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USSR

STATE STANDARD

T-4096

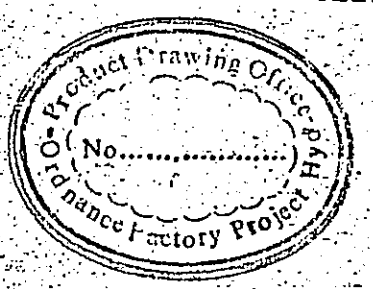
MEASURING INSTRUMENTS

DIALS AND SCALES

TECHNICAL REQUIREMENTS

GOST 5365-73

Official Publication



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The State Committee for Standards
of the Council of Ministers of the USSR

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Group II 04

USSR STATE STANDARD

I 4096

MEASURING INSTRUMENTS
DIALS AND SCALES
TECHNICAL REQUIREMENTS

GOST
5365-73
Supersedes
GOST 5365-70

By the decision of the State Committee for Standards of the Council of Ministers of the USSR dated July 18, 1973 No. 1752, declared effective

from July 1, 1974
to July 1, 1979

NON-OBSERVANCE PROSECUTED

1. This Standard covers dials and scales of indicating instruments and recorders intended for measuring electric and non-electric quantities.

The Standard does not cover:

dials and scales of aviation instruments;

dials and scales of instruments for measuring time and mass;

dials and scales in which the readings are taken by the level of a liquid or gas without an indicator;

dials and scales, the technical requirements for which are established in state standards for separate types of instruments;

dials and scales in which the readings are taken through magnifying optical devices or by projecting the image on a screen;

auxiliary scales;

2. The form of the dials is:

flat, cylindrical, conical;

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3. The scales are made:

by form:

tape (horizontal and vertical), fan (angle up to 180°, inclusive) and circular (arc angle exceeding 180°);

by the relationship of the division lengths within one scale

linear and non-linear;

by luminescence

luminous and non-luminous.

4. The materials, coatings, paints and enamels used for making dials and scales shall comply with the requirements to separate groups of measuring instruments depending on the operating conditions.

5. The external view of the dial face - according to coatings of class II as per GOST 9.032-74.

6. The dial face shall have a light silvery white dull surface (for direct-contrast scales) or a black dull surface (for reverse-contrast scales). It is allowed to coat dials with short-time action luminous paint. The coating shall be without curtains, spots and other defects which worsen the external view of the dial.

7. Marks, numerals and designations on a white dial shall be black, and on a black dial they shall be white or yellow. The marks, numerals and designations may be coated with short-time action luminous paint.

8. The functional zones of the scales, separate marks and/or numerals may be made as dashes or strips of bright colour by Customer's request, the red colour designating the emergency value of the parameter, the yellow one - the zone of extreme values of the parameter, the green one - the zone of normal parameter values.

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For multiscale instruments the scales may be indicated with paint of different colours - red, blue, green; the designations on the functional zones shall not be marked out thereat with colour.

The total number of different colours on one dial shall not exceed four.

9. The main structural element of a scale is the graduation base - the interval between two successively numbered marks.

The graduation base may have marks of different sizes A, B, and C (see Fig. 1) which form respectively:

the primary divisions;

the secondary divisions, and

the ternary (lowest order) divisions.

