

**Threaded Joints – Course: Techniques of Fitting and Assembling  
Component Parts to Produce Simple Units. Instruction Examples for  
Practical Vocational Training**



# Table of Contents

<b><u>Threaded Joints – Course: Techniques of Fitting and Assembling Component Parts to Produce Simple Units. Instruction Examples for Practical Vocational Training</u></b> .....	1
<u>Preliminary Remarks</u> .....	1
<u>Instruction Example 33.1. Making a Threaded Joint</u> .....	1
<u>Instruction Example 33.2. Making a Threaded Joint with Locking Devices</u> .....	4
<u>Instruction Example 33.3. Making a Container with Lid</u> .....	7
<u>Instruction Example 33.4. Making a Pipe Joint</u> .....	10



# Threaded Joints – Course: Techniques of Fitting and Assembling Component Parts to Produce Simple Units. Instruction Examples for Practical Vocational Training

Institut für berufliche Entwicklung e.V.  
Berlin

Original title:  
Lehrbeispiele für die berufspraktische Ausbildung  
“Schraubverbindungen”

Author: Frank Wenghöfer

First edition © IBE

Institut für berufliche Entwicklung e.V.  
Parkstraße 23  
13187 Berlin

Order No.: 90–33–3133/2

## Preliminary Remarks

The present material includes four selected instruction examples by means of which methods of making threaded joints can be practised. In doing so, the trainees use different types and kinds of bolts, screws, nuts and locking elements.

In the exercises which are described in this material they shall practise making simple threaded fastening joints with bolts, screws and nuts, consolidating at the same time their abilities in thread cutting. In another exercise, a container is to be made by screwing together sheets. In the final example two pipes are to be joined through a bell piece. The prepared parts which are to be joined should merely be accurate in size and angle. The trainees are required to cut all threads.

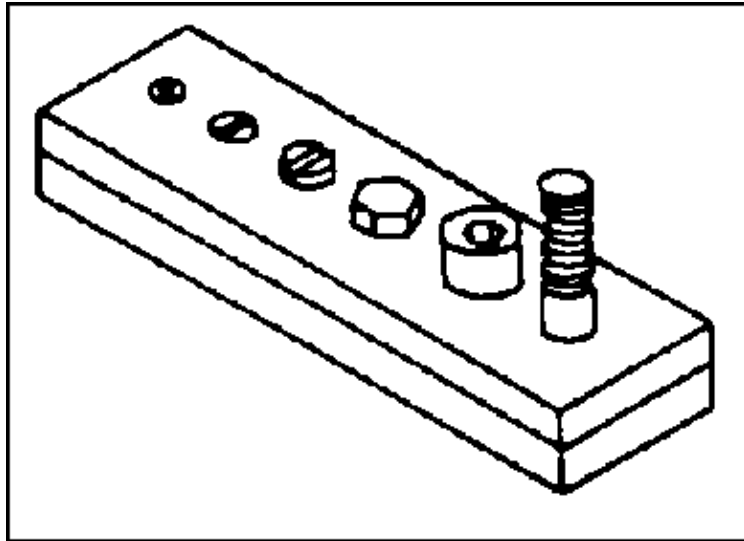
For each instruction example, the necessary materials, tools, measuring and testing means, as well as auxiliary accessories are specified to facilitate the preparation and execution of the work. Furthermore, the previous knowledge is given that is required to carry out the exercises. The working drawings and sequences of operations which are attached to the respective exercises shall help the trainees to accomplish them independently.

## Instruction Example 33.1. Making a Threaded Joint

The purpose of this exercise is to assemble component parts using different types of screws and bolts. The techniques of cutting internal thread is involved, and knowledge of this has been assumed.

### Material

- 2 pcs. of flat metal, any type 10 mm thick, 20 mm wide, 140 mm long
- 1 pc. countersunk bolt with intersecting slot M4 x 12, (1)
- 1 pc. countersunk bolt with cross slot M5 x 14, (2)
- 1 pc. Cheese head bolt with cross slot M6 x 16, (3)
- 1 pc. Hexagonal head screw M8 x 18, (4)
- 1 pc. Hexagonal socket-head screw M10 x 20, (5)
- 1 pc. Stud bolt M12 x 8, (6)



## Tools

Drilling machine with accessories, marking gauge, steel scribe, centre punch, locksmith's hammer, drills acc. to the dimensions of the minor thread diameter and the through holes, 60° and 90° included angle countersinks, nut taps for the dimensions of the bolt threads, screw drivers for cross slot and intersecting slot screws, open ended wrenches 13/17, hexagon pin-type wrench 8 mm, two open ended wrenches 17/19.

