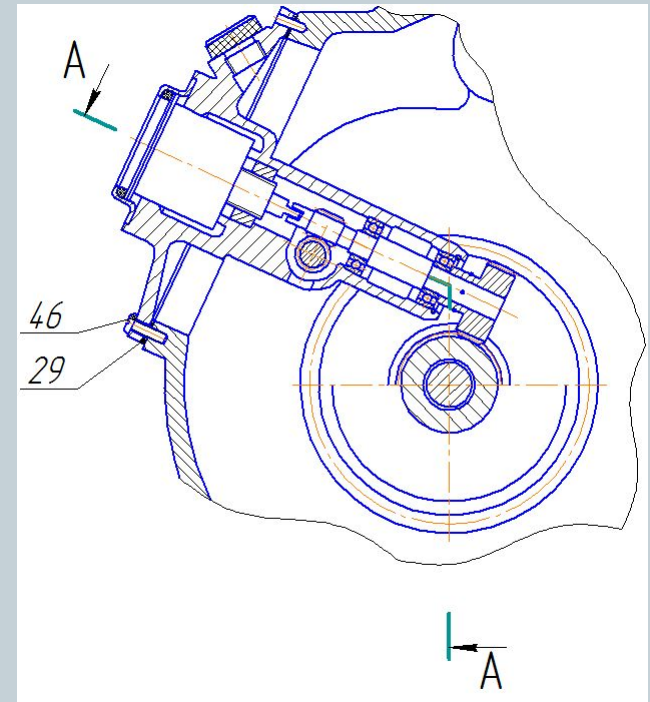
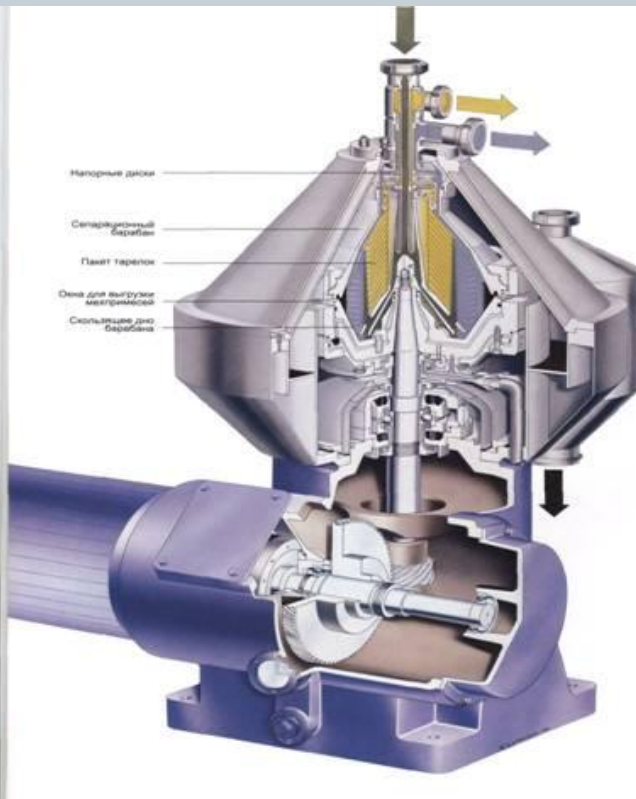


# Introduction to Engineering Drawing.

## Basic rules of drawing execution.



### LECTURE 1



# Drawings definition



- **Drawing** is one of the most widely used forms of graphic communication
- A **drawing** is a graphic representation of an object (building, equipment, machine and etc.), or a part of it (unit, detail).
- Drawings, photographs, slides, transparencies, and sketches are all forms of graphic communication.

# Types of drawing

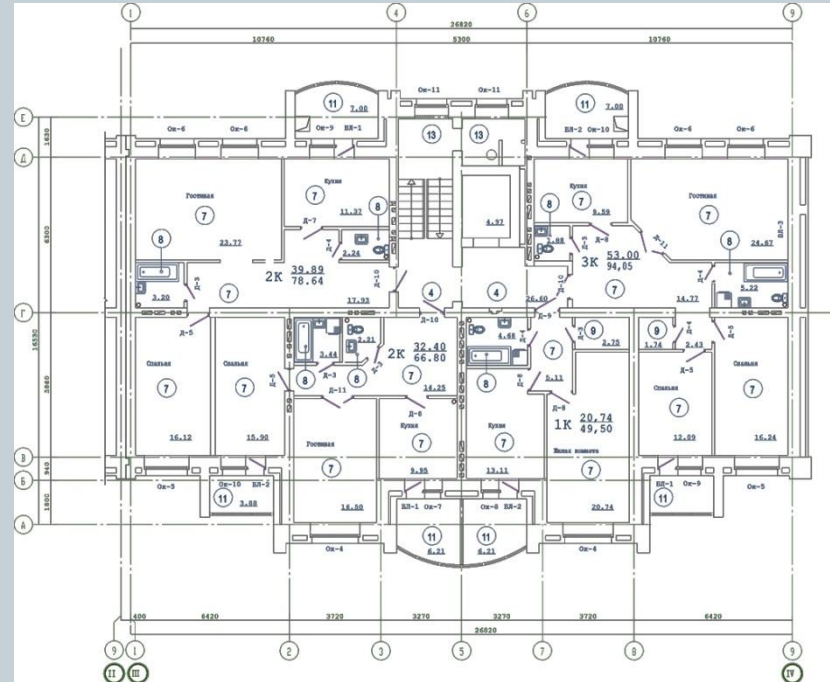
There are two basic types of drawings:

## Artistic



**Artistic drawings are used to express the feelings, beliefs, philosophies, and ideas of the artist**

## Technical drawings



**Technical drawing is a means of clearly and concisely communicating all of the information to transform an idea into reality**

# Drawing equipment and tools



For engineering purpose the drawing must be clear, neat and legible. Hence it is extremely important for engineers to have good *speed, accuracy, legibility and neatness in the drawing work*

1) **DRAWING PAPER** is the sheet of paper, on which drawing is to be made.

