

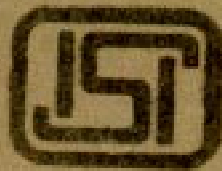
IS : 2286 - 1963

Indian Standard

SPECIFICATION FOR PANTOGRAPH

(Second Reprint JULY 1985)

UDC 744.346



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INDIAN STANDARDS INSTITUTION
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

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May 1963

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SPECIFICATION FOR PANTOGRAPH

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Indian Standard

SPECIFICATION FOR PANTOGRAPH

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 28 February 1963, after the draft finalized by the Optical and Mathematical Instruments Sectional Committee had been approved by the Engineering Division Council.

0.2 Pantograph is an instrument used for copying of maps, drawings and designs either on the same scale or on a larger or a smaller scale. The copying may be done either in the erect or reverse manner.

0.3 Taking into consideration the views of producers and consumers, the Sectional Committee responsible for the preparation of this standard felt that it should be related to the manufacturing practices followed in the country in this field.

0.4 Wherever a reference to any Indian Standard appears in this specification, it shall be taken as a reference to the latest version of the standard.

0.5 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS: 2-1960 Rules for Rounding Off Numerical Values (*Revised*). The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

0.6 This standard is intended chiefly to cover the technical provisions relating to pantographs, and it does not include all the necessary provisions of a contract.

1. SCOPE

1.1 This standard covers the requirements of pantographs commonly used in drawing offices.

2. SIZES

2.1 The pantographs shall be of four sizes, namely 1 250, 1 000, 750 and 500 mm. The size of a pantograph is designated by the length of the longer of the two graduated arms.

3. MATERIAL

3.1 The pantograph shall be constructed of suitable square or rectangular metal tubing. The thickness of the tubing shall be such that it is not easily deformed in use.

3.2 The castors shall be constructed of stainless steel or any other suitable material having a low coefficient of friction.

4. CONSTRUCTION

4.1 The two longer arms *AB* and *AC* (see Fig. 1) shall be freely hinged together without play at *A*. The two shorter arms *DF* and *EF* shall be freely hinged similarly with each other at *F* and with the longer arms at *D* and *E* respectively. The shorter arms shall be of such lengths as to make the figure *ADFE* a true parallelogram at every position of the instrument.

4.2 All the joints shall be perpendicular to the plane of the board on which the instrument is used in order to enable the instrument to work freely and accurately.

4.3 All the metallic parts shall be finished smooth.

4.4 Five free moving castors shall be provided in the positions indicated in Fig. 1. They shall support the instrument parallel to the paper and allow it to move lightly over the paper in all directions.

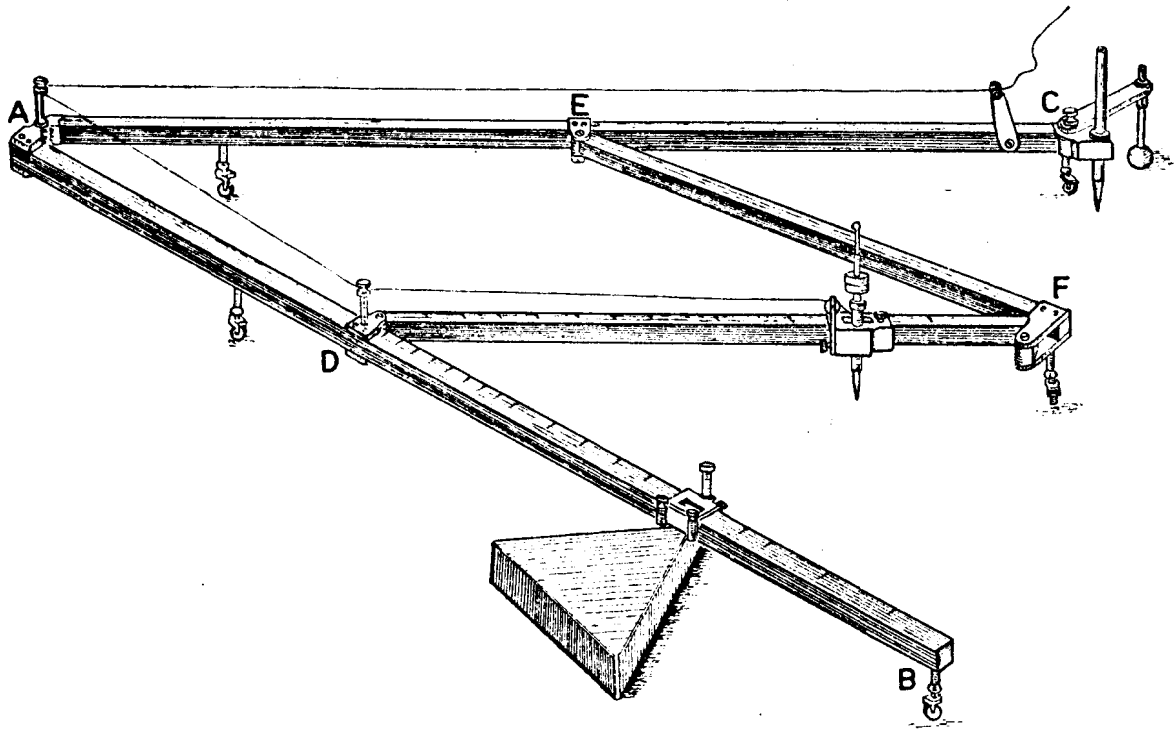
4.5 Each of the arms *AB* and *DF* shall carry a sliding index. Each index shall have a knurled screw for clamping it in any desired position on the arm and shall carry a socket with a hole in a direction perpendicular to the paper. The arm *AC* shall also carry a similar socket near the end *C*. The holes in all these sockets shall be collinear with the axes of the respective hinges and shall be of suitable diameter so as to hold either a pencil holder, tracing point or a fulcrum pin as required. Besides the clamps, the sockets on the arms *AB* and *DF* shall also have a slow motion device.