## Measuring and testing means

Vernier calliper, try square

## Auxiliary accessories

Vice, tap wrench, cutting fluid, two hexagon nuts M12, clamp, machine grease

## Necessary previous knowledge

Manual material working: Measuring, testing, marking, punching, drilling, countersinking, thread cutting.

## Sequence of operations

## Comments

- |   |  |
|---|--|
| 1. Prepare your workplace, make all tools, component parts, etc. available  | Check for completeness   |
| 2. Check all dimensions and angles for correct specifications.  | All faces should be clean and even.                              |
| 3. Clamp the flat component parts together.   | Use clamping fixture.  |
| 4. Mark the drill centres, punch and drill all holes with drills of the sizes of the minor threaded diameters.                    | Calculate the bore hole diameter from the equation $D = N - S$ . |
| 5. Take the components apart, spotface the bottom ends of the bore holes and cut internal thread for the intended bolt dimension. | Use 60° included angle countersink.                              |

6. Cut internal thread in the upper portion of hole (6), bore all other holes for the intended bolt sizes in the through holes.

7. Bore and countersink holes for bolts (1) and (2) in the upper portion.

Use 90° included angle countersink.

8. Put the flat component parts together and insert bolts (1) to (5) successively.

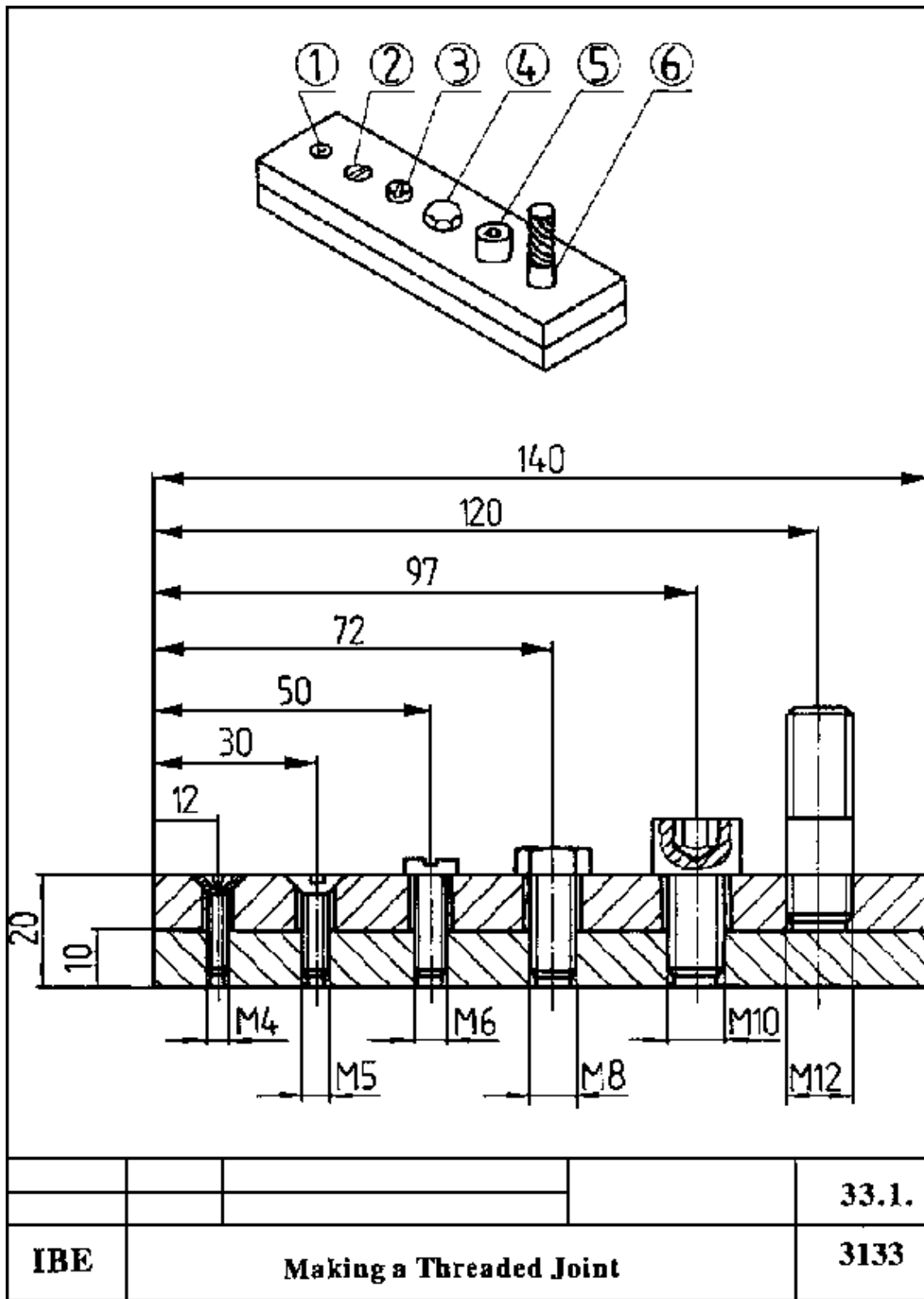
Apply grease to the thread.

