INTERNATIONAL STANDARD

ISO 7397-2

First edition
1993-07-01

Passenger cars — Verification of driver's direct field of view —

Part 2:
Test method

Voitures particulières — Vérification du champ de vision directe du conducteur —

Partie 2: Méthode d'essai

Reference number
ISO 7397-2:1993(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 7397-2 was prepared by Technical Committee ISO/TC 22, *Road vehicles*, Sub-Committee SC 17, *Visibility*.

ISO 7397 consists of the following parts, under the general title *Passenger cars — Verification of driver's direct field of view*:

— *Part 1: Vehicle positioning for static measurement*

— *Part 2: Test method*

Annex A forms an integral part of this part of ISO 7397. Annex B is for information only.

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Passenger cars — Verification of driver's direct field of view —

Part 2:
Test method

1 Scope

This part of ISO 7397 specifies a test method for verifying the compliance of a passenger car (as defined in ISO 3833) with the requirements of EEC Directives 77/649 and 88/366 for the driver's 180° forward field of view.

It does not preclude the use of other methods, provided that the validity of the results obtained can be proved, and that due account is taken of the accuracy of the method employed.

NOTE 1 Part 1 specifies the vehicle positioning for static measurement as the stage prior to carrying out this test method.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 7397. 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 7397 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 3833:1977, *Road vehicles — Types — Terms and definitions*.

ISO 7397-1:1993, *Passenger cars — Verification of driver's direct field of view — Part 1: Vehicle positioning for static measurement*.

EEC Directive 77/649, *Field of vision of motor vehicle drivers*.

EEC Directive 88/366, *Amendment to annexes I and IV to EEC Directive 77/649.*

3 Definitions

For the purposes of this part of ISO 7397, the following definitions apply.

3.1 [vehicle] A-pillar: Roof support forward of the R-point which includes all non-transparent items such as windscreen mouldings and door window frames, attached to or contiguous with such support.

3.2 direct field of view: View capable of being seen by the driver without the aid of mirrors. [ISO 7397-1:1993, definition 3.2]

3.3 eye points; E points: Specific points on the left and right eyellipse contours positioned in the same relative position on each ellipse.

3.4 eyellipse: Contraction of the words "eye" and "ellipse", describing the elliptical shape of the driver's eye range. [ISO 4513:1978, definition 4.2]

NOTES

2 The term "eyellipse" is used solely in this application.

3 Eyellipse is synonymous with driver's eye range.

3.5 eyellipse template: Two-dimensional design tool consisting of a plan view and a side view of the driver's left and right eye ranges from which sight lines may be constructed for the purpose of describing the location of objects in the field of view of the seated driver. [ISO 4513:1978, definition 4.3]

3.6 field of view: Solid angle subtended by sight planes emanating from tangents on the eyellipse contours or from the appropriate vision origin point.

3.7 H-point: Pivot centre of the torso and thigh on the three-dimensional H-point machine used for actual H-point determination. It is located on the centre plane of the device which is between the H-point sight buttons on either side of the H-point machine. [adapted from ISO 6549:1980, definition 4.2]

3.8 design H-point; R-point; seating reference point: Point which

a) establishes the rearmost normal driving or riding position of each designated seating position as stipulated by the manufacturer and which accounts for all modes of adjustment (horizontal, vertical and tilt) that are available for the seat;

b) has coordinates established with respect to the designed vehicle structure;

c) simulates the position of the pivot centre of the human torso and thigh;

d) is the reference point employed to position a two-dimensional template. [ISO 6549:1980, definition 4.2.1, adapted]

3.9 neck pivot point; P-point: Specific point about which the driver's head turns on a horizontal plane. The point is about 98,8 mm to the rear of the midpoint between the eye points. It, when combined with the eye points, is used in lieu of the complete eyellipse contour.

3.10 design seat-torso angle: Angle measured between a true vertical line through the R-point (seating reference point) and the torso line of a two-dimensional template. [adapted from ISO 6549:1980, definition 4.3.1]

3.11 vision origin points: Vision points (V points) and eye points (E points), these latter rotating around the neck pivot point (P point).

3.12 vision point; V-point: Specific point on a sight plane, used instead of the complete eyellipse contour in specifying direct field of view requirements and in checking vehicle compliance with these requirements.

3.13 fiducial marks: (See ISO 7397-1:1993, definition 3.1, and figure 1 below.)

4 Vehicle positioning

4.1 The vehicle shall be positioned in accordance with the procedure given in ISO 7397-1.

4.2 The vehicle attitude shall be that related to the loading condition given in clause 2.3 of annex I of EEC Directive 77/649; it shall be achieved by setting up the vehicle using the fiducial marks indicated by the vehicle manufacturer for that loading condition, taking account of any special characteristics of the vehicle suspension.