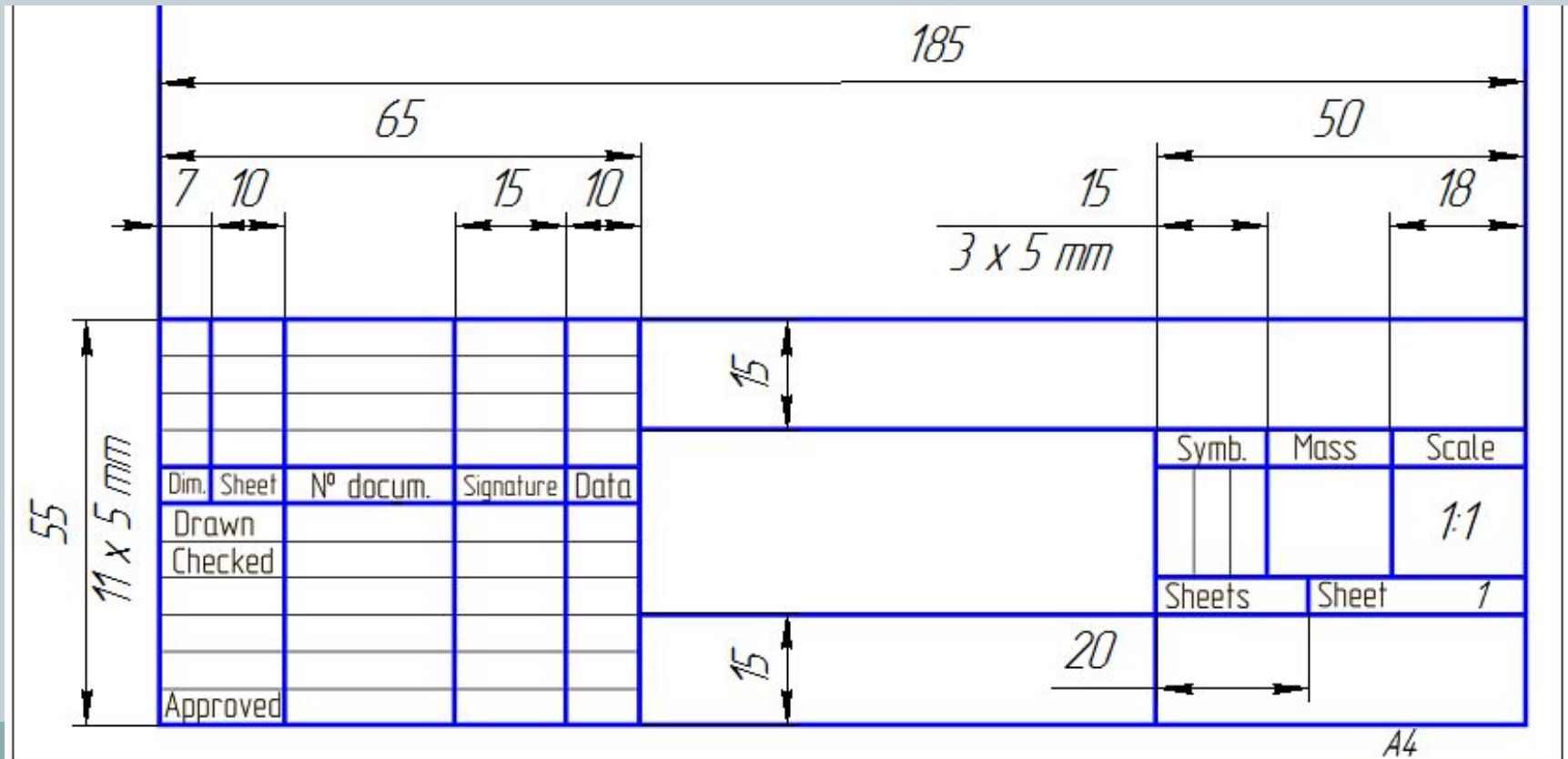
All engineering drawings are made on sheets of paper of strictly defined sizes. The ISO most recommended paper sizes for technical drawings are known as **A-FORMATS**

A-Format designation	Dimension, mm	Surface area, m <sup>2</sup>
A0	1 189 x 841	1,000
A1	594 x 841	0,500
A2	594 x 420	0,250
A3	297 x 420	0,125
A4	297 x 210	0,062

