

INTERNATIONAL STANDARD

ISO
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Numerically controlled draughting machines — Drawing test for the evaluation of performance —

Part 1: Vector plotters

*Machines à dessiner à commande numérique — Essai de traçage pour
l'évaluation des performances —*

Partie 1. Traceurs de vecteurs



Reference number
ISO 9959-1:1992(E)

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 9959-1 was prepared by Technical Committee ISO/TC 10, *Technical drawings, product definition and related documentation*, Sub-Committee SC 9, *Media and equipment for drawing and related documentation*.

ISO 9959 consists of the following parts, under the general title *Numerically controlled draughting machines — Drawing test for the evaluation of performance*:

- *Part 1: Vector plotters*

The drawing test for the evaluation of the performance of raster plotters will form the subject of ISO 9959-2.

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Numerically controlled draughting machines — Drawing test for the evaluation of performance —

Part 1: Vector plotters

1 Scope

This part of ISO 9959 specifies a drawing test for vector plotters (electromechanical plotters¹⁾ as defined in ISO 9179-1) for evaluating the graphical quality capabilities, for example the dynamic accuracy and the required drawing time, independently of the machine type.

It does not permit the evaluation of the static drawing accuracy which is normally determined at the place where a drawing is made because dimensional changes of the drawing media under different climatic conditions can influence the test results.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 9959. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 9959 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 554:1976, *Standard atmospheres for conditioning and/or testing — Specifications.*

ISO 5457:1980, *Technical drawings — Sizes and layout of drawing sheets.*

ISO 9179-1:1988, *Technical drawings — Numerically controlled draughting machines — Part 1: Vocabulary.*

3 Drawing test method

3.1 Principle

Plotting of a standard drawing, preferably of A4 size (see for example figure 1).

For A4 plotters, the area within the border lines (zone 0) shall be the usable plotting area.

3.2 Plotting time

The plotting time starts at zone 0 with a cross and ends, after completion of zone 11, at zone 0 with a cross superimposed on the first one.

3.3 Test conditions

For evaluating a test drawing, the following test criteria are required and shall be specified in the title block of the test drawing (see for example figure 14), together with the plotter type and manufacturer, the name of the person who carried out the test drawing and the date.

- Draughting tool (with the manufacturer's reference)
- Draughting media
- Draughting speed, in millimetres per second, if selectable
- Draughting acceleration, expressed relative to the acceleration of free fall, if selectable

1) An International Standard on raster plotters is in preparation.

- Test atmosphere (see ISO 554), in particular:
 - a) temperature, in degrees Celsius
 - b) relative humidity, in per cent
- Plotting time, in seconds (see 3.2)
- Draughting procedure [in accordance with this part of ISO 9959 (i.e. ISO 9959-1) or other (to be specified) (see 3.4)]
- Additional optional information, for example atmospheric pressure, draughting ink, etc.

3.4 Procedure

3.4.1 Division of plotting zones and drawing sequence

The test is based on 14 zones (see figure 1), zone 12 being reserved for multi-pen plotters or for specific applications.

To enable results to be compared, the drawings shall be carried out in increasing numerical order of the zones 1 to 13 (see figure 1). Each zone starts at the start point "A" and ends at the end point "E", in increasing order of the line numbers defining the

plot to be carried out. The drawing direction is given by an arrow.

Missing line numbers correspond to segments of lines drawn outside zone 0 or to segments drawn with the draughting tool lifted.

The elements constituting zones 8 to 10 are similar and repetitive. Figures 10 to 12 show a single element of each of these zones. The zones may, however, comprise as many repetitions of these elements as required.

3.4.2 Description of the test drawing and definition of corresponding test criteria

See table 1.

3.5 Evaluation of results

The quality of the test drawing shall be evaluated using the test criteria given in table 1. The drawings shall be examined with a $\times 10$ magnifying glass and, if necessary, compared with model drawings such as those illustrated in figure 1. When evaluating results, it is advisable to take into account the required performance, which may be very different depending on the field of application of the plotter. The test conditions specified in 3.3 shall be taken into consideration.

Table 1 — Description of the test drawing and definition of corresponding test criteria

Zone	Designation	Line sequence	Test criteria	Details, see figure No.
0	Border line	1 to 4	Usable plot area (A4 plotters only)	2
	Cross marks	6 to 8 and 411 to 413	Static positioning repeatability	
1	Grid pattern	10 to 31	This shall be measured at the same time as zone 6	3
2	Fan	32 to 59	Deviation from straightness	4
3	Parallel lines	61 to 113	a) Bounce at the beginning of lines b) Over/undershoot at points of contact	5
4	Diagonal lines	115 to 157	a) Deviation from straightness (mainly at the beginning and end of lines) b) Perpendicularity deviation in the area of intersection c) Line straightness deviation	6
5	Circles	159 to 187	a) Circularity b) Linearity deviation (especially at the beginning of the circle)	7
6	Curves/squares	189 to 214	a) Line width deviations in the area of the tangents b) Mismatch at the points of contact between circles and squares	8
7	Corner pattern	216 to 234	a) Over/undershoot at corners b) Deviation from straightness	9
8	Meander	236 to 295	a) Mismatch at superimposed lines of the meander (line width deviation) b) Line straightness deviation	10
9	Dashed lines	297 to 327	a) Alignment of the beginning and end points of a pair of dashed lines drawn in opposite directions b) Uniformity of line width	11
10	Symbols	329 to 409	a) Symmetry of the symbols b) Distortion at the transition between straight and curved lines c) Alignment of the symbols	12
11	Lettering ¹⁾	—	Legibility	—
12	Tool change	415 to 521	a) Deviation of the tool positioning b) Uniformity of line quality	13
13	Title block	—	Field for general data	14