5 Verification of vehicle

5.1 Test equipment

5.1.1 Device for projection of beams in any desired direction, for instance towards the windscreen datum points, which can be mounted relative to the three-dimensional system of the vehicle on the head of a three-dimensional measuring and marking-out machine.

5.1.2 Device for projection of obstruction angles which can be mounted on the head of a three-dimensional measuring machine and can be pivoted around the P-point.

NOTE 4 The devices described in 5.1.1 and 5.1.2 may be a laser measuring device conforming to annex A.

5.1.3 Transparent overlay to cover the windscreen.

5.2 Test procedure

5.2.1 After positioning the vehicle on the measuring base plate (see figure 2) corresponding to the coordinates of the measuring system by use of jacks, the springs are relieved, and the vehicle R-point set to zero on the machine. Mount the beam projection device onto the head of the measuring machine, level it and calibrate its *X*- and *Y*-axes.

5.2.2 Adjust the projection device position so that the origin of the beam comes out of V_1 (see table 1).

5.2.3 Cover the windscreen with the overlay and adjust the desired angles either 17° forward and outward from V_1, or 7° forward and upward from V_1, and mark these points on the overlay (see figure 3).

5.2.4 Adjust the projection device position so that the origin of the beam comes out of V_2 (see table 1), adjust the angle of 5° forward and downward from V_2, and mark this point on the overlay (see figure 3).

5.2.5 Verify by measurement that three additional datum points are obtainable symmetrical to the points determined in 5.2.3 and 5.2.4 in relation to the median longitudinal plane of the vehicle.

5.2.6 Adjust the projection device so that the origin of the beam comes out of P_m (see table 2) with an angle of 2° forward and upward, and determine the intersection of the two-degree plane with the most forward point of the A-pillar. This intersection point defines the Z-coordinate of S_1 (see figure 4).

Repeat this procedure with an angle of 5° forward and downward to get the Z-coordinate of the lower horizontal intersection S_2 of the A-pillar (see figure 4).

5.2.7 Install the device for ascertaining obscuration on to the projection device and position the origin of the beam coming out horizontally from P_1 with the Z-coordinate of S_2. Rotate the theodolite around P_1 so that the beam out of E_1 (see figure 5) meets the A-pillar at its left side. Fix this theodolite position and change only the Z-coordinate to that of S_1. Rotate the micrometer screw to meet the A-pillar at its right side. The micrometer gives the obstruction angle of this A-pillar (in degrees).

5.2.8 Repeat this measurement out of the position of P_2 with a symmetrical device.

5.2.9 Position the projection device as in 5.2.2 and rotate a horizontal beam.

5.2.10 Verify that no obscuration is apparent except that caused by A-pillars, vent window division bars, rear-view mirrors, windscreen wipers and radio aerials.

5.2.11 Position the projection device as in 5.2.4 and adjust it to an angle 4° downward; rotate the device by its vertical axis through the 180° forward range.

5.2.12 Ensure no obstruction is apparent as in 5.2.10. When any obstruction is observed, check the direction of the tangent beam in the following manner.

The tangent angle of incidence α or α' which may pass through glazed areas shall be at least:

