

**Marking and Punch Marking – Course: Technique for Manual Working  
of Materials. Methodical Guide for Instructors**



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# Marking and Punch Marking – Course: Technique for Manual Working of Materials. Methodical Guide for Instructors

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## 1. Objectives and contents of practical vocational training in the working techniques of “Marking and Punch Marking”

By concluding their training, the trainees shall have a good command of the working techniques of “Marking and Punch Marking”. Therefore, the following objectives are to be achieved:

### Objectives

- Knowledge of the purpose and application of the marking and punch marking techniques.
- Mastery of the various working techniques of marking and punch marking and capability of preparing the workpieces for good–quality working.
- Capability of selecting the proper scribing tools and their proper use.
- Capability of making decisions on quality independently.

The following contents have to be imparted to the trainees:

### Contents

- Purpose of marking and punch marking
- Types and application of scribing tools and accessories
- Preparation of the surface of the workpiece.

## 2. Organizational preparation

In order to guarantee a trouble–free development of instruction, exercises and teaching it is necessary to prepare this training properly.

The following steps have to be envisaged:

### 2.1. Preparation of instruction on labour safety

Prior to the exercises, a brief instruction on the proper use of marking and punch marking tools has to be given.

This comprises hints for accident-free work. Emphasis is to be laid on:

- Points of scribes and dividers have to be protected by covering them with cork or plastic cases.
- Never put scribing tools with projecting points in your pockets.
- Vernier height gauges have to be put down with their points turned away.
- Never use damaged or blunt scribing tools.
- As copper-sulphate solutions are poisonous, they have to be stored in marked and sealed vessels; avoid any contact with your skin when handling such solutions.

Familiarity with these hints is to be confirmed by the trainee's signature in a control book.

## 2.2. Provision of teaching aids

- For demonstration purposes during instruction, a small surface plate should be installed on the workbench.
- The "Trainees' Handbook of Lessons – Marking and Punch Marking" is to be handed out to the trainees,
- When using the transparencies series of "Marking and Punch Marking" (transparencies 2.1. – 2.5.) check whether they are complete and whether the overhead projector is functional. (Check operating conditions at the site of use and make sure of the proper mains supply!)
- Surveys etc. which are to be written on the blackboard have to be completed prior to instruction.
- All the marking and punch marking tools mentioned in section 3 should be kept ready for illustration purposes.

## 2.3. Provision of working tools and materials

- Sufficient copies of the "Instruction Examples for Practical Vocational Training – Marking and Punch Marking" must be handed out to the trainees to provide them with the theoretical foundations of the exercises to be carried out.
- The initial materials required for the exercises are to be prepared and laid out in sufficient numbers according to the materials specified in the "Instruction Examples...".
- Each trainee is to be provided with a plane steel plate, which serves as a surface plate, and ideal lighting conditions.
- It must be checked that all workbenches are equipped with scribing tools and accessories appropriate to the exercises that are planned,

Recommended basic equipment:

- steel rule, steel straightedge, try square, bevelled edge square
- universal bevel protractor
- steel scribe, dividers, marking gauge, height gauge
- paint
- bastard files and smooth files (flat) 200 – 300 mm
- hammer; marking-out, centre and double-type punches

## 2.4. Time schedule

Time planning is recommended for the following training stages:

- introduction to the working techniques by way of instruction
- necessary demonstrations
- job–related instructions in preparing the exercises
- carrying out the exercises
- recapitulation and tests.

The necessary time share depends on the respective training conditions. Most of the time is to be allocated to the exercises.

### **3. Recommendations for practical training in the working techniques of “Marking and Punch Marking”**

The following paragraphs comprise proposals on conducting trainee instruction, carrying out demonstrations as well as exercises and tests. We recommend two course variants:

#### Variant No. 1

This variant should be chosen for trainees with generally good achievements and receptiveness,

- 1.1. Introductory instruction for the whole subject with demonstrations according to the “Trainees’ Handbook of Lessons”
- 1.2. Exercises in marking and punch marking from the “Instruction Examples...” (2.1. – 2.7.) and subsequent evaluation.
- 1.3. Final test of theory knowledge based on the contents of “Examples for Recapitulation and Tests”

#### Variant No. 2

This variant is to be chosen for trainees with little previous knowledge or poor achievements.

- 2.1. Introductory instruction for the whole subject of “Marking and Punch Marking” with demonstrations according to the “Trainees’ Handbook of Lessons”.
- 2.2. Exercises in marking and punch marking from the “Instruction Examples 2.1. and 2.2.” and subsequent evaluation.
- 2.3. Supplementary instruction for the subject of scribing with scribing blocks.
- 2.4. Exercises in marking and punch marking from the “Instruction Examples 2.3. – 2.5.” and subsequent evaluation.
- 2.5. Supplementary instruction in the field of boring–line production.
- 2.6. Exercises in marking and punch marking from the “Instruction Examples 2.6. and 2.7.” and subsequent evaluation.
- 2.7. Final test of theory knowledge based on the contents of “Examples for Recapitulation and Tests”.

Practical skills should be evaluated immediately after the handing in of the finished workpieces. Knowledge of theory should be constantly checked. However, it is recommended that a final test (item 1.3. or resp., 2.7.) should be written after concluding the exercises.

#### 3.1. Introductory instruction

If possible, this instruction should be given in a classroom. Make sure that the trainees put down necessary supplementary hints or answers to questions in their “Trainees’ Handbook of Lessons”.