1) Use preferably lettering of type B (5 mm) in accordance with ISO 3098-1:1974, *Technical drawings — Lettering — Part 1: Currently used characters*.

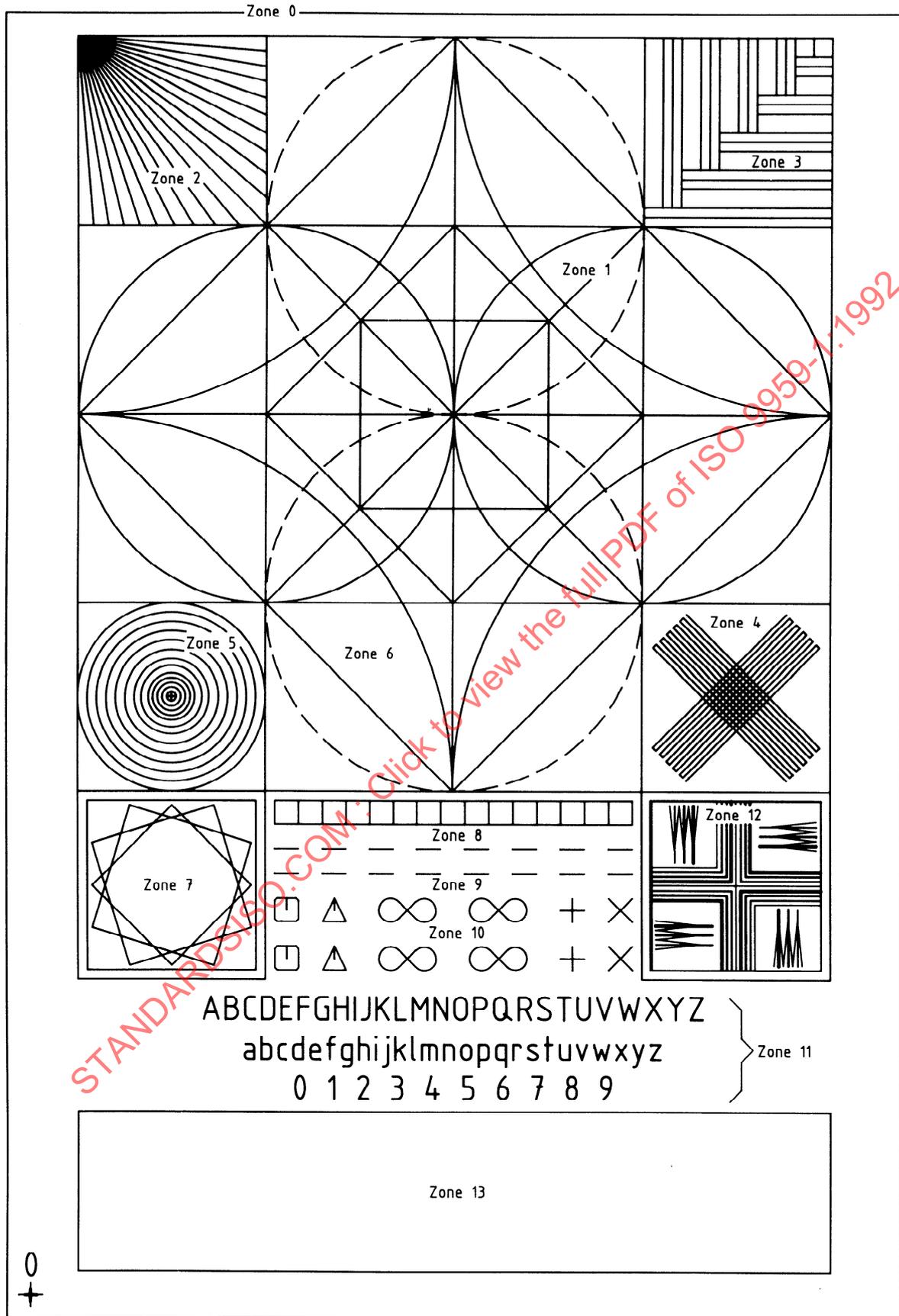


Figure 1 — Example of a test drawing (not to scale)

