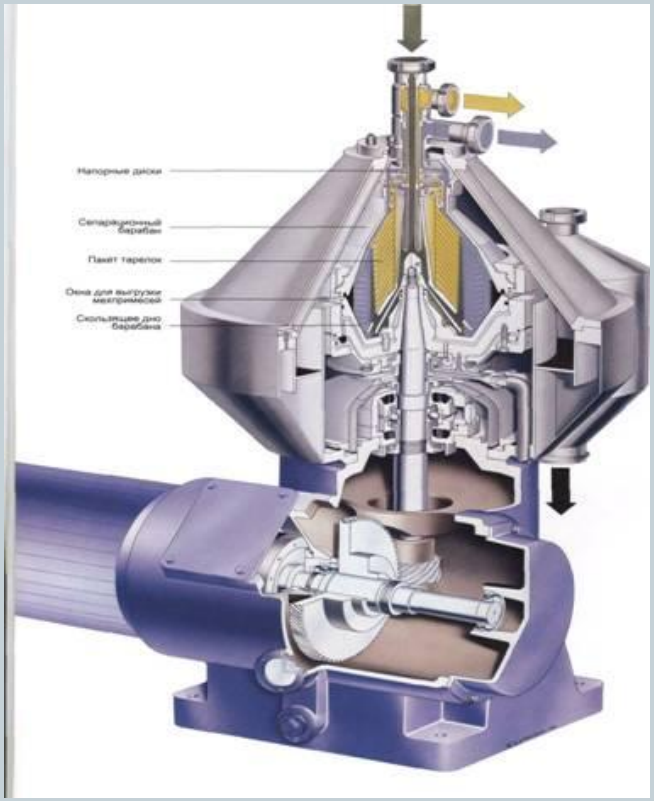
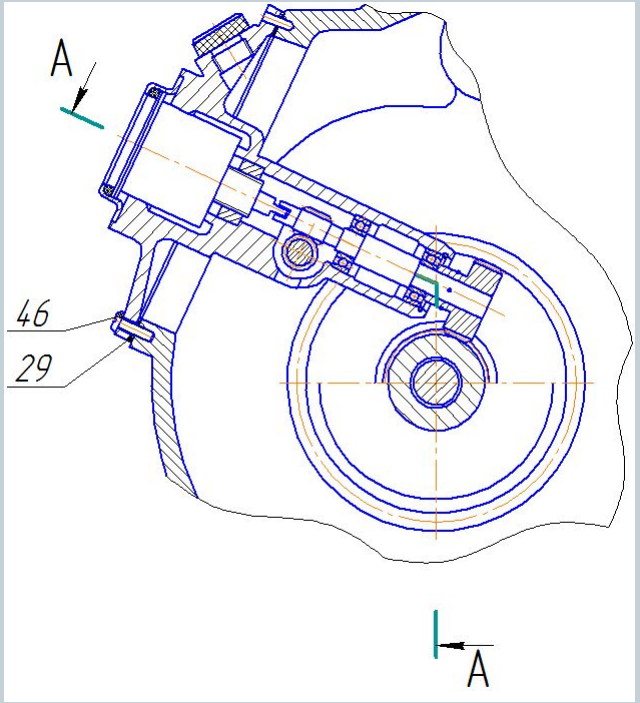
Introduction to Engineering Drawing.
Basic rules of drawing execution.



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.

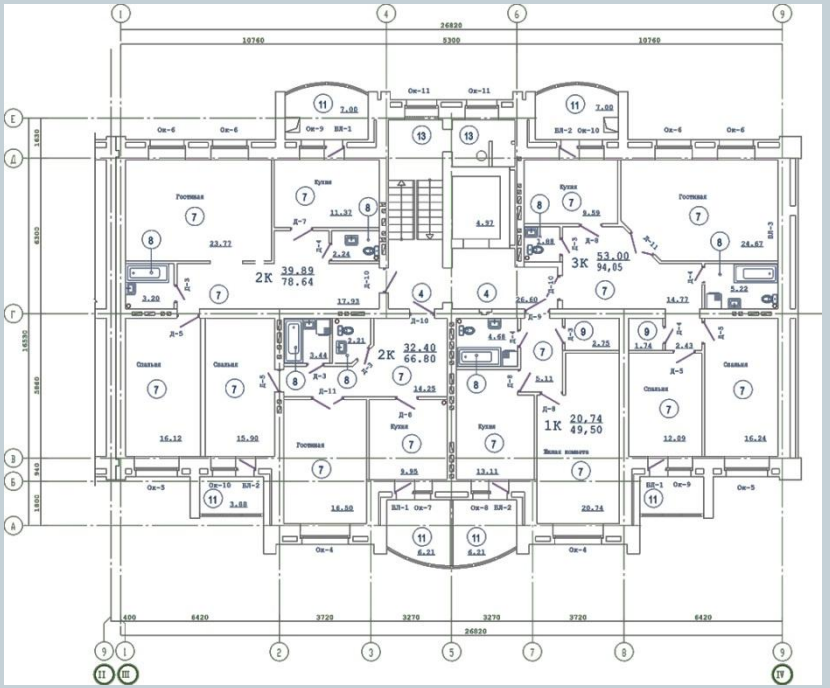
Types of drawing

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.