9. Screw a nut and a counternut on bolt (6) and tighten, then screw in.

Remove nut and counternut again.

10. Check the threaded joint.

Check for tightness and the flush seat of the bolt heads. Heads are to be flush with the surface of the component of the joint.



Making a Threaded Joint

### Instruction Example 33.2. Making a Threaded Joint with Locking Devices

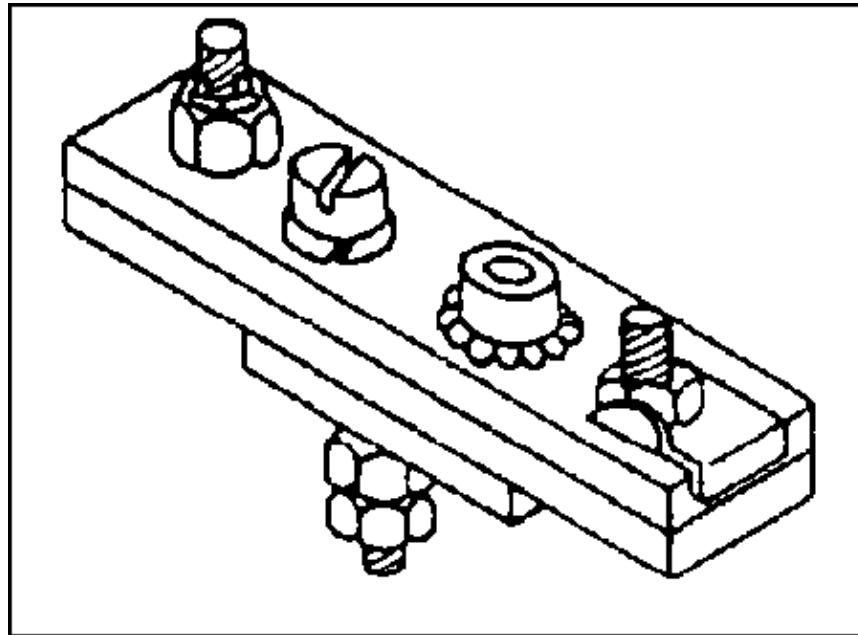
The purpose of this exercise is to assemble component parts using different types of locking devices.

#### Material

- 2 pcs. of flat metal, any type 10 mm thick, 20 mm wide, 140 mm long
- 1 pc. of flat metal, any type 5 mm thick, 20 mm wide, 50 mm long



- 2 pcs. Hexagon head bolt M8 x 30, (1) and (4)
- 1 pc. Cheese head bolt with cross slot M8 x 15, (2)
- 1 pc. Hexagonal socket-head screw M8 x 15, (3)
- 1 pc. Stud bolt M8, (5)
- 3 pcs. Hexagon nut
- 1 pc. Crown nut M8 with cotter pin
- 1 pc. each of spring ring, toothed lock washer, locking plate with tang for threaded bolt M8



### Tools

Drilling machine with accessories, marking gauge, steel scribe, centre punch, locksmith's hammer, drills 2 mm, 6.75 mm and 9 mm diameters, 60° included angle countersink, nut tap M8, screw drivers, hexagon pin-type wrench 6 mm, two open ended wrenches 13/17, flat chisel.

