentioned under (2) and (3) through the roller of the straightening machine without any further manual treatment Check evenness.

					15.5.
<b>IBE</b>	<b>Dented and Corrugated Metal Sheets</b>				<b>3115</b>

Dented and Corrugated Metal Sheets