— in the driving direction, ($\varphi = 0°$): $\alpha \geqslant 4°$

— in the transverse direction, ($|\varphi| = 90°$): $\alpha' \geqslant 4°$

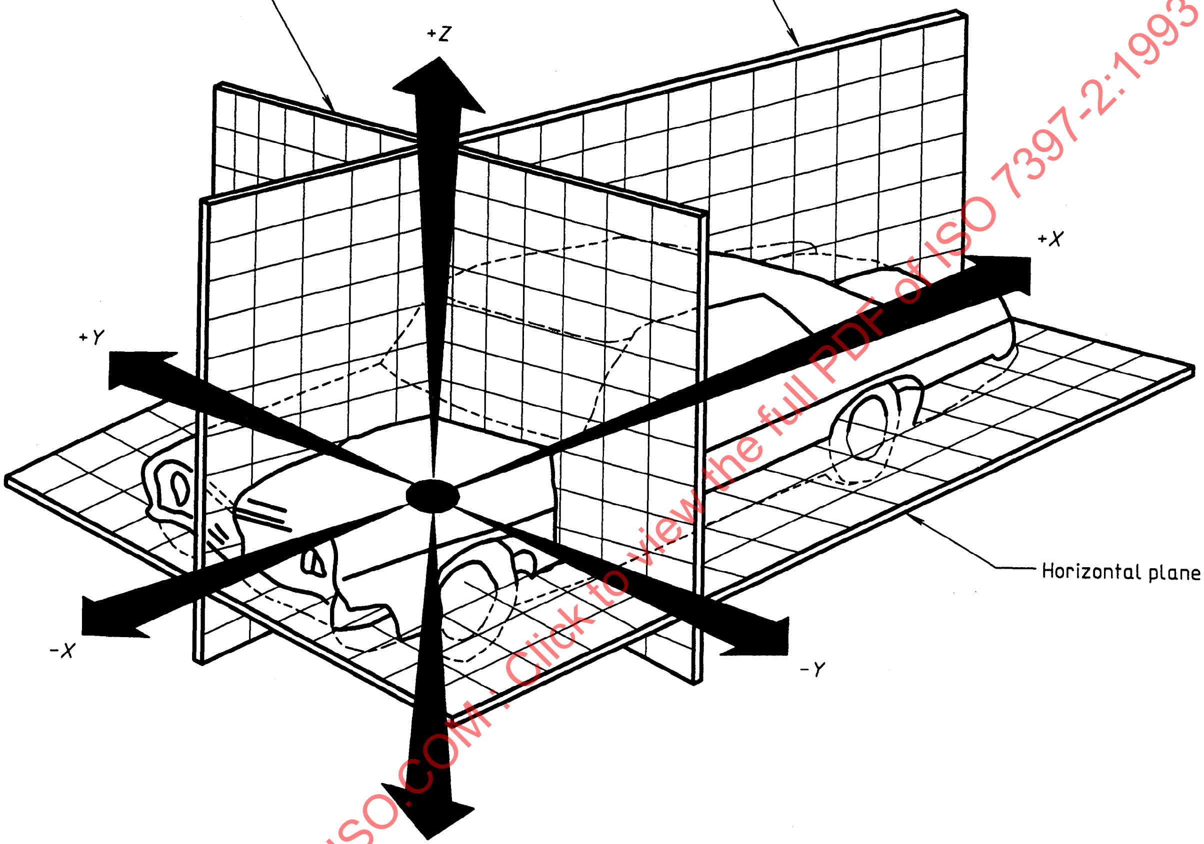
— for $0° < |\varphi| < 45°$: $\alpha \geqslant \arctan(\cos|\varphi| \times \tan 4°)$

— for $45° \leqslant |\varphi| < 90°$:
$\alpha' = \arctan\{\cos[|\varphi| - 2 \times (|\varphi| - 45)] \times \tan 4°\}$

5.3 Laser measuring device — Additional test procedure

5.3.1 Install the laser theodolite in accordance with the operating instructions of the producer and ensure that the radiation of the low-power beam source cannot hit the operator's eyes.

5.3.2 Check calibration by observing the laser spot on a screen, by running the machine along the X-axis. The parallel to the X-axis and the theodolite is levelled exactly.



NOTE — This figure is adapted from the figure in ISO 4130:1978.