### Measuring and testing means

Vernier callipers, try square

### Auxiliary accessories

Vice, tape wrench, cutting fluid, clamping fixture, machine grease

### Necessary previous knowledge

Manual material working: Measuring, testing, marking, punching, drilling, countersinking, thread cutting

### Sequence of operations

### Comments

- |   |                                      |
|---|--------------------------------------|
| 1. Prepare your workplace, make all component pieces, tools etc. available. | Check for completeness.              |
| 2. Check the dimensions and angles for correct specifications.              | All faces should be clean and level. |
| 3. Clamp together the two flat components 10 x 20 x 140.                    | Use clamping fixture.                |

4. Mark, punch and drill the through holes (1) to (4). Use 6.75 mm drill.

Read marking dimensions from the workshop drawing.

5. Take the two parts apart, clamp the lower component together with the flat component 5 x 20 x 50 and drill hole (5).

6. Take the two components apart and cut thread in holes (2), (3) and (5) of the lower component 10 x 20 x 140. Bore all holes with 9 mm drill.

Check the components carefully for boring. Make sure that they cannot be displaced.

7. Grease the bolts, put the locking devices in place and screw in tightly.

Hole (1): Crown nut with cotter pin

– Drill hole cotter pin (2 mm dia.) after tightening.

Hole (2): Spring ring

Hole (3): Toothed lock washer

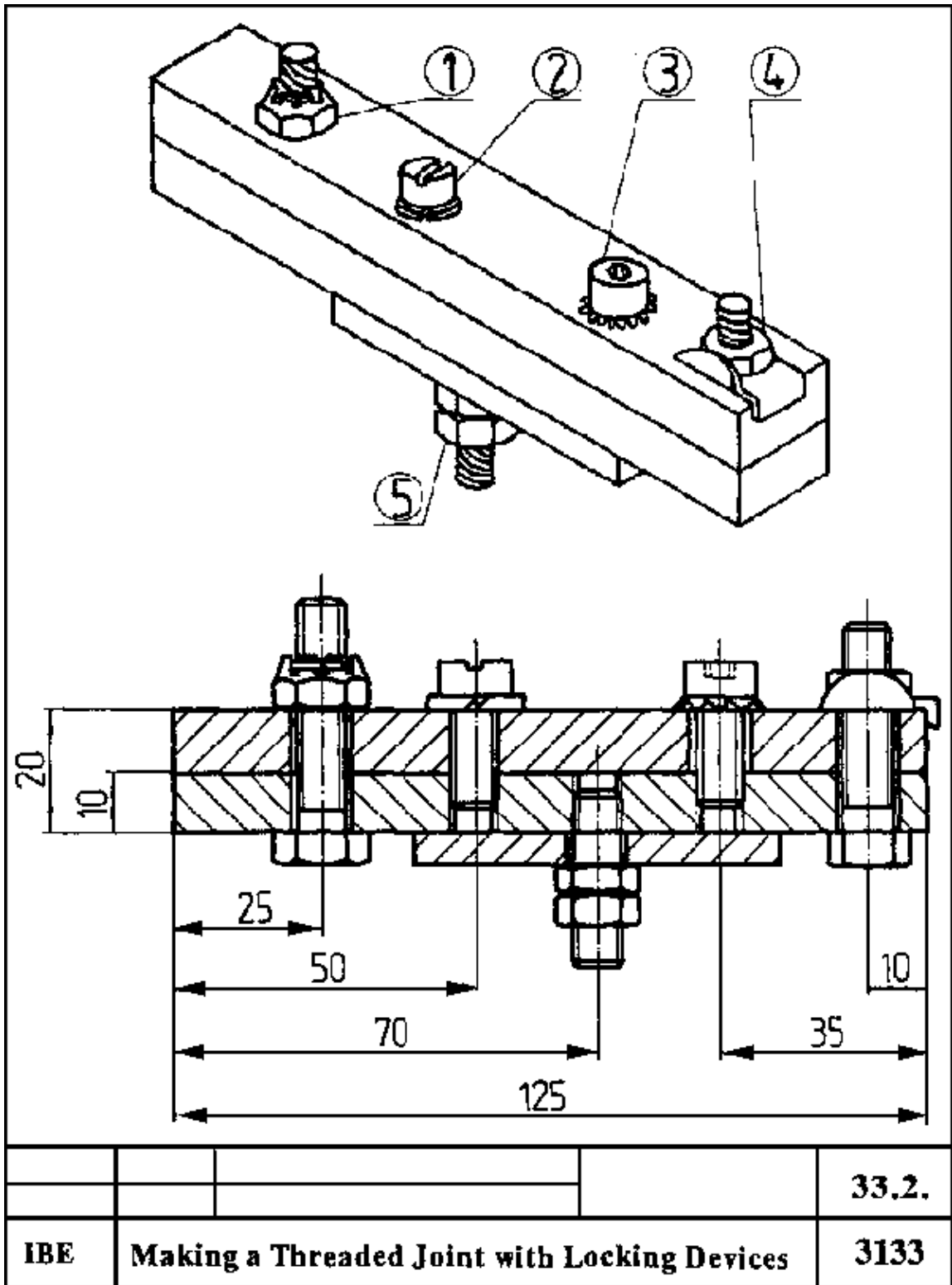
Hole (4): Locking plate with tang

Hole (5): Nut and conternut

– Lift the side of the locking plate with a flat chisel and turn over.

8. Check the joints and locks.

Check the joints for tightness, the dimensions and position of the locking devices.



Making a Threaded Joint with Locking Devices