# Drawing equipment and tools

## 2) TITLE BLOCK, BORDERS AND FRAMES

### Russian Standard Title block (First sheet)

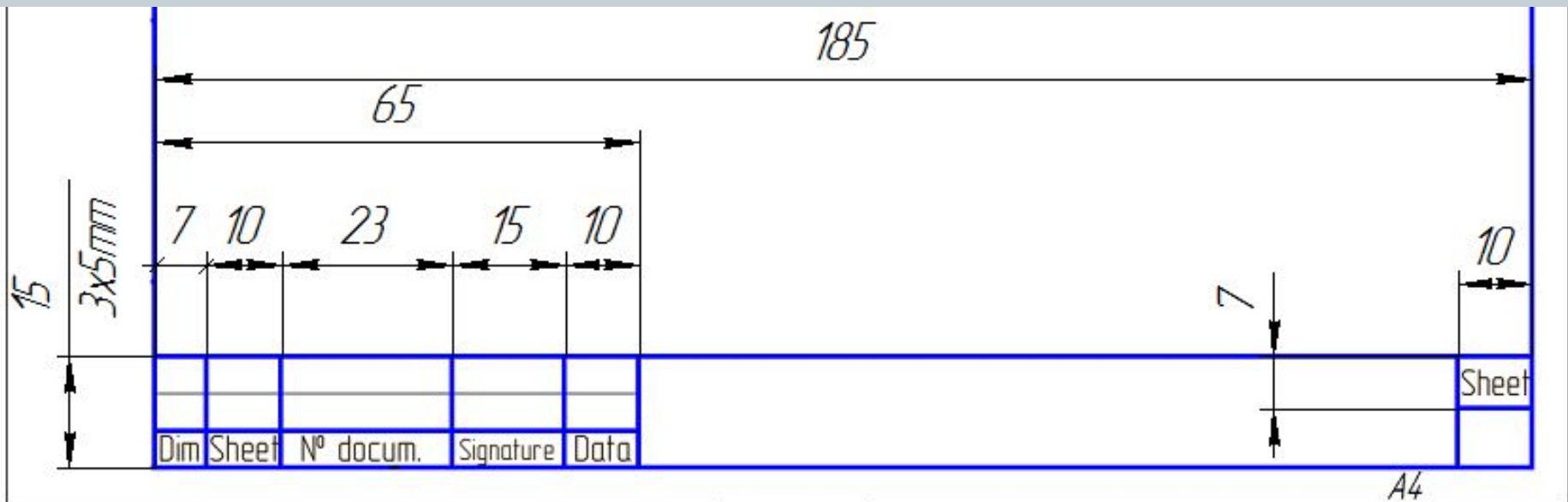


# Drawing equipment and tools



## 2) TITLE BLOCK, BORDERS AND FRAMES

### Russian Standard Title block (for subsequent sheets)



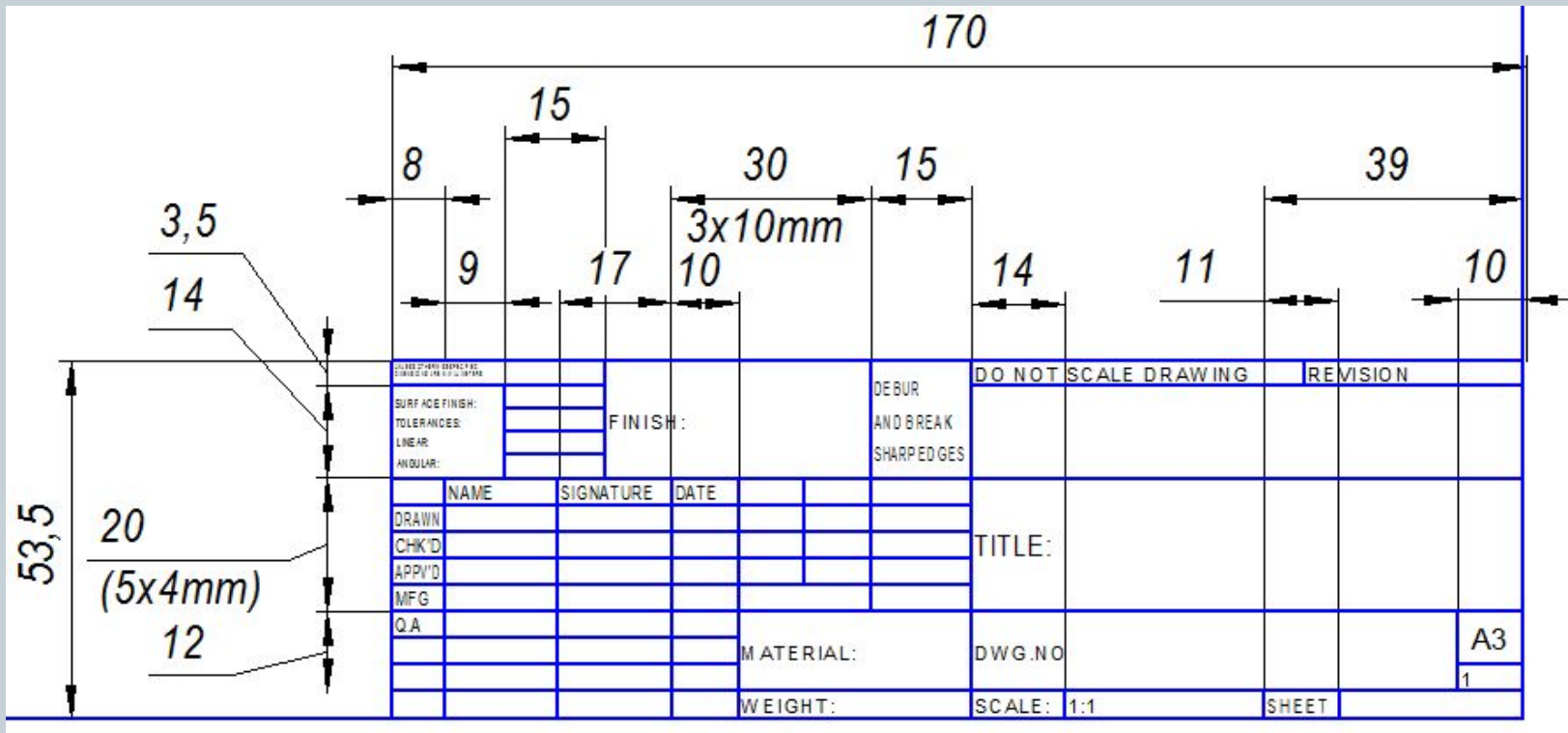


# Drawing equipment and tools



## 2) TITLE BLOCK, BORDERS AND FRAMES

### ISO 7200:2004 Title block



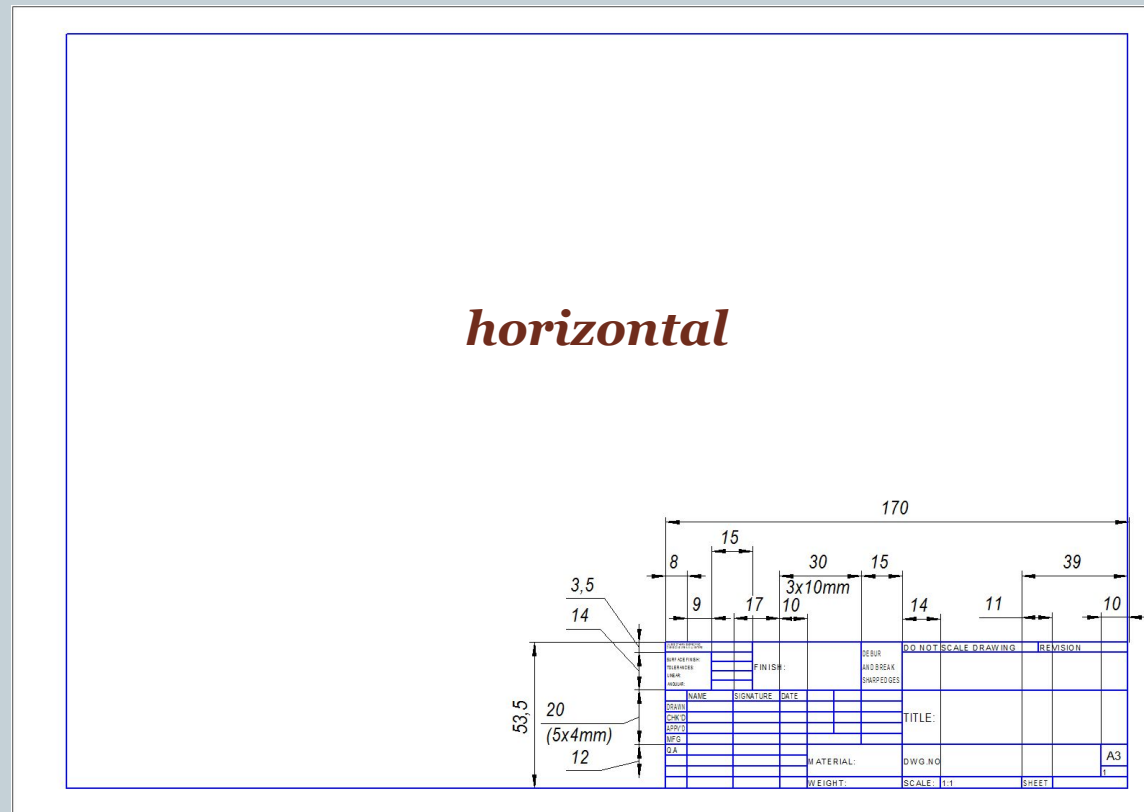