Instruction can be carried out on the basis of the main points contained in the "Trainees' Handbook of Lessons".

#### Purpose of marking and punch marking

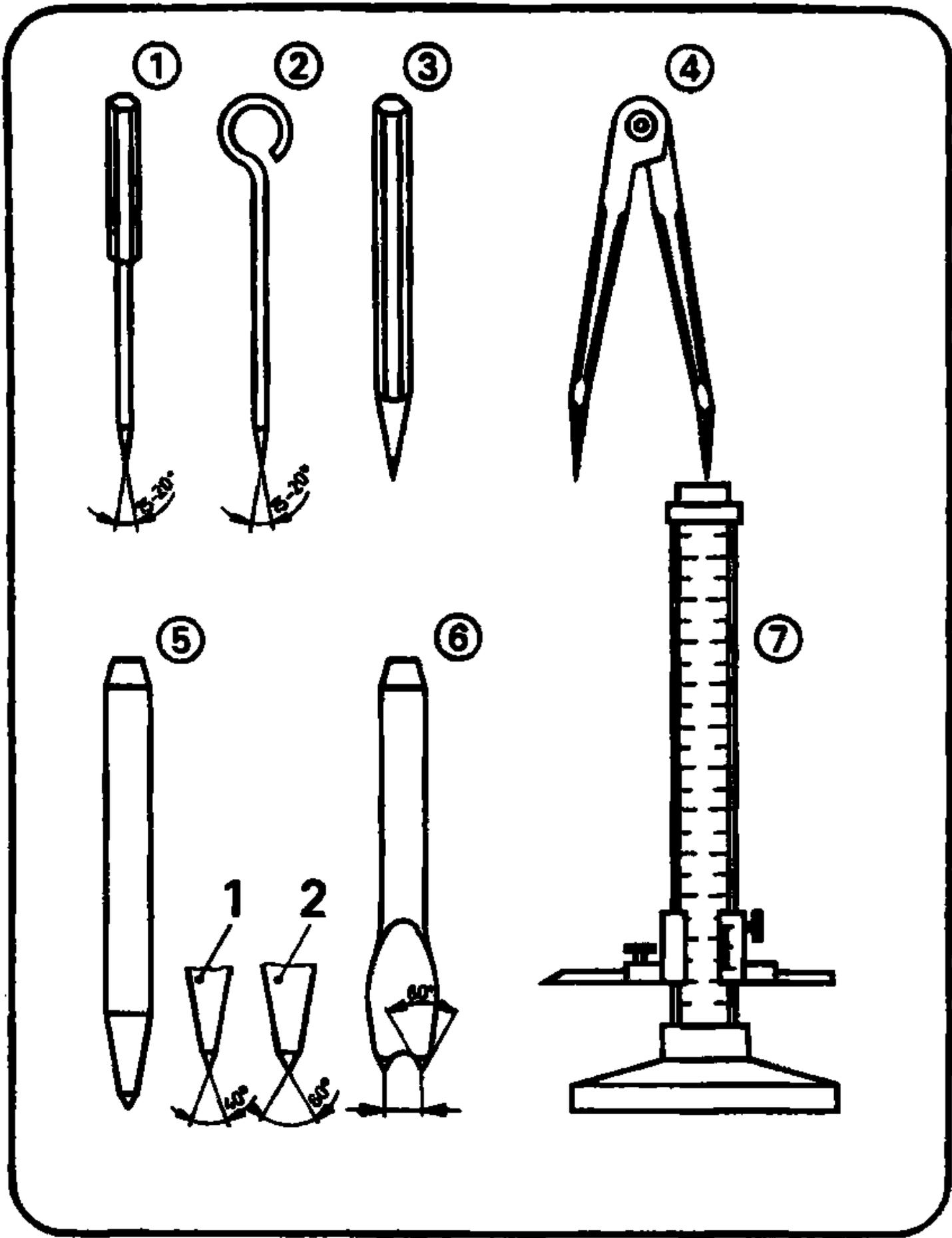
Instruction is to begin with the definition of terms and concepts. This is followed by pointing out the significance of the scribing quality for the accuracy to size of the manufactured workpieces. The trainees should be encouraged to carry out the planned exercises with great care and accuracy.

#### Scribing tools and accessories

The introduction of scribing tools should follow the list contained in the "Trainees' Handbook of Lessons".

- steel scriber
- brass scriber
- soft pencil
- dividers (various types)
- scribing blocks (caliper gauge or marking gauge; height gauge)
- prick punches (marking-out, centre, double-point and stencil punches)

Demonstrating the original tools may be supported by using transparency no. 2.1.



The trainees must learn how and when to use the individual tools. They must be able to select the appropriate scribing tool necessary for completing the tasks and depending on the kind and surface of materials. The instruction in the field of accessories has to lay emphasis on the respective fields of application:

- surface plate
- angle plate
- large-size steel parallels
- vees
- stencils.

The instruction has to mention the measuring and testing tools the specific form of which makes it possible to support the motion of the scriber:

- steel rule
- try square
- T-square and centre square.

When dealing with the application of parallel scribing processes the instruction has to mention the mode of using scratch gauges.

### Preparing the surface of the workpiece

The trainees should be shown that it is not always possible to produce clearly visible scribed lines on the various surfaces of the workpiece, if the scribing is performed directly on the surface. The trainee has to be instructed in the use of paints.