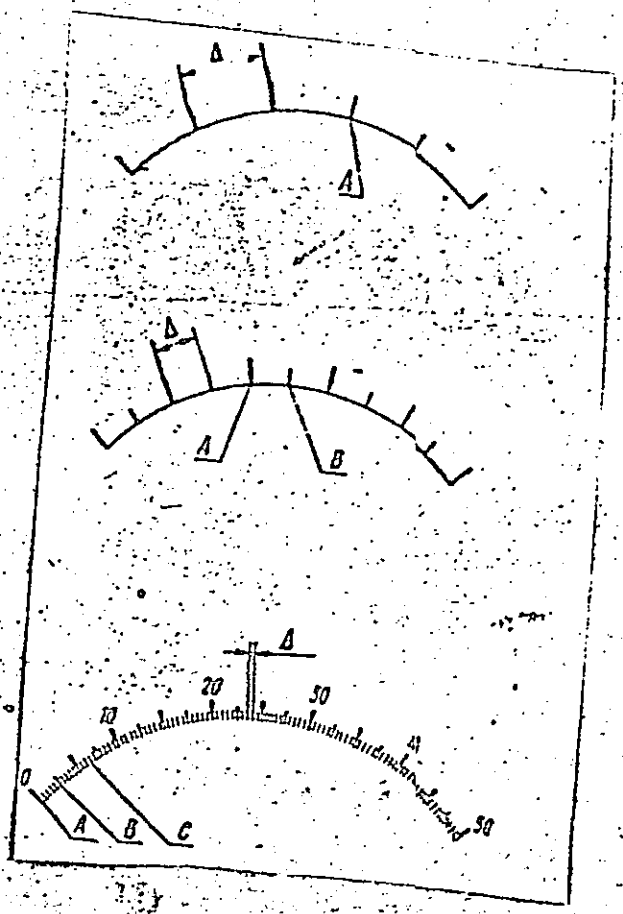

Fig. 1

Besides marks A, B, C on the dial there may be arranged other marks which directly refer to the taking of readings. I 4096

The width of the marks A, B, and C for scales of portable instruments of the classes of accuracy from 0.02 to 0.5 shall be the same and shall not exceed 0.2 mm.

For other instruments the width of the marks shall correspond to that shown in Table 1, the case of uniform width of the marks A, B, and C being preferable.

Within one scale the marks of one and the same order shall not differ from one another by width, mm, more than:

0.05 - for mark width up to 0.5 mm;

0.1 - for mark width exceeding 0.5 up to 1 mm, inclusive;

0.2 - for mark width exceeding 1 mm.

To increase the accuracy and facilitate the taking of readings the dials and scales may have additional designations, the requirements to which are established in standards for the corresponding groups of instruments.

Table 1

Scale length (conditional) mm	Scale mark width, mm					
	Portable instruments, except for class of accuracy 0.5 and more accurate ones			Panel instruments with reading distance, m		
				0.5-2.0		
	A	B	C	A	B	C
Up to 15	0.1-0.3	0.1-0.3	0.1-0.2	0.1-0.4	0.1-0.2	0.1-0.2
Exc. 15 to 30	0.1-0.3	0.1-0.3	0.1-0.3	0.2-0.5	0.2-0.3	0.1-0.3
Exc. 30 to 60	0.1-0.3	0.1-0.3	0.1-0.3	0.3-0.6	0.2-0.4	0.1-0.3
Exc. 60 to 100	0.1-0.5	0.1-0.3	0.1-0.3	0.3-1.0	0.2-0.6	0.1-0.4
Exc. 100 to 150	0.1-0.7	0.1-0.4	0.1-0.4	0.5-1.5	0.2-0.8	0.1-0.5
Exc. 150 to 300	0.1-1.0	0.1-0.6	0.1-0.6	0.6-2.0	0.3-1.2	0.1-0.8
Exc. 300 to 600	0.1-1.5	0.1-0.7	0.1-0.7	0.7-2.5	0.4-2.0	0.1-1.2
Exc. 600 to 1000	0.1-1.6	0.1-0.8	0.1-0.8	0.6-3.0	0.4-2.4	0.1-1.5
Exc. 1000	0.1-1.7	0.1-1.0	0.1-0.8	0.7-3.5	0.5-2.6	0.1-1.8