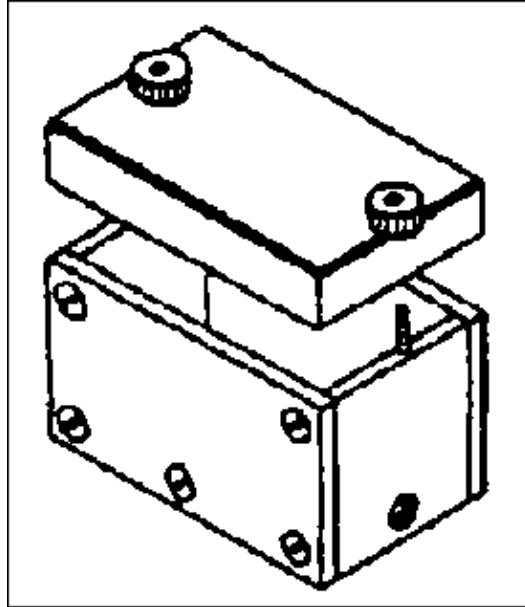
### Instruction Example 33.3. Making a Container with Lid

The purpose of this exercise is to make screwed joints using countersunk screws and stud bolt.

#### Material

- 2 pcs. of metal plate, any type 8 mm thick, 84 mm wide, 100 mm long
- 3 pcs. of metal plate, any type 8 mm thick, 100 mm wide, 150 mm long
- 1 pc. of metal plate, any type 8 mm thick, 84 mm wide, 134 mm long

- 12 pcs. Countersunk screws M4 x 14, (1)
- 2 pcs. Stud bolt M4, (2)
- 2 pcs. Knurled nut M4, (3)



**Tools**

Drilling machine with accessories, marking gauge, steel scribe, centre punch, locksmith's hammer, drills 3.3 mm, 4.2 mm diameter, 90° included angle countersink, serial tap M4, screw driver, two open ended wrenches 5.5/7

**Measuring and testing means**

Vernier callipers, try square

**Auxiliary accessories**

Clamping fixture, two hexagon nuts M4, lap wrench, cutting fluid

**Necessary previous knowledge**

Manual material working: Marking, testing, measuring, punching, countersinking, thread cutting

**Sequence of operations**

**Comments**

- |   |                                   |
|---|-----------------------------------|
| 1. Prepare your workplace, make all component parts, tools, etc. available. | Check for completeness.           |
| 2. Check the dimensions and angles for correct specifications.              | All faces must be clean and even. |
| 3. Clamp on front end part with the bottom of the container.                | Use clamping fixture.             |
| 4. Mark, punch and drill hole of 3.3 diameter, 18 mm deep.                  |                                   |

5. Take the clamped components apart, drill front end part up to hole diameter of 4.2 mm and countersink with 90° included angle tool. Countersunk hole diameter is 7 mm.

6. Tap container bottom, use serial tap M4.

Consider correct angles.

7. Fit second front end part to container bottom.

Repeat operations Nos. 3 to 6.

8. Screw together the two front end parts and the bottom part.

Use countersunk screws M4, (1).

9. Chuck the two side plates to the assembled parts and proceed.

Repeat operations Nos. 4 to 6.

10. Remove screws from side plates. Put on the lid.

Bore holes in the lid and the container to 3.3 mm dia.  
Bore holes in the lid up to 4.2 mm dia.  
Cut thread in container.

11. Screw stud bolts (2) into container, use hexagon nuts.

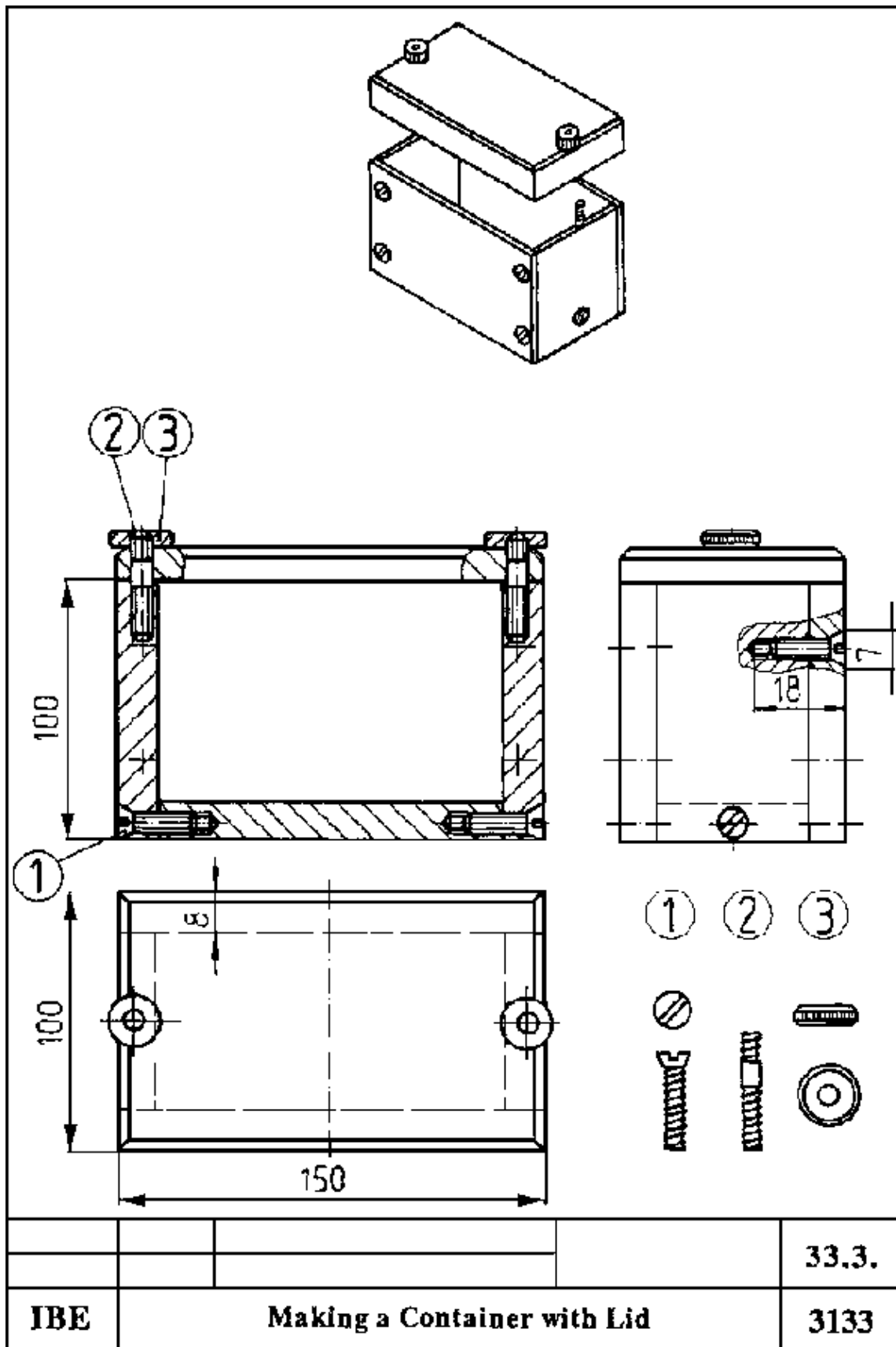
Screw in the shorter thread end.

12. Remove the hexagon nuts, fit the lid on.

Screw on knurled nuts (3).

13. Check the screwed joints.

check for flush seat of the heads.



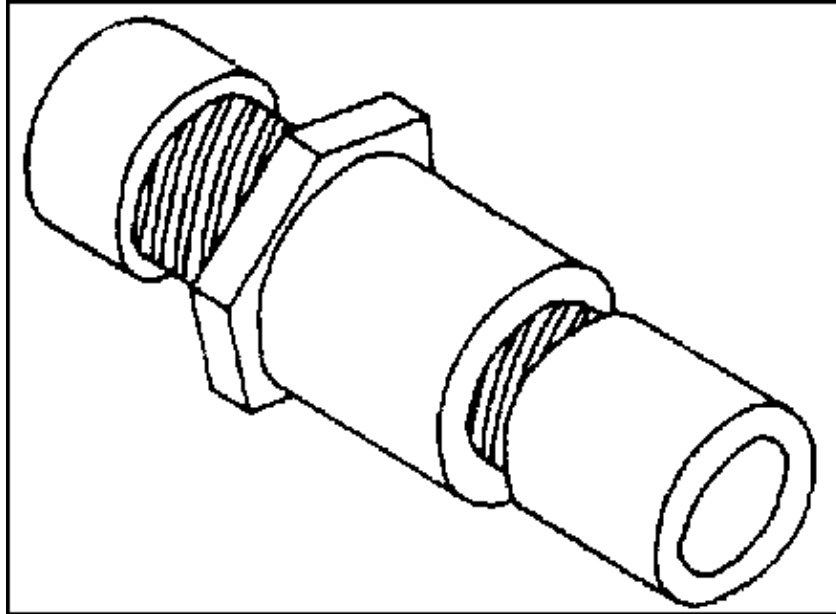
Making a Container with Lid

### Instruction Example 33.4. Making a Pipe Joint

The purpose of this exercise is to make a long-thread joint of two pipes using a bell piece.

## Material

- 2 pcs. Pipe (1) and (2), 1–inch diameter, abt. 400 mm long
- 1 pc. Pipe nut (2), R 1–inch
- 1 pc. Ring gasket (3)
- 1 pc. Pipe bell with internal thread (4), R 1–inch



## Tools

Die stock with cutting dies, R 1–inch, open ended wrench to fit the pipe size, half–round file

## Measuring and testing means

Steel rule

## Auxiliary accessories

Cutting fluid, hemp, vice, acid–free grease

## Necessary previous knowledge

Manual material working: Measuring, testing, marking, thread cutting

### Sequence of operations

1. Prepare your workplace, make all component parts, tools, etc. available.
2. Check the original dimensions of the pipe pieces.
3. Prepare the die stock, mount R 1–inch cutters.

### Comments

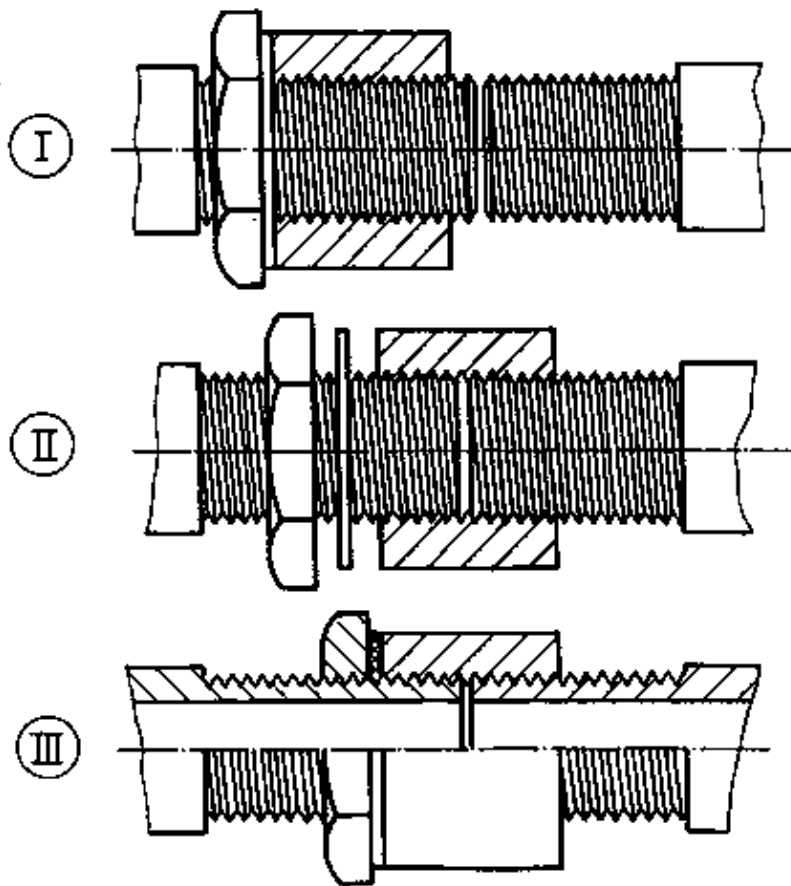
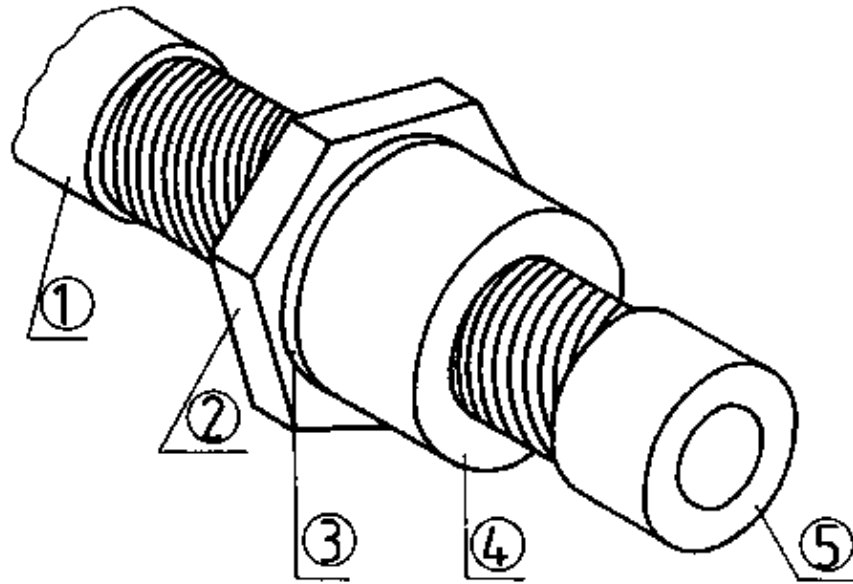
Check for completeness.

Check angles, edges inside and outside for burrs.

Mount the cutters in the right 1 to 4 sequence.

4. Mount the fast piece of pipe (2), rough-cut and re-thread the long thread.	Apply cutting fluid to the pipe end. After rough-cutting, set fine adjustment for re-threading.
5. Mount second pipe piece (2) and cut short thread (abt. 19 mm).	Rough-cut and re-thread.
6. Clean the thread and check.	Allow no defects in the thread.
7. Screw pipe nut (2) and the ring gasket (3) onto long thread. Continue screwing the bell (4) until it stops.	Stage (I): Bell to be flush with the pipe.
8. Hold the short thread against the long thread and screw back the bell.	Stage (II): Apply a hemp packing if required, to make the joint tight.
9. Tighten the pipe nut with the ring gasket on the bell.	Stage (III): Use a pipe wrench and open ended wrench.
10. Check the joint.	Check the pipe bell for correct and tight fit.





			33.4.
<b>IBE</b>	<b>Making a Pipe Joint</b>		<b>3133</b>

Making a Pipe Joint