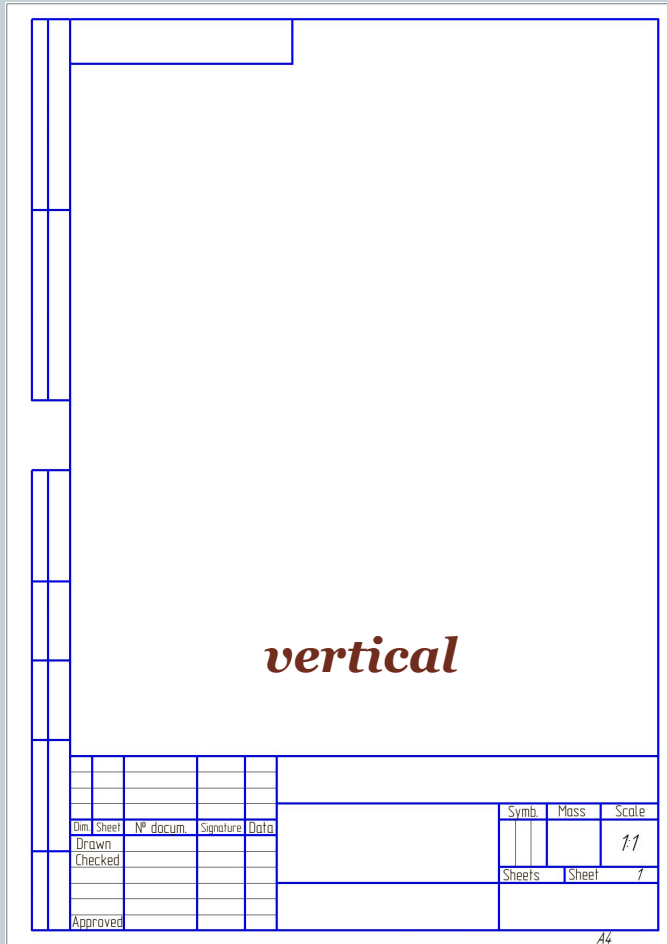
The total width is 170-180 mm for an A4 sheet, with the left margin being 20 mm and the right margin 10 mm. The same title block is used for all paper sizes.



# Drawing equipment and tools



## 2) BORDERS AND FRAMES, AND LAYOUT

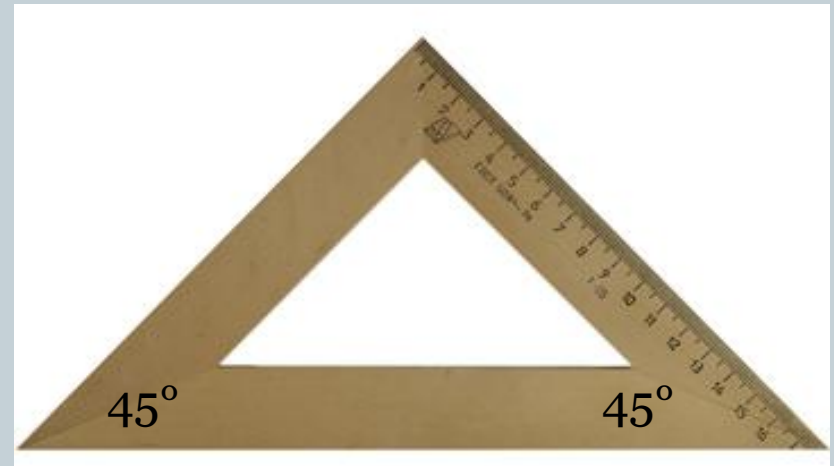


**Layout of sheet for engineering drawing**

# Drawing equipment and tools



## 3) TOOLS: triangles (setsquares)

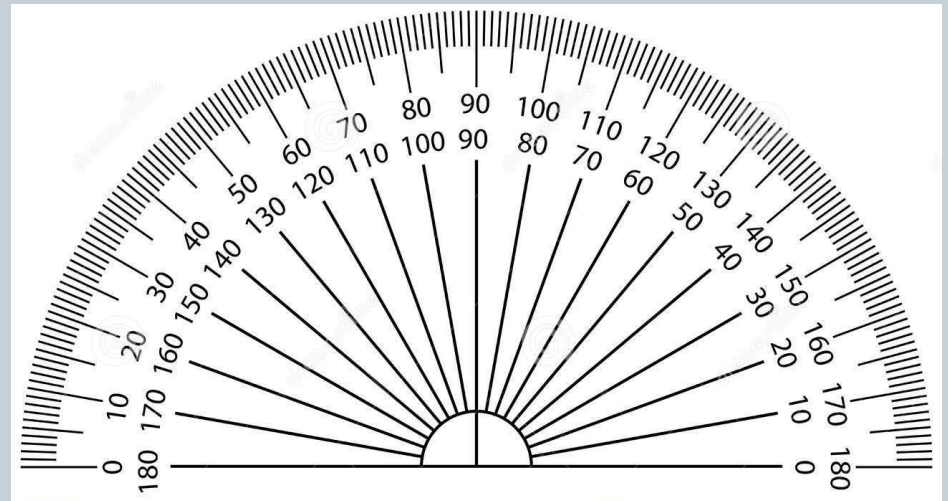
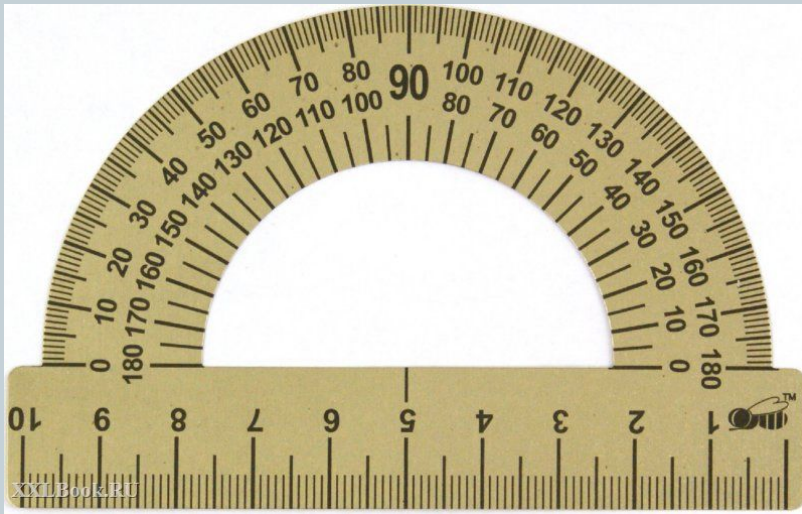