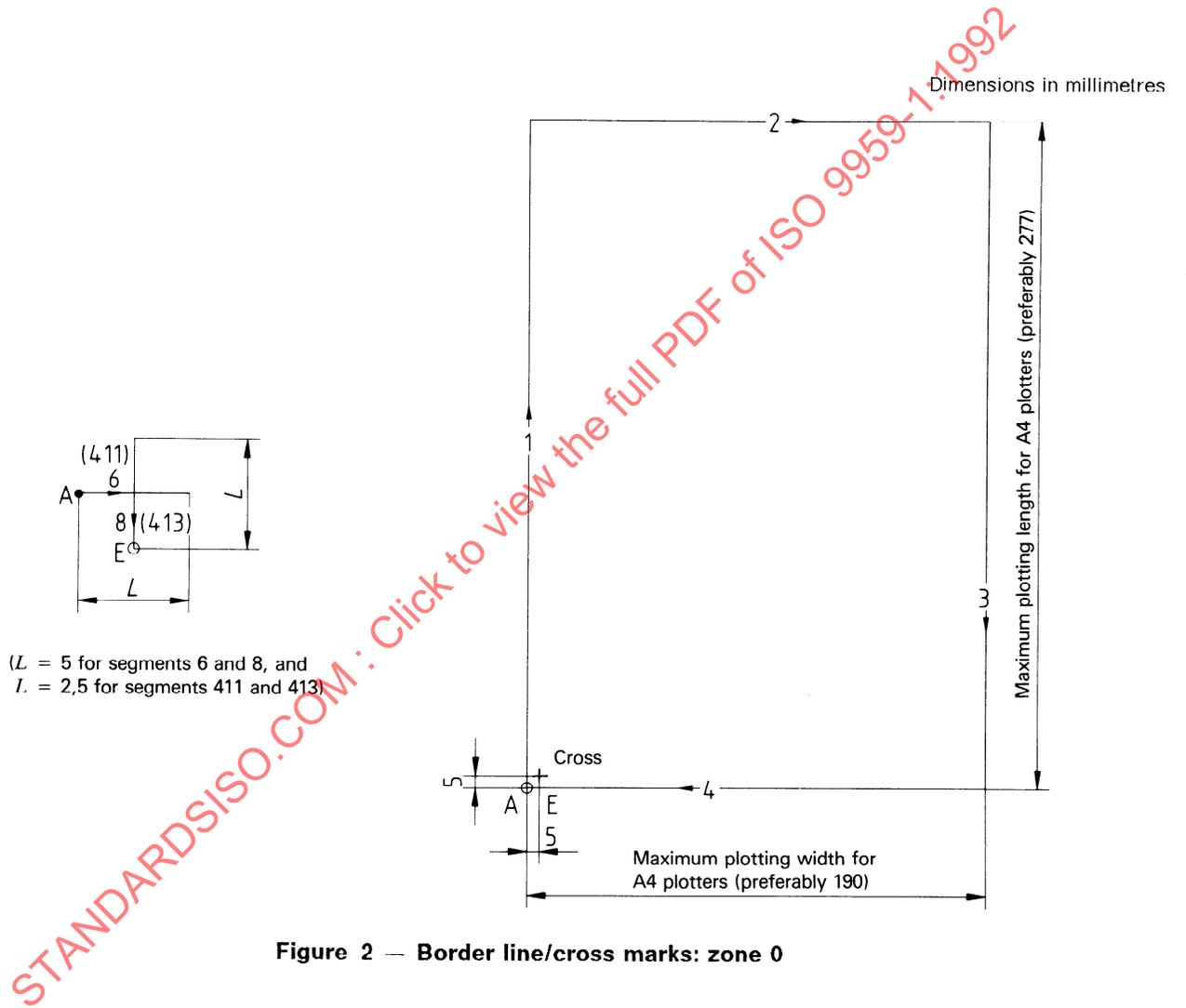


Figure 2 — Border line/cross marks: zone 0

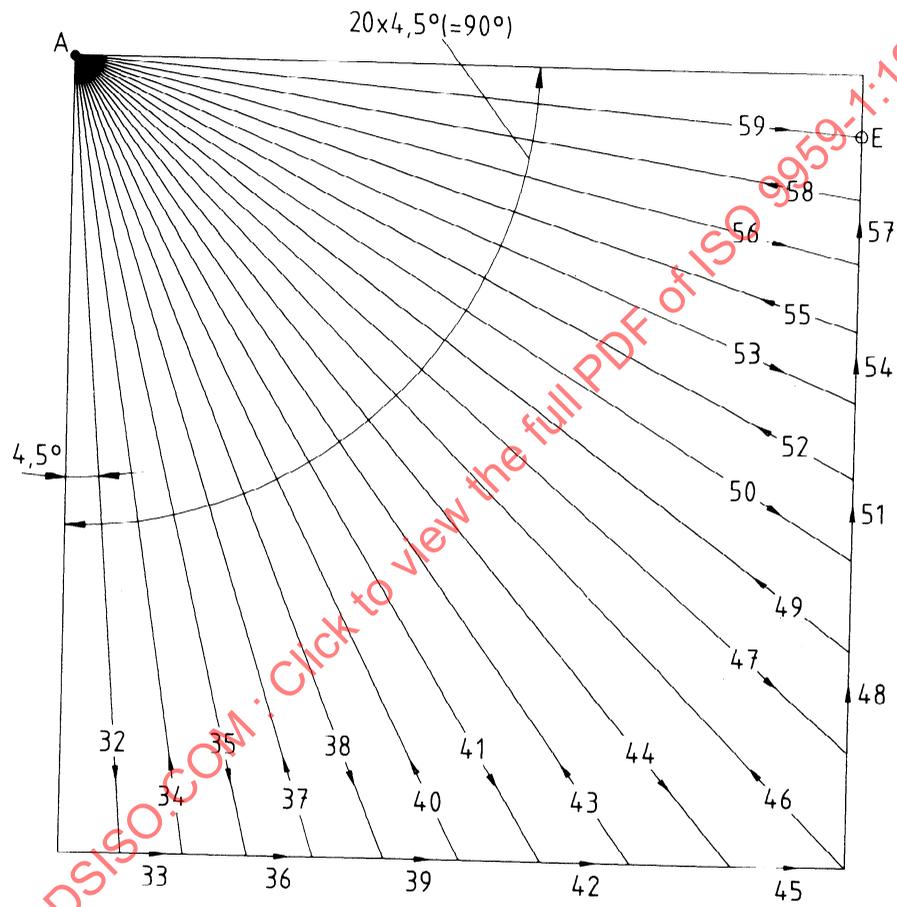


Figure 4 — Fan: zone 2

Dimensions in millimetres