4.6 A suitable triangular or circular fulcrum weight should be provided having three suitably located feet ending in sharp points, to enable it to remain firm and steady in position.

4.7 The pencil holder shall be so constructed that small weights may be slipped on its top to cause the pencil to mark with the required distinctness.

4.8 The raising of the pencil holder off the drawing should be effected either by means of a wire release or by string and pulleys or by any other suitable device.

4.9 The fulcrum, pencil and tracer should always be in a true line, when the instrument is set for use.



NOTE—Slow motion device not shown.
FIG. 1 PANTOGRAPH

5. GRADUATIONS

5.1 The ratio in which the resulting figure is reduced or enlarged shall be equal to the distance of the pencil from fulcrum divided by that of the tracer from the fulcrum.

5.2 The following reduction ratios shall be engraved on the arms *DB* and *DF*:

1/15, 1/12, 1/10, 1/8, 1/6, 1/5, 1/4, 1/3, 2/5, 3/7, 4/9, 5/11, 6/13, 7/15,
8/17, 9/19, 10/21, 1/2

5.2.1 Appendix A gives the method of calculating the ratio either by erect or reverse method for ratios other than those engraved on the scales.

NOTE — To produce an enlarged copy, the pencil and tracer would have to change places; the proportion, of course, would be the same.

6. TESTS

6.1 The instruments shall be tested practically throughout the whole range of the scale both in the erect as well as the reverse manner. The results shall be accurate to within one millimetre at 2:1 enlargement and proportionately for other enlargements and reductions.

7. MARKING

7.1 Each pantograph shall be marked at a suitable place with its size, manufacturer's name or trade-mark and if required by the purchaser, the year of manufacture.

7.1.1 The pantographs may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

8. PACKING

8.1 Each pantograph shall be supplied in a suitably padded wooden box, together with operating instructions.

APPENDIX A

(Clause 5.2.1)

WORKING RATIOS

A-1. Setting on the graduated arms *DB* and *DF*, required for any ratio, may be calculated with the help of the following formulæ:

Erect Method:

For ratios 1: *R* between 1:2 and 1:15 with fulcrum on arm *DB*:

$$\text{Setting on arm } DB = \frac{100}{R-1}$$

$$\text{Setting on arm } DF = \frac{200}{R}$$

Reverse Method:

$$\text{Setting on arm } DB = \frac{100}{R}$$

$$\text{Setting on arm } DF = \frac{200}{R+1}$$

Example 1:

Taking a reduction ratio of 9/19 the values of arm settings will be:

Erect Method:

$$\text{Setting on arm } DB = \frac{100}{R-1} = \frac{100}{19/9-1} = \frac{900}{10} = 90$$

$$\text{Setting on arm } DF = \frac{200}{R} = \frac{200}{19/9} = \frac{1800}{19} = 94.7$$

Reverse Method:

$$\text{Setting on arm } DB = \frac{100}{R} = \frac{100}{19/9} = \frac{900}{19} = 47.4$$

$$\text{Setting on arm } DF = \frac{200}{R+1} = \frac{200}{19/9+1} = \frac{1800}{28} = 64.3$$

Example 2:

Taking a reduction ratio of 5/11 the values of arm settings will be:

Erect Method:

$$\text{Setting on arm } DB = \frac{100}{11/5 - 1} = \frac{100 \times 5}{6} = \frac{250}{3} = 83.3$$

$$\text{Setting on arm } DF = \frac{200}{11/5} = \frac{200 \times 5}{11} = \frac{1\,000}{11} = 90.9$$

Reverse Method:

$$\text{Setting on arm } DB = \frac{100}{11/5} = \frac{100 \times 5}{11} = \frac{500}{11} = 45.5$$

$$\begin{aligned} \text{Setting on arm } DF &= \frac{200}{11/5 + 1} = \frac{200}{16/5} = \frac{200 \times 5}{16} = \frac{1\,000}{16} \\ &= 62.5 \end{aligned}$$

INDIAN STANDARDS INSTITUTION

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg
NEW DELHI 110002

Telephones : 26 60 21, 27 01 31

Telegrams : Manaksanstha (Common to all Offices)

Regional Offices:

	Telephone
*Western : Manakalaya, E9 MIDC, Marol Andheri (East) BOMBAY 400093	6 32 92 95
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Inspection Office (with Sale Point):

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