## 3) TOOLS: French curves

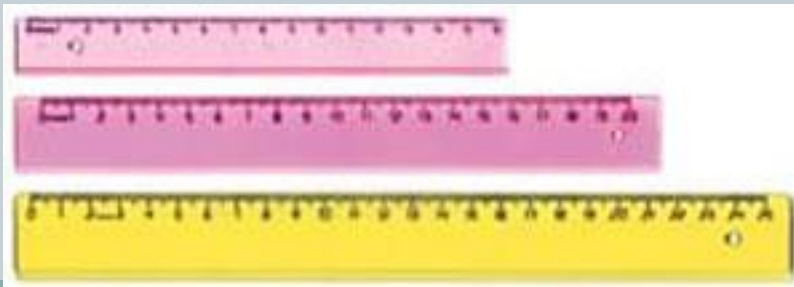


# Drawing equipment and tools

## 3) TOOLS: Protractor

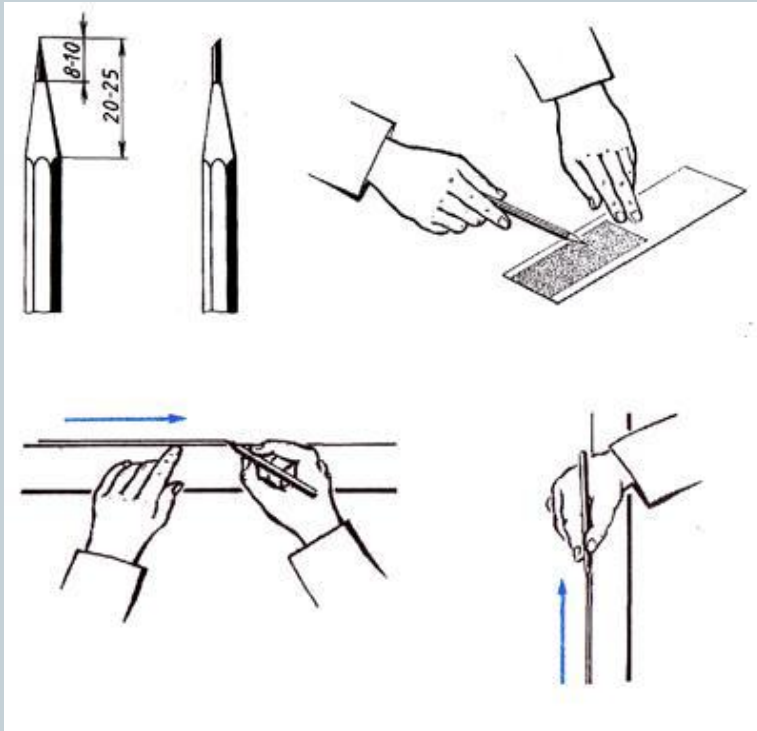


## 3) TOOLS: Scales (rulers)



# Drawing equipment and tools

## 3) TOOLS: Pencil

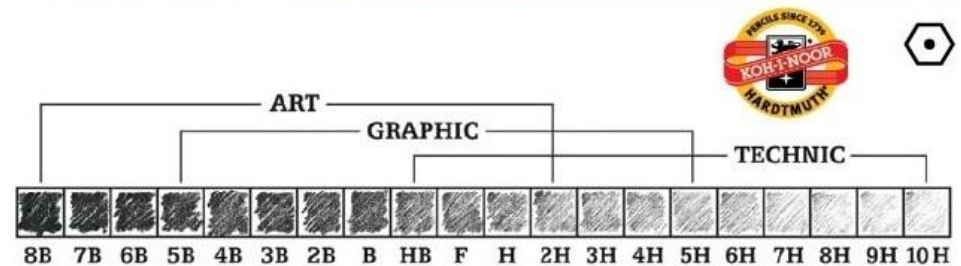
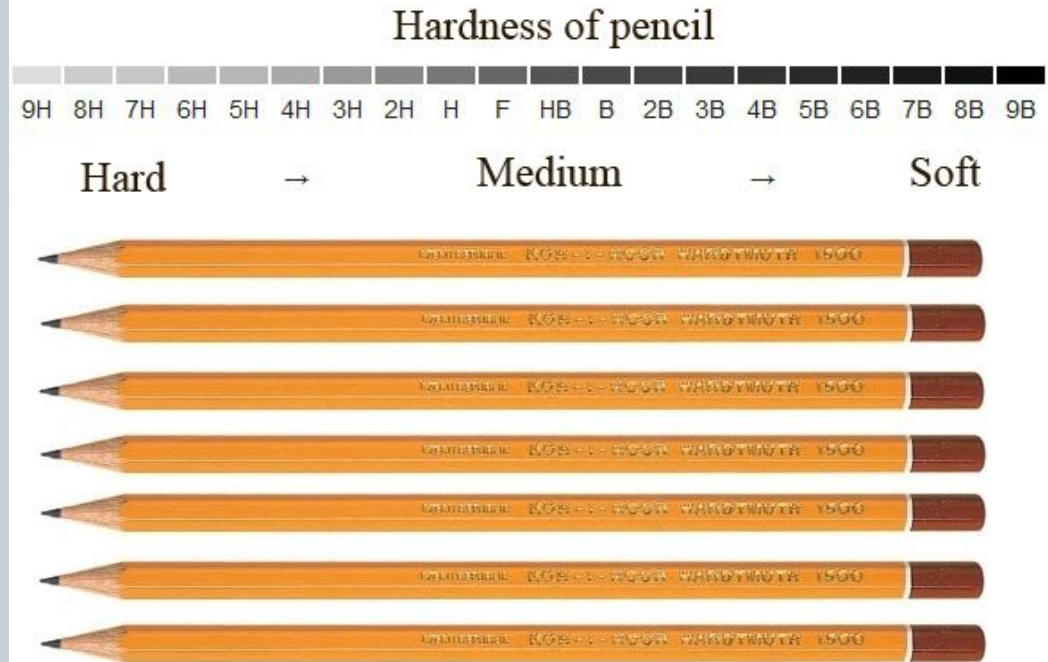