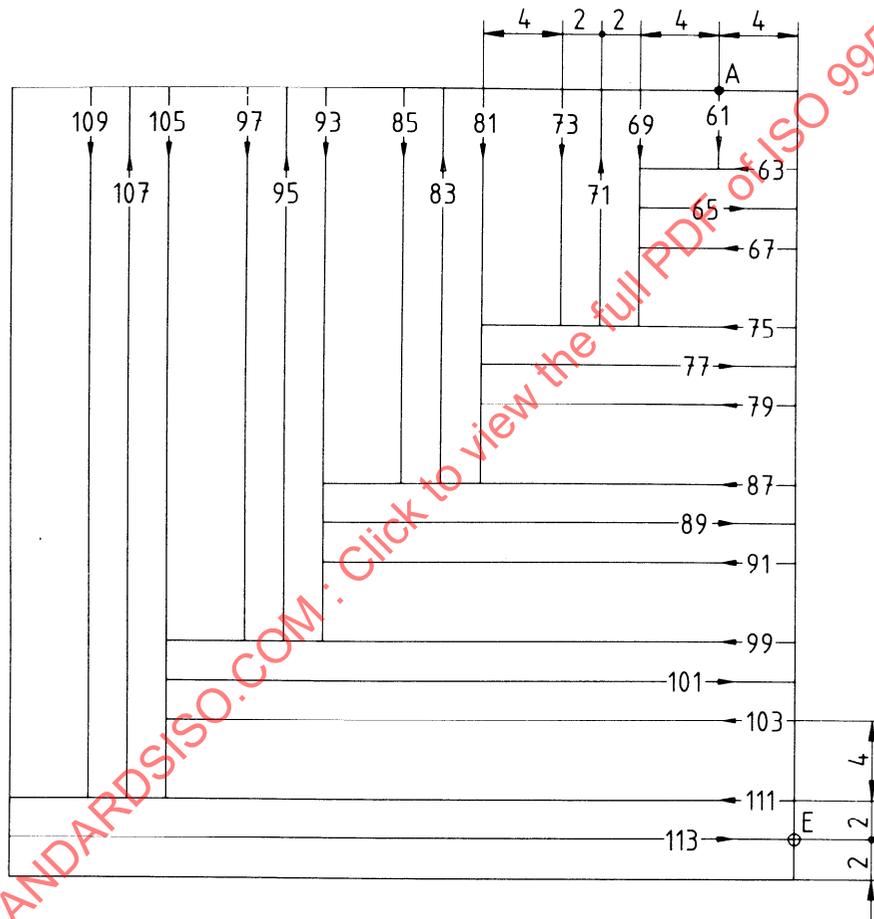


Figure 5 — Parallel lines: zone 3

Dimensions in millimetres

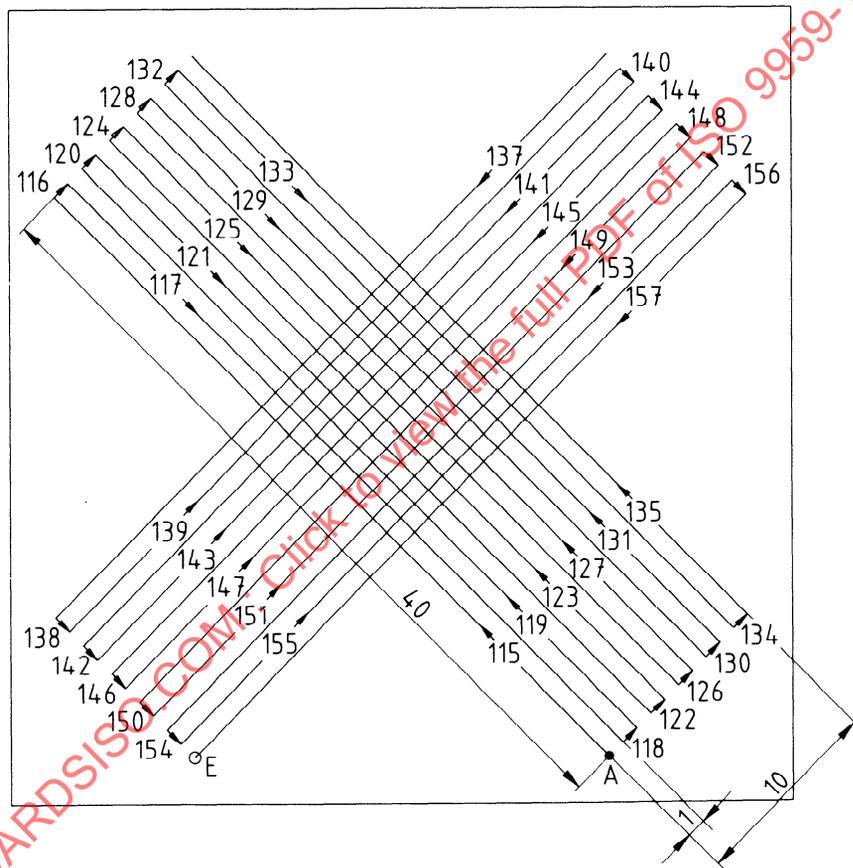
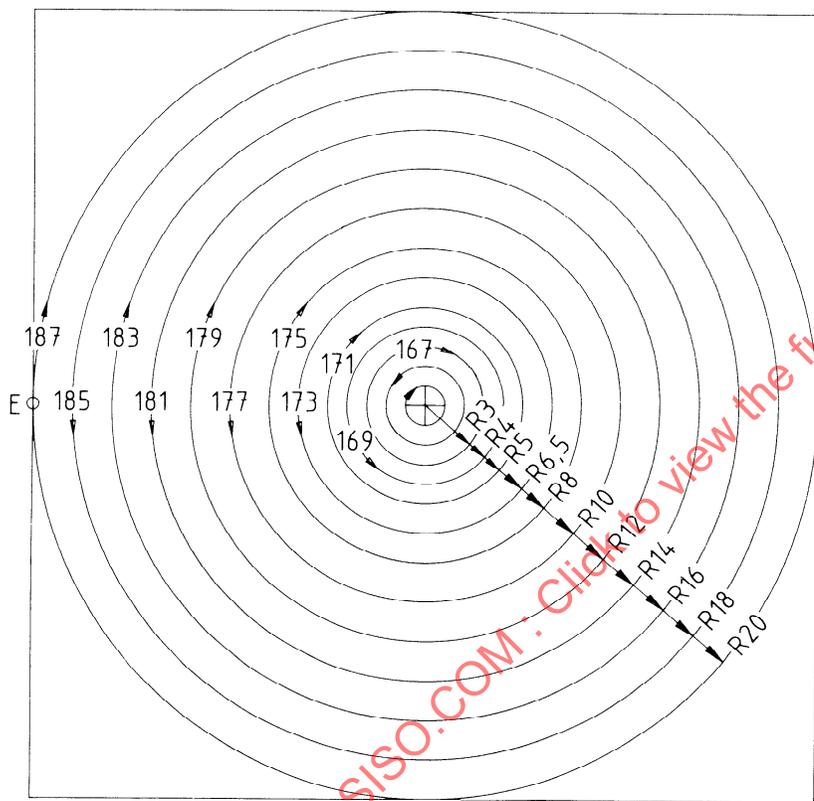
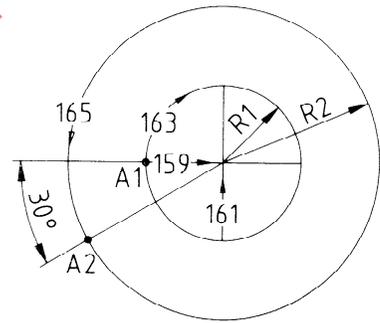


Figure 6 — Diagonal lines: zone 4



Dimensions in millimetres

Detail of the area in the middle



NOTE — The starting point of each successive circle is shifted by 30° counterclockwise.