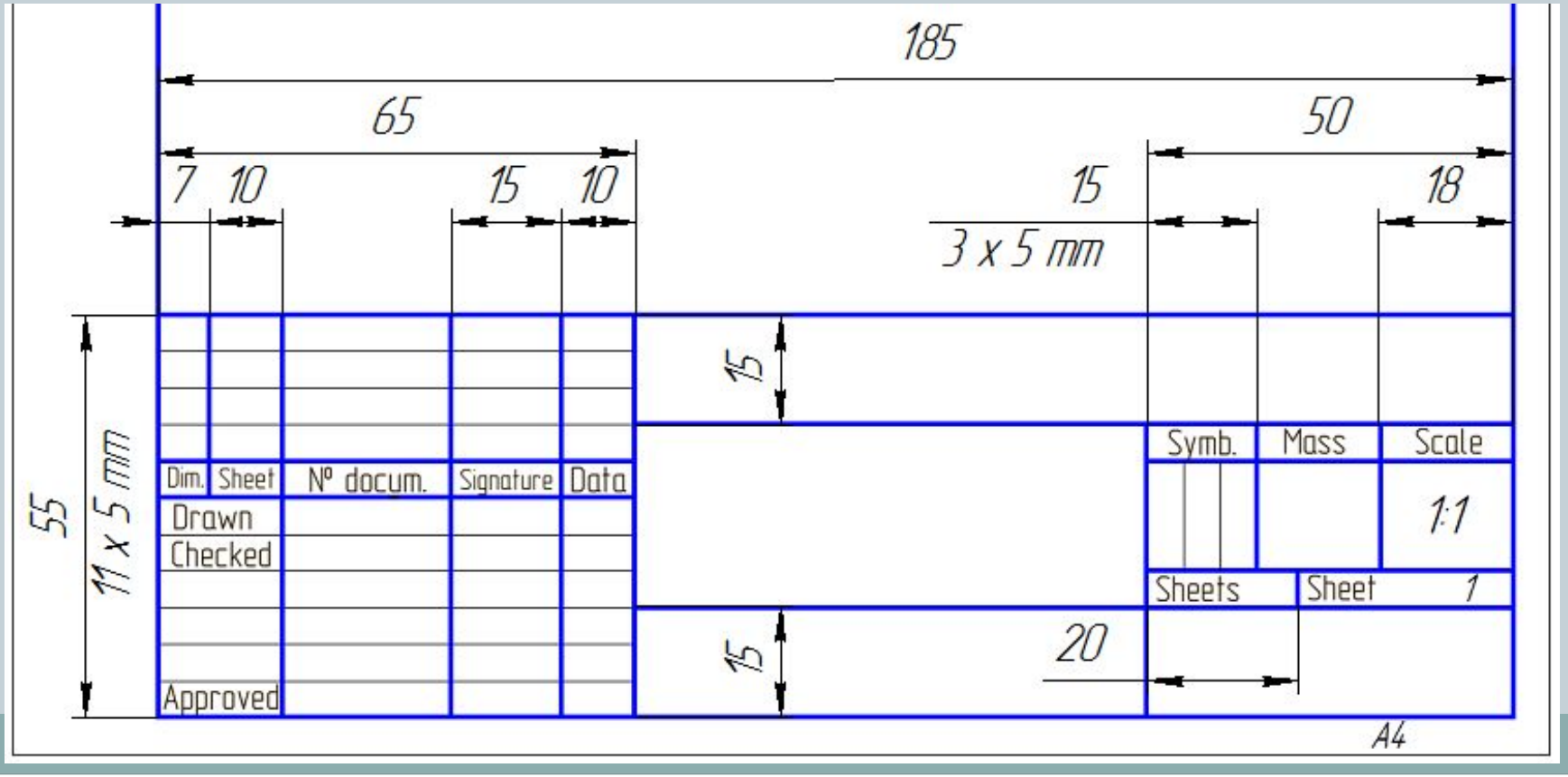
All engineering drawings are made on sheets of paper of strictly defined sizes. The ISO most recommended paper sizes for technical drawings are known as **A-FORMATS**

A-Format designation	Dimension, mm	Surface area, m^2
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**

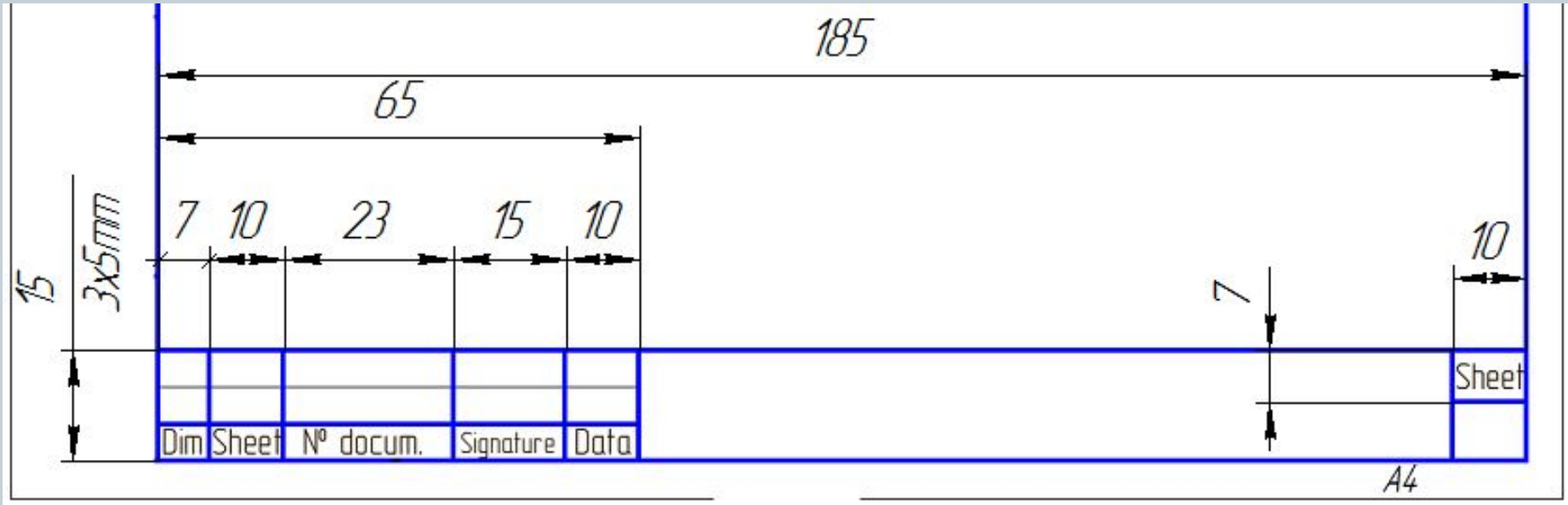
Russian Standard Title block (First sheet)