Recommended size of the lead is **8-10 mm**

Recommended direction of drawing

- 1) *From left to right*
- 2) *From bottom to top*

## Hardness of pencil

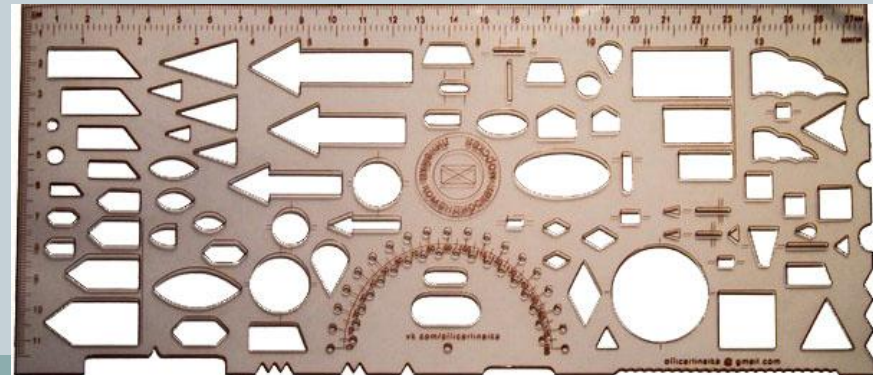
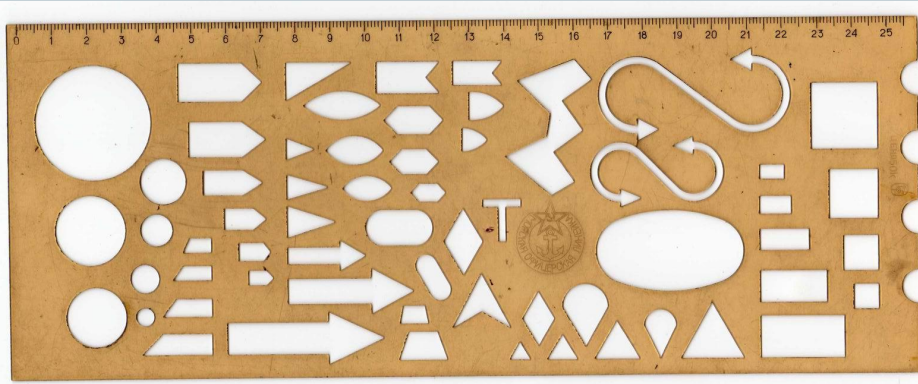


# Drawing equipment and tools

## 3) TOOLS: Compass



## 3) TOOLS: Template



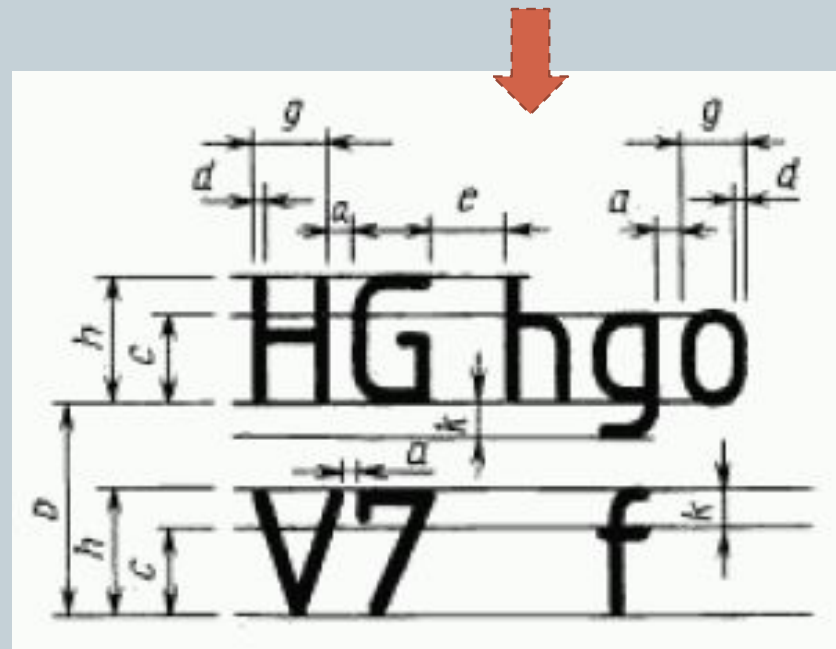
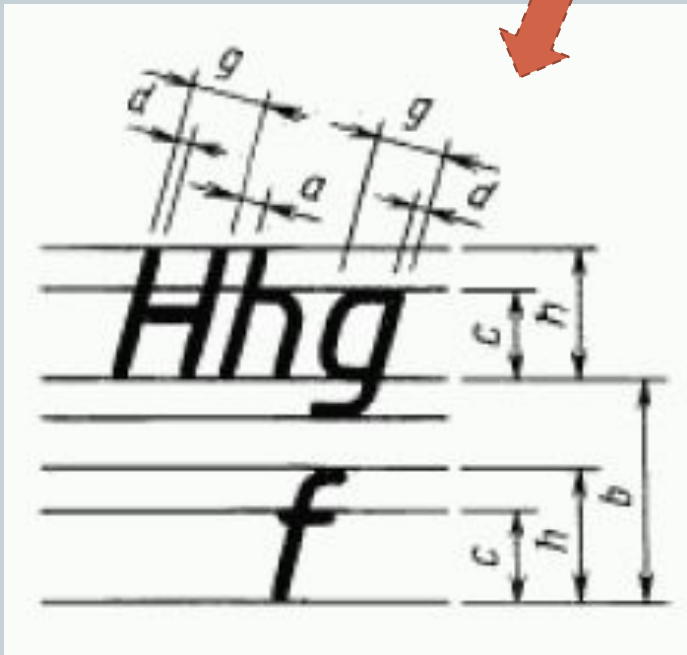
# Lettering

## 4) LETTERING

Lettering used on technical drawing written according to Russian standard 2.304-81.