The following survey can be used to give instructions in employing paints:

<b>surface of workpiece</b>	<b>paint coating</b>
rough and big pore surfaces of castings and forgings	coating with whiting prepared in water (a low percentage of linseed oil added)
hard and scaled steel parts	coating with copper sulphate solution (CuSO <sub>4</sub> ) – Caution: poisonous!
large pre-machined surfaces and light metals	coating of shellac or scribing varnish

This survey is also contained in the "Trainees' Handbook of Lessons".

Having dealt with these problems you should mention the problem of reference surfaces and lines. The emphasis is to be laid on:

- datum faces and edges
- datum lines.

You have to point out the significance of these datum possibilities for the accuracy of the scribed line.

### Selected working techniques of marking and punch marking

Demonstrations of the working techniques should include:

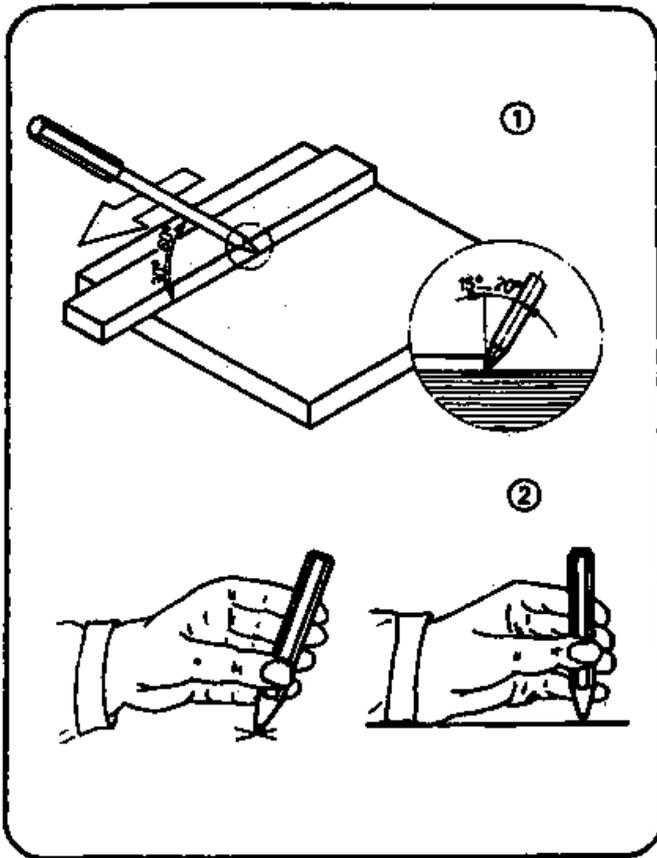
- Scribing with steel scriber and steel straightedge: emphasis is to be laid on the proper position of the scriber.

Transparency No. 2.2. can supplement this demonstration.

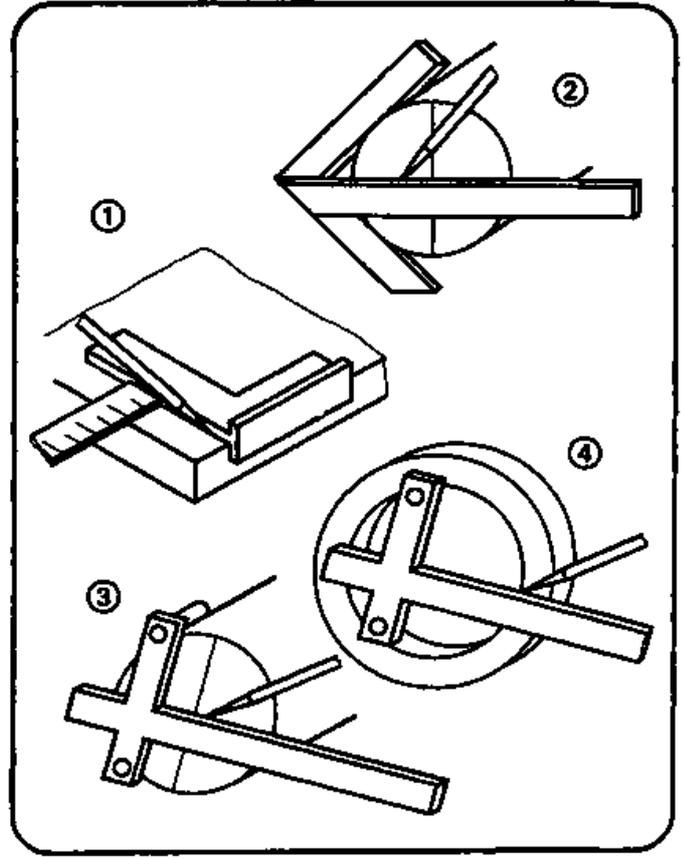
- Scribing with steel scriber and try square:

You have to underline that it is necessary to have one or two datum faces/edges in order to lay the try square properly.