Table 1 cont'd

Length of scale (conditional) mm	Scale mark width, mm of panel instruments for reading distance, m					
	2 - 5			5 - 10		
	A	B	C	A	B	C
Up to 15						
Exc. 15 to 30						
Exc. 30 to 60						
Exc. 60 to 100						
Exc. 100 to 150	0.8-3.0	0.6-2.5	(.5-2.0			
Exc. 150 to 300	1.0-4.0	0.8-3.0	(.7-2.5			
Exc. 300 to 600	1.5-5.0	1.2-4.0	.0-3.0	1.7-5.0	1.5-4.0	1.2-3.6
Exc. 600 to 1000	1.7-5.0	1.5-4.0	.2-3.0	1.8-6.0	1.6-5.0	1.5-3.5
Exc. 1000	2.0-7.0	1.8-6.0	1.6-4.0	2.2-8.0	2.0-5.0	1.8-5.0

NOTE. 1. The conditional scale length corresponds to the distance between the most extreme scale marks measured along a straight line between the points on the ends of the marks facing the indicator geometric axis.

2. For panel instruments of class of accuracy 1.5 and higher the width of the marks may be the same and equal to that of mark C.

10. The kinds of graduation bases are established by the standard for a group of instruments.

Examples of graduation bases for linear scales are given in the recommended Appendix 1.

11. For panel instruments the marks A and B may be rectangular or triangular as shown in Figs. 2 and 3.

12. The length of the marks A, B, and C shall correspond to the dimensions given in Table 2.

When two or more scales are located on a dial, as well as for circular scales the length of the marks A, B, and C may be twice as smaller as that indicated in Talle 2, although the length of

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the shortest mark shall be not less than 0.8 mm. Additional marks on the scale should differ from marks A, B, and C by length or colour.

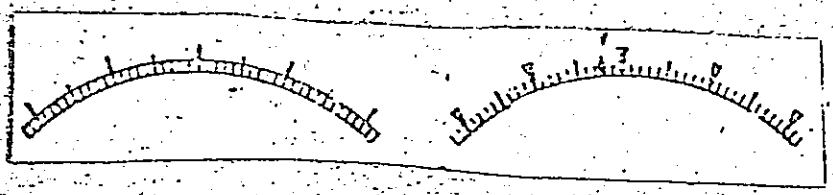

Fig. 2

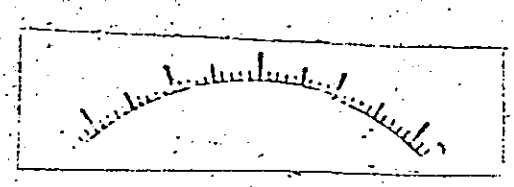

Fig. 3

Within one scale the lengths of the marks of one order may differ from one another, mm, not more than:

0.2 - at mark length up to 4 mm;

0.5 - at mark length exceeding 4 mm.

13. The spacing of the scale shall correspond to the standard requirements for a group of instruments.

14. In instruments with a constant spacing the effective range of the scale may have extreme divisions with a spacing differing from that of the remaining divisions. The mark which designates this division should be shorter than the previous mark but not smaller than 2/3 of the shortest mark of the scale (see Fig. 4).