Figure 7 — Circles: zone 5

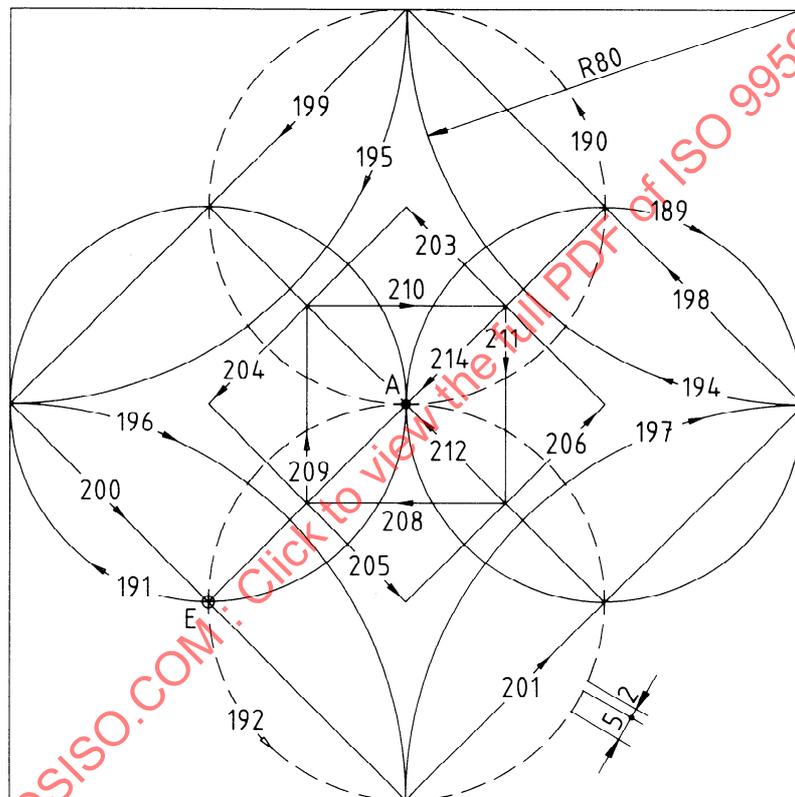


Figure 8 — Curves/squares: zone 6

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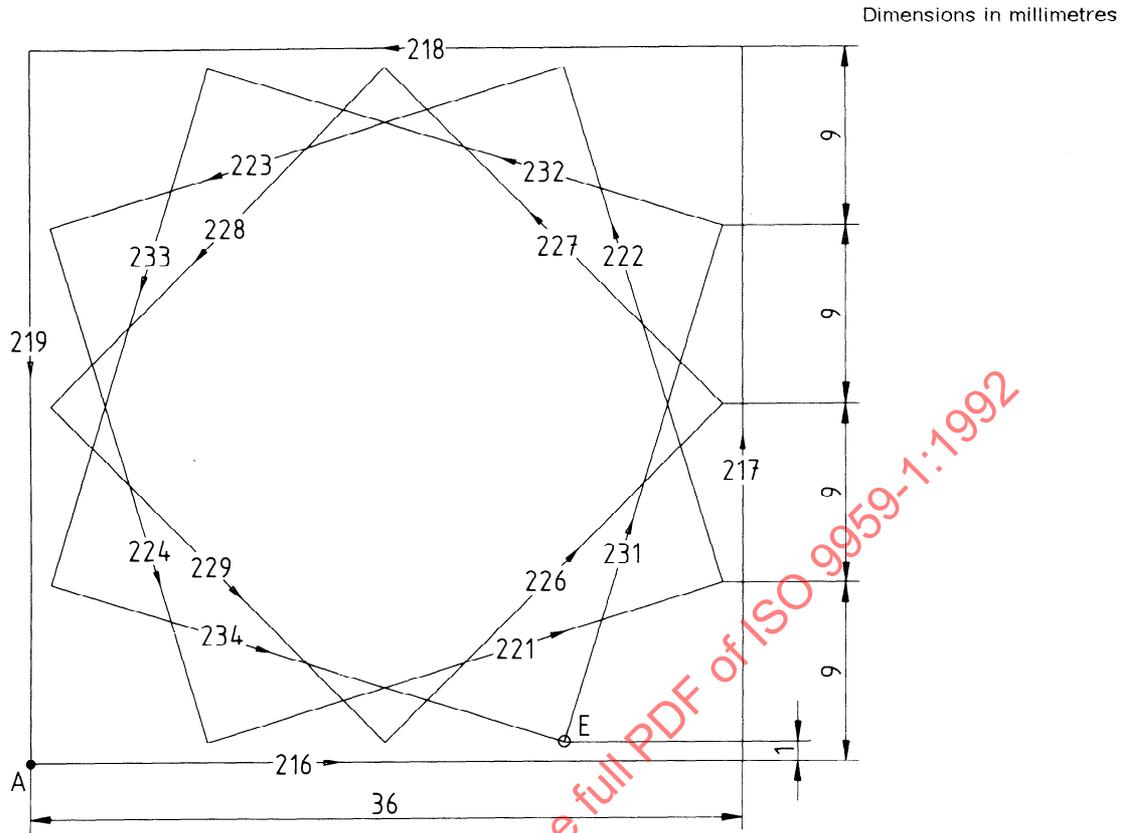