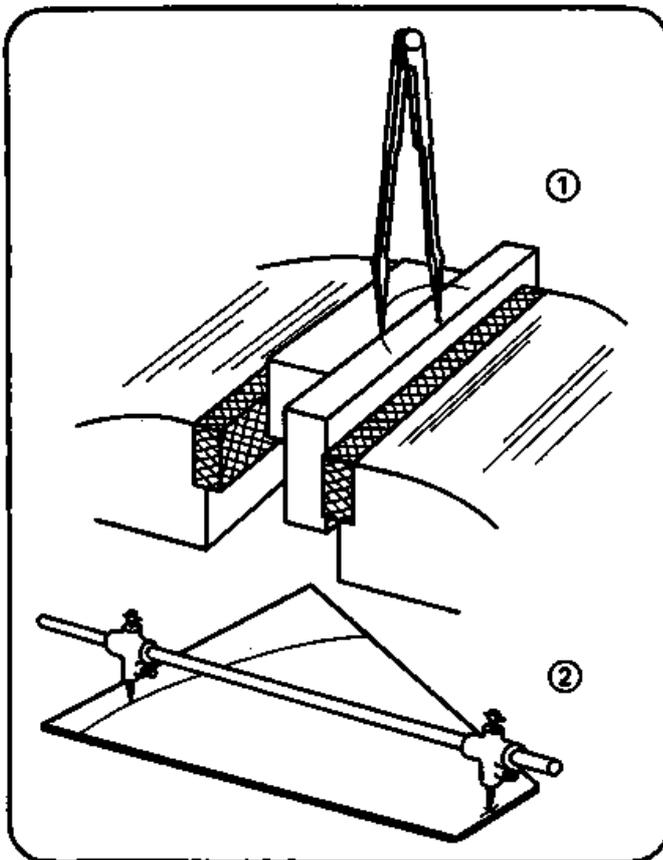
Transparency No. 2.3. can be used as a supplement to instructions in the use of centre squares and T-squares.



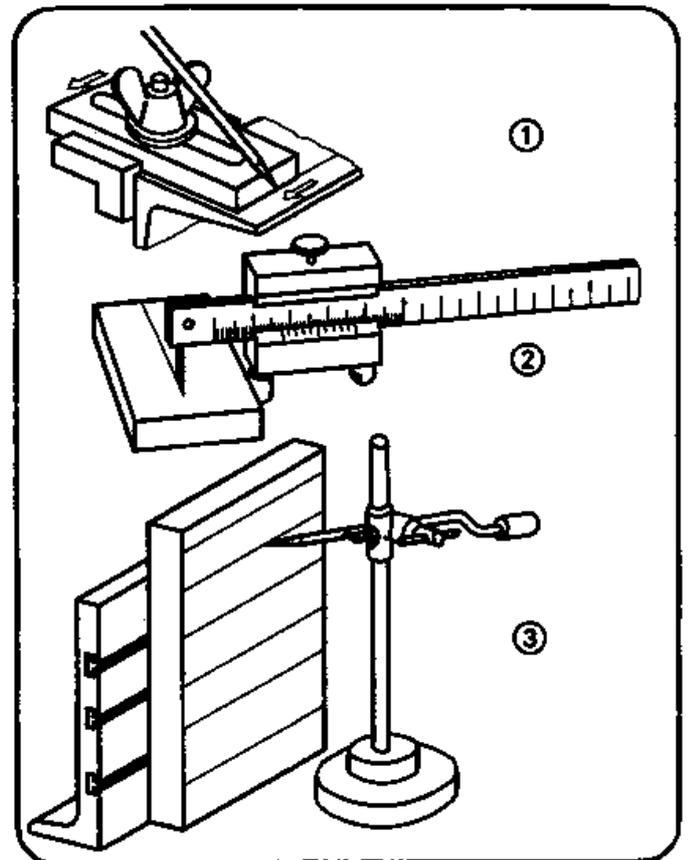
2.2



2.3



2.4



2.5

## Scribing with dividers

Special emphasis is to be laid on the working stages of adjusting the dividers and control of the circular arc.

Transparency No. 2.4. will serve to demonstrate working situations in which the supporting point is located outside the work-piece.

## Scribing with height gauge scriber

The difference in using the various height gauge scriber techniques has to be shown.

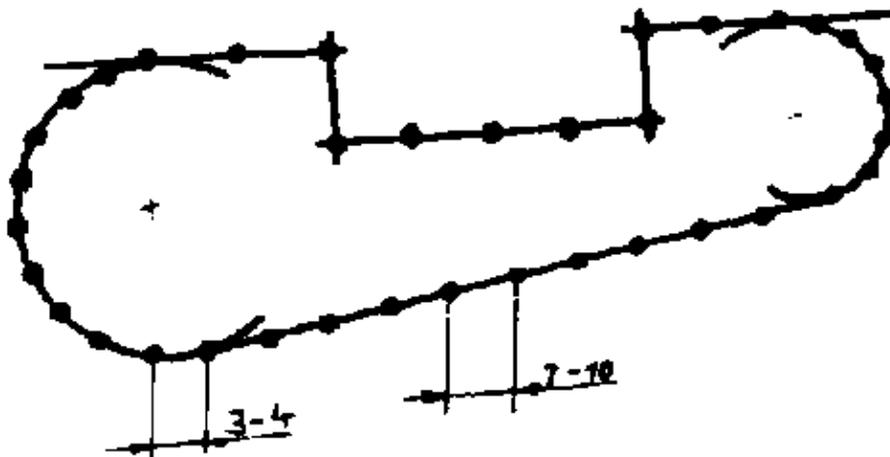
Transparency No. 2.5. can be used additionally to illustrate these techniques.