Drawing equipment and tools

2) **TITLE BLOCK, BORDERS AND FRAMES**

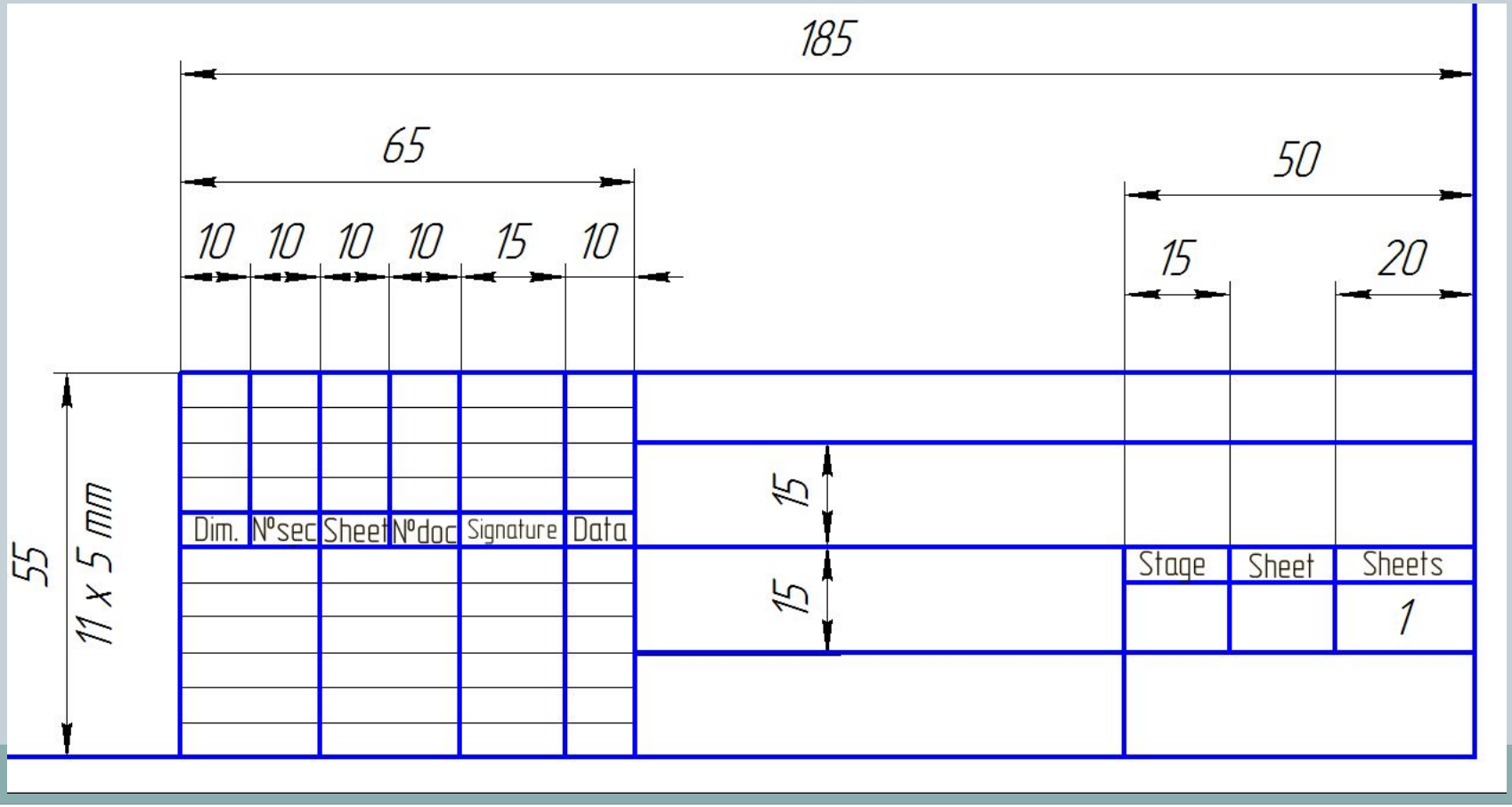
Russian Standard Title block (for subsequent sheets)



Drawing equipment and tools

2) **TITLE BLOCK, BORDERS AND FRAMES**

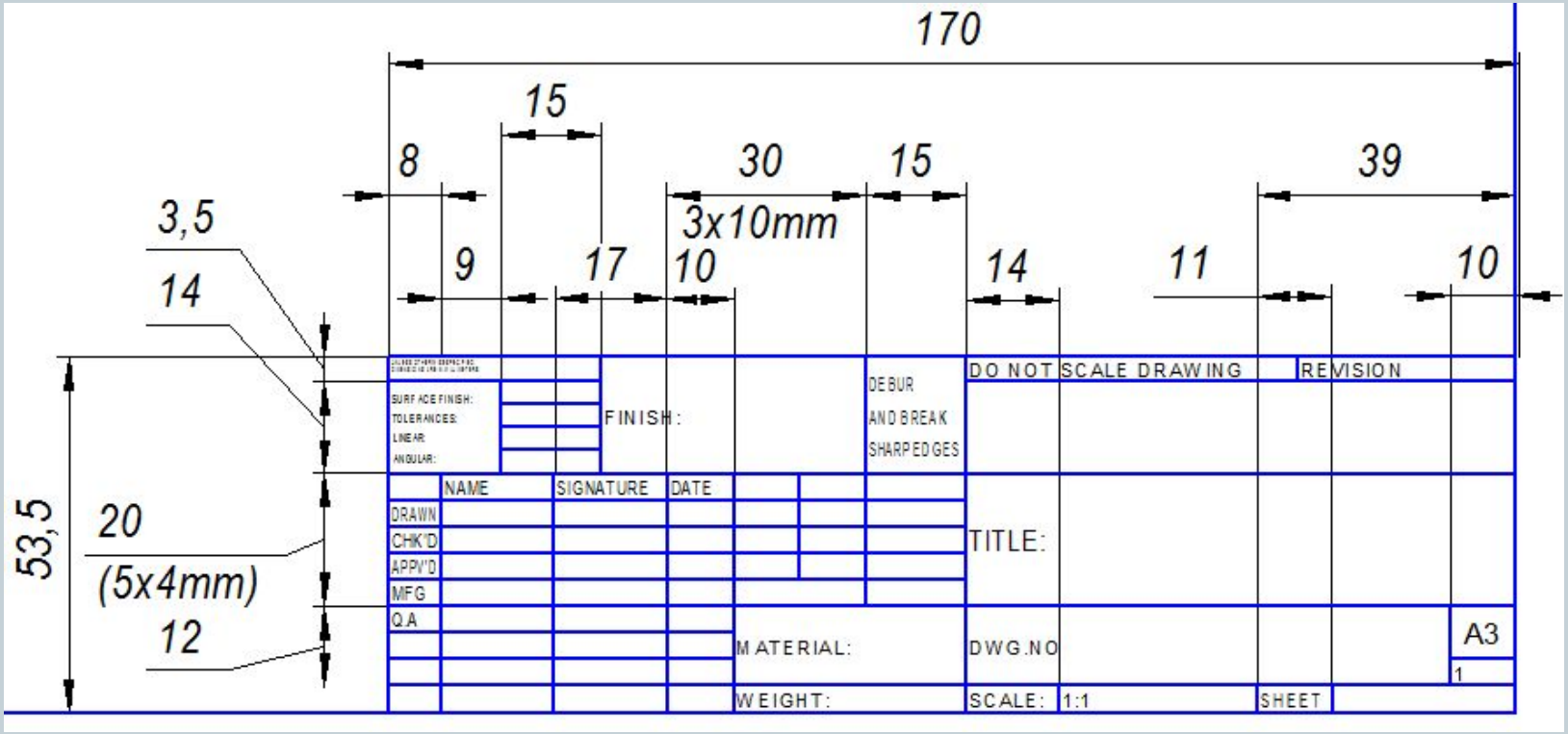
Russian Standard Title block (for Civil Engineering)