Figure 1 — Three-dimensional reference grid

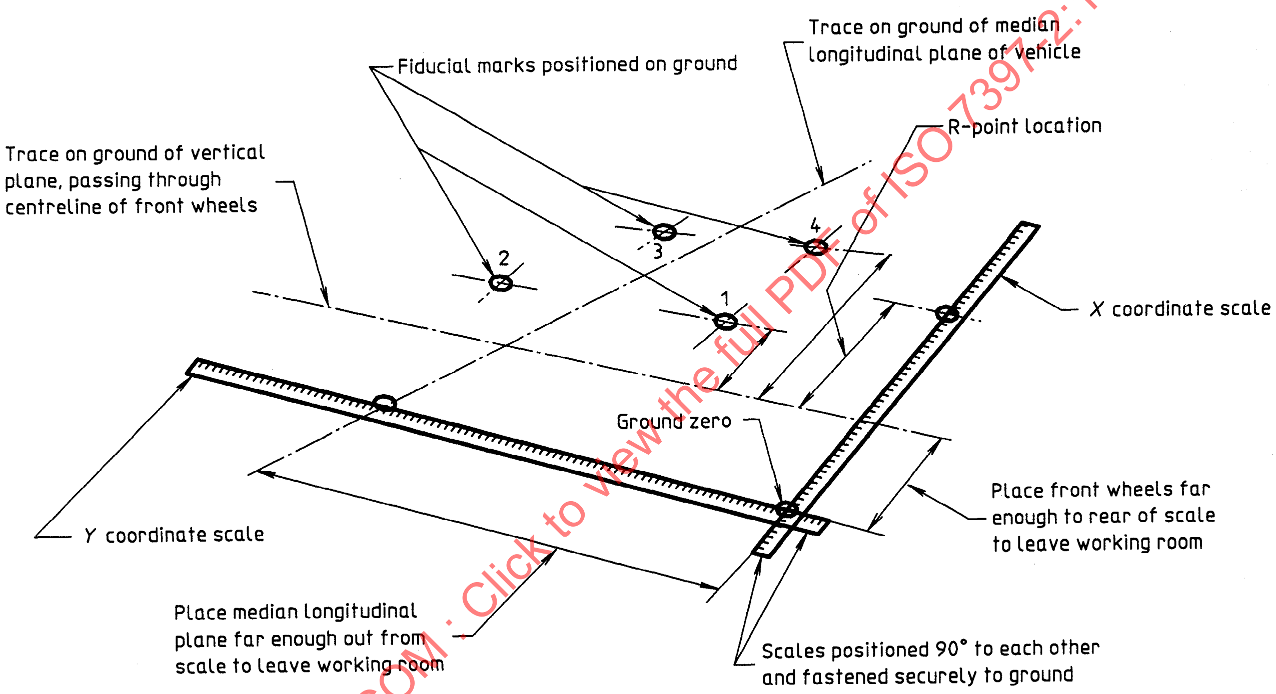


Figure 2 — Measuring base plate

Table 1 — V-points — Basic coordinates for a design seat-torso angle of 25°

Dimensions in millimetres

V-point	Coordinate		
	X	*Y*	*Z*
V_1	68	−5	665
V_2	68	−5	589

NOTES

1 The positions of the V-points in relation to the R-point, as indicated by *X*, *Y* and *Z* coordinates from the three-dimensional reference grid (see figure 1) are as shown in tables 1 and 4.

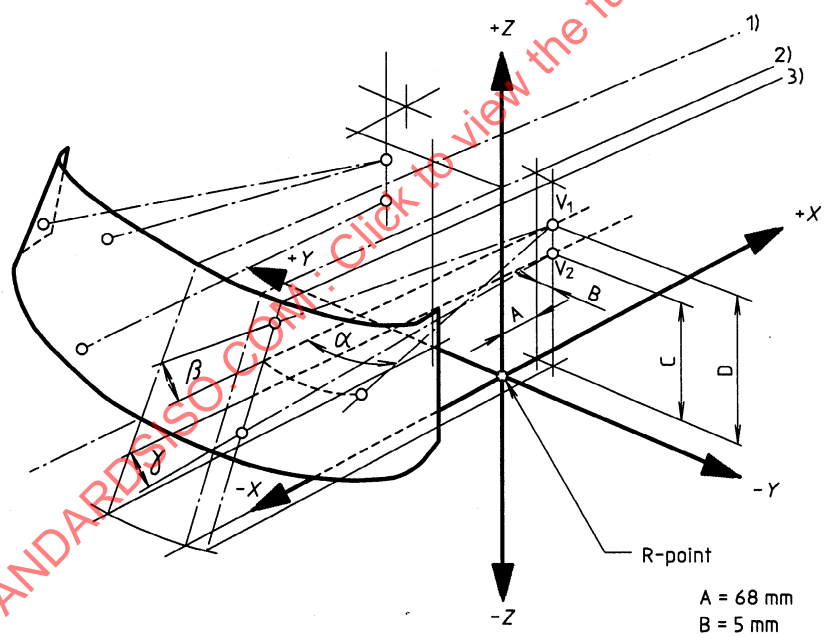
2 The positive direction for the coordinates is indicated in figure 3.

Table 2 — P-points — Basic coordinates for a design seat-torso angle of 25°

Dimensions in millimetres

P-point	Coordinate		
	X	*Y*	*Z*
P_1	35	−20	627
P_2	63	47	627
P_m	43,36	0	627

NOTE — The positive direction for the coordinates is indicated in figure 3.



1) Line tracing the median longitudinal plane of the vehicle.
2) Line tracing the vertical plane passing through R.
3) Line tracing the vertical plane through V_1 and V_2.

NOTE — In 77/649/EEC, $\alpha = 17°$, $\beta = 7°$ and $\gamma = 5°$.