## Punch marking after scribing

Instruction in handling the prick punches is to be supplemented by hints about how to make check punch marks according to recommended values.

The figures and formulas (also in the "Trainees' Handbook of Lessons") supplement the detailed instruction in the use of double-point punches for producing bore lines. Recommended values for check punch marks:

- spacing on straight sections 7 – 10 mm
- spacing on curved sections 3 – 4 mm.



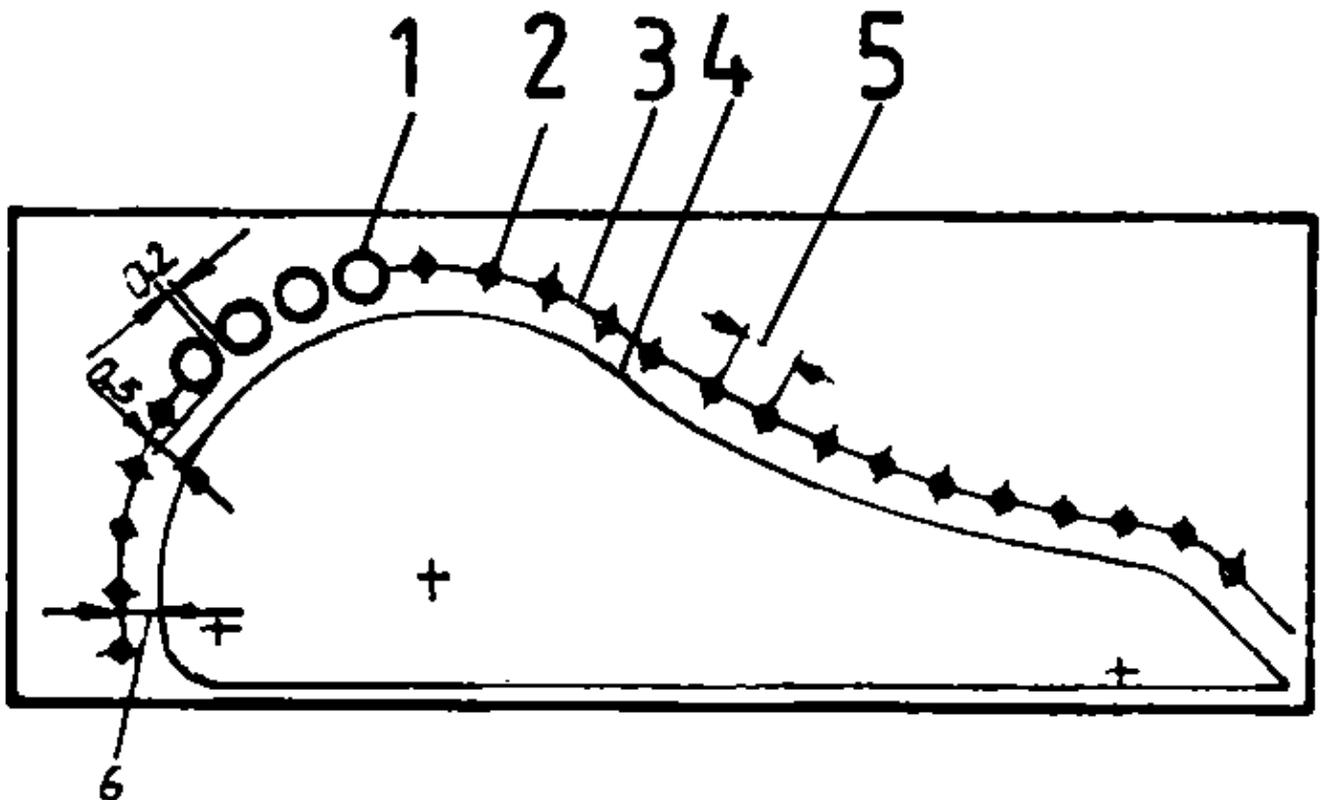
Correct spacings of check punch marks.

Formulas to calculate the boring lines:

$$D = y - 0.2 \text{ mm}$$
$$x = D/2 + 0.5 \text{ mm}$$

Conditions of producing a bore line

1 bore hole (0), 2 punch mark, 3 bore line, 4 scribed line – line of working, 5 width of double-point punch (y), 6 distance between bore line and scribed line (x)



The trainees have to be shown that the compliance with these conditions of producing bore lines guarantees a minimum of additional treatment when finishing the workpiece.

### 3.2. Exercises

The degree of difficulty with these exercises is to be increased step by step – beginning with very simple scribing techniques. The trainees should start their work with simple and straight scribing operations using a steel scriber. They must know the exact objective of the exercise and that their results might be evaluated.

A short practice to consolidate the use of the tools is to be started with exercises from the “Instruction Examples for Practical Vocational Training”. However, it will be necessary to prepare each exercise by “job-related instructions”, in which the trainees are shown a finished workpiece to illustrate the objectives and main problems of this exercise.

The instructor must have made such a workpiece himself in order to be familiar with all the problems which might arise in producing such a workpiece.

Thus the instructor can mention the major points of evaluation as well as the problems involved. During these lessons of special instruction the sequences of operations and working drawings must be placed on the tables so that the trainees can make notes therein.

All the trainees can carry out these exercises simultaneously, if the appropriate number of scribing tools is available.

This being the case, the trainees can do each exercise by themselves without being pushed by time limits.