Figure 9 — Corner pattern: zone 7

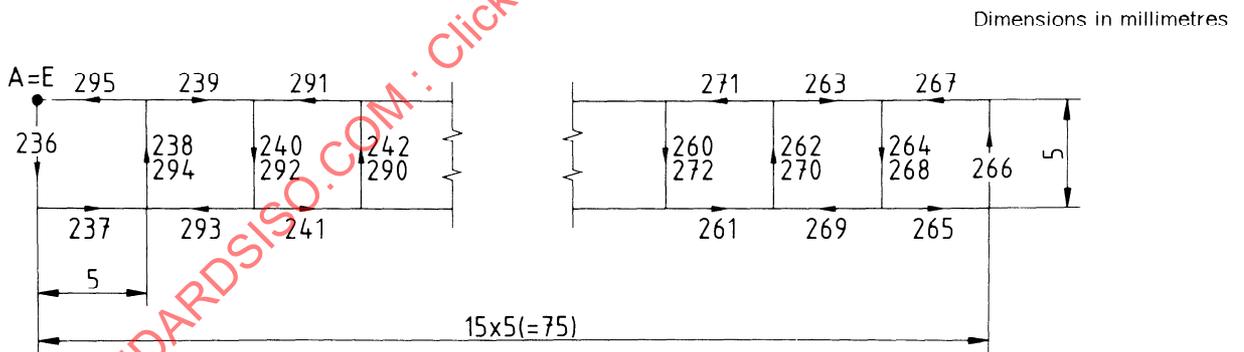


Figure 10 — Meander: zone 8

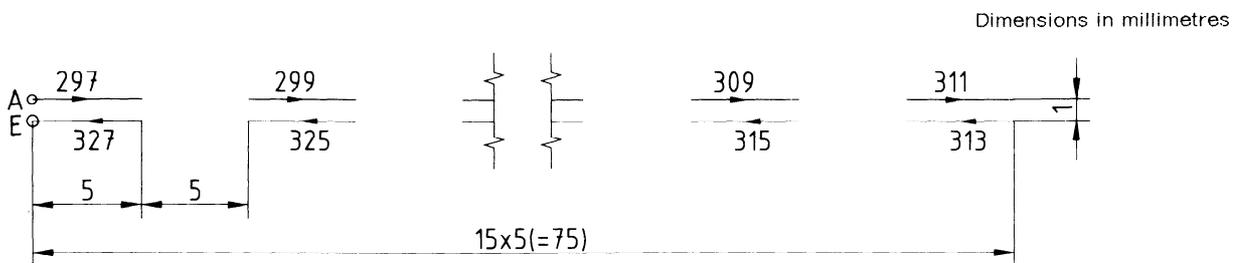
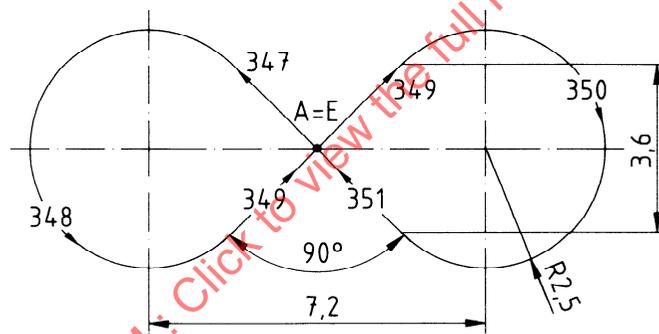
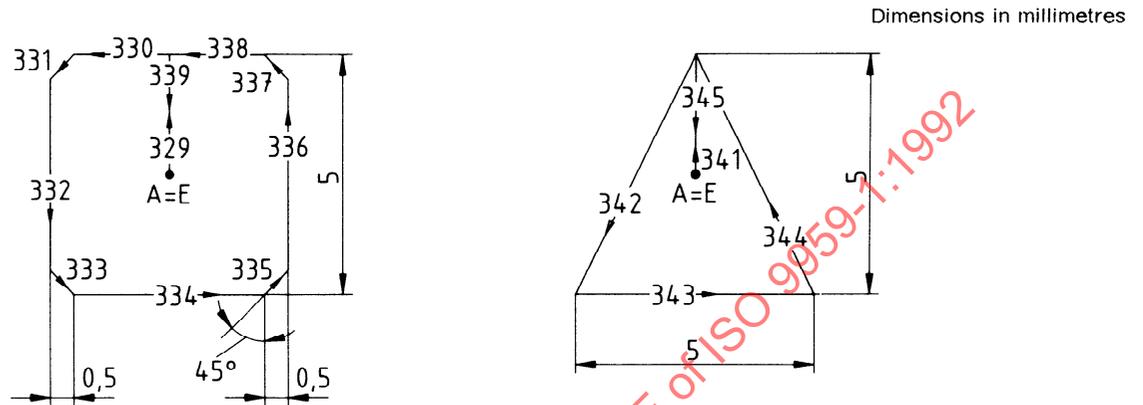
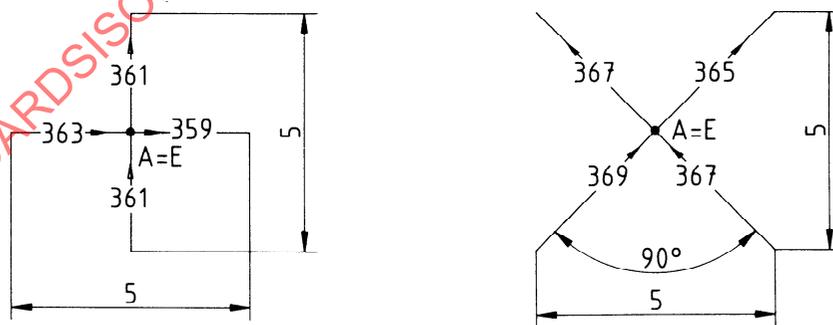


Figure 11 — Dashed lines: zone 9



Sequences up to 357



Sequences up to 409

Figure 12 — Symbols: zone 10

- Sequence 415 to 427 is drawn with tool No. 1
- Sequence 429 to 441 is drawn with tool No. 2
- Sequence 443 to 455 is drawn with tool No. 3
- Sequence 457 to 469 is drawn with tool No. 4
- Sequence 471 to 497 is drawn with tool No. 1
- Sequence 499 to 505 is drawn with tool No. 2
- Sequence 507 to 513 is drawn with tool No. 3
- Sequence 515 to 521 is drawn with tool No. 4

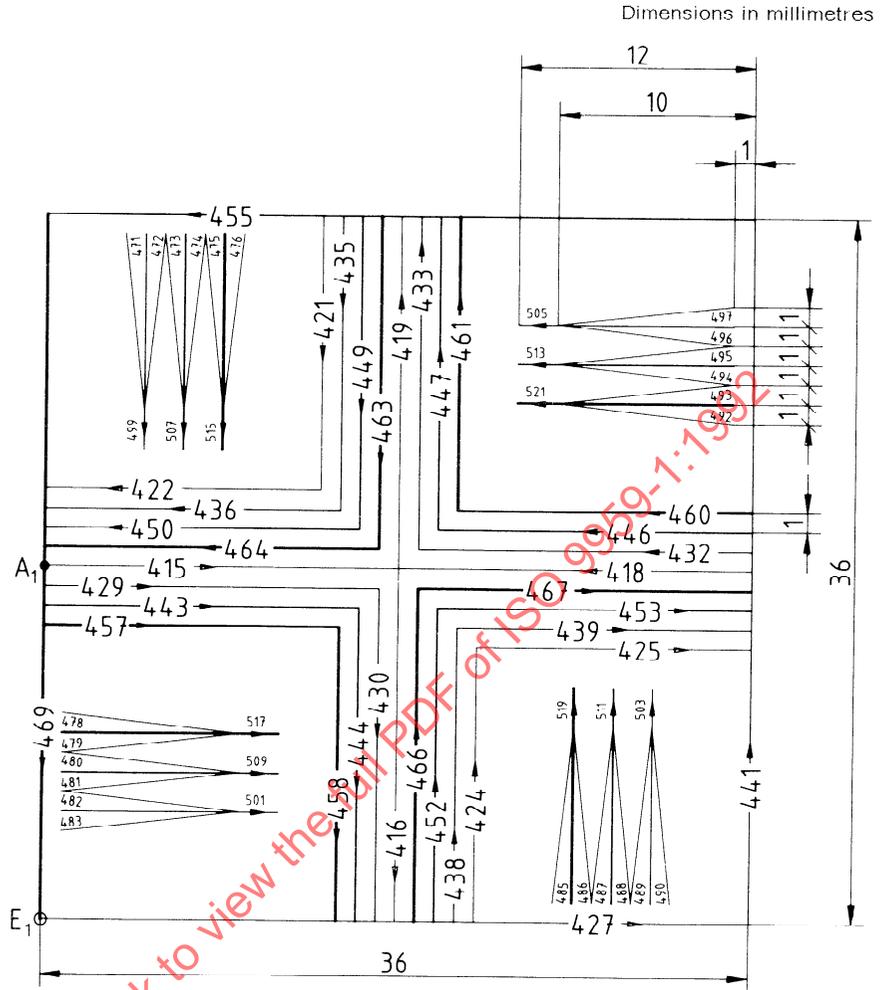


Figure 13 — Tool change: zone 12

Draughting tool:		Temperature: °C
Manufacturer's reference:		Test atmosphere
Draughting media:		Relative humidity: %
Draughting speed: mm/s		1)
Acceleration (relative to acceleration of free fall) g		Test procedure: 2)
Time taken for test: s		Manufacturer Name: Type of plotter:
Date:		
Plotted by:		

1) Available for additional information. For example, atmospheric pressure, draughting ink, etc.
2) ISO 9959-1 or other (to be specified).

Figure 14 — Example of title block: zone 13 (Maximum length in accordance with ISO 5457)