Drawing equipment and tools

2) TITLE BLOCK, BORDERS AND FRAMES

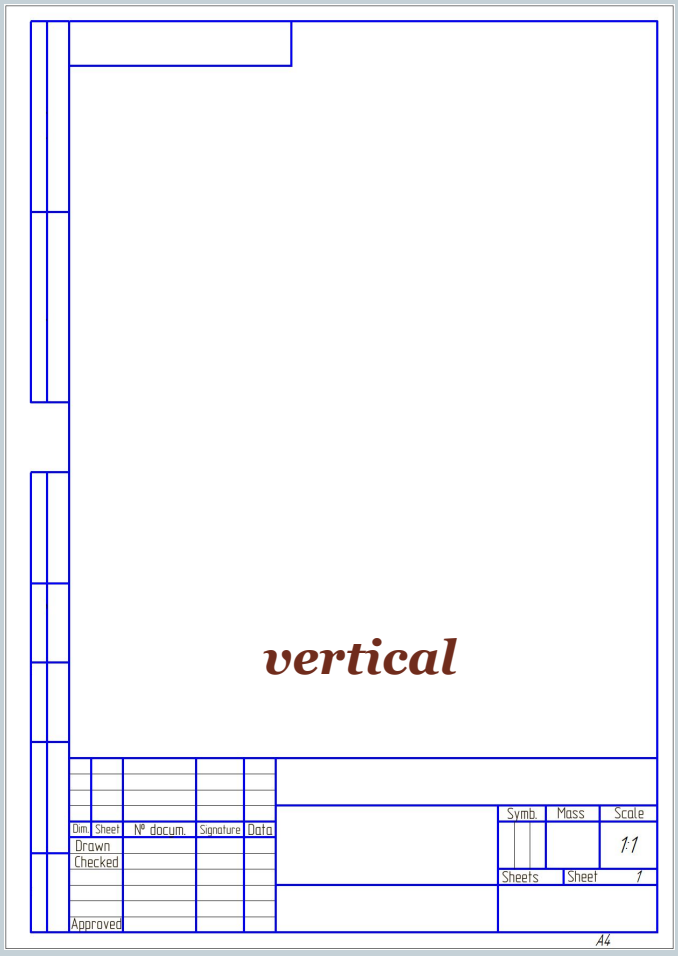
ISO 7200:2004 Title block

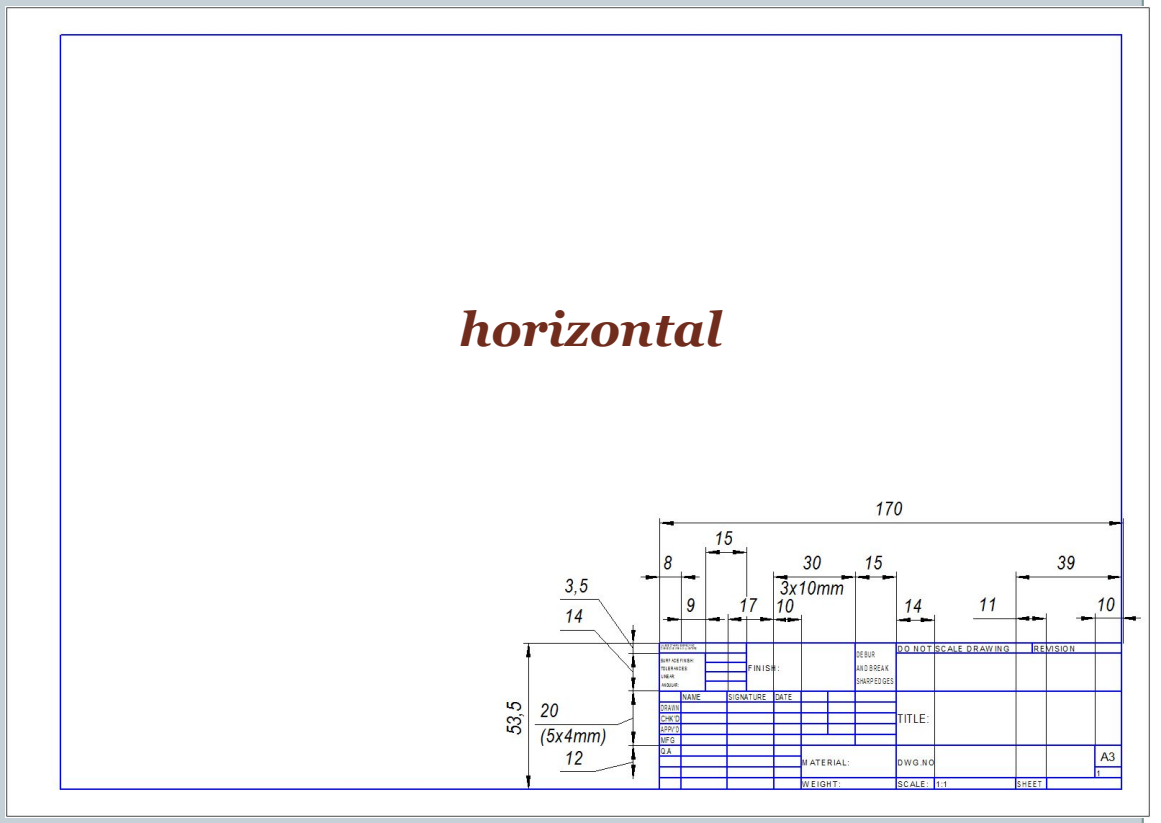


The total width is 170-180 mm for an A4 sheet, with the left margin being 20 mm and the right margin 10 mm. The same title block is used for all paper sizes.