If the required number of scribing tools cannot be provided, the group of trainees has to be subdivided according to the various categories of scribing applications:

- group no. 1 – scribing with steel scribers
- group no. 2 – scribing with scribing blocks
- group no. 3 – scribing with dividers and punching with double-point punches

### 3.3. Examples for recapitulation and tests

This section comprises questions which are to consolidate and test the acquired skills and knowledge. Each question is accompanied by the respective answers. Questions which are also contained in the "Trainees' Handbook of Lessons" are marked with the letter "A".

1. What is the purpose of scribing?

(Transfer of form and size of workpieces according to the dimensions on the manufacturing drawings to the blanks in order to enable true-to-size working).

2. What is the purpose of punch marking?

(Punching of tapered recesses for permanent marking of scribed lines, for supporting dividers points and drills.)

3. What are the conditions a scribed line has to fulfil?

"A" (Careful finish, accuracy, visibility during the entire manufacturing process.)

4. Which effect must be produced by scribing tools?

"A" (They have to produce clearly visible lines on the work-piece).

5. What makes the difference in the use of steel scribers and brass scribers?

"A" (Their results: steel scribers leave a fine notch; brass scribers plot lines.)

6. When do we use dividers with adjustable points?

(If radii are to be marked on stepped surfaces.)

7. What are the conditions a workpiece has to fulfil, if it is to be marked with scribing blocks?

"A" (They must avail of flat datum faces/edges to lay the scribing blocks.)

8. How do marking-out punch and centre punch differ?

(Marking-out punch: angle of taper  $40^\circ$  for scribed lines; centre-punch: angle of taper  $60^\circ$  for prick-punching of holes)

9. What are the conditions a workplace has to fulfil?

"A" (Clean; well illuminated; spacious enough to put down work-piece and accessories.)

10. What are the accessories to be used?

(Surface plate, angle plate, large-size steel parallels, vees, stencils, some measuring and testing tools.)

11. What makes the difference in the use of centre squares and try squares?

"A" (Centre square: scribing of central points at front sides of cylindrical workpieces; try square: scribing of straight lines on flat surfaces of workpieces.)

12. Why must certain surfaces of workpieces be coated with paint prior to scribing?

"A" (Because the roughness of certain workpieces does not allow a clearly visible scribed line.)

13. What paint is used as a coating for hard or scaled sheet metal (scaled by hot rolling)?

(Copper sulphate solution.)

14. What kinds of datum are there for scribing?

"A" (Datum surfaces, edges and lines.)

15. How do we guide the scriber at the steel straightedge or try square?

"A" (Drawing the scriber point directly along the edge of the straightedge or square with the scriber slightly inclined towards the body.)

16. What is a necessary intermediate step in scribing with dividers?

"A" (Making of check arcs to check the set radius.)

17. What are the accessories necessary for scribing with height gauge scribers?

"A" (Surface plate, angle plate, parallel piece.)

18. What are the conditions under which a parallel piece has to be used as workpiece support when employing height gauge scribes for scribing?  
(If the height gauge scribe does not allow a zero-position of the scribe at the level of the surface plate.)
19. What makes punch marking of scribed lines necessary?  
“A” (This must be done, if the following treatment will blur these lines or if the visibility during manufacture is restricted or if the surface conditions of the workpiece deteriorate the visibility.)
20. What spacing must be used for check punch marks?  
(Straight sections: 7–10 mm)  
(curved sections: 3 – 4 mm)
21. What size is of prime importance for bore line marks?  
“A” (Width of double-point punch /y/ of the double-point punch to be used.)
22. How is punching done with double-point punches?  
(One point of the double-point punch has to be placed in the previous punch mark; the punch has to be set upright; punching can be performed now.)
23. What are the dangers associated with the use of scribing tools?  
(Danger of injuries by the sharp points.)

#### **4. Application of the working techniques of “Marking and Punch Marking”**

The sequence of exercises can focus on one topic each according to the variant mentioned in section 3 or it may be divided into several stages.

The “Instruction Examples for Practical Vocational Training” provide 7 exercises whose degree of difficulty increases gradually.

These “Instruction Examples...” comprise a list of required materials (initial material, hand tools, measuring and testing tools, accessories) as well as the sequence of operations for carrying out the exercise and an illustrative working drawing. Thus, the trainees avail of the necessary information to do their exercises in an objective-related way.

The selection of exercises takes into consideration that such workpieces are scribed which will be used in the further stages of treatment with other working techniques, i. e. that they serve a certain purpose.

That is the reason why these workpieces should be marked with the trainee’s name in order to finish them at a later stage.

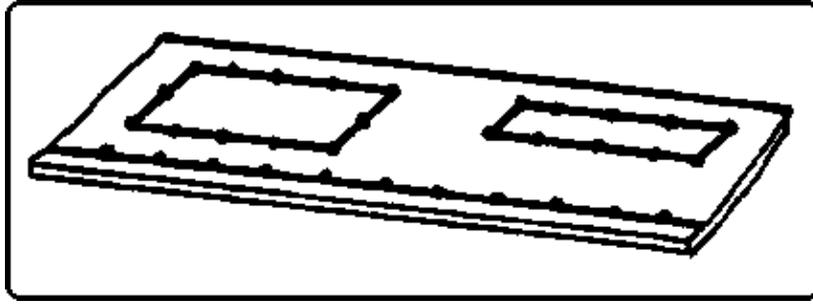
##### **4.1. Instruction Examples**

To give a survey of the workpieces on which the prior knowledge shall be verified, the individual training examples are described in brief here,