The height  $h$  of the capital letter is taken as the base of dimensioning.

The lettering may be **inclined 75°** to the horizon or may be **vertical**.



# Lettering



## 4) LETTERING

The two standard ratios for d/h, **1/14 (Type A)** and **1/10 (Type B)**, are most economical as they result in a minimum number of line thickness.

ABCDEFGHIJKLMNO

PQRSTUVWXYZ

abcdefghijklmnopq

rstuvwxyz

ABCDEFGHIJKLMN

OPQRSTUVWXYZ

abcdefghijklmnop

qrstuvwxyz

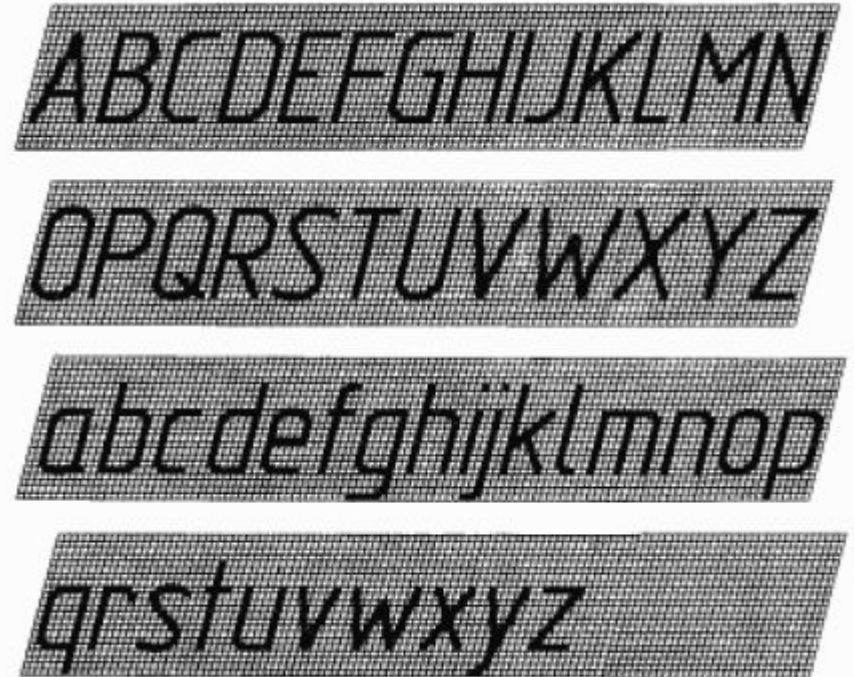
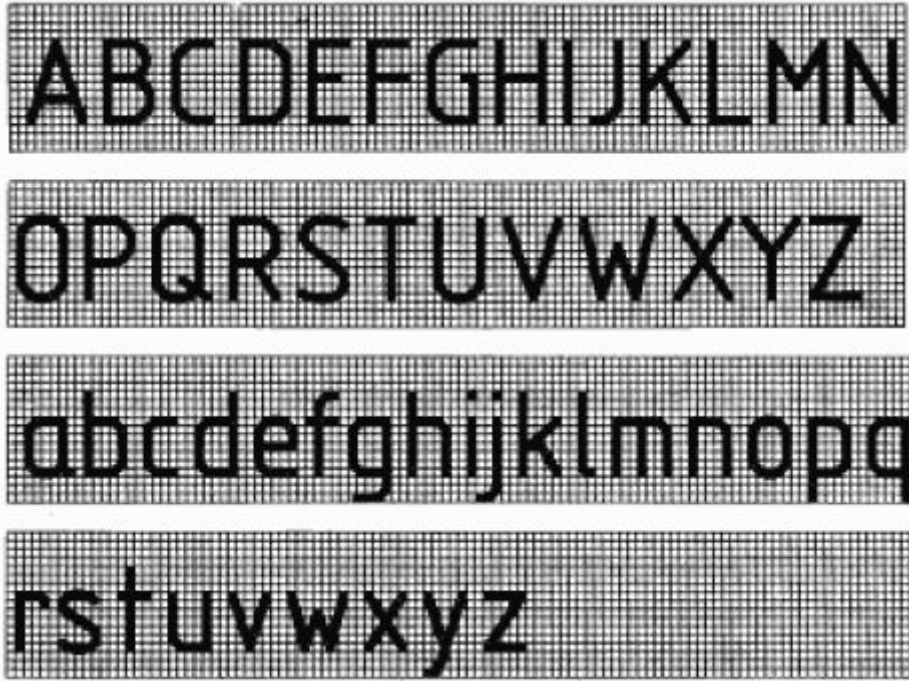
**TYPE A**

# Lettering



## 4) LETTERING

The two standard ratios for d/h, **1/14 (Type A)** and **1/10 (Type B)**, are most economical as they result in a minimum number of line thickness.