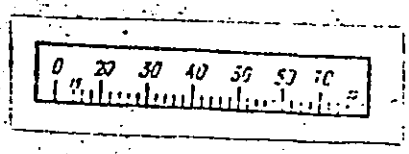

Fig. 4

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Scale length (conditional) mm	Scale mark length, mm											
	of portable instruments			of panel instruments for reading distance, m								
				0.5-2			2-5			5-10		
	A	B	C	A	B	C	A	B	C	A	B	C
Up to 15	1.8-4.0	1.4-3.0	0.8-1.5	2-4	1.8-3.0	0.8-1.5						
Exc. 15 to 30	2.0-5.0	1.8-3.5	1.0-2.0	3-5	2.0-3.5	1.0-2.0						
Exc. 30 to 60	3.0-6.0	2.5-4.5	1.5-3.0	3-6	2.5-4.5	1.5-3.0						
Exc. 60 to 100	5.0-8.0	4.0-6.0	2.5-4.0	4-10	3.0-8.0	2.0-5.0						
Exc. 100 to 150	5.0-10.0	4.0-8.0	2.5-5.0	6-12	4.0-9.0	2.5-6.0	10-20	5-12	4-10			
Exc. 150 to 300	6.0-12.0	4.5-10.0	3.0-8.0	7-14	4.5-12.0	2.5-8.0	12-24	6-15	4-12			
Exc. 300 to 600	6.0-12.0	4.5-10.0	3.0-8.0	8-16	5.0-12.0	3.0-8.0	14-25	8-17	6-15	16-30	12-25	10-20
Exc. 600 to 1000	6.0-12.0	4.5-10.0	3.0-8.0	8-16	6.0-14.0	4.0-9.0	15-28	10-22	8-18	20-40	16-30	12-25
Exc. 1000	7.0-14.0	5.0-8.0	4.0-9.0	9-17	6.0-14.0	4.0-9.0	16-30	12-25	10-20	30-50	20-40	15-30

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15. The ends of the scale marks may be connected with a limiting line. The width of this line shall be within the limits given in Table 1 for marks C.

16. The effective range of the scale should be sharply defined from the non-effective range or the overload range.

17. The ends of marks of fan and circular scales facing the indicator shall be located at an equal distance from the centre of the scale.

18. The beginning of the scales should be located:

in the left-hand side of the dial - for a horizontal tape scale;

in the lower part of the dial - for a vertical tape scale (except for depth gauges);

in the left-hand and lower part of the dial - for a fan scale;

at the points of intersection of the scale by the vertical or horizontal diameter - for a circular continuous scale;

in the left-hand lower quadrant - for a circular scale with an interval between its beginning and end.

If there are two or more scales on a dial then it is allowed for the initial mark of one of them to be located at the right-hand side or in the upper part; the zero marks of the remaining scales should be located so as to provide the possibility of simultaneous setting of the indicator to all the zero marks located on one side, or to the mechanical zero mark - for set-up scales (Fig. 5).

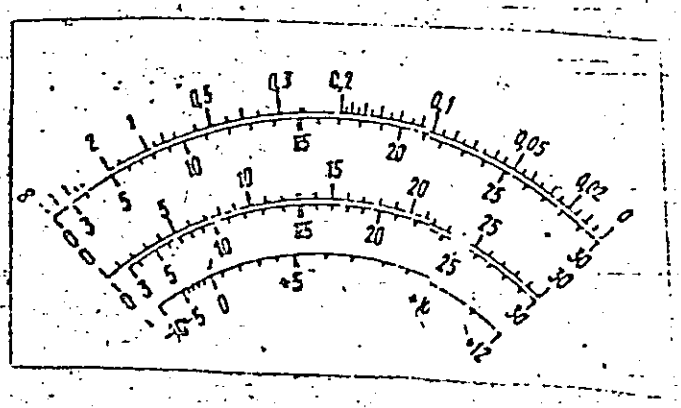

Fig. 5

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19. In multiscale instruments it is allowed to inscribe two scales on one arc (on its external and internal sides). In case the scales are inscribed on two or more arcs the distance between the arcs shall be not less than 0.5 mm.

20. The marks axes along the full length of the scales shall coincide with the geometric axis of the indicator.

21. The scale must have not less than four numeric marks, and for small-size and miniature instruments - not less than three.

The reading numbers must be inscribed opposite mark A.

It is allowed to leave some marks without numbers for the interval between two adjacent numbers to be not less than 1 1/2 of the width of one numeral. For non-linear scales it is allowed to shorten the intervals if the reading numbers are located along the marks axes of symmetry (fig. 6).

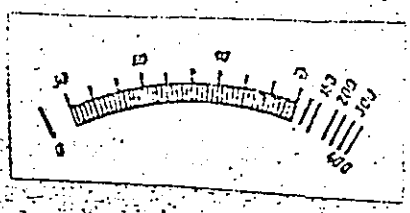

Fig. 6

22. In multirange instruments for measurement ranges which differ by the factor 10^n (n - any integer positive or negative number) it is allowed to inscribe several rows of reading numbers (Fig. 7).