###### **Instruction Example 2.1.**

###### **Door Lock Panel**

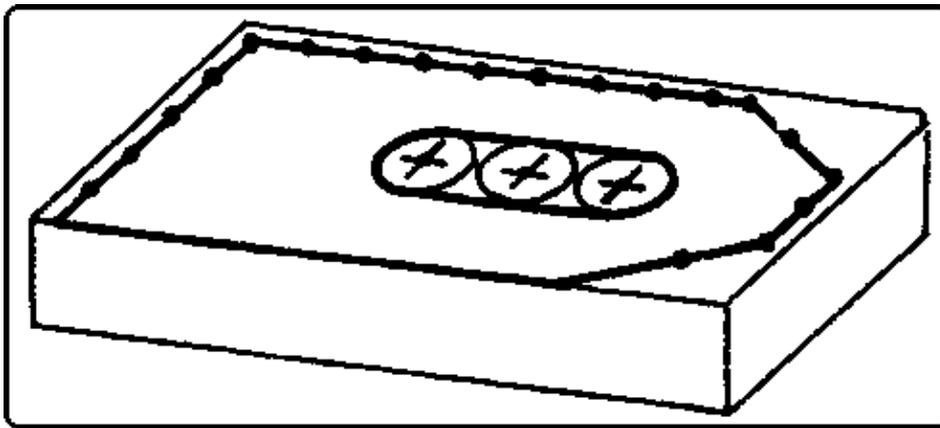
Scribing of straight and parallel lines on steel plates by using the steel rule, steel straightedge and steel scribe starting from datum edges.



The dimensions of the break-throughs can be adapted to local conditions so that this component can be screwed on a door frame after being finished by sawing, drilling and filing.

Instruction Example 2.2.  
Holding Clamp

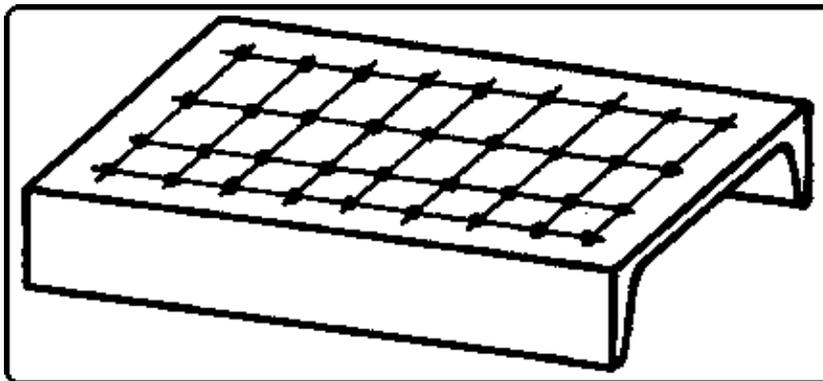
Scribing of straight and angular lines on steel sheet using a try square and protractor as well as a datum edge and a datum line.



Together with the instruction examples 5.1., 5.2. and 5.5. this will constitute a set of clamping tools for an upright drilling machine.

Instruction Example 2.3.  
Drill Stand

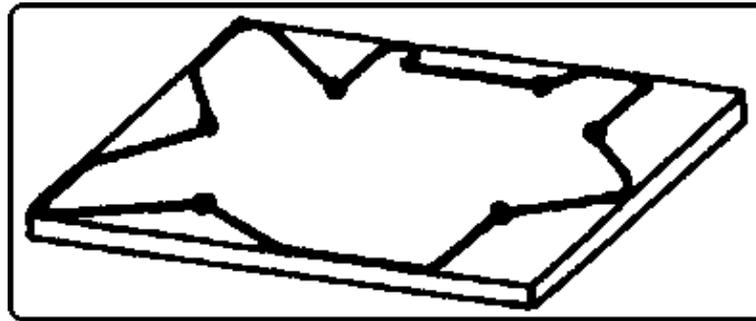
Scribing of straight and parallel lines using scribing blocks on rolled steel channels based on datum edges.



After having finished this part it can be used as support for drills. Instruction example 7.4. describes how to finish this component •

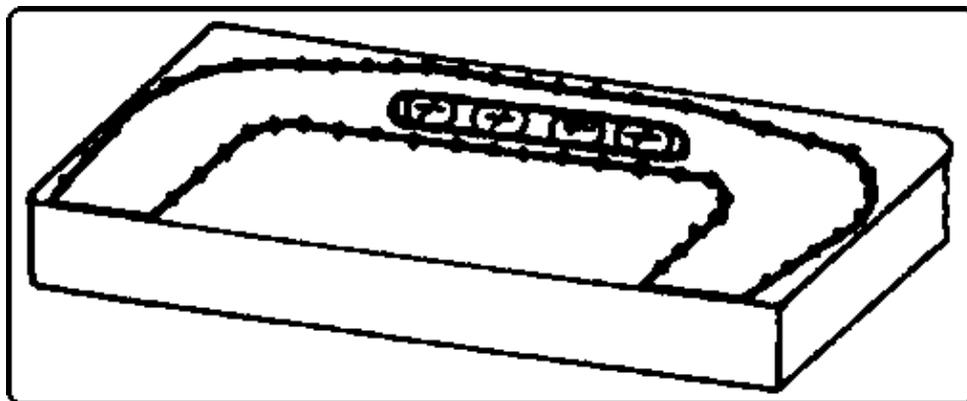
Instruction Example 2.4.  
Angle Gauge

The universal bevel protractor is used for scribing angular lines on steel sheet based on datum edges. After having been finished, this instrument can serve as a testing tool in the field of sharpening tools, as this gauge contains the most important angle sizes.