**TYPE B**

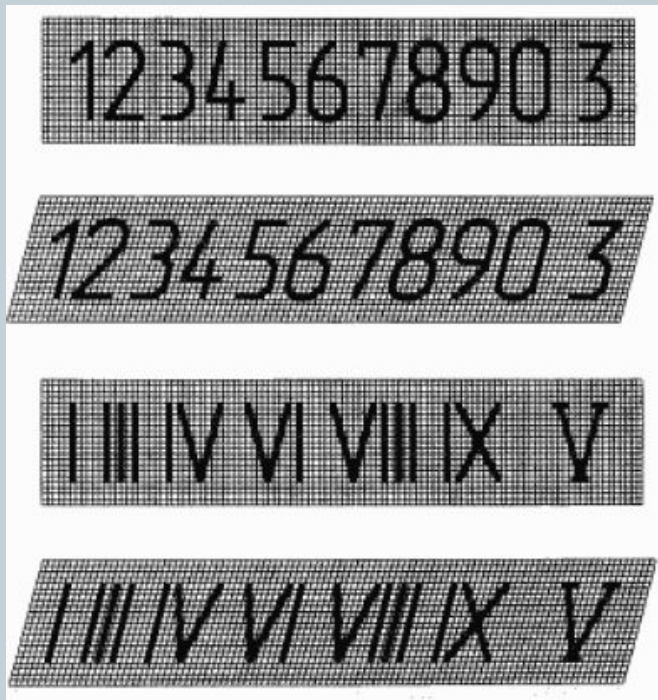


# Lettering

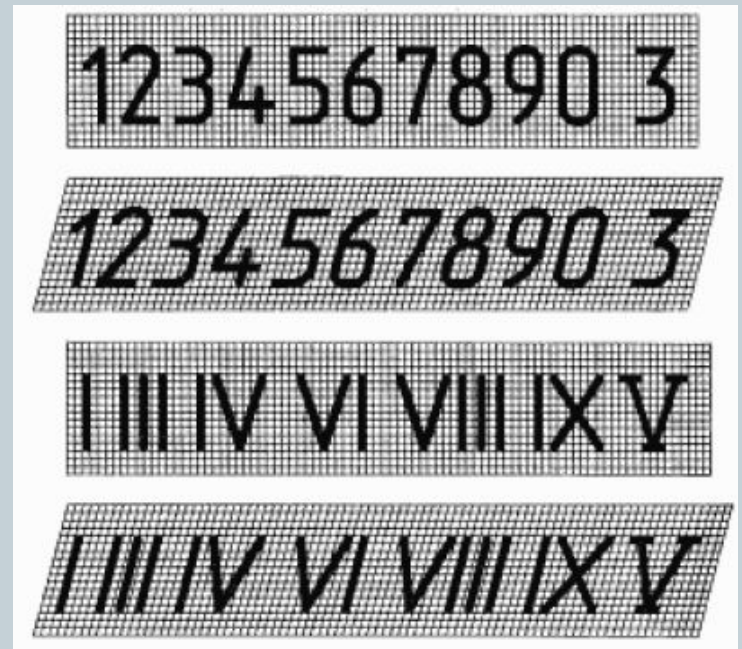


## 4) LETTERING

### Numerical symbols



**TYPE A**



**TYPE B**

# Lines on drawings



*Each line on a technical drawing has a definite meaning and is drawn in certain ways.*



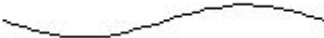
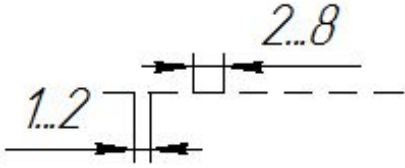
In technical drawings, make construction lines so light that they can barely be seen, with a ***hard sharp pencil such as 4H to 6H.***

For visible lines, hidden lines, and other “thick” lines use relatively ***soft pencils, such as F or H.***

All thin lines except construction line **must be thin, but dark.** They should be made with a ***sharp medium grad pencil, such as H or 2H.***

***Note***, that there should also be a distinct contrast in the thickness of different kinds of lines, particularly between the thick lines and thin lines.

# Types of the lines on drawings

<i>Type of line</i>	<i>Line</i>	<i>Thickness related to the basic line</i>	<i>General applications</i>
<i>Continuous thick (basic line)</i>		$S$	<i>Visible outlines</i> <i>Visible edges</i>
<i>Continuous thin</i>		<i>from <math>S/3</math> to <math>S/2</math></i>	<i>Dimension lines</i> <i>Leader lines</i> <i>Hatching</i> <i>Outlines of revolved section in place</i> <i>Short centre lines</i> <i>Lines of revolved elements limitation</i>
<i>Continuous thin freehand</i>		<i>from <math>S/3</math> to <math>S/2</math></i>	<i>Limits of partial or interrupted views and sections</i>
<i>Dashed thin</i>		<i>from <math>S/3</math> to <math>S/2</math></i>	<i>Hidden outlines</i> <i>Hidden edges</i>

# Types of the lines on drawings

<i>Chain thin</i>	<p>A diagram showing a thin chain line. It consists of a horizontal line with a vertical tick mark. Above the line, a dimension line indicates a length of 3..5. Below the line, a dimension line indicates a length of 5..30.</p>	<i>from S/3 to S/2</i>	<i>Centre lines Lines of symmetry Section lines for revolved section in place and removed section</i>
<i>Chain thick</i>	<p>A diagram showing a thick chain line. It consists of a horizontal line with a vertical tick mark. Above the line, a dimension line indicates a length of 3..8. Below the line, a dimension line indicates a length of 3..4.</p>	<i>from S/3 to 2/3S</i>	<i>Indication of surfaces to which a special requirement applies (coating, heat treatment)</i>
<i>Open-ended</i>	<p>A diagram showing an open-ended line. It consists of a horizontal line with a vertical tick mark. Above the line, a dimension line indicates a length of 8..20.</p>	<i>from S to 1.5S</i>	<i>Cutting plane lines</i>
<i>Continuous thin with zigzags</i>	<p>A diagram showing a continuous thin line with a zigzag pattern. The line is horizontal and has a single zigzag section in the middle.</p>	<i>from S/3 to S/2</i>	<i>Long lines of interrupting</i>
<i>Chain thin double dashed</i>	<p>A diagram showing a chain thin double dashed line. It consists of a horizontal line with a vertical tick mark. Above the line, a dimension line indicates a length of 5..30. Below the line, a dimension line indicates a length of 4..6.</p>	<i>from S/3 to S/2</i>	<i>Lines of metal folding on development Alternative or extreme positions of movable parts</i>

# Scales



**Scale** is the ratio of the linear dimension of an element of an object as represented in the original drawing to the real linear dimension of the same element of the object itself.

- 1) When the object is drawn in its **full size**, a scale with the ratio **1: 1** is used.
- 2) **Enlargement Scale** is a scale where the ratio is larger than 1 : 1. These scales are used for describing small elements of the object.
- 3) **Reduction Scale** is a scale where ratio is smaller than 1: 1. These scales are used for describing a large element of the object if decreasing does not influence on the object understanding.

<i>Type of scale</i>	<i>Russian Standard</i>	<i>ISO 5455:1979 Technical drawings - Scale</i>
<b>Enlargement scales</b>	2 : 1	2 : 1
	2,5 : 1	-
	4 : 1	-
	5 : 1	5 : 1
	10 : 1	10 : 1
	20 : 1	20 : 1
	40 : 1	-
	50 : 1	50 : 1
<b>Full size</b>	1 : 1	
<b>Reduction scales</b>	1 : 2	1 : 2
	1 : 2,5	-
	1 : 4	-
	1 : 5	1 : 5
	1 : 10	1 : 10
	1 : 15	-
	1 : 20	1 : 20
	1 : 30	-
	1 : 40	-
	1 : 50	1 : 50
	1 : 100	1 : 100