Figure 3 — Determination of V-points

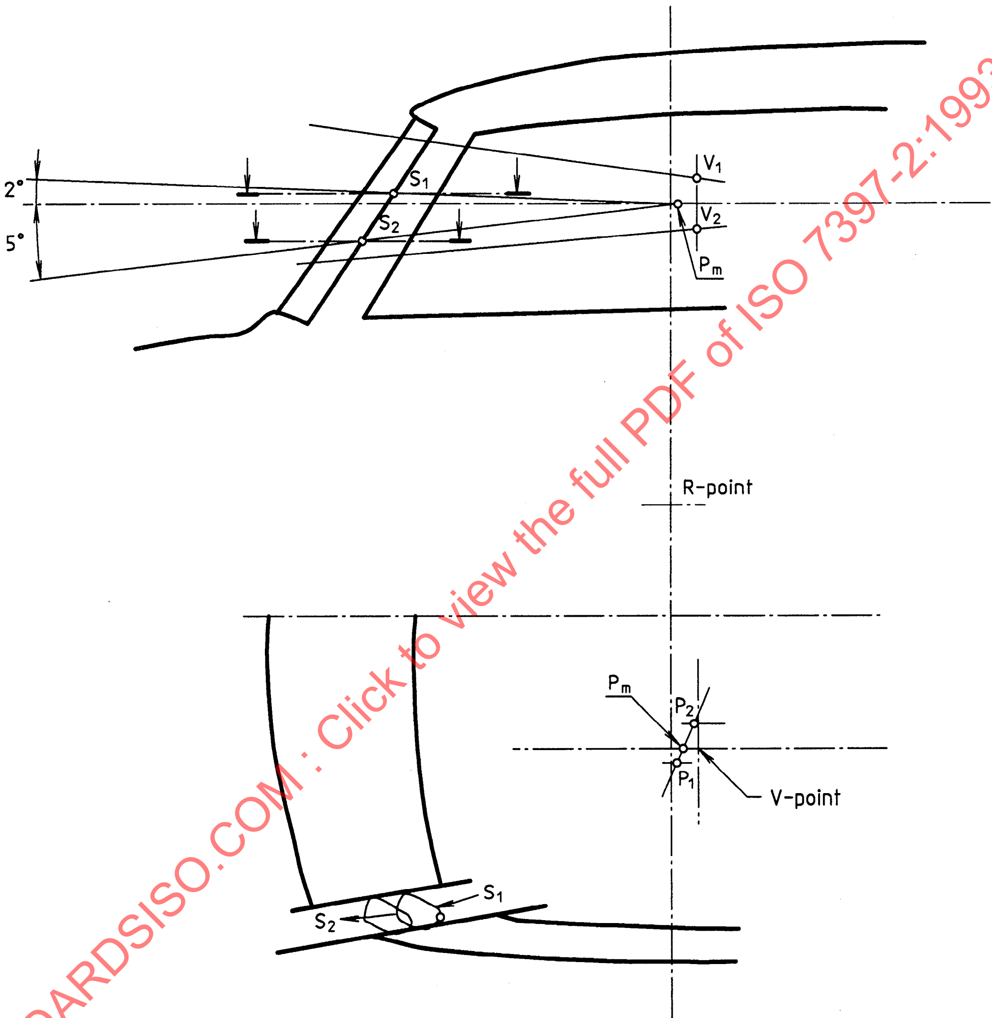


Figure 4 — Obstruction caused by A-pillars

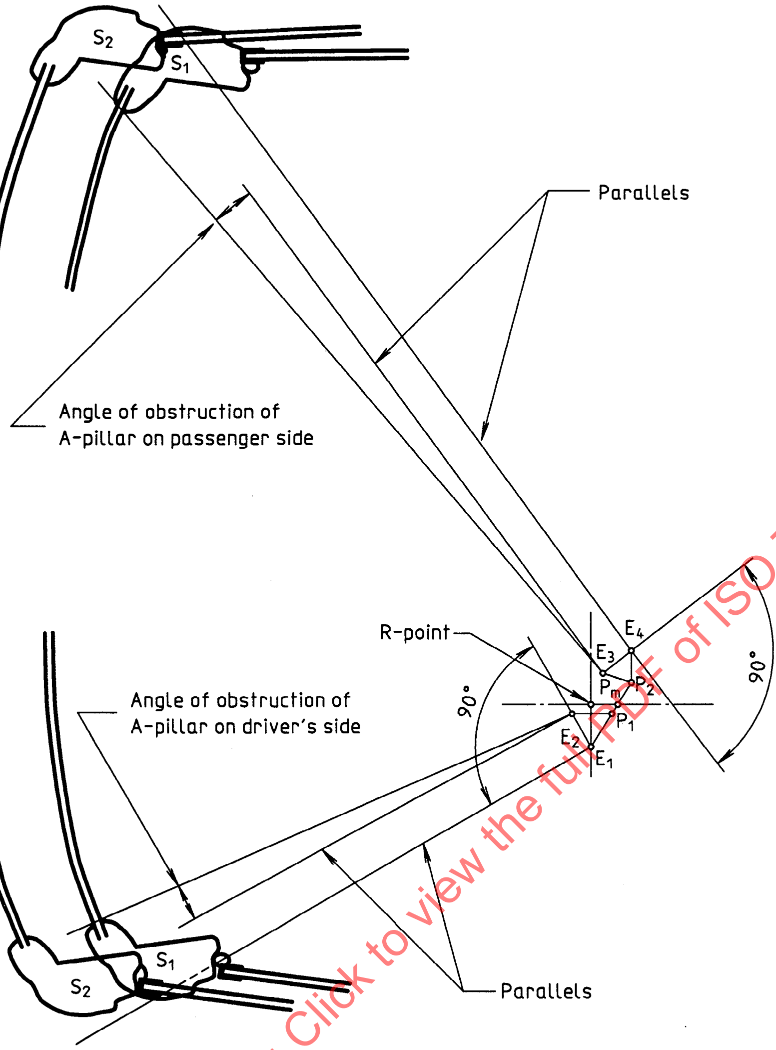


Figure 5 — Horizontal intersections of A-pillars to ascertain obstruction angles

Table 3 — Corrections to be made to X coordinates of P_1 and P_2 when horizontal seat-adjustment range exceeds 108 mm