Drawing equipment and tools

2) BORDERS AND FRAMES, AND LAYOUT

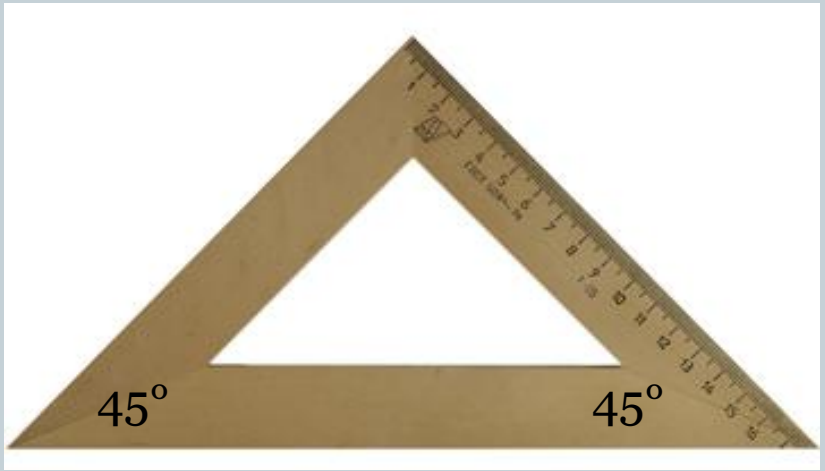




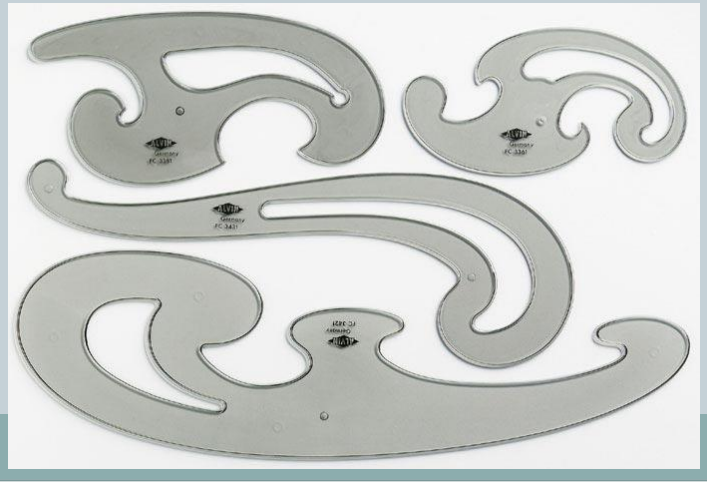
Layout of sheet for engineering drawing

Drawing equipment and tools

3) **TOOLS: triangles (setsquares)**

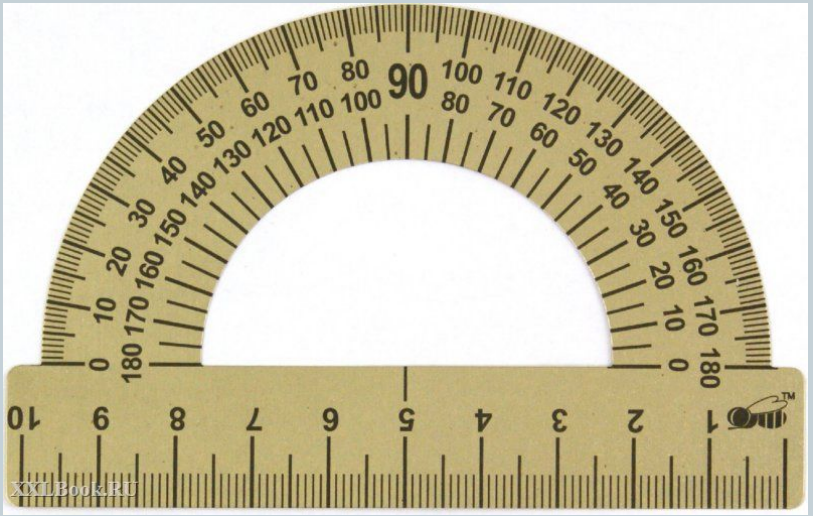


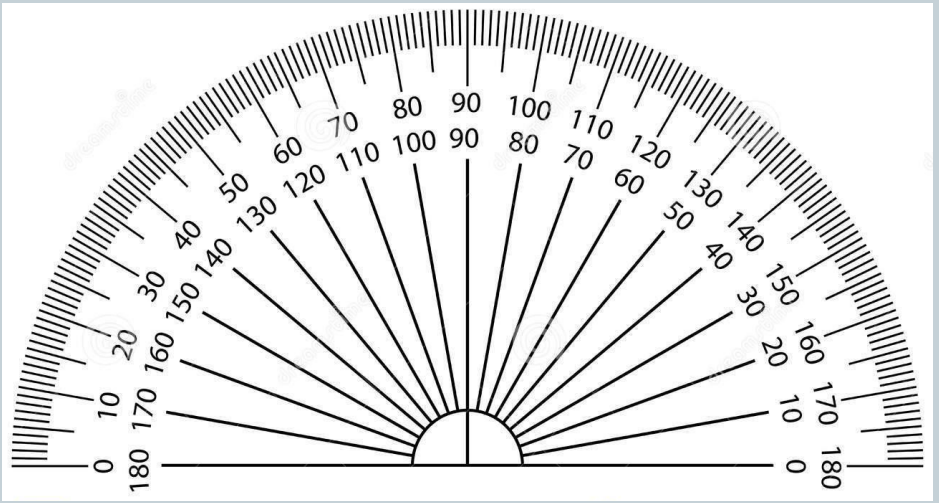
3) **TOOLS: French curves**



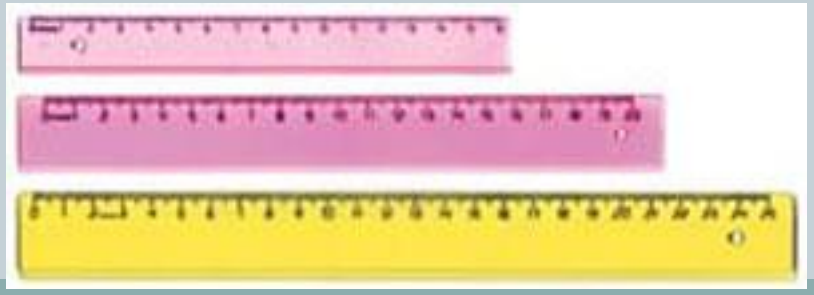