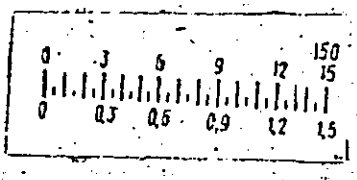

Fig. 7

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23. For multirange instruments it is allowed to use one row of reading numbers for two adjacent scales (Fig. 8).

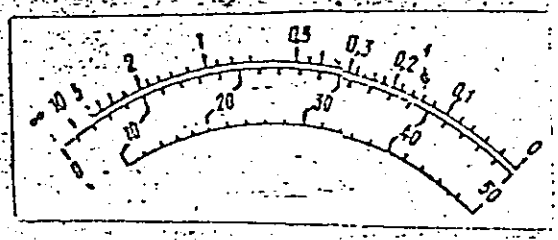

Fig. 8

24. The reading number must be inscribed irrespective of the mark dimension against the mark where the spacing changes (Fig. 9).

Fig. 9

25. The dimensions of the reading numbers in the beginning and end of the measurement range should be smaller than the intermediate ones, and they should be absent in scales up to 100 mm long. The reading numbers of the extreme marks are allowed to be located not in level with the remaining reading numbers, but symmetrically with respect to the end of the marks (Fig. 10).

26. The reading numbers shall be located symmetrically with respect to the corresponding marks if the mark axes are parallel or perpendicular to the number axes. The maximum shift of the number with respect to the mark axis of symmetry shall not exceed one half of the width of one number for horizontal scales, and one quarter of the height for vertical scales (except for the cases mentioned in item 23).

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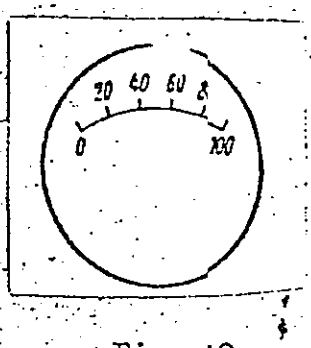

Fig. 10

27. The number axes on dials with circular or fan scales should be vertical (for movable dials - radial), the point of intersection of the diagonals of the rectangles into which the number is inscribed being located on the continuation of the mark axis (Fig. 11).

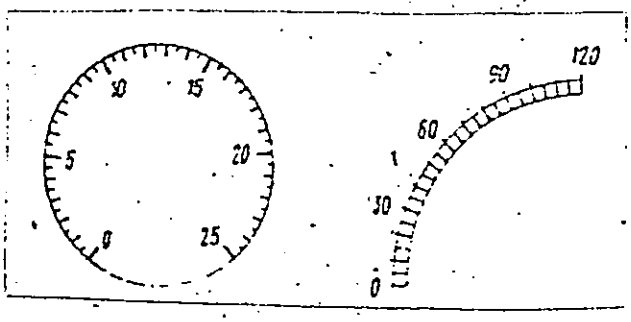

Fig. 11

For fan scales it is allowed to inscribe the figures parallel or perpendicular to the mark's axes of symmetry (Fig. 6).

28. Between the reading numbers and the ends of the scale marks there should be a vacant space:

for instruments with the conditional scale length exceeding 100 mm - not less than 2 mm;

for instruments with the conditional scale length from 60 to 100 mm - not less than 0.5 mm;

for instruments with the conditional scale length less than 60 mm, and for multirange and combined instruments - not less than 0.2 mm.

29. The reading numbers should contain not more than three

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figures, except for the extreme value of the scale. Numbers with more figures should be reduced as follows:

a) by using multiple and submultiple names of the physical quantities as per GOST 7663-55;

b) by using the factor 10^n (n - any integer positive or negative number) which is inscribed before the designation of the measured quantity, and in case of space shortage - in the most visible part of the dial (except for pressure gauges, vacuum gauges and vacuum manometers); the multiplication sign must be put before the factor (Fig. 12).