Dimensions in millimetres

Horizontal seat-adjustment range	ΔX
108 to 120	− 13
121 to 132	− 22
133 to 145	− 32
146 to 158	− 42
> 158	− 48

NOTE — The positive direction for the coordinates is indicated in figure 3.

Table 4 — Corrections to be made to X and Z coordinates of each P-point and each V-point when design seat-torso angle is not 25°

Seat-torso angle degrees	Δ X mm	Δ Z mm	Seat-torso angle degrees	Δ X mm	Δ Z mm
5	− 186	28	23	− 18	5
6	− 177	27	24	− 9	3
7	− 167	27	**25**	**0**	**0**
8	− 157	27	26	9	− 3
9	− 147	26	27	17	− 5
10	− 137	25	28	26	− 8
11	− 128	24	29	34	− 11
12	− 118	23	30	43	− 14
13	− 109	22	31	51	− 18
14	− 99	21	32	59	− 21
15	− 90	20	33	67	− 24
16	− 81	18	34	76	− 28
17	− 72	17	35	84	− 32
18	− 62	15	36	92	− 35
19	− 53	13	37	100	− 39
20	− 44	11	38	108	− 43
21	− 35	9	39	115	− 48
22	− 26	7	40	123	− 52

NOTE — The positive direction for the coordinates is indicated in figure 3.

Annex A
(normative)

Laser measuring devices

A.1 Type

A laser measuring device consists of either the type described in A.1.1 or A.1.2.

A.1.1 A laser device pivoting about fixed vertical and horizontal axes: typical axis system of a theodolite [see figure A.1 a)] or beam splitter, mounted onto the laser device, to obtain E-points [see figure A.1 b)].

A.1.2 A laser device fitted on a pivoting axis normal to a fixed horizontal pivoting axis (see figure A.2).

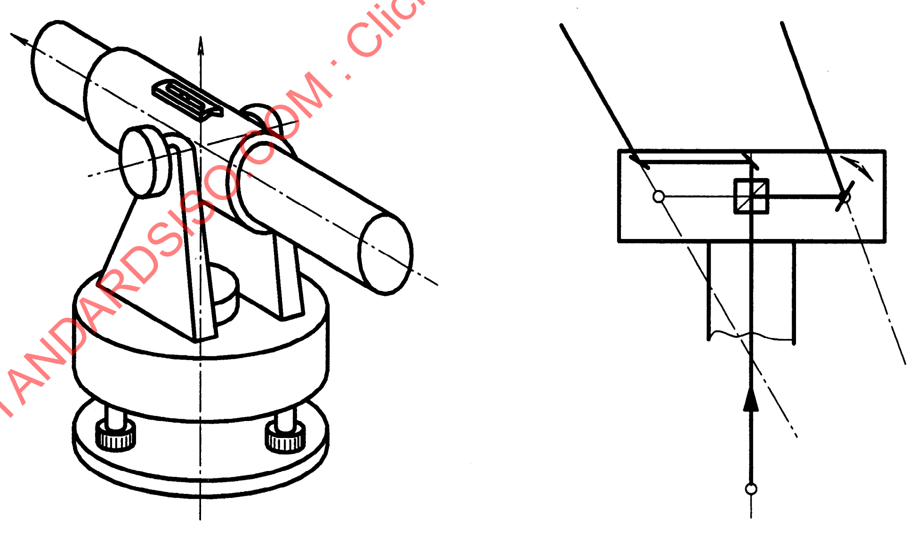
A.2 Angular corrections

A.2.1 The laser positions obtained after pivoting the devices in A.1 of the same angle values for α and β in the case of A.1.1, and for v and h in the case of A.1.2, are not identical. The differences are due to the following:

— in A.1.1, when the laser pivots about the vertical axis (α) of a given value with respect to the horizontal axis (β), the laser beam describes a cone with a semi-angle vertex ($\pi/2 - \beta$);

— in A.1.2, when the laser pivots about the horizontal axis of a value v, then of a value h about the other axis, the laser beam remains in a plane.