Drawing equipment and tools

3) **TOOLS: Protractor**



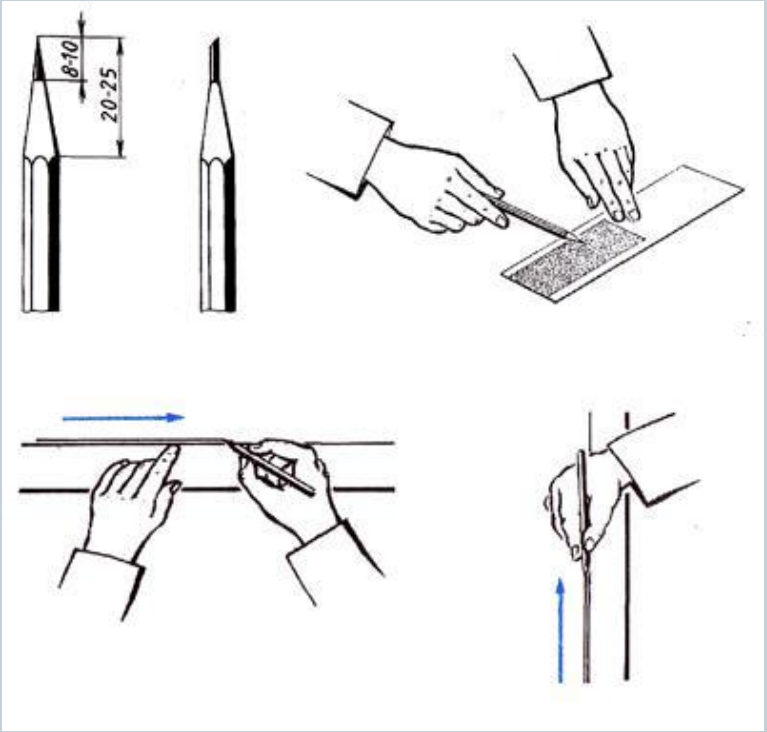


3) **TOOLS: Scales (rulers)**



Drawing equipment and tools

3) TOOLS: Pencil

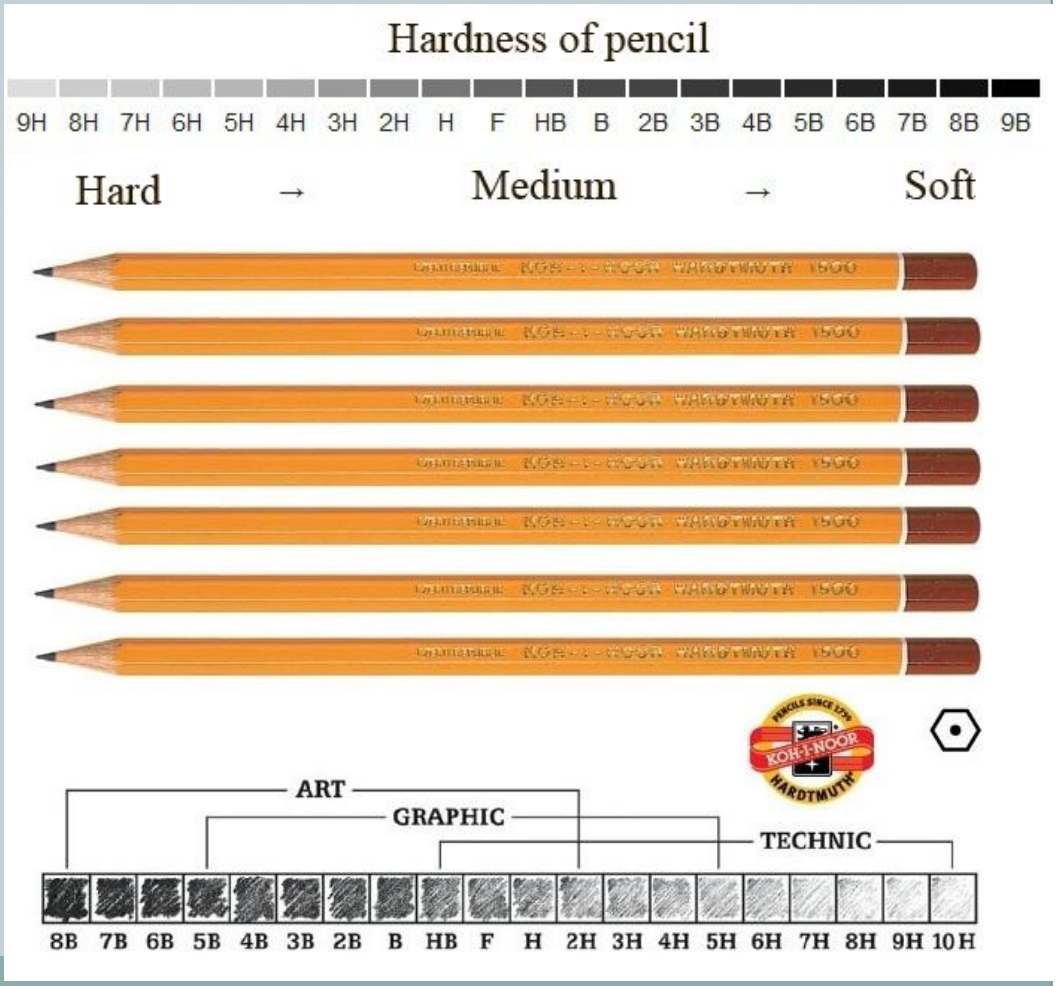


Recommended size of the lead is 8-10 mm

Recommended direction of drawing

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

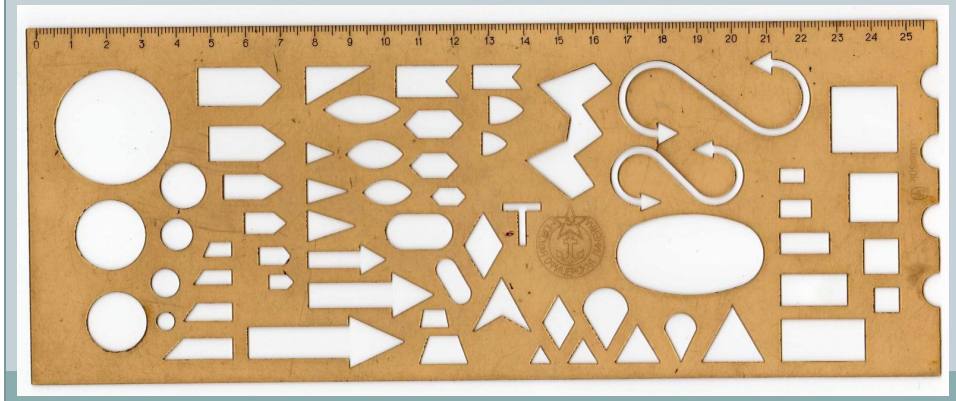
Hardness of pencil

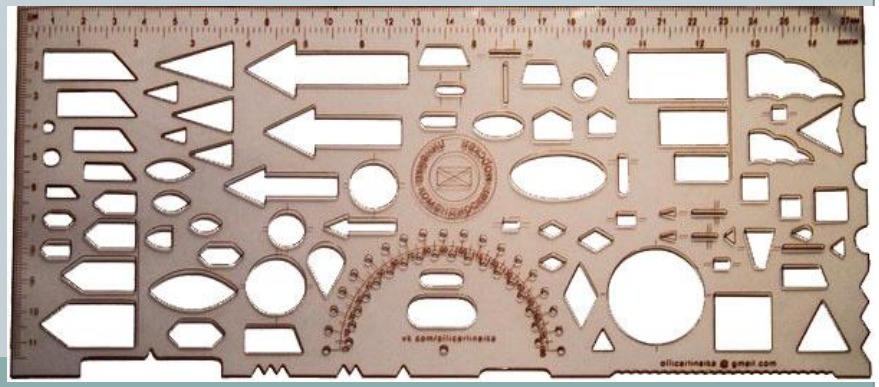


Drawing equipment and tools

3) **TOOLS: Compass**

3) **TOOLS: Template**





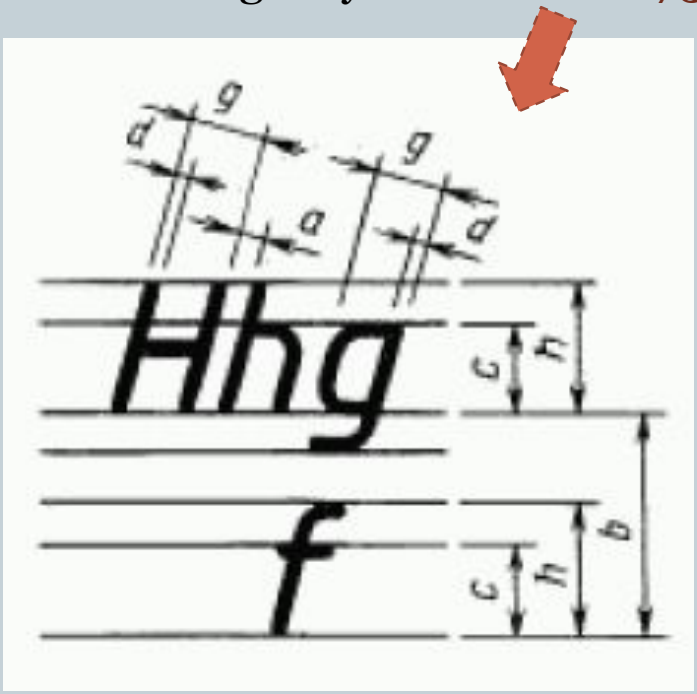
Lettering

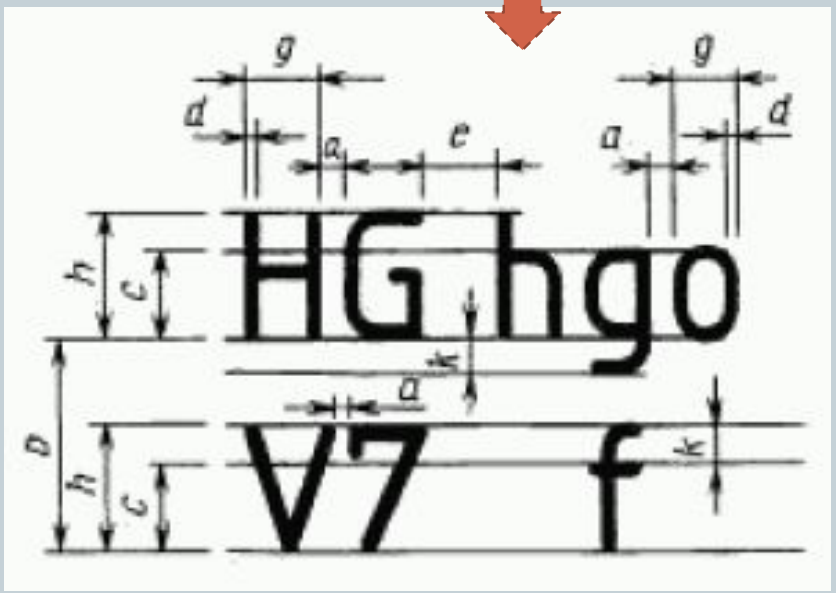
4) **LETTERING**

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.**

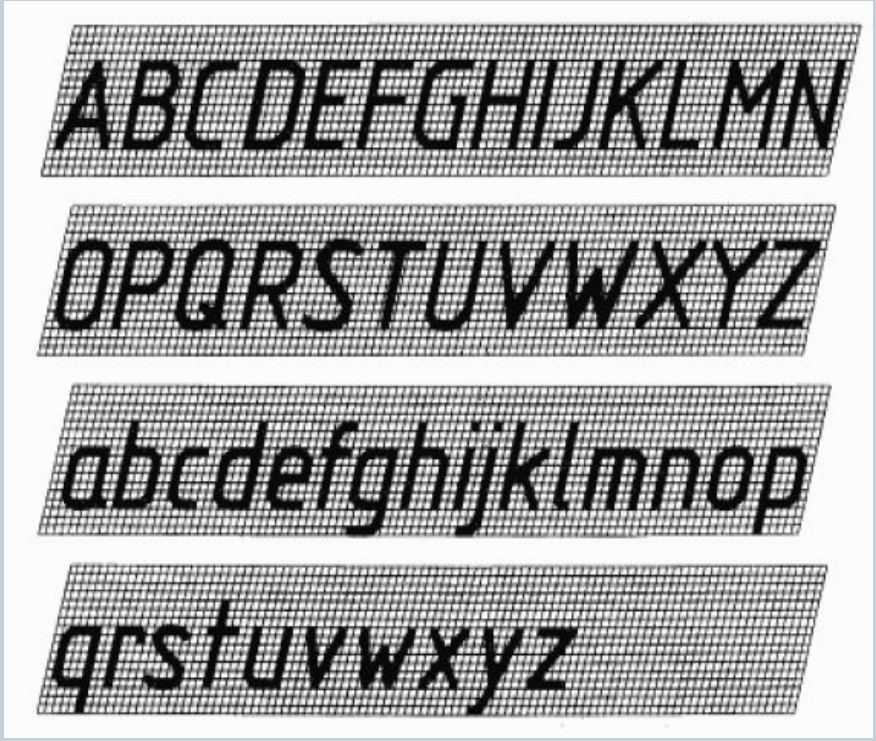




Lettering

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.

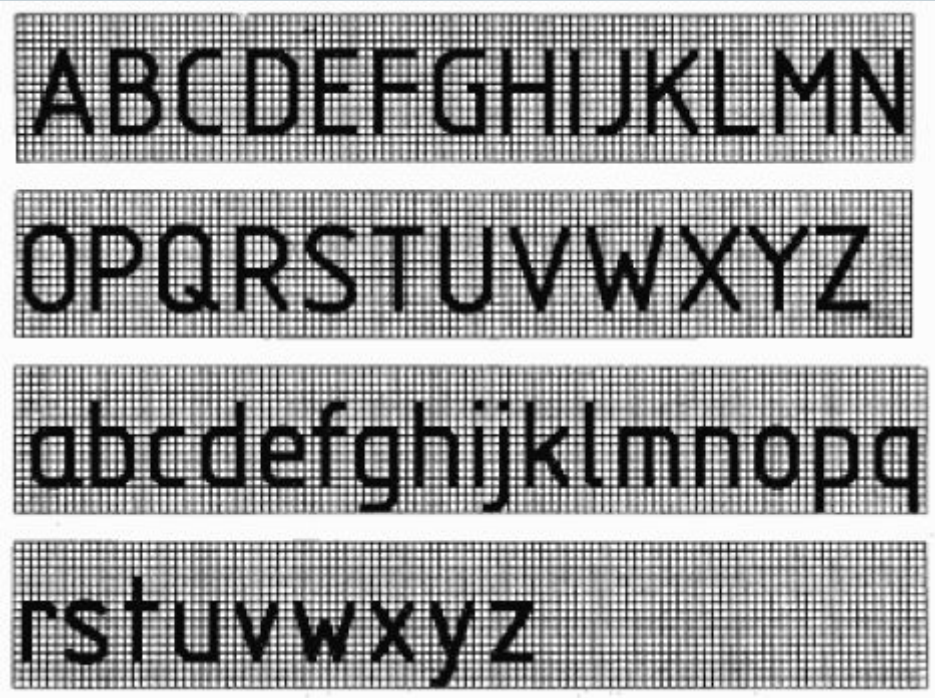


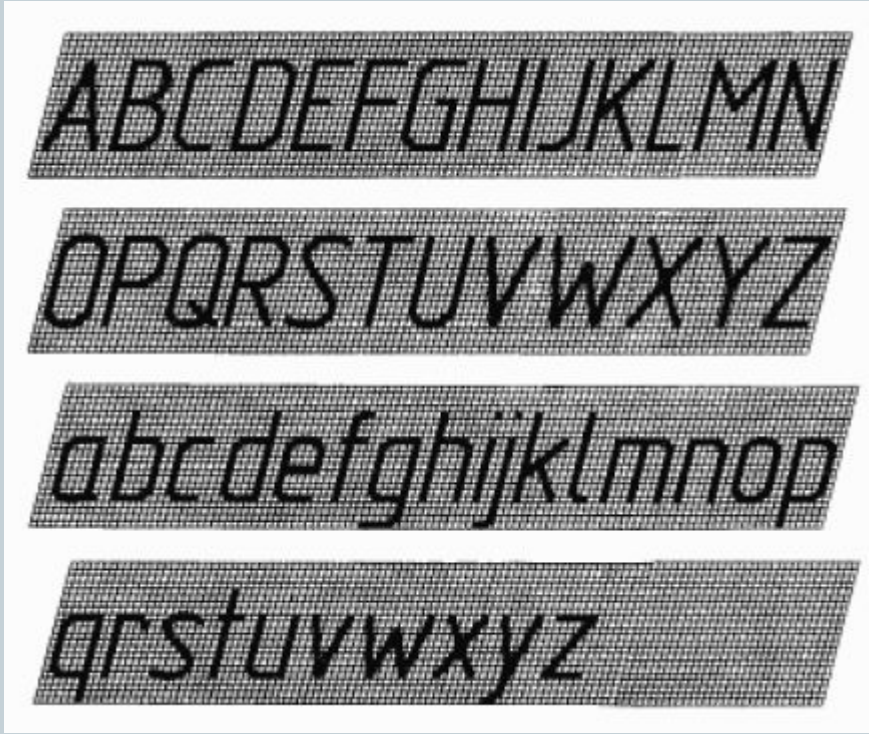
TYPE A

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.



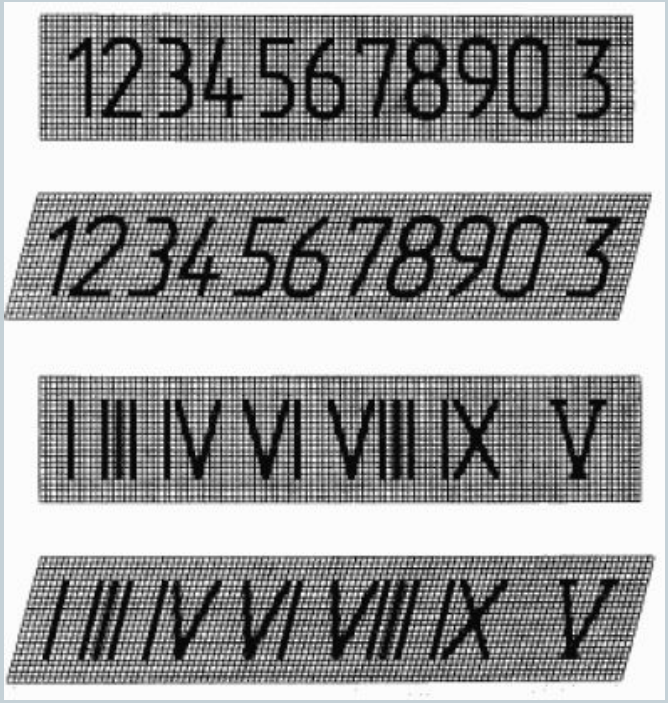


TYPE B

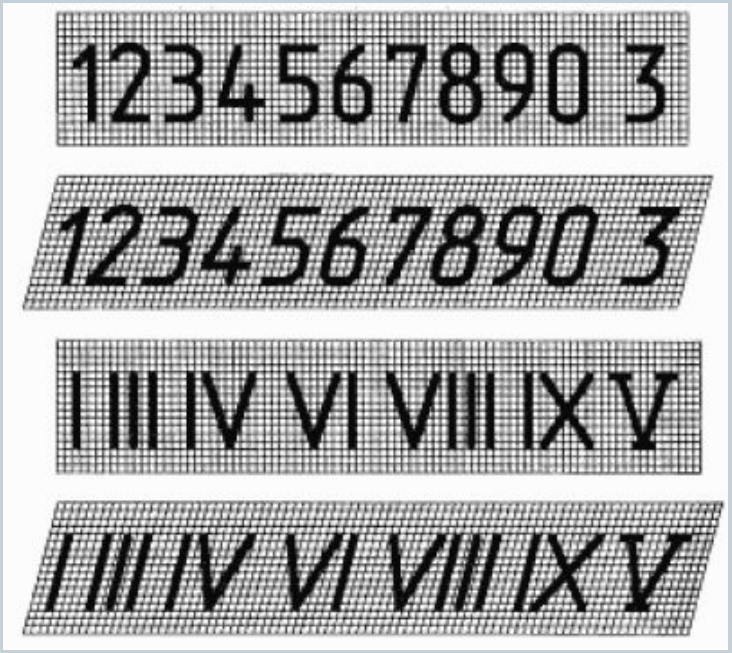
Lettering

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.

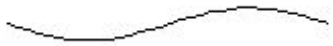
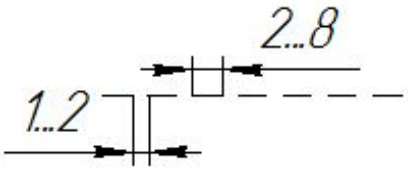
In technical drawings, make *construction lines* so light that they can barely be seen, with a ***hard sharp pencil such as 4Hto 6H***.

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

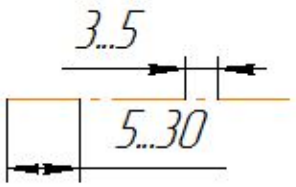
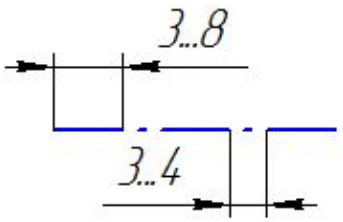
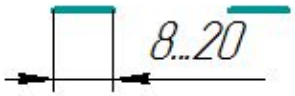
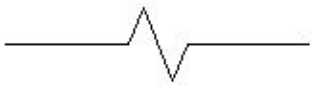
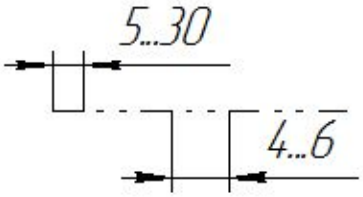
All *thin lines* except construction line **must be thin, but dark.** They should be made with a ***sharp medium grad pencil, such as H or 2H.***

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

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

Types of the lines on drawings

Chain thin		from S/3 to S/2	Centre lines Lines of symmetry Section lines for revolved section in place and removed section
Chain thick		from S/3 to 2/3S	Indication of surfaces to which a special requirement applies (coating, heat treatment)
Open-ended		from S to 1.5·S	Cutting plane lines
Continuous thin with zigzags		from S/3 to S/2	Long lines of interrupting
Chain thin double dashed		from S/3 to S/2	Lines of metal folding on development Alternative or extreme positions of movable parts

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.

Type of scale	*Russian Standard*	*ISO 5455:1979 Technical drawings - Scale*
Enlargement scales	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
Full size	1 : 1	
Reduction scales	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