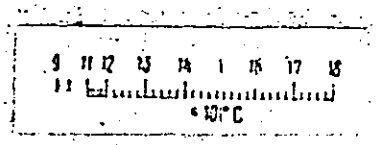

Fig. 12

30. The dials should have designations and inscriptions bearing a direct relationship to the taking of readings.

31. The designations and the inscriptions, except for the reading numbers and the physical quantity units, are recommended to be inscribed on the dial outside of the band sweeped by the pointer (Fig. 13).

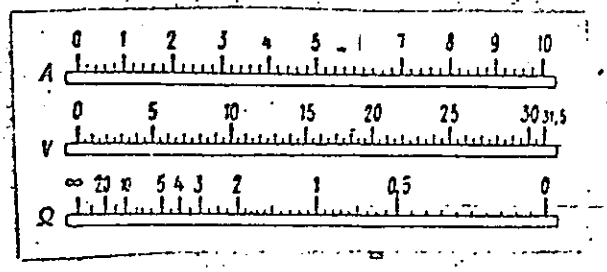

Fig. 13

32. The height of the figures which provide optimum distinction depending on the distance of reading is given in Table 3.

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Table 3

Reading distance, m	Height of figures, mm, not less
0.5	1
1.0	4
1.5	6
2.0	8
3.0	12
4.0	16
5.0	24
7.0	30
10.0	40

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Appendix 1 to GOST 5365-73

Recommended

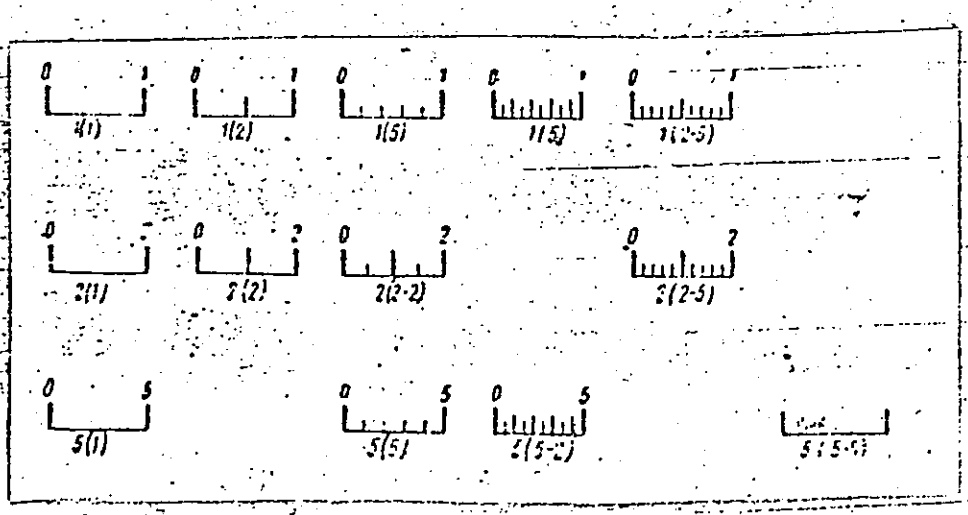
Examples of kinds of graduation bases of linear scales with the primary division spacing of 1, 2, and 5.

In the Figure are given examples of kinds of graduation bas for linear scales, where:

the figure before the parentheses is the spacing of the graduation base (primary division spacing);

the first figure in the parentheses designates the number c secondary divisions in the graduation base;

the second figure in the parentheses designates the number of ternary (lowest order) divisions into which the secondary division is divided.



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Appendix 2 to GOST 5365-73

For reference

DEFINITIONS OF SOME TERMS MENTIONED IN THIS STANDARD

1. Dial - part of the reading device of the instrument onto which the scales, inscriptions, signs and conditional designations which characterize the instrument are inscribed.

2. Multirange instrument - instrument with several (two or more) measurement ranges or with several rated values.