A.2.2 When the laser measuring device is not provided with an automatic adjusting system, the angle correction tables (tables A.1 to A.10) shall be used.



a)   b)

Figure A.1 — Typical axis system of theodolite

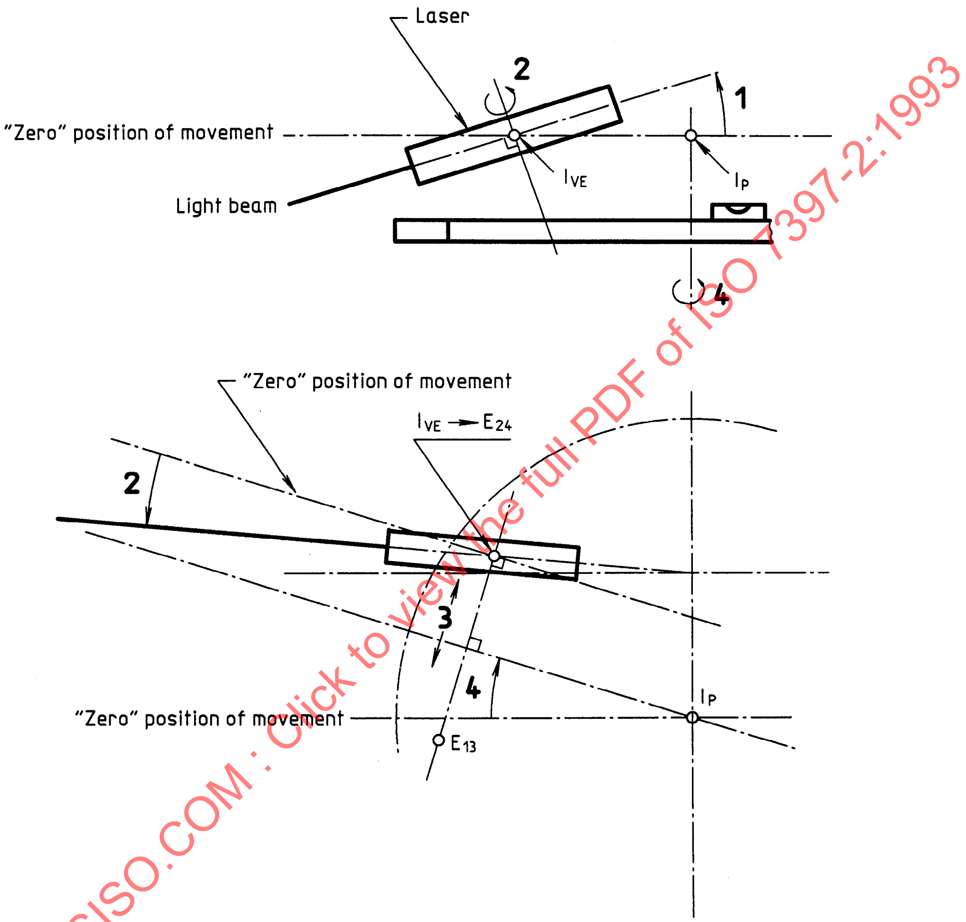


Figure A.2 — Laser device fitted on pivoting axis normal to fixed horizontal pivoting axis

Table A.1 — Angle corrections for *h* variants from 0 to 30° with *v* at 4° inclined plane

Values in degrees

v	*h*	α	β
4	0	4	0
4	1	4	1
4	2	4	2
4	3	3,99	3,01
4	4	3,99	4,01
4	5	3,98	5,01
4	6	3,98	6,01
4	7	3,97	7,02
4	8	3,96	8,02
4	9	3,95	9,02
4	10	3,94	10,02
4	11	3,93	11,03
4	12	3,91	12,03
4	13	3,9	13,03
4	14	3,88	14,03
4	15	3,86	15,03
4	16	3,84	16,04
4	17	3,82	17,04
4	18	3,8	18,04
4	19	3,78	19,04
4	20	3,76	20,04
4	21	3,73	21,05
4	22	3,71	22,05
4	23	3,68	23,05
4	24	3,65	24,05
4	25	3,62	25,05
4	26	3,59	26,06
4	27	3,56	27,06
4	28	3,53	28,06
4	29	3,5	29,06
4	30	3,46	30,06

Table A.2 — Angle corrections for β variants from 0 to 30° with *v* at 4° inclined plane

Values in degrees

v	*h*	α	β
4	0	4	0
4	1	4	1
4	2	4	2
4	2,99	3,99	3
4	3,99	3,99	4
4	4,99	3,98	5
4	5,99	3,98	6
4	6,98	3,97	7
4	7,98	3,96	8
4	8,98	3,95	9
4	9,98	3,94	10
4	10,97	3,93	11
4	11,97	3,91	12
4	12,97	3,9	13
4	13,97	3,88	14
4	14,97	3,86	15
4	15,96	3,84	16
4	16,96	3,82	17
4	17,96	3,8	18
4	18,96	3,78	19
4	19,96	3,76	20
4	20,95	3,73	21
4	21,95	3,71	22
4	22,95	3,68	23
4	23,95	3,65	24
4	24,95	3,62	25
4	25,95	3,59	26
4	26,94	3,56	27
4	27,94	3,53	28
4	28,94	3,5	29
4	29,94	3,46	30[1)]

1) Limit angular value for 4° inclined planes.