Instruction Example 2.5.  
Bow for C Clamp

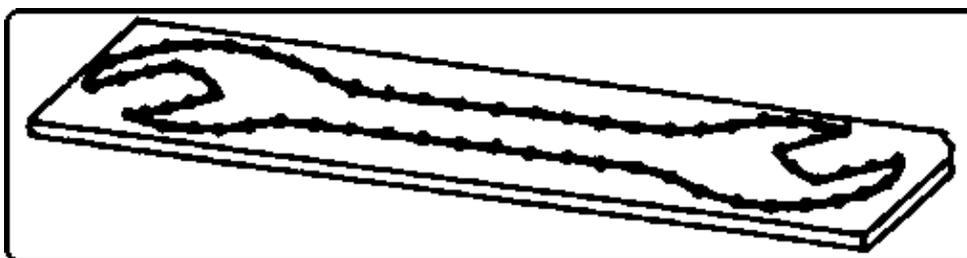
Scribing of lines on steel sheet using height gauge scriber and dividers based on datum edges and a datum line.



Another major point of work refers to marking a bore line according to fixed dimensions. After being completed, this part will be a component of a C clamp which can be used in the workshop. (This comprises also the parts mentioned in the instruction examples 7.6., 8.2. and 9.5.)

Instruction Example 2.6.  
Open-end Wrench 19/24

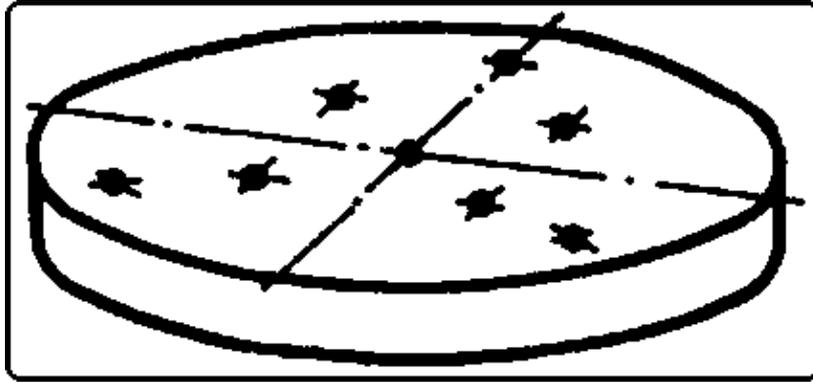
Scribing of symmetrical, curved and straight lines on steel sheet using a datum line as the central line.



Additionally, a bore line will be scribed and punch marked. After finishing this test workpiece it can be used in the workshop to fasten/loosen hexagonal-head bolts and M12 or, resp. M16 nuts.

Instruction Example 2.7.  
Base Plate

On a circular steel plate the contour and markings for boreholes will be scribed using a steel rule, dividers and centre square. Then a bore line is to be scribed. When this workpiece has been finished, various devices (e.g. workbench lamp) can be mounted with this base plate on a workbench,



#### 4.2. Criteria for practical training

It is recommended to determine some major points of observation and evaluation when the work is being carried out. The following criteria may serve as a guideline:

- Does the trainee use the scribing tools so that injuries will be avoided?
- Are the surfaces of the workpiece coated with the appropriate paints, if necessary?
- Are the datum lines/edges up to the standards?
- Is the position of the steel scriber correct?
- Are the transitions from straight lines to curved ones clean and without steps?
- Does the trainee draw the necessary lines only or does he produce a maze of lines?
- Are the scribed lines clear and a single line only or are there any double lines?
- Are the supporting points for the dividers sufficiently prepunched?
- Are the scribers of the scribing block exactly adjusted?
- Are the spacings of the check punch marks correct?
- Are the check punch marks exactly on the scribed line or not?
- Are the bore lines correctly scribed and punched according to the given conditions?

### 5. Captions and legends to the “Marking and Punch Marking” transparencies series

#### Transparency No. 2.1. Scribing Tools

- (1) steel scriber
- (2) brass scriber
- (3) pencil (soft)
- (4) dividers
- (5) prick-punches
  - 1 – marking-out punch
  - 2 – centre punch
- (6) double-point punch
- (7) height gauge scriber with scale

#### Transparency No. 2.2. Technique of Scribing and Prick-Punching

- (1) locating of scriber
- (2) placing the punch and upright position for punching.

#### Transparency No. 2.3. Scribing with Steel Squares

- (1) scribing with try square
- (2) scribing of shaft centre with centre square
- (3) scribing of shaft centre with T-square
- (4) scribing of central lines with T-square

#### Transparency No. 2.4. Scribing with Dividers

(1) scribing with toolmakers' dividers  
(using an inset, because the supporting point is located outside the workpiece)

(2) scribing with beam trammel

Transparency No. 2.5. Scribing with Scribing Blocks

- (1) caliper gauge
- (2) marking gauge
- (3) height gauge scriber