Table A.3 — Angle corrections for h variants from 31° to 60° with v at 4° inclined plane

Values in degrees

v	h	α	β
4	31	3,43	31,06
4	32	3,39	32,06
4	33	3,35	33,06
4	34	3,32	34,06
4	35	3,28	35,07
4	36	3,24	36,07
4	37	3,19	37,07
4	38	3,15	38,07
4	39	3,11	39,07
4	40	3,06	40,07
4	41	3,02	41,07
4	42	2,97	42,07
4	43	2,92	43,07
4	44	2,88	44,07
4	45	2,83	45,07
4	46	2,78	46,07
4	47	2,73	47,07
4	48	2,68	48,07
4	49	2,62	49,07
4	50	2,57	50,07
4	51	2,52	51,07
4	52	2,46	52,07
4	53	2,41	53,07
4	54	2,35	54,07
4	55	2,29	55,07
4	56	2,24	56,06
4	57	2,18	57,06
4	58	2,12	58,06
4	59	2,06	59,06
4	60	2	60,06

Table A.4 — Angle corrections for β variants from 31° to 60° with v at 4° inclined plane

Values in degrees

v	h	α	β
4	30,94	3,43	31
4	31,94	3,39	32
4	32,94	3,35	33
4	33,94	3,32	34
4	34,93	3,28	35
4	35,93	3,24	36
4	36,93	3,19	37
4	37,93	3,15	38
4	38,93	3,11	39
4	39,93	3,06	40
4	40,93	3,02	41
4	41,93	2,97	42
4	42,93	2,92	43
4	43,93	2,88	44
4	44,93	2,83	45
4	45,93	2,78	46
4	46,93	2,73	47
4	47,93	2,68	48
4	48,93	2,62	49
4	49,93	2,57	50
4	50,93	2,52	51
4	51,93	2,46	52
4	52,93	2,41	53
4	53,93	2,35	54
4	54,93	2,29	55
4	55,94	2,24	56
4	56,94	2,18	57
4	57,94	2,12	58
4	58,94	2,06	59
4	59,94	2	60

Table A.5 — Angle corrections for *h* variants from 61° to 90° with *v* at 4° inclined plane

Values in degrees

v	*h*	α	β
4	61	1,94	61,06
4	62	1,88	62,06
4	63	1,81	63,06
4	64	1,75	64,06
4	65	1,69	65,05
4	66	1,63	66,05
4	67	1,56	67,05
4	68	1,5	68,05
4	69	1,43	69,05
4	70	1,37	70,04
4	71	1,3	71,04
4	72	1,24	72,04
4	73	1,17	73,04
4	74	1,1	74,04
4	75	1,03	75,03
4	76	0,97	76,03
4	77	0,9	77,03
4	78	0,83	78,03
4	79	0,76	79,03
4	80	0,69	80,02
4	81	0,63	81,02
4	82	0,56	82,02
4	83	0,49	83,02
4	84	0,42	84,01
4	85	0,35	85,01
4	86	0,28	86,01
4	87	0,21	87,01
4	88	0,14	88
4	89	0,07	89
4	90	0	90

Table A.6 — Angle corrections for β variants from 61° to 90° with *v* at 4° inclined plane

Values in degrees

v	*h*	α	β
4	60,94	1,94	61
4	61,94	1,88	62
4	62,94	1,81	63
4	63,95	1,75	64
4	64,95	1,69	65
4	65,95	1,63	66
4	66,95	1,56	67
4	67,95	1,5	68
4	68,95	1,43	69
4	69,96	1,37	70
4	70,96	1,3	71
4	71,96	1,24	72
4	72,96	1,17	73
4	73,96	1,1	74
4	74,97	1,03	75
4	75,97	0,97	76
4	76,97	0,9	77
4	77,97	0,83	78
4	78,97	0,76	79
4	79,98	0,69	80
4	80,98	0,63	81
4	81,98	0,56	82
4	82,98	0,49	83
4	83,99	0,42	84
4	84,99	0,35	85
4	85,99	0,28	86
4	86,99	0,21	87
4	88	0,14	88
4	89	0,07	89
1)	90	0	90

1